CONTINUOUS IMPROVEMENT IN TEAMS
THE (MIS)FIT BETWEEN IMPROVEMENT AND OPERATIONAL
ACTIVITIES OF IMPROVEMENT TEAMS

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Preface

This book contains the results of my Ph.D. research into continuous improvement by teams. Performing research is like making a journey through unknown worlds: you only know where you start, but you don’t know where you will end up and what you will find along the way. During the journey I have been behind the Golden Wall (see the quote at the beginning of the third chapter) and I discovered that research methodology is such a Golden Wall. If you are one of the people in front of it, you think that behind it everything is orderly, controlled, and reliable. However, when you have been using research methods, you find out that, behind the Golden Wall, the chaos is not much less than in front of it. In addition, during the journey, I experienced the secret of the white section of the city that Momo had also experienced (see the quote at the beginning of the fifth chapter). The quicker I wanted to work with the analysis of the research data, the slower I proceeded. And the slower I tried to walk, the more I saw and the quicker the analysis went. Now I’ve finished my journey through the world of continuous improvement by teams, I see that I did not discover anything new. The ideas that were found during the research had always been inside of me (see the quote at the beginning of the second chapter). Although it is the goal of every researcher to develop new insights into the world, I have to confess that the major ideas elaborated in this thesis are not really mine; they were developed by my mum. The major idea in this thesis is that the regular daily work of people influences the other things they do, for example activities in improvement processes. This idea of the influence of daily work, was told to me by my mother during my youth when she explained to me the differences between the families of frontier guards, and the families of people having their own companies in our neighbourhood. The only thing I had to do was apply these ideas to the situation of improvement teams. Although the things I found during the research were inside me all the time, the many nice and interesting people I met during my journey also influenced the things I found. In this way, many people contributed to the research and many of the results would not have been there had I not met them on my journey. At this point I would like to mention them.

Some of the major contributions, without which the research could never have been performed, came from the companies that allowed me to study the improvement processes going on at their sites. I would like to thank the managers of the companies, Sietse Stellingwerf and Ruud Kortink, for their hospitality. They gave me the freedom to report everything, even when it was the less positive things happening. In addition, I would like to thank the co-ordinators at the companies, Gertjan van der Strate, Harald Luijten, and Cees de Groot. We worked closely together to introduce and facilitate the improvement teams, and together we experienced the good, and the less good, times with all the improvement teams. Every week when I visited their companies, they welcomed me warmly and they helped me to collect the information I needed. Together, we discussed at length the functioning of the teams and many of these discussions were highly useful to the research because they gave me new insights and inspiration. In addition, important contributions to the research came from the members of the improvement teams and their coaches. I enjoyed seeing their commitment to the operational work and their enthusiasm for working on improvements. The team
members and coaches were always very open with me, and they told me much of their concerns which highly facilitated the research. I would like to thank them all for their openness and hospitality. Thank you, Stefan, Harry, Karina, Marcel, Gerda, Anneke, Isaak, Jan, Peter, Jeannet, Imro, Mario, Ed, Hans, Marchel, Freddy, Yvonne, Willem, Gerwin, Johan, Fanny, Ron, Mark, Bisoen, Ronald, Ria, Raymond, Gerrit, Hugo, Peter, Rob, Wim, Rajdew, Hans, Hans, Wim, Erwin, Leo, Aad, Gerard, Clive, Wolter, Bobby, Henk, and Paul.

Another contribution to the research came from the students who researched continuous improvement for their graduation projects. During the discussions with them, my understanding of the subject of continuous improvement, both in practice and in theory, increased significantly. Further, I have to thank several other organisations, Vlisco, Aerpac, and DSW Rijswijk, that have worked together with researchers from this university in the field of continuous improvement. They helped us to sharpen the existing knowledge on continuous improvement by giving us examples of improvements in their daily practice.

Alongside the people at the companies, also people at the university contributed to the research. First of all, there are Koos Krabbendam, my promoter, and Harry Boer, my co-promoter. I would like to thank them for the trust they had in me, and for the many fruitful discussions during which new insights were developed. Further, I would especially like to thank Harry for his accurate way of reading through all the intuitive and unstructured thoughts I wrote down. Each time he produced a large number of comments, which helped me to sharpen my rough ideas and to express my thoughts better; even mistakes in the list of references were detected by his pencil! He performed the role of devil’s advocate in a way I will never forget.

Next to Koos and Harry, there are several other people at the university who had their influence on this research. I would like to thank Roel Schuring for the stimulating criticisms and ideas during the first period of the research. Further, I would like to thank all the members of the Technology and Organisation group. Although I came to the university for only a few days each week they made me feel very much at home. They were always interested, even if I wanted to tell them again (in an OOTO) about my research. Further, they provided me with many good experiences, not only about research but also about the more ordinary things in life like the newest gossip on things going on in the faculty. Also their concern during the final months of thesis writing was very stimulating. A special word of thanks is needed for Klaasjan and Irene, who always let me stay in their excellent ‘Hotel Visscher’ when I had to stay overnight in Enschede.

Alongside developing the main ideas of this research, my mum and dad helped me in many other ways. They always gave me the opportunity to find my own way in life, and they have always stimulated me to learn and develop new capabilities. Thanks to them, I developed a learning attitude that was highly beneficial during the research. Thanks for this! Not only my parents, but also my sisters, Cristhel and Mirjam, contributed to the research. They taught me to discuss ideas for hours and to never quit during a discussion, something that was very useful for all the discussions that were needed in this research. Further, they were always there to talk about things that had nothing to do with the research, something that was also
very important and relaxing. This also holds true for many of my friends; they were always interested in my work, but they also were there to discuss other things in life. Some of them even trusted Richard and me with their kids to practice parental skills!

Finally, I owe much to Richard, the most important person in my life. He helped me with many things during the research, and, more important, thanks to him the research never became the most important thing in my life. When I’m together with him, research is nothing more than a nice job, and it is obvious that life has many more important aspects.

Den Haag, April 1999

Ellen de Lange-Ros
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Chapter 1: Literature on continuous improvement

*But I am positive there is still a Joker roaming around the world. He will make sure that the world never rests. Whenever possible - and wherever possible – a little fool will jump out wearing long donkey ears and jingling bells. He will look deep into our eyes and ask, Who are we? Where do we come from? (Jostein Gaarder, ‘The solitaire mystery”, 1996, p.309)*

1.1. Introduction

Each piece of research has its origins, which heavily influence the questions that are examined. The purpose of this chapter is to clarify the origins of this research, and the origins of the field that is examined: that is the field of incremental continuous improvement. In this way, the goal of this chapter is the same as the goal of the Joker in the above quote, namely to ask ourselves: who are we? where do we come from?

Organisational change and especially improvements get much attention in literature as well as in practice. Often in literature, a distinction is made between major and minor, or incremental, changes. Punctuated equilibrium models stress the occurrence of minor and major changes during periods of evolution and revolution (Tushman, 1996). In these models it is argued that change oscillates between long periods of stability and short bursts of radical change that fundamentally alter an industry. Systems evolve through the alternation of periods in which persistent underlying structures permit only incremental change, and periods of revolution, in which these underlying structures are fundamentally altered (Gersick, 1991). The goals of organisations during periods of incremental change are to adapt to change and to gain stability. After a period of revolution a rather long period of stability exists, in which the firm searches for the equilibrium that was lost due to the reorientational change. It is a time of adjustment, in which the organisation undergoes many incremental changes and searches for stability (Choi, 1995). Although punctuated equilibrium models emphasise that periods of evolution are relatively stable compared to periods of revolution, the consequences of changes in the periods of stability must not be underestimated. Several authors have emphasised that apparently modest changes to the existing technology can have dramatic competitive consequences (Choi, 1995), for example when the architecture of components in a product changes (Henderson, 1990). Further Brown (1997) emphasises that, in practice, the experience of many firms is that continuous change and continuous product innovation is a critical factor in their success. Eisenhardt (1995) also shows the importance of adaptation through small frequent shifts in how firms compete in the marketplace. It is clear that although in periods of evolution change is less radical, incremental change can play an important role and is worth considering. During the last fifteen years, several authors have started to pay explicit attention to incremental improvements (see for example Imai, 1986; Robinson, 1991; Bessant 1993a). They have all emphasised that continuous incremental improvements are a powerful potential source of competitive advantages for organisations.
Because of the importance of incremental improvements for organisations, in this research the focus is on incremental improvements. In the following sections, first the origins of continuous incremental improvements are discussed and an overview of the existing literature is presented. Based on this overview, it is discussed which things remain open for further research and the major purposes of this research project are formulated.

The concept of continuous improvement did not appear out of the blue. To understand the concept, it is important to understand the tradition of thinking on organisations and organisational improvements within which the concept was developed. In the next section, the increase of attention paid to continuous improvement in literature in recent decades is described. Attention will be paid to the Japanese way of management, quality circles, Total Quality Management, lean production, and continuous improvement. Next, other concepts are described which also pay attention to incremental improvement. At the end of the chapter, an overview of different concepts on incremental improvements is given and the existing literature on continuous improvement is evaluated and discussed. This shows the gaps that remain for further research.

1.2. Growing attention for continuous improvement

1.2.1. Japanese management

During the 70s and 80s, companies in the West increasingly faced strong competition from companies in Japan. This was seen as the cause of many problems for Western companies. Therefore, in literature, the Japanese companies got more and more attention (Keys, 1984). The question arose as to why the Western companies had problems in competing with the Japanese. Various answers were given, such as the non-effective policies of governments, higher wages because of the role of the unions, the rise in energy costs because of OPEC, the role of environmentalists, non-motivated employees, and cultural differences between Japan and the West. Many authors emphasised that these answers were not the right ones and rather they paid attention to the difference between the Western and the Japanese way of organising a company (see for example Abernathy, 1981; 1983; Takeuchi, 1981, Bolwijn, 1987; Cole, 1991). Literature described the attention that Japanese companies gave to the processes that create the products of the company: the product development and the manufacturing processes. The Japanese way of understanding and organising these processes was seen as the main reason for the success (Wheelwright, 1981), and having an effective organisation and operational capabilities became important (Lillrank, 1995). This gave rise to a huge number of studies in the field of operations management on the Japanese way of organising. The studies on the Japanese ways of organising production resulted in some major themes that

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1 The overview shows that often literature is rather prescriptive, for example authors claim ‘improvement needs to be managed as a process instead of as a single event’. It should be reminded that the overview of opinions in literature do not necessarily reflect our own opinions about incremental improvements.
became incorporated in Western literature on organisations. Next, it is described how the Japanese way of organising production emerged during the 20th century and the concepts it contains are discussed.

The attention to organising and improving manufacturing processes in Japan started primarily after World War II when the Americans introduced aid programs to Japan. These programs had the aim of rebuilding industry quickly in order to prevent widespread starvation and unrest in Japan. Part of this aid was the Training Within Industry (TWI) program and the Japanese suggestion scheme grew mostly out of this program. In this manner the TWI had a large impact in training Japanese workers and managers in methods of analysis and it laid a solid foundation for continuous improvement and Kaizen (Schroeder, 1991; Robinson, 1993).

Quality control got much attention in the aid programs. Invitations went out to American quality leaders Deming and Juran, to lecture in Japan and their visits are widely considered to have been highly influential (Takeuchi, 1981; Schonberger, 1982a; Wood, 1983; Munchus, 1983; Lillrank, 1995), although Robinson (1993) argues the influence of these gurus was on the conceptual and inspirational level and that the American aid programs were influential on the practical level of quality management. Since the second world war, Japan developed quality concepts and put them into use. Instead of allowing quality control to remain the province of quality control engineers, management made it the responsibility of all employees (Munchus, 1983). This way of adapting quality reflects the way the Japanese worked on rebuilding their industry after world war II. They paid much attention to the adaptation of American principles, so that these principles would fit in to the Japanese way of working. Nadler (1984) discusses a wide range of American concepts that the Japanese adopted and used: attention to quality, working with quality circles, using supervisory and management training, using industrial engineering in the organisation, developing a long-term vision, using cooperation between industry and universities, the use of standardised components, developing marketing research, and the use of sales training programs. It is striking that many of these American concepts, transferred during the 1950s, were put into use in Japan in such an excellent way that within twenty years the Japanese became a strong competitor to American industry. As a result, the attention given to the Japanese way of working rose, and the Japanese concepts were transferred to the Western world; these concepts now were regarded as ‘Japanese’.

The most important themes in literature on the Japanese way of managing are now discussed. One important theme is the Japanese focus on perfection. The aim is to continuously improve the existing situation: trying to reduce costs, striving for zero defects, striving for zero inventories, and trying to offer a large product variety (Hayes, 1981; Womack, 1990; Lillrank, 1995). Consequences of the focus on perfection can be seen in many different areas. One of these areas is the control of the production system, the logistics. The Japanese way of controlling the production system is to lower stocks to make the real problems clear and then

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2 Several authors (for example Wheelwright, 1985; Clark, 1988) discuss on a more global level why Japanese manufacturing management was so successful. This is beyond the scope of this research.
solve these real problems. These principles are now well known as Just In Time production (Schonberger, 1982b; Abernathy, 1981). By solving the real problems, the Japanese try to prevent problems later in the processes. The main idea behind this philosophy is that correcting problems costs much more then preventing them. A focus on the total chain of activities is another important theme. Activities are not studied in isolation, instead the whole chain from supplier to customer is taken into account and all the activities in this chain are important. The people in the process are regarded as very important, the primary responsibility for quality is assigned to the production team and not to the quality control department (Schonberger, 1982a). The focus on the total chain of activities is combined with attention to perfection and striving to prevent problems. This becomes clear in the organisation of improvement programs; there, much attention is given to the role of the workers on the shop floor in improvement programs (Schonberger, 1982a). The focus on the total chain of activities results in several themes that get much attention:

- One such theme is that **product development and production processes get much attention** in Japan. Authors have argued this attention to manufacturing did not exist in Western companies. In the West companies gave too much attention to marketing and finance; manufacturing and technology did not get enough attention from top management (Skinner, 1969; Hayes, 1980, 1981; Buffa, 1984; Wheelwright, 1985; Clark, 1988). The Japanese have learned to think about manufacturing operations in an effective way (Wheelwright, 1981). The Japanese never consider a production problem solved, never underestimate the challenge of building and improving the ‘factory of the present’ (Hayes, 1981).

- Another theme is the **attention on the relationships with suppliers**. In Japan companies tend to buy from the same few suppliers year after year, so the suppliers develop a competency that is particularly attuned to the delivery and quality needs of the buying firm (Schonberger, 1982a). The suppliers selected had to perform very well, in order that they could guarantee their production and quality checks were not needed within the manufacturing process. Problems in production caused by bad inputs could be prevented in this way rather than being corrected during production. These close relationships with the suppliers blur the traditional boundaries between the organisation and its environment (Spencer, 1994).

- A theme also resulting from the focus on the total chain of activities is **the focus on the customer**. Every part of the process has its customers and it is very important that these customers are satisfied with the products they get. This satisfaction of a customer is translated into a quality level; quality is what the (internal) customer wants. This focus on the customer is combined with striving for perfection. The customer can always be better satisfied, so the quality of the performance can always be improved. This results in continuous attention to ways of improving quality.

Although most literature on Japan is enthusiastic, also criticisms can be heard. Sethi (1984) discusses several aspects of the Japanese management system that are no longer successful in
Literature on continuous improvement

Japan such as lifetime employment, seniority based promotion and wage system, and decision making by consensus. Sullivan (1992) says that what the Japanese people say about their way of working, and especially the human relations aspects of it, shows a desire to make nice unthreatening statements but these statements do not reflect reality. Real life in Japan is not as pleasant as the statements would suggest. Some authors (Lillrank, 1995; Keys, 1984) argue that the Japanese management ideas that were influential on management thinking originated from a rather small set of industries and companies such as motor vehicles, steel, precision machinery, and consumer electronics. Lillrank says these ideas apply best to mass production and he mentions several other successful concepts in operations management for other types of production including the German engineering paradigm in make-to-order industries, and the Silicon Valley model focusing on rapid innovation cycles. Although such criticism exists, the literature on the Japanese way of working has been very influential in the West. It has resulted in some major themes becoming incorporated in Western literature on organisations. For example, the Japanese way of production control with JIT and Kanban, and the attention paid to quality were highlighted in the West. In the next sections, some themes that became incorporated, and that are relevant to incremental improvements, are discussed.

1.2.2. Quality circles

The success of Japanese companies led many people to examine the reason for this success. Many different themes emerged, but some themes were more popular than others. In the first instance, the Japanese success was attributed to the Japanese management approaches and especially to quality circles (Wood, 1983). For example Takeuchi (1981) gives a lot of attention to quality circles when he discussed the Japanese way of organising production. Quality circles were seen as a way to regain competitiveness in the West. The properties of quality circles, such as their accessibility, the low risk of implementing quality circles, and the fact that managers did not have to give up any control contributed to the popularity of quality circles (Lawler, 1985).

A quality circle is a small, formally organised, voluntary group of workers. The agenda and procedures are usually quite structured, but the details vary according to the firm (Schonberger, 1982a). Members of a group choose a particular problem to study, gather data, and use various methods to form a recommendation that can be presented to management (Munchus, 1983; Wood, 1983; van de Water, 1988). Often management decides if a recommendation will be implemented. The team can do the implementation itself, but often also outsiders, such as managers or staff members, implement the ideas. The methods used by the circle get much attention and statistical tools are important, alongside tools on problem solving and team building techniques (Wood, 1983; Baisier, 1992). Members often receive training in the tools to be used. A facilitator helps to train members and ensures that things run smoothly (Wood, 1983). Members of a quality circle may get recognition but rarely receive financial awards. Often a quality circle program creates a parallel organisation structure, circles operate independently and in ways different from the existing organisation (Lawler, 1985). Several goals when implementing quality circles in the West are discussed in
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The first goal is that quality circles should increase the involvement of employees by means of participation (Takeuchi, 1981; Munchus, 1983; Griffin, 1988; Hill, 1991). Wood (1983) argues that individuals are involved often for only one hour a week in a team, and it can be questioned if this will cause changes in the involvement of employees. On the other hand he shows that employees are often treated as unskilled, which results in low utilisation of their potential. Quality circles can lead to a better utilisation of the latent skills possessed by employees and this can lead to increased job satisfaction. The second goal of a quality circle is to enhance business effectiveness by raising continuous improvement (Takeuchi, 1981; Hill, 1991). Wood (1983) shows the members of a quality circle develop problem solving skills and this can result in enhanced problem-solving effectiveness within the organisation. Further goal setting and feedback can lead to significant increases in performance because they inspire workers to exert greater effort on the task. Through presentations, quality circles are a mechanism for workers to communicate work related problems to managers. This can improve the circulation of ideas and bring more knowledge to bear on solving problems (Wood, 1983). The third goal of quality circles is that they mark the commitment of companies to changing organisational culture (Hill, 1991). During the 1980s the importance of an organisation culture became clear and quality circles were seen as a means to change the existing culture of organisations.

Quality circles became very popular in the West in the 1980s. Many organisations were inspired by the success stories and started to use quality circles. However, nowadays they only exist in a few companies. In literature several reasons for the failure of quality circles in the West have been mentioned:

**No clear way of organising:** An important reason for the failure of quality circles is that responsibility for quality was not linked with the requisite authority. The hierarchy of quality circles was often parallel to, rather than integrated into, the existing organisational hierarchy (Hill, 1991). Baisier (1992) argues that circles therefore are not a real part of the organisation and they can be bypassed easily. The hierarchy of the quality circles allocated responsibility to managers for overseeing circles but denied them the corresponding authority. Organisations were often not structured to respond to bottom-up initiatives (Hill, 1991). Further, quality circles sometimes have been regarded as direct competitors to the suggestion system. In addition, some people became uncomfortable with the split between the way they are treated in quality circle meetings and how they are treated in the day-to-day operations (Alänge, 1992).

**No implementation of ideas:** Another major problem was that the bulk of quality improvement issues went beyond the competence of the circles because they transcended the workplace and the authority of workers and foremen. The identification and solving of problems was often separated from the implementation of solutions, since quality circles proposed, but managers decided and implemented (Hill, 1991). Managers’ tardiness in implementation, or their outright refusal to implement, have been cited as the major obstacles facing circles (Hill, 1991; Lawler, 1985). The people who have to implement ideas, often managers, were not involved in the initial activities of the quality circle and
therefore had little investment in them. In addition, only those individuals who develop the ideas, not those who implement them, receive recognition and rewards (Lawler, 1985; Alänge, 1992). Further, the people who have to implement ideas are often faced with a choice between continuing their normal activities and picking-up on ideas that the quality circles have suggested. Unless these people are willing to put their regular duties aside, they will never implement the ideas (Lawler, 1985). Another reason for the lack of involvement by managers and staff-personnel could be that they feel threatened because they think their role is being taken over by the quality circles (Wood, 1983; Alänge, 1992).

**Lack of top-management commitment:** A cause of the failure of quality circles is that managers have unrealistic expectations; they expect significant gains in a short period. This can lead to an adoption-disappointment-discontinuation cycle (Wood, 1983; Alänge, 1992). Often management left quality circles without further support after initially having expressed support and promoted start-up activities (Alänge, 1992). Further, there were signals that top management lacked commitment to quality circles after an initial period of enthusiasm. One indication was the failure to overcome the parallel structure of the circles in the overall organisation. Top management made no efforts to integrate circles into the organisation (Hill, 1991). Further, often there was a lack of appraisal and rewards for activities in the circles, which could be interpreted as meaning that quality circles were an extra activity divorced from the normal managerial duties and with no penalties for those who chose to opt out. Another indicator of the lack of top management commitment was that circle facilitators were young and junior managers, or people who were known to have reached their career limits. A major principle of quality management is that top management should be the driver of quality, but in practice top management did not take an active role (Hill, 1991). Managers delegated the direction of quality circles to facilitators and consultants, and this delegation led to much confusion and resentment through by-passing the supervisory structure (Alänge, 1992). Also it must be mentioned that one reason for the widespread adoption of quality circles in the US is the competence with which consulting groups have marketed their ideas and programs on quality circles (Wood, 1983). After an initial period of enthusiasm, organisations have added more groups which then have to compete for management attention. Often these newer groups are established more mechanistically than the first groups and the interest of managers declines (Lawler, 1985; Griffin, 1988).

**Emphasis on human relations aspects:** Quality circle programs in the US had more emphasis on aspects of human relationships than the Japanese concept. In Japan statistical quality control and related methods for identifying and solving work-related problems are the foundation upon which quality circles are built. The emphasis on human relationships may be reflected by a de-emphasis on the quality control functions of quality circles (Wood, 1983). In Japan quality circles exist mainly in larger corporations with a dominant market position which are able to generate the slack resources needed to offer employees special benefits on the job, such as quality circles. Circles are maintained regardless of the
Literature on continuous improvement

extent to which they contribute to improvements in productivity, it appears misleading to suggest that quality circles are a major cause of Japanese productivity (Wood, 1983).

**Limited perspective on circles:** In Japan, quality circles were only one part of the total system of quality improvement, they were not the most important part of the program itself (Schonberger, 1981; Hill, 1991). Despite this observation, in the West many companies introduced quality circles as the main part of their quality program without understanding the other important parts. Hill (1991) says it seems that organisations outside of Japan borrowed the part of a total system of Total Quality Management that was the most visible and apparently the easiest to implement, without an understanding of the whole. It is clear that one part, quality circles, could not survive on its own. It was not understood that quality circles are but one contributing component in a more complex multidimensional company-wide quality strategy (Alänge, 1992). Often it was not recognised that changes in the organisational structure were also needed in order to work successfully with quality circles. Lillrank (1995) argues that the organisational and strategically significant property of quality ideas was not transferred well from Japan to the Western world.

Lawler (1985) suggests it is unlikely that managers will institutionalize and sustain quality circle programs over a long period of time because circles contain in their design many of the elements that lead to their elimination and destruction. Several authors suggest ways in which the concept of quality circles can be altered to prevent with them. One application of quality circles is to use them only to collect ideas from individuals close to the work. Membership of the quality circle should rotate between various work areas, so that circles work on the most obvious problems and then move elsewhere (Lawler, 1985). Another solution is to use quality circles to deal with temporary or critical organisational issues, for example when introducing new technologies (Lawler, 1985; Alänge, 1992). The problem at hand will define the circle’s lifetime. In these teams there is often an absence of the strong educational-training as in quality circles. Especially for the solving of ill-structured problems teamwork can be useful. In an ill-structured problem, a solution usually has to be found by combining several different actions by individuals. Groups consistently outperform individuals on these types of problems and therefore groups can effectively solve this kind of problem (Wood, 1983). Further, quality circles can be used as an interim device in moving towards a more participative management system and culture. Quality circles can evolve into other forms of employee participation and expand organisational commitment. But this transition, from quality circles to an institutionalised participative structure, is difficult and managers who want to adopt a participative philosophy may want to avoid using quality circles as a first step (Lawler, 1985). Further, concepts such as the quality circle might be more successful if a broader approach was adopted. The ideas on quality from Japan have been transferred on a low abstraction level, with too much attention paid to one specific tool: quality circles. If the ideas from Japan were transferred on a higher abstraction level, the Japanese ideas could be adjusted to the Western situation, and a unique Western approach could start to emerge. Masaaki Imai makes a first step in this direction by explaining the more abstract concept of
Kaizen. Womack and Jones took the debate up to the level of management paradigms and launched the concept of lean production, of which Kaizen is an important part. The abstract concept of Kaizen, connected to a grand strategy, has freed Western thinking from the low abstraction Japanese examples and inspired experimentation with new organisational arrangements (Lillrank, 1995). Hill (1991) suggests that Total Quality Management is a much more useful concept to borrow from Japan than quality circles. Based on such critical reflections on the limited success of quality circles, during the 1980s organisations in the West became conscious of the limitations of quality circles. As a consequence, more general concepts about quality in Japan were studied and a more general view of quality developed in the West, which was called Total Quality Management. This concept is discussed in the next section.

1.2.3. Total Quality Management

Total Quality Management returned to the West when attention was paid to the Japanese way of organising, but its history is much longer. Reeves (1994) mentions discussions by Greek philosophers like Socrates, Plato, and Aristotle about quality or excellence. During this century, many people have written about quality and TQM. Often mentioned names are W. Edwards Deming, Joseph Juran, Kaoru Genich Tachuchi, and Philip B. Crosby. Most of these founders of principles of quality come from Western countries. Their ideas were transported to Japan after World War II. The Japanese put these ideas into use and became very successful competitors to Western companies. Then the attention paid by Western companies to quality rose, and Western companies started to discover the major ideas on quality that they had denied for many years. Dean (1994) constructs three main principles of TQM: customer focus, continuous improvement, and teamwork. Each principle is implemented through a set of practices and these practices are supported by a wide array of techniques.

- The first principle of TQM is the belief that customer satisfaction is the most important requirement for long term success of an organisation and that this satisfaction requires that the whole organisation be focused on customer needs. Practices exemplifying customer focus include promoting direct contact with customers, collecting information about customer’s expectations and disseminating this information within an organisation. Techniques used to accomplish these activities include customer surveys and more elaborate methods such as quality function deployment. These practices and techniques can also be applied to internal customers.

- The second principle, continuous improvement, means a commitment to constant examination of technical and administrative processes in search of better methods. Underlying this principle is the concept of organisations as systems of interlinked processes (Dean, 1994, Schonberger, 1994) and the belief that by improving these processes organisations can continue to meet the increasingly stringent expectations of their customers. Relevant practices include process analysis and re-engineering. Many techniques, including flowcharts and statistical process control, are associated with this principle (Dean, 1994). Hackman (1995) identifies two additional principles that,
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according to Total Quality Management authorities, should guide interventions intended to improve quality. Uncontrolled variance in processes is the primary cause of quality problems and this variability must be analysed. In addition, in a problem solving cycle, at every point, the use of systematically collected data is needed, management by fact is important. Hackman shows that much attention is given to the use of scientific methods to monitor performance and to identify points of high leverage for performance improvement. Examples of these methods are control charts, and Pareto analysis. Furthermore, he shows the attention paid to the use of process management heuristics to enhance team effectiveness. Examples of these heuristics are: flowcharts, brainstorming, and cause-and-effect-diagrams. Another aspect of quality that is not mentioned so far in this literature, is the explication and standardisation of operational processes by recording the official procedures of the organisation in quality books to achieve an ISO certificate.

- The third principle of TQM is teamwork, the collaboration between managers and non managers, between functions and between customers and suppliers (Dean, 1994; Schonberger, 1994). The use of teamwork between managers and non managers is based on the assumption that all employees can make important contributions to organisations when they have the power and the necessary preparation. Teamwork among functions is based on the notion that organisations as systems cannot be effective if subunits emphasise their own outcomes over those of others. The principle of teamwork with customers and suppliers is based on the perceived benefits of partnerships. Teamwork practices include identifying the needs of all groups and organisations involved in decision making, trying to find solutions that will benefit everyone involved, and sharing responsibilities and credit. Often such practices are promoted by forming teams that draw together various organisational units. Teambuilding techniques are often used. The three principles relate closely to each other. Anderson (1994) examines the theoretical principles behind the Deming management method and she emphasises employee fulfilment alongside the concepts already mentioned by Dean. Employees are empowered to make decisions, build relationships, and take the steps needed to improve quality within the system designed by management (Spencer, 1994). Also the reward of employees for their work on quality improvements is frequently an important theme (Schonberger, 1994). According to Anderson, it is implicit in TQM that organisational leadership plays a crucial role in ensuring the success of quality management, because it is the leader’s responsibility to create and communicate a vision that moves the firm towards continuous improvement (Anderson, 1994). Waldman (1994) discusses Deming’s opinion of problems in organisations and the role of management. According to Deming, the vast majority of variances in a process are due to common causes, which are system based. Managers are responsible for correcting system based causes of poor performance, not employees.

Attention to Total Quality Management is not restricted to manufacturing. For example literature on public management and management of health care also pays much attention to Total Quality Management and improvement activities (see for example Sensenbrenner,
Literature on continuous improvement

1991; Dobbs, 1994; Shortell, 1995). Mixon (1994) discusses how lawyers can profit by using quality management procedures in their law offices. Mixon also shows that the ideas of Deming can help law schools to improve their performance.

Total Quality Management is an approach to management that has evolved from a narrow focus on statistical process control to encompass a variety of technical and behavioural methods for improving organisational performance (Dean, 1994). TQM consists of a whole range of philosophies, practices, and techniques that are highly intertwined. It is often hard to separate the different constituent parts, and this makes it hard to define what TQM is and what it is not. Total Quality Management is a rather general concept on the importance of improvement; it is less concerned, for example, with how operational or improvement processes in practice should be organised. Following the concept of TQM, other concepts emerged that do pay attention to this aspect: lean production and continuous improvement. The concept of lean production is described in the next section.

1.2.4. Lean production

Based on literature on Japan, concepts like quality circles and Total Quality Management got much attention in specific streams of literature. Alongside this literature, literature emerged that discussed ways of organising production. The most influential book is the work of Womack & Jones ‘The machine that changed the world’. Incremental improvements are again an important subject. In ‘The machine that changed the world’ (Womack, 1990) the term ‘lean production’ is used to indicate the way of organising mass production in Japan, as opposed to the Western way. It is important to realise that the term lean production is not only about manufacturing, it is about the whole process of making a product, for example R&D is included also. In the lean production concept, work is organised around the primary processes. An important theme in lean production is the Just In Time philosophy. Goods arrive in the correct quantities with right quality at the right place at the right time and consequently little internal inventory exists between work stations. Relationships with customers and suppliers are very important. In lean manufacturing, incremental improvements are an important topic. Through the whole organisation, there is a commitment to quality and continuous improvement in all aspects of operations. Product designs are focused on eliminating waste and contribute to quality. In the lean production concept, the core building blocks in production are teams. Because of the use of teams, the organisation is flatter and structured horizontally around the processes instead of structured vertically (Cutcher-Gersenfeld, 1994), however, vertical structures are still important in lean production, they have not disappeared (Vink, 1996). Alongside their production tasks, production teams have several other tasks. They have to plan their own work. Further they have responsibilities for monitoring quality and also formal problem solving is organised around work teams (Cutcher-Gersenfeld, 1994; Vink, 1996). Literature on lean production pays much attention to the organisation of the operational processes. Further, it emphasises the importance of improvements. When improvements are discussed, most attention is given to the techniques for organising the production tasks and to the improvement efforts by
specialists such as designers and engineers. Improvement activities by the shop floor people get less attention. Closely related to the literature on lean production, is literature on continuous improvement. The latter pays less attention to the organisation of the operational processes; it stresses the organisation of improvement processes.

1.3. Literature on continuous improvement

Influenced by literature on management in Japan, quality circles, Total Quality Management, and lean production, authors started to pay explicit attention to the organisation of ongoing incremental improvements, which resulted in literature on continuous improvements. Authors claim that incremental improvements are very valuable to an organisation if they have an ongoing character. Single incremental changes may not amount much to an increase in performance, but added together they can lead to considerable improvements. Therefore, authors write about ‘continuous improvements’. Key authors in this field are Imai, Robinson, and Bessant. Their main ideas are discussed below.

1.3.1. Main ideas of Imai

Imai (1986) discusses ‘Kaizen’, by which he means ‘ongoing improvement involving everyone’. Imai says the essence of Japanese approaches such as TQM, quality circles, and Just In Time is Kaizen: continuous improvement. He sees Kaizen as the umbrella concept covering most Japanese practices. Imai argues that Kaizen is between maintenance and innovation and he pays much attention to the differences between Japan and the West. He says that in Western countries, the focus is on innovation, and, unlike in Japan, continuous improvements get almost no attention.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Kaizen</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term but undramatic, small steps</td>
<td>Maintenance and improvement</td>
<td>Short-term but dramatic large steps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scrap and rebuild</td>
</tr>
<tr>
<td>Timeframe</td>
<td>Continuous and incremental</td>
<td>Intermittent non-incremental</td>
</tr>
<tr>
<td>Involvement</td>
<td>Everyone</td>
<td>Select a few champions</td>
</tr>
<tr>
<td>Spark</td>
<td>Conventional know-how and state of the art</td>
<td>Technological breakthroughs: new inventions and new theories</td>
</tr>
<tr>
<td>Efforts</td>
<td>Requires little investment but great effort to maintain it</td>
<td>Requires large investment but little effort to maintain it</td>
</tr>
<tr>
<td></td>
<td>Orientation of effort on people</td>
<td>Orientation of effort on technology</td>
</tr>
<tr>
<td>Evaluation criteria</td>
<td>Process and efforts for better results</td>
<td>Results for profits</td>
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Table 1-1: Differences between Kaizen and innovation, according to Imai

Imai contrasts the Japanese process oriented thinking to the Western result oriented way of thinking. Kaizen generates process oriented thinking, since processes must be improved before improved results are achieved. Consequently, management is more focused on supporting and stimulating the efforts of people to improve the process, instead of controlling result oriented criteria. Further, management has a long-term outlook rather than of the Western focus on short-term results. The starting point for improvement is to recognise the
need, in other words: a problem. If no problem is recognised, there is no recognition of the need for improvement. Therefore Kaizen emphasises problem awareness and provides clues for identifying problems. Once identified, problems must be solved. Thus, Kaizen is also a problem-solving process. In fact, Kaizen requires the use of various problem-solving tools. In the case examples, Imai gives much attention to the tools used, such as Pareto- or Ishikawa diagrams. In order to consolidate the new level that is reached with every problem solved, improvements must be standardised. An important tool mentioned by Imai is the Plan-Do-Check-Action cycle, developed by Deming. ‘Plan’ means planning improvements in present practices by using statistical tools. ‘Do’ means the application of that plan. ‘Check’ means seeing if it has brought about the desired improvements, and ‘Action’ means preventing recurrences and institutionalising the improvement as a new practice for further improvement. Thus ‘action’ must not be confused with implementation, it is about standardisation of the solution; implementation takes place in the ‘do’-phase. The phases ‘Plan’ and ‘Action’ are carried out by management. The ‘Check’ phase is carried out by management and inspectors. The ‘Do’ is carried out by the workers. A well planned program for Kaizen can be broken down into three parts: management oriented Kaizen, group oriented Kaizen, and individual oriented Kaizen. Management oriented Kaizen is focused on however many achievements that management chooses in systems and procedures, and is performed by line and staff project teams. Group oriented Kaizen is focused on usually two or three improvements per year within the same workshop, and is performed in small groups or through suggestion schemes. Individual oriented Kaizen is focused on many improvements within one’s own working area, and it is done using the suggestion scheme, it is only focused on generating ideas and not on the whole plan-do-check-action cycle. Further, according to Imai, Policy Deployment is important, which is the process of internalising policies for Kaizen throughout the company from highest the to the lowest level. It is about translating and applying the general strategy to each department of the organisation. Policy deployment calls for everyone to interpret policy in the light of his own responsibilities, and for everyone to develop criteria to check their own success in carrying out the policy. Imai pays some attention to issues such as quality deployment in the design of a product, labour relations and job security during improvements. Much further attention is given to the attitude needed of people to realise Kaizen. In later work (Imai, 1997), much attention is paid to the importance of the shop floor. This is the real place (the ‘gemba’ in Japanese) where the product is made or the service of the organisation is delivered. Imai stresses that managers should spend much time on the gemba; the gemba must be the place where improvements are realised and information is collected.

Many themes in the work of Imai are also discussed in the more general literature on Japanese management and Total Quality Management. What is new in this book is the explicit attention paid to incremental ongoing improvements. Important themes are the use of the knowledge of the people from the shop floor and control by management. It is striking that Imai pays much attention to the contrasts between Japanese and Western approaches. It can, however, be questioned whether the contrasts are as sharp as stated by Imai. Further,
Imai pays much attention to prescriptions on how to organise incremental improvements, and the tools that should be used. In this way, he tries to rationalise and program incremental improvement processes by shop floor people. The ideas of Imai have been highly influential in the West; since his first book emerged, the importance of ongoing incremental improvements have received ever more attention in the West.

1.3.2. Main ideas of Bessant

Bessant (1997) defines continuous improvement as an organisation-wide process of focused and sustained incremental innovation. Continuous improvement is concerned with incremental innovation whose impacts derive from being sustained over time and from a large number of contributors. Continuous improvement capability is composed of a number of associated routines, such as: continuous innovation rather than occasional, empowerment of all staff to participate in innovation rather than dependence on specialists, problem finding and solving rather than problem avoiding as the norm, experimentation as a complement to maintenance of standards rather than rigid concern for the elimination of variation, articulation and sharing of knowledge rather than tacit and hidden knowledge, measuring and monitoring incremental change rather than a focus on major change, rewarding and recognising widespread innovation rather than output-oriented mechanisms. “Despite its attractions, evidence suggests that CI often fails, or fails to take root in organisations which try to implement it. Arguably this is a problem of design and management of CI systems” (Bessant, 1993a). Bessant suggests the need of five key systems:

- An underlying belief/assumptions system that contains the core CI values (Bessant, 1995). There appears to be at least three core cultural beliefs that are important in enabling CI to flourish. The first is a belief in the value of small step incremental innovation. The second belief relates to the view that everyone has creative potential that could be brought to bear. The third cultural value of importance concerns an organisation’s attitude to mistakes. CI by its nature involves experiments and it is unlikely to thrive in a culture in which mistakes are discouraged and people expect to be blamed for them (Bessant, 1993a).

- A CI process system that embodies the core CI behaviours (Bessant, 1995). CI needs to be managed as a process rather than as a single event. It involves a learning cycle, moving from identification, through exploration and selection of improvement suggestions to implementation and review (Bessant, 1993a).

- An infrastructure system which contains the artefacts (structures, procedures, etc.) required to enable CI and is consistent with CI values (Bessant, 1995). Successful CI appears to require supporting infrastructures in the organisation. There are two components to this, a general context within which CI can thrive and develop, and a specific CI enabling infrastructure (Bessant, 1993a).
• A tool system which provides support to, and reinforcement of, CI routines (Bessant, 1995). There is little doubt that CI activities can be enhanced and diffused more widely across the organisation through the use of suitable supporting tools (Bessant, 1993a).

• A strategy system which sets the direction and manages the development of CI routines (Bessant, 1995). CI needs a clear strategic framework and CI needs to be managed strategically (Bessant, 1993a).

Bessant (1996) remarks that prescription is relatively simple, but implementation remains extremely difficult. Making CI work is a complex organisation-wide task and progress along the road to CI may appear slow and demand considerable effort. But CI may represent the key capability necessary for effectively dealing with the uncertainty of the 1990s environment (Bessant, 1993a, 1996).

Bessant discusses improvements as a subject, he sees CI as a subject with properties, but he is vague about what exactly happens in an organisation that has CI. It is not clear what an organisation with CI is actually doing, or which processes are taking place. Bessant gives much attention to the more general conditions needed to realise and control CI in an organisation.

1.3.3. Main ideas of Robinson

Robinson (1991) provides a selection from different textbooks about Japanese techniques and philosophies that can be used to improve operations. When Robinson talks about improvement, he focuses on the reduction of waste; reduction of waste and improvement are one and the same. A main theme in the work of Robinson is that the source of profit is the manufacturing process. Value differs from price, value is the reason a customer buys a product and this value is created in the manufacturing process. Much attention is paid to reducing waste. An ideal condition for manufacturing is where there is no waste in machines, techniques, equipment and personnel, and where they work together to increase the added value to produce profit. Robinson’s book contains many different ideas, tools, and techniques for eliminating waste. Robinson says that in a period of low growth, holding a large inventory causes the waste of overproduction. Waste in stock and overproduction is dangerous. It is best to manufacture everything in a balanced manner, so that a smooth production system is realised. To eliminate waste, a good flow of products in the system is important, and a system should be developed in which the materials needed come exactly at the moment they are needed and in the quantity needed, this is ‘Just In Time’. The concept of Just In Time has several consequences:

• The Just In Time principle is combined with the principle of Kanban. The most important idea in Kanban is that parts will only be produced if they are needed by the next stage of the process. Consequently, the stocks inside the process are very low, and the control of the production of the parts is very simple. Because Kanban is a pull-system, the wishes of the next stage of the process, the (internal)
customer, are the main engine behind an earlier stage of the process, and the process is driven by the customer at the end of the line.

- Because production must be smooth, it is best not to produce large batches of one product and then switch to another product. It is better to produce small batches of different products in turn. Consequently, the lead times between the batches must be as small as possible and reduction of lead times must be a goal.

- If there is an abnormality in production, everything must be stopped immediately to solve the problem. The reasons for the problem must be investigated from the bottom up. Further, problems must be prevented by inspecting parts, or organising the production in such a way that mistakes cannot be made, the poka yoka concept. Maintenance must be focused on preventing breakdowns.

- Working together as a team is important for everything to run smoothly.

Robinson argues that improvement of the existing processes is very important. Every process in production must be regarded as experimental because improvement of the process is always possible. In working on improvements, experiments and trial and error are very important. The most important thing with improvements is to learn how to do things well. The people who perform a job have much experience and through a suggestion system, people from the shop floor can voice their ideas, and management can adopt and implement the ideas. The important thing in a suggestion scheme is to look at the small routine problems in daily work. Careful analysis of an occurrence will usually show there is more than one cause, the true cause is often hidden in first instance. To solve a problem, it must first be understood. This means gathering all the relevant facts. The data collected must be organised so that it is easily understood. Much attention is given to the tools that can be used, and the steps which have to be taken, in a suggestion system.

Robinson promotes the philosophies of Japanese organisations in the West. He has many ideas about the design, organisation, and management of operations and gives many examples from Japan. Compared to Imai, Robinson gives more attention to the design of operational processes, whereas Imai focuses more on incremental improvement processes.
1.3.4. Improvement teams

An important topic in work about continuous improvement is improvement teams. An improvement team is a group of people who work, sometimes assisted by a coach, on the realisation of improvements. Many different ways to realise improvements in groups exist, and therefore several types of improvement teams can also be distinguished. In Table 1-2 an overview of some differences between types of teams is given. Based on this classification, several types of teams in theory are possible, however, only three types of teams are common:

- The first type of improvement team consists of people from one department who work on problems in their own work in a different grouping than in their daily work. Often, in their daily work, the team members have rather individual tasks, while they work as a group on improvements. They work sequentially on different improvements. Often a coach or facilitator assists the team. When an improvement team is discussed in literature, most of the time it is this kind of improvement team. Often, these teams are expected to use formal methods to solve problems. Not many differences exist between the quality circles of the 1980s and this type of improvement team; the basic contents of the quality circle have been regarded in this type of improvement team. One difference between these improvement teams and quality circles is significant. Many companies who used quality circles at the beginning of the 1980s did not realise that quality circles were just a part of a broader philosophy on quality and they didn’t give sufficient attention to the necessary support for quality circles. Now, more than 10 years later, and with all the literature on the importance of TQM, the importance of a facilitating structure for teams is clearer. Therefore, improvement teams could face less problems than quality circles did in the 1980s.

- Another type of improvement team is one with people from different departments. These teams are working beyond the confines of the departments and, in this way, they are a correction to the vertical structure of many companies (Baisier, 1992; Ykema, 1993). Such teams can consist of shop floor people of the organisation, but often staff and middle managers are also members. Often these teams are temporary and focus on solving one specific problem. After the problem is solved, the team breaks up. Because the team exists only temporarily, the activities in the team are separated from the daily work of its members, although it is possible that some members work most of their time in different problem solving teams.

<table>
<thead>
<tr>
<th>Scope of team</th>
<th>Improvements concerning one group or department</th>
<th>Improvements concerning more than one department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouping for daily work versus improvement work</td>
<td>Improvement activities are performed in teams that differ from the grouping for daily work</td>
<td>Improvement activities are performed in teams that correspond with the grouping for daily work</td>
</tr>
<tr>
<td>Permanence of team</td>
<td>Teams exist for the duration of several projects</td>
<td>Teams exist for the period of one project only</td>
</tr>
</tbody>
</table>

Table 1-2: Differences between types of improvement teams
• In another type of team, the grouping in the teams while working on improvements is mostly the same as the grouping for daily work. Often in literature on such teams, the attention is on the organisation of the daily work; these teams are not called improvement teams but they are named according to the organisation principle of the daily work, for example sociotechnical teams or lean production teams. Often, the subject of improvement will be the work of the group. These teams will not split up after one problem has been solved, because they continue to perform their daily work. It is possible that alongside this structure, some members of the group will participate in teams separated from their daily work, for example to work on problems concerning multiple groups, or to work in a team which will be split up after working on a problem.

There are many more variants of improvement teams possible than the three described above. Further, it is important to realise that these teams are just one part of an improvement organisation. Often organisations have many different ways of working on improvements, for example they might use industrial engineering, suggestion schemes, and several types of improvement teams.

1.3.5. Summary of the major themes in literature on continuous improvement

In the preceding sections, the most important developments on continuous improvement were discussed. The discussion showed the major themes in literature. The most important themes are now summarised. A first observation is that several authors treat incremental improvements in organisations as their major subject; incremental improvement is regarded by authors as an important subject that deserves separate attention, and authors promote the importance of incremental improvements. The (cumulative) effect of improvements is regarded as very important. Many authors propose that improvement activities should be aligned with each other to create a large resultant effect. People are pressed to eliminate wasteful practices so that standard operating procedures are constantly improved (Choi, 1995). The availability of a good standard method of working is regarded as important as the improvement of these standards. The alignment of activities is facilitated by the direction given by top management for a corporate mission and vision. Further, improvement activities are predicated on involving everyone in the organisation (Choi, 1995), the importance of using the knowledge of people from the shop floor is especially emphasised. It is often emphasised that it is the task of top management to create a structure and culture that will facilitate improvements by the shop floor people. Much attention is paid to the structures that must be built to ensure that incremental improvements, as a process, runs smoothly and how to control incremental improvements. Authors suggest that incremental improvement is not something that occurs by coincidence without deliberate purpose. One often mentioned structure is the improvement team including people from the shop floor. Another often mentioned structure is a suggestion scheme where people from the shop floor can drop their ideas, and management then decides about implementation (for example Schroeder, 1991). Often attention is given to the need for people from the shop floor to use a structured
approach to solve problems, and training in problem solving techniques is seen as very important.

Attention to continuous incremental improvements rose dramatically after literature on Japan emerged, and much western literature on continuous improvement is heavily influenced by this Japan experience. However, other perspectives on incremental improvements also exist and these are discussed below.

1.4. Other literature on incremental improvements

1.4.1. Concepts on incremental improvements by specialist and managers

Since the beginning of the 20th century, attention has been paid to improvements alongside operational tasks. Much attention has been given to the role of specialists and managers in (incremental) improvements. Several different concepts, ideas, and techniques were developed and some of these are still important in today’s organisations.

Scientific management

Frederick Winslow Taylor (1856-1917) was the founder of the movement known as ‘scientific management’. The mutual interdependence of management and workers, and the necessity of them working together towards the common aim of increased prosperity for all seemed self-evident for Taylor. He wondered why there was so much antagonism and inefficiency, and one of the causes he suggested was that there are inefficient, rule-of-thumb, effort-wasting, methods of work. Taylor said this could be overcome by a systematic study of work to discover the most efficient methods of performing the job, and then by a systematic study of management leading to the most efficient methods of controlling the workers. Taylor formulated four major underlying principles of management: (1) The development of a true science of work: the establishment of what is a reasonable daily task by scientific investigation. (2) The scientific selection and progressive development of the worker. (3) Bringing together the science of work and the scientifically selected and trained worker. (4) The constant and intimate cooperation of management and workers. Management takes on all the work for which they are better fitted than the workers: scientific specification and verification of methods, continuous supervision and control of the workers (Pugh & Hickson, 1989). The preceding discussion shows that Taylor had important ideas on organising incremental improvements. He gave explicit attention to incremental improvements by his search for ‘the one best way’ to perform a task. Further, he separated operational activities from the improvement of those activities and argued that these analytical improvement activities had to be performed in a scientific way by a specialist (the manager).

Industrial engineering and quality control

Taylor’s methods have been followed by many others, who developed his thinking into what is now called Work Study or Industrial engineering (Pugh & Hickson, 1989). Since Taylor, the search for the ‘one best way’ to perform a task has gained an explicit place in organisations through the function of industrial engineering. Industrial engineering is a
profession that, among other things, conducts work studies to improve working methods. The approach employs specialists working as individuals (Schonberger, 1982a). Emphasis lies on the use of quantitative methods and tools to analyse systems by specialists, industrial engineers. The strategy of using industrial engineers to simplify job content was reinforced in America during the 1970s when companies in the US had large numbers of unskilled workers (Cole, 1985), this approach however did not solve the problems of the high rates of absenteeism and turnover. In Japan, industrial engineering is highly esteemed. Often it is the only specialty that exists as a sizeable staff department, and the industrial engineering concepts are influential from the top to the bottom of the organisation. In Japan an industrial engineer is often the right-hand man of a foreman, or an active resource person in quality circles and worker groups (Schonberger, 1982a). An important difference to the American form of industrial engineering is that in Japan industrial engineering is used alongside small group activities on incremental improvements with employees. In the US small group activities were not used so extensively, industrial engineers worked alone on improvements.

A function closely related to, or often even part of, industrial engineering is Quality Control. Western quality control, or quality assurance, employs individual analysis by specialists, not group studies by workers. The objective is the improvement of quality, and procedures (for example statistical quality control charting) are used to realise this. A difference to industrial engineering is that quality control has a quality, rather than a work methods, objective. In Japan, there are few quality control people, since production has the primarily responsibility for quality (Schonberger, 1982a). It is not a specialist function as in the West. Since the 1980s, in many Western organisations the function of Quality Control has developed into Quality Management (see section 1.2.3).

Incremental improvements by managers

Taylor explicitly distinguished the activities in the operational processes from improvement activities. According to Taylor improvement activities had to be performed in a scientific way by a specialist, for example a manager. Today, managers are still expected to perform improvements. Chase and Aquilano (1995) state that the improvement of the production system is a part of operations management, and line management is responsible for it. Many management activities are focused on realising both radical and incremental improvements. Because management activities are very diverse and can be organised in many different ways, the concepts of incremental improvements by managers are also very diverse. Improvements can be realised for example by individual managers, by (multi functional) groups, or in cooperation with others such as specialists. Further, many different tools and techniques can be used by managers when working on incremental improvements. In management literature, incremental improvements are an important subject, and likewise management is an important subject in literature on incremental improvements. However, the two topics have not yet been structured together; the different concepts that exist about managers working on incremental improvements have not been discussed in a structured way.
Conclusion on incremental improvements by specialists and managers

In many organisations, incremental improvements are realised by managers and specialists. However, in organisational theory little specific attention has been paid to these incremental improvement processes. Only in some specialist fields, such as industrial engineering, has attention been paid to it. It is as if working on incremental improvements is so ordinary, and a part of the daily work of specialists and managers in organisations, that it is no longer recognised by organisation theorists.

Alongside concepts on incremental improvements by specialists and managers, concepts also exist that discuss incremental improvements by employees. Some of these are discussed below.

1.4.2. Concepts on incremental improvements by employee participation

Mathematical and statistical developments dominated the evolution of operations management from Taylor’s time up to around the 1940s. One exception was the Hawthorne studies, conducted in the 1930s by a research team supervised by E. Mayo. These experiments were designed to study the effects of certain environmental changes on assembly workers’ output at the Western Electric plant in Hawthorne. To the surprise of the researchers, as reported by Roethlisberger and Dickson, changing the level of illumination, for example, had much less effect on output than the way in which the changes were introduced to the workers. Discoveries such as these had tremendous implications for work design and motivation (Chase & Aquilano, 1995). The influence of the motivation of employees on production performance received more attention in operations management and this led to a growth of research on employee participation. Participation is a process in which influence on decision making is shared between hierarchical superiors and their subordinates (Wagner, 1987). Many organisations let employees participate in diverse aspects of decision making. One argument for participation is that employees have a lot of knowledge about their work and the use of this knowledge will lead to a better quality of decisions (Miller, 1987). McGregor states in his theory Y that many more people are able to contribute to the solution of organisational problems than do so and the potential of the average person is not fully used. Other arguments are that it will lead to an increased motivation of employees, more organisational commitment, and less intention by employees to leave an organisation. A common assumption in literature is that participation leads to better performance (Schonberger, 1982a). Several researchers have examined this assumption, but the findings are inconsistent regarding the effects of participation on various outcome measures (Miller, 1986; Wagner, 1987; Griffin, 1988; Baisier, 1992). A reason for this could be that different forms of participation exist, and the influence of participation on performance can differ if the form of participation differs (Cotton, 1988). Much literature on participation considers the possibilities of letting employees participate in incremental improvements, and thus incremental improvements receive attention. Several of the different concepts are discussed below.
Literature on continuous improvement

Suggestion scheme
One, very old, concept on employee participation in incremental improvement processes is the use of employee suggestions, for example in a suggestion system. Employee suggestions are individually generated ideas on improvement possibilities that generally can receive cash awards. These awards are supposed to improve motivation. Motivation is also improved by the opportunity to participate (Schonberger, 1982a). In some employee suggestion schemes, employees can put their ideas in a suggestion box. A committee decides if a suggestion is good enough to implement, and managers or staff personnel carry out the implementation. Schroeder (1991) shows that employee suggestion schemes have already existed for a long time. He discusses systems dating from 1871, 1894, and 1921 in the USA and Europe. Also in Japan, reward systems for good ideas have had a long history. Schroeder (1991) mentions a shogun from 1721 in Japan who collected ideas in a box and rewarded the good ones.

Scanlon plans
Another old concept on employee participation in incremental improvement is the Scanlon plan. Scanlon plans involve workers acting in groups to cut costs. Savings are passed on to the workers as a whole (Schonberger, 1982a), to shop floor people, staff, and management. The idea originates from an article in 1946 about Joseph N. Scanlon, a trade union official (Geare, 1976), and focuses on the improvement of work methods. With Scanlon plans, motivation of employees is improved by the cash payout, plus the chance to participate (Schonberger, 1982a; Cotton, 1988). The Scanlon plan uses a committee system for processing those suggestions that involve more than just the individual’s job (White, 1979). The committees are usually formed on a departmental basis with an overall screening committee. Their function is to consider employee and managerial suggestions on ways to improve efficiency and productivity (Geare, 1976). Groups often have the authority to make and implement decisions that affect only their work area and they generally have a small budget they can draw on. Often there is a hierarchy of committees, so lower-level groups can pass on to higher-level groups problems that cannot be solved at that level (Lawler, 1985). Scanlon plans were popular in the USA at the end of the 1960s and the beginning of the 1970s.

Work simplification
Another way to organise incremental improvements by employees is the use of a work simplification program. In a work simplification program, supervisors and workers are taught how to conduct systematic method studies through the use of process flow charts, etc. After training, the workers in a group may study and improve their own work. Work simplification programs, a US innovation, had their heyday around 1940. Work simplification is limited to the study of work methods, not quality or morale enhancing improvements (Schonberger, 1982a). It seems the work simplification programs were an attempt to transfer the systematic and scientific quantitative tools used by industrial engineers to the work place.
**Sociotechnical design**

Sociotechnical design is a concept in which the participation of employees and job enrichment gets much attention. It is founded on a study by Trist of the Travistock Institute on the organisation of work in British coal mines in the 1950s. Well known researchers in sociotechnical design are Trist, Miller, Rice, Emery, and, in the Netherlands, De Sitter. Although several different forms of sociotechnical design exist today (van Eijnatten., 1994), some general principles exist. Sociotechnical design systems are described as an approach to work design that integrates the requirements of the social system (people working together in an organisational context), the technical systems (systems, tools, techniques and knowledge used), and the environmental system (for example the customers). Next to increased productivity and flexibility of the organisation, the quality of working life is an important aspect. A central principle is the placing of complex tasks in a simple structure rather than simple tasks in a complex structure. From a sociotechnical viewpoint, the team is the smallest unit of organisation, and vertical and horizontal fragmentation of tasks is prevented by forming autonomous work groups. These groups perform ‘whole tasks’ so that the interdependencies between the group and the rest of the organisation are as few as possible. The tasks of an autonomous group consist of production tasks, planning, and control, but production tasks are the most important of these. Improvement activities are often performed by operational groups instead of by the autonomous task groups. These operational groups work at a higher level in an organisation and they have the specific knowledge needed to improve the production function. Radical innovations generally do not take place within these operational groups but at a higher hierarchical level, the level of the business unit. In sociotechnical design, the structuring of the tasks of the shop floor people gets much attention, but this attention is mainly focused on the organisation of production tasks and control activities. Recently, it was explored how autonomous groups can contribute to product- and process improvements (de Leede, 1997).

**Organisational development**

While organisational development is concerned with improving company performance, a primary focus is on the development, well-being, and fulfilment of people. It uses techniques from behavioural sciences to improve performance (Daft, 1992). It is both worker and specialist oriented. A premise in organisational development is that organisations have to learn how to renew themselves. The organisational development specialist has the role of a coach who tries to start up processes of change by providing feedback on what happens within groups of the organisation (Assen, van, 1983). Formal procedures are often followed in developing prescriptions for change. Objectives of organisational development are morale-enhancing changes and motivation gained by worker involvement. Organisational development specialists employ an extensive set of social-psychological tools, and sometimes they view quality circles as just one more ‘intervention strategy’ (Schonberger, 1982a). Organisational development is not specifically focused on incremental improvements, although they can be part of it.
Literature on continuous improvement

Work counselling

Work counselling (in Dutch: werkoverleg) is a form of participation. In work counselling, all employees of a department meet in a regular formalised meeting. The head of the department leads the meeting, so the hierarchical lines are kept intact. People discuss subjects that are important to the work of their own department, for example problems or possible improvements. Participation is not voluntary, work counselling is seen as a part of everyone’s job. Often the only standardised methodology used is an agenda for the meeting. Other methodologies are not used, because the subjects to be discussed are too diverse. The roots of work counselling can be found in the 1960s when people discussed the quality of working life, and work counselling was expected to be a way to raise this quality (Baisier, 1992). The objectives of quality of work life programs are broad: emphasising morale enhancing changes and motivation, and also can sometimes include work methods, quality, and product design (Schonberger, 1982a). During the 1980s, attention shifted to quality management and, in literature on quality management, participation is an important subject, although there is more attention paid to economic motives than in earlier work (Baisier, 1992).

Employee committees

Another kind of participation are committees on more specific goals of a company, for example a committee focused on the assurance of safety or personnel issues. Often these committees consist of employees who participate on a volunteer basis and delegates from management. On a regular basis, for example once a month, the committee discusses small scale problems within their specific interest (Baisier, 1992). These committees work on incremental improvements at the work place, often focused on one specific subject.

Conclusions on incremental improvements by employee participation

The discussion has showed that many different concepts have been developed for employee participation. In literature on participation, authors discuss in detail how participation can be organised and much attention is paid to what the results of participation will be. Incremental improvements are a minor topic; often the organisation of incremental improvements is not discussed in much detail. In literature on participation, less attention is paid to the use of quantitative analytical tools, compared to, for example, the literature on continuous improvement or incremental improvements by specialists. Much literature on participation focuses on the promotion of one concept, for example sociotechnical design. It seems as if the concepts have to be ‘sold’ to organisations in practice. Concerning this promotion of concepts, it is surprising that many the concepts on participation of employees (exceptions are suggestion schemes and employee committees) have been used in practice for only a limited period or by few organisations. This can be contrasted with concepts on incremental improvements by specialists and managers. These concepts are less often mentioned in organisation theory, but they are used by many organisations in practice.
1.5. Overview of the different concepts on incremental improvements

The tables below present an overview of the different concepts on incremental improvements that have been discussed in the preceding sections.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Activities performed</th>
<th>People involved</th>
<th>Arrangements</th>
<th>Tools used</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality circle</strong></td>
<td>Identification and analysis of problems by the circle, authorisation and implementation by management</td>
<td>A voluntary group of employees, often assisted by a coach</td>
<td>Formal grouping of people into groups; formal meetings; formal procedures for who performs which activities in the improvement process</td>
<td>Diverse problem solving tools, statistical tools; team building techniques.</td>
</tr>
<tr>
<td><strong>Lean production</strong></td>
<td>Work groups solve small production problems; specialists try to eliminate waste and contribute to quality</td>
<td>Work groups of employees; specialist (designers, industrial engineers)</td>
<td>Formal grouping of people into work groups; formal groups or departments with specialists</td>
<td>Specialists use ideas from operations management and industrial engineering</td>
</tr>
<tr>
<td><strong>Improvement team</strong></td>
<td>Identification and analysis of problems by the team, often also authorisation and implementation by the team. Different improvement processes follow each other</td>
<td>A voluntary group of employees, often from one department, and often assisted by a coach</td>
<td>Formal grouping of people into groups; formal meetings</td>
<td>Diverse problem solving tools; team building techniques.</td>
</tr>
<tr>
<td><strong>Interdepartmental improvement team</strong></td>
<td>All activities of one specific improvement process</td>
<td>Staff and managers from different departments, sometimes also employees</td>
<td>Formal grouping of people into temporary groups; formal meetings</td>
<td>Diverse problem solving tools</td>
</tr>
</tbody>
</table>

Table 1-3: Concepts on incremental improvements based on literature on Japan
### Concepts on incremental improvements by specialists and managers

<table>
<thead>
<tr>
<th>Concept</th>
<th>Activities performed</th>
<th>People involved</th>
<th>Arrangements</th>
<th>Tools used</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial engineering</strong></td>
<td>Analysing improvement possibilities in operational processes</td>
<td>Specialists</td>
<td>Often a formal group or department with specialists</td>
<td>Many different formal systematic methods to analyse quantitative data</td>
</tr>
<tr>
<td><strong>Quality control</strong></td>
<td>Inspecting products, analysing quality improvement possibilities</td>
<td>Specialists</td>
<td>Often a formal group or department with specialists</td>
<td>Statistic methods to analyse quantitative data</td>
</tr>
<tr>
<td><strong>Improvements by managers</strong></td>
<td>Solving operational problems, improving operational processes</td>
<td>Supervisors and managers</td>
<td>Ad hoc projects; sometimes multi-functional project groups focused on one specific operational improvement</td>
<td>Project management tools</td>
</tr>
</tbody>
</table>

*Table 1-4: Concepts on incremental improvements by specialists and managers*
The overview of the literature shows that many different concepts exist that discuss incremental improvements. The overview also shows that incremental improvements can be

<table>
<thead>
<tr>
<th>Concept</th>
<th>Activities performed</th>
<th>People involved</th>
<th>Arrangements</th>
<th>Tools used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggestion scheme</td>
<td>Suggestion of improvement ideas by employees, authorisation of idea by committee, implementation by management</td>
<td>Individual employees; committee of experts</td>
<td>Formal procedure used to evaluate suggestions; formal committee of experts</td>
<td>Formal scheme for rewards</td>
</tr>
<tr>
<td>Scanlon plan</td>
<td>A hierarchy of groups tries to solve problems and implement ideas at their own level. Higher level groups solve more complex problems.</td>
<td>All employees, working in groups</td>
<td>Formal grouping of people into groups and levels; formal meetings</td>
<td>Formal scheme for rewards</td>
</tr>
<tr>
<td>Work simplification</td>
<td>Systematic work method studies</td>
<td>Employees and supervisors in a group</td>
<td>Formal grouping of people; formal meetings</td>
<td>Use of formal methods for analysis</td>
</tr>
<tr>
<td>Sociotechnical design</td>
<td>Operational groups work on improvements</td>
<td>Mostly operational groups, less often autonomous groups</td>
<td>Formal grouping of people</td>
<td></td>
</tr>
<tr>
<td>Organisational development</td>
<td>Specialist coaches on the organisational change process</td>
<td>Specialists together with employees in a group</td>
<td>Formal procedures used in the prescriptions for change; formal grouping of people; formal meetings</td>
<td>Specialists use socio-psychological tools</td>
</tr>
<tr>
<td>Work counselling</td>
<td>Discussing diverse problems in own department</td>
<td>Supervisor and employees in a group</td>
<td>Formal grouping of people; formal non-voluntary meeting</td>
<td>Agenda for meeting</td>
</tr>
<tr>
<td>Employee committee</td>
<td>Discussing one specific subject</td>
<td>Employees and some managers in a group</td>
<td>Formal grouping of people; formal meeting</td>
<td>Agenda for meeting</td>
</tr>
</tbody>
</table>

Table 1-5: Concepts on incremental improvements by employee participation
organised in many different ways. However, many more concepts are still possible, and in the future, there may be new concepts that we have not even thought of today.

1.6. Discussion of the literature on continuous improvement

1.6.1. Influences on the concept of continuous improvement by other concepts

The overview of different concepts of incremental improvement has shown that the attention to incremental improvements is not new. More than a century ago, people were already thinking about smart ways to better organise incremental improvements. Since then, many different concepts have emerged, and many of them have also disappeared. However, elements of earlier concepts are still present. For example, ideas on quality circles and worker participation still exist in improvement teams. These older concepts might not be on the surface so much, but they form an important basis for the new concepts on continuous improvement. The older concepts can be compared with the roots of a large tree; they are not on the surface, but they are important because they feed the parts that are visible. The parts that are on the surface can never be fully understood without an understanding of the less visible parts beneath the surface. Thus, to understand today’s concepts on incremental improvement, it is important to understand their history. The overview helps in understanding the concepts of today and tomorrow better. The influences of several concepts on the concept of continuous improvement are discussed below.

Bessant (1995) argues that there are a number of different paths that have led to the concept of continuous improvement. Routes towards continuous improvement have been via the work on Total Quality Management and via lean production. Another road that has been travelled is that which began in the human relations school and was particularly inspired by the work of the Tavistock Institute on social-technical systems. Here the dominant themes are how the workgroup can become a source of improvements, and how this can be enabled. Another road has been travelled when trying to solve manufacturing problems by large investments in advanced technology. During these investment projects, attention increased for integrating people into key roles, and for changing organisational structures to make the best use of new technological opportunities. Part of this process is a recognition of the contribution continuous improvement can make to the performance of technologies themselves. Another road to continuous improvement can be seen in the field of innovation management research, where there is growing interest in the possibilities of wider involvement in the innovation process, and of sustaining incremental innovation (Bessant, 1995). The influences of several of these paths can be clearly identified in literature on continuous improvement as was discussed in this chapter. In general, literature on continuous improvement has much in common with literature that emerged after the increased attention paid to Japan, for example literature on Total Quality Management, and lean production. Major themes are the importance of incremental improvements, attention to operational processes, the use of the knowledge of the people from the shop floor, the use of teams, the importance of management taking care of a proper organisation around the improvement processes, and the
use of systematic methods. Differences in literature arise because the emphasis of each stream differs somewhat, as was shown in the previous sections. When the major authors on continuous improvement are examined several paths that were influential can be identified. The ideas of Imai and Robinson are clearly influenced by literature on Total Quality Management and lean production. The work of Robinson is mostly related to lean production since he explicitly discusses the organisation of operational processes; Imai gives less attention to this aspect, he focuses on the incremental improvement processes. It is striking that Bessant hardly refers to Japan when he discusses continuous improvement. His interest in continuous improvement is less based on Japan; it stems more from innovation management and the implementation of new technologies. Several themes in literature on continuous improvement have correspondences with Taylor’s scientific management. These include the importance of the availability of good standards, and the continual efforts to improve these standards, and the task of management to create a structure that will facilitate improvements made by people from the shop floor. Furthermore, several themes are shared with industrial engineering, for example the importance of using a structured approach to solve problems, and the importance of training in problem solving techniques. Literature on continuous improvement is also influenced by literature on employee participation. Its main influences are: (1) the idea that it is good to use the knowledge of shop floor employees in improvement processes, and (2) the role of rewarding employees for their efforts in improvement processes. Some of the concepts on employee participation are (partly) used in continuous improvement, for example suggestion schemes.

1.6.2. Discussion of the literature on continuous improvement

In the overview of the literature, the literature on continuous improvement was only described; in the next sections, the literature is evaluated. In discussing the literature on continuous improvement it is useful to categorise the literature into three types (see de Lange-Ros, 1998):

1. The first type of literature is attention literature. This literature stresses the importance of incremental improvements. Sometimes authors try to raise the perceived importance of the subject by the use of strong metaphors which ‘sell’ their subject very effectively. This literature often discusses general prescriptive conditions for continuous improvement, but it can be questioned if these prescriptions are based on scientific research. The work of Imai and Bessant falls into this category (for another example see Mertins, 1997). A strong feature of this type of literature is that it shows the importance of incremental improvements and it directs attention to the subject.

2. The second type of literature is descriptive literature. This literature describes a large variety of techniques that are used in practice. The work of Robinson is a clear example of this type (further see for example also Hessenberger, 1997). In the field of continuous improvement, the techniques described are often imported from Japan, such as Just In Time production, poka yoka, or the quick exchange of dies. Literature also exists that examines the spread of continuous improvement and the practices used (see for example...
Literature on continuous improvement

Gieskes, 1997; Chapman, 1997; Coughlan, 1997). The strong feature of this literature is that it describes the different practices of incremental improvements.

3. A third type of literature on continuous improvement is theory building literature. This literature is based on an examination of what is going on in practice and it then tries to build a theory based on the descriptions and categorisations of practice. Theory building literature gives attention to explaining empirical observations, it tries to explain why things happen in a specific way and it investigates the mechanisms and rules behind the observations. Continuous improvement theory building literature often stresses ways to organise incremental improvement. It discusses for example what an improvement team is, which types of teams exist, and why teams are important. (see for example van Leeuwen, (1993), Choi, 1995; Berger, 1997; Lindberg, 1997; Riis, 1997; Bartezzaghi, 1997; Smeds, 1997; and several contributions to Boer 1998). A strong point of this type of literature is that it explains what is going on in practice.

Much of the popular literature on continuous improvement is of the attention type; authors emphasise the importance of continuous improvement and they promote the concept. Following the success stories on incremental improvements, written for example by Imai or Bessant, organisations have recognised the importance of improving processes and the role of incremental improvements alongside innovations. Dean (1994) argues that management theorists have only a limited coverage of topics on the management of the quality of the process, such as how design, operational, and support processes are designed and improved. TQM and continuous improvement literature pays much attention to these processes. This is a major contribution from existing literature that should not be neglected. However, until recently, less emphasis has placed on describing what is happening in practice and attempting to build theory that explains what is going on. This is reflected in several ways:

- Most of the existing literature on incremental improvements assumes that continuous improvement is problematic. Gerlach (1996) suggests that literature on business re-engineering has certain common characteristics that shape its textual practices. Also in literature on continuous improvement, several common arguments are used without question by many theorists. A major common theme is that companies have to change, to improve, to stay in business. Often this is related to Japan and it is claimed that Japan performs better than the West and that this is a threat to the future of the West. To save the West, companies in the West have to change, and one of the things they have to change is their organisation of incremental improvement processes. Almost no discussion exists on several of these statements, for example: that companies should improve, that Japan performs better, and that this better performance of Japan is a threat to the Western world. Of course these statements can be questioned or examined in more depth. For example, Eccles (1992) wonders how our description of good management would look like now if Germany, a country also with large economic development, had been the centre of our interests in the 1980s because of the success of a hypothetical book ‘Theory G’, instead of the book ‘Theory Z’ from Ouchi that focused on Japan.
Most literature on incremental improvements is focused on prescribing solutions. First, a problem is described: the West is not competitive enough. Then the solution is offered: organisations should pay more attention to incremental improvements. Literature then concentrates on describing what this solution is, what should be done to solve the problem. Consequently, literature is offering recipes. While prescribing solutions, several aspects get much attention:

- Much attention is paid to the tools that must be used, for example tools to analyse data, such as Pareto-diagrams or histograms. Other important tools are action plans that should ensure that the right steps are taken during an improvement project. Much literature on tools is normative: the use of a tool is said to be essential for success.

- Much attention is paid to the description of ways to organise incremental improvements. Supportive structures, like working in teams or using a suggestion box, are emphasised and a major part of the overview of the literature consisted of an overview of different types of such supportive structures. Some authors give an overview of different structures and emphasise in which circumstance which supportive structure will develop and can be used (see for example Cole, 1985; van de Water, 1988; Baisier, 1992; Cutcher-Gersenfeld, 1995).

- Much attention is paid to ways of controlling the shop floor people and improvement projects. The focus is on how a manager can control incremental improvements. Shop floor people are seen as very important in realising incremental improvements, because they have a lot of knowledge that is yet not used. The attention than shifts to ways managers can control the shop floor people when they work on improvements. One often mentioned way of controlling the shop floor people is by ‘shaping the right culture’, so people do the things you want them to do. Gerlach (1996) notes that other writers about business re-engineering implicitly state that employees can be programmed with corporate values. In literature on incremental improvements this also gets a lot of attention. Much attention is given to the importance of designing a strategy and a culture that support and control incremental improvements by shop floor people.

The object of literature on incremental improvements is to offer solutions to managers, but the scientific base of the prescriptions is not clear. Most recipes are based on best practice stories or obscure data that are not clear to the reader. This makes it hard to use literature to build a theory. Hackman (1995) concludes about TQM: “If knowledge of the effects of TQM on organisational effectiveness is to cumulate, researchers must focus less on evaluation studies of the 30-percent-gain-in-productivity variety and more on research that includes both explicit manipulation checks and measurement of process criteria”. With regard to continuous improvement emphasis is placed on attention literature which sells the subject rather than on theory building. Because the scientific base of the recipes is not clear, it is uncertain if the solutions offered will really work in practice. Hackman (1995) says: “Too much of the TQM literature consists of anecdotal case reports or
Literature on continuous improvement

simplistic before-and-after evaluation studies, that may be of more use politically in promoting TQM than they are in building knowledge about TQM processes and practices”. Wood (1983) gives a reason for the many success stories told about quality circles: those telling the stories are often either the managers responsible for the program or consultants who are selling their concepts. The storytellers have something to gain with a success story. Dean (1994) argues total quality initiatives often do not succeed, but as yet there is little theory available to explain the differences between successful and unsuccessful efforts. These comments are not only relevant for to on TQM, but also to literature on continuous improvement. This literature is also focussed on promoting concepts, and it gives many recipes whose scientific base is not clear.

- **Existing theory is not adjusted to contingencies.** Most literature offers general recipes for every situation. “TQM recommendations tend to be context independent and, therefore, implicitly universal. There is little attention in TQM devoted to the boundary conditions for TQM applicability, or even how variation in organisational settings might be reflected in TQM implementation” (Dean, 1994). Literature on incremental improvements in general is also seldom adjusted to contingencies. Sometimes it is mentioned that the solution should be adjusted to the specific situation but almost never do authors give insights into how this should be done (Ros, 1997a).

Aside from the criticisms about the theoretical level of much literature on continuous improvements, several other remarks about the existing literature are worth making. A strong feature of the existing literature is that it gives attention to the organisation as a system and to the technical aspects of the organisation. Dean argues that the core ideas behind TQM are that organisations are sets of interlinked processes and that the improvement of these processes is very important. The set of interlinked processes is seen as a system. With this focus, TQM highlighted, as did sociotechnical design, the importance of treating the organisation as a system. “Management theorists may have gone too far in emphasising sociobehavioural over process and technical factors in explaining variation in processes. (...) Management researchers have rarely extended their theories to include both social and technical aspects of organisational and process design. The lesson of the Hawthorne studies should have been that both of these aspects are important for organisational success.” (Dean, 1994). In literature on continuous improvement, much attention is paid to the organisation as a system and also to the more technical aspects of the organisation. This can be considered as a strength of the existing literature. However, it might also be argued that the existing literature goes too far in its emphasis on rational technical processes. Much of the literature on incremental improvements assumes a rational model about information processing. Dean (1994) analyses the way TQM handles information. “Literature on TQM suggests that organisations that consistently collect and analyse information will be more successful than those that do not. (...) In fact, the TQM prescriptions to scrupulously collect and analyse data in order to enhance organisational effectiveness is quite similar to the well-known rational model of decision making (...). Several themes in the research literature, however, comprising a less optimistic view of how information is actually used in organisations, complicate the
link between analysis and performance. Other researchers have concluded that rational, comprehensive information processing is of limited usefulness or even counterproductive under conditions in which multiple problem definitions are possible, goals are ambiguous, or uncertainty is great”. Literature on continuous improvement ignores objections already made to the rational way of working and still uses the rational model. It is accepted nowadays that the rational model of decision making fits well in situations with not much uncertainty, but not in highly uncertain situations. It is therefore striking that literature contains claims that organisations can better handle the uncertainties of today with their rational models. One field of literature that might be promising in this regard is organisational learning. In this field, improvements in organisations get attention, but rational models for information processing are less used. Influences in the literature on organisational learning might be very promising in the development of the field of continuous improvement. Bessant (1995, 1996) has already made some attempts to integrate ideas on organisational learning with continuous improvement.

1.7. Conclusion

1.7.1. Lack of theory about continuous improvement

As the discussion of the existing literature has shown, much of the well-known literature on continuous improvement is of the attention type. Emphasis is on promoting incremental improvements and showing the importance of the subject. Because of this, the subject of continuous improvement has been recognised and it has had much attention. However, attention literature also has its weaknesses, since not much effort is put into describing what is going on in practice, and building theories that can explain these observations. The major contribution from the existing literature on continuous improvement is that it places attention on the concept. Less attention is paid to describing what is going on in practice, and building theories that can explain these observations.

The promotion of the importance of incremental improvements inspired organisations to give more attention to the subject and many companies tried to organise incremental improvements. However, in practice, several attempts to organise incremental improvements failed. Dean (1994) argues total quality initiatives often do not succeed, but as yet there is little theory to explain the differences between successful and unsuccessful efforts. This also holds true for continuous improvements; Bessant says that evidence suggests that CI often fails, or fails to take root in organisations that try to implement it. He argues that despite its apparent simplicity, making continuous improvement work is a complex task and he argues that there is a need to develop our understanding of the routines associated with creating and sustaining incremental innovation (Bessant, 1993a, b). Lindberg (1997) also notes that Western organisations have expressed a need for a better understanding the processes of continuous improvement. One important shortcoming of the existing literature is that it has promoted continuous improvements, but the failures in practice have not been studied in
detail. Consequently, companies often know that they should improve, but they do not know what to do or which problems they can expect. Often organisations have to find all the relevant knowledge by trial and error, a way of working that costs a lot of time and effort. There is a lack of literature that describes what is going on in practice, and builds up more general theories that can be used to transfer knowledge about incremental improvements to other organisations and contexts.

There is a lack of theory that explains to organisations why efforts to realise incremental improvements fail in practice.

1.7.2. Research goal

A goal of this research is to solve the theoretical and practical problems of the lack of theory on continuous improvement. The aim of this research is to contribute to the development of theory on continuous improvement. Based on what is going on in practice concerning incremental improvements, theory will be developed that explains the practical situations. Because not much theory on continuous improvement exists, the emphasis in the research will be on developing new theory and less on testing existing theory. In addition, it is an aim of the research to contribute to the practice of continuous improvement. Therefore, another goal of the research is to develop theory that is practically of use for organisations.

As the overview of the literature on incremental improvements has shown, many different concepts for organising incremental improvements exist. Not all of them can be examined in depth in this research; a focus is needed. Because there is a lack of theory that describes and explains what is going on in practice, the focus in this research is based on concepts that are popular in practice, on the major practices of continuous improvement. Recent surveys (see for example Gieskes, 1997; Chapman, 1997) show that the organisation of continuous improvement activities, in practice, is that shop floor and improvement teams are the ones that perform the improvement activities, while senior management is responsible for direction setting with little actual involvement in improvement activities. Thus, in practice incremental improvements performed by teams are an important topic. In addition, literature gave attention to incremental improvements in teams. Several authors stressed that everyone in an organisation should be involved in incremental improvements (see for example Imai, 1986; Robinson, 1991; Bessant, 1995), and working in teams is one of the ways to realise this. In other literature on incremental improvements, working in teams has received much attention, for example in literature on quality circles, Scanlon plans, organisational development, sociotechnical design, and work counselling. Thus, working in teams is regarded both in practice and in literature as one of the concepts that can be used to realise improvements and it could become an important practical way of realising incremental improvements in the future. Therefore, focus in the research is on incremental improvements by teams. The goal of the research is to develop theory that explains incremental improvements by improvement teams. In the next chapter, it will be discussed in more detail what the research goal will be exactly.
1.7.3. **Structure of the thesis**

In the subsequent chapters, the following subjects will receive attention:

- In the next chapter, the view of the world, and the view of organisations as used in this research will be described. Based on these views, a theory is developed that helps to explain incremental improvement processes as performed by improvement teams. After this discussion, the research questions are formulated.

- In the third chapter, the research methods that were used to answer the research questions are described. The chapter discusses the research design, the methods that were used to collect data, and the framework that was used to analyse the data. In addition, the research questions of the second chapter are operationalised.

- The fourth chapter discusses the relevant context of the improvement teams that were examined. The case descriptions are not included in the thesis. The full database with case descriptions is available on: http://www.sms.utwente.nl/vakgr/teno/eng_edu_contineth.html

- The analysis of the case data is discussed in two chapters. The first analysis chapter, the fifth chapter of this thesis, discusses the analysis of the different improvement activities that were performed by the teams.

- The second analysis chapter, the sixth of the thesis, focuses on the correspondences and differences between the improvement tasks and the operational tasks. It discusses how the improvement tasks differed and corresponded with the operational tasks, and it gives reasons why problems occurred with tasks or not.

- The final chapter, the seventh, reflects upon the analyses of the fifth and sixth chapter. It contains a discussion and further explanation of the research results. In this final chapter, the major contributions made by this research, and directions for further research, are discussed.
Chapter 2: Theory to explain improvements in teams


The goal of the research is to develop a theory that explains incremental improvements by teams. This chapter works towards the research questions. To analyse incremental improvement processes, several different views of the world and of organisation can be used. Which view is used, influences the problems that will be found and the knowledge that is built up. First, the more general view of the world as used in this research will be discussed. Based on this view of the world, the view of organisations used in this research is described.

2.1. View of the world

Each researcher has his own ‘view of the world’, his personal perception of the world. This view is highly influential on the research and thus it is important to describe this view as well as possible to others. Gummeson discusses this when he says: in the practice of today’s research, a platform of the absolute truth is subjectively chosen. Lacking an “absolute truth” from which to approach the world, we create via social consensus an absolute reference point, our paradigm. Mainstream scientists who just apply “approved” methods without being aware of the subjective foundation of their activities are not scientists, they are technicians (Gummeson, 1991). In this research, many subjective foundations were relevant, they are called the ‘view of the world’. This view of the world was not deliberately chosen at the start of the research; it was influenced by the research traditions in the group where the research was performed. The view of the world accompanied a view of the organisations and the theoretical model that was used in the research. Although the view of the world was not deliberately chosen, it is very influential on the research; to understand the theoretical model used in the research, it is important to understand the accompanying view of the world. In the following paragraphs, the view used is explained.

Organisations can, at least partly, be seen as social systems. In studying social systems, several different views of the world can be used. Based on Burrel and Morgan, Jackson

³ Unofficial translation: “Wait”, I called, “how do I proceed from here?” Looking away from me, the ferryman said: “It depends on what you hope to find. There are people who think the island has something to give to those who search. As if someone can find something that one does not contain within oneself already”.
(1991) makes a distinction between objective and subjective assumptions about the nature of social science. The table below gives an overview of the differences between those two fundamental views of the world.

<table>
<thead>
<tr>
<th>Assumptions about nature of social science:</th>
<th>Objective</th>
<th>Subjective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social reality is perceived as</strong></td>
<td>Having a hard, objective existence, external to the individual (realist ontology)</td>
<td>Having a more subjective existence as the product of individual and/or shared consciousness (nominalist ontology).</td>
</tr>
<tr>
<td><strong>Theory will seek to</strong></td>
<td>Establish the existence of regularities and causal relationships in the social world (a positivist epistemology)</td>
<td>Acquire knowledge by attempting to understand the viewpoint of people involved in creating social reality (antipositivist epistemology)</td>
</tr>
<tr>
<td><strong>Human behaviour will be seen as</strong></td>
<td>Being determined by external circumstances (determinist)</td>
<td>Possessing free will (voluntarist)</td>
</tr>
<tr>
<td><strong>Preferred techniques for acquiring detailed knowledge</strong></td>
<td>Scientific tests and qualitative analyses (nomothetic methodology).</td>
<td>Getting as close as possible to the subject under investigation (ideographic methodology)</td>
</tr>
</tbody>
</table>

*Table 2-1: Objective versus subjective assumptions about the nature of social science (based on Jackson, 1991)*

Based on the differences between objective and subjective assumptions about the nature of social science, Jackson (1991) discusses different paradigms that are used in systems thinking. He distinguishes among others a *functionalist* paradigm, which is based on objective assumptions, and a *interpretive* paradigm, which is based on subjective assumptions. The discussion of the differences between a functionalist and an interpretive paradigm in systems thinking illustrates the differences between the objective and subjective assumptions in more detail. If systems are viewed from within the *functionalist paradigm*, they seem to have a hard, easily identifiable existence independent of the observer. The working of such a system can be understood if regularities in the relationships can be found between subsystems and the whole. Human beings in the system present no more problem than the other component parts. It is possible to construct a quantitative model of the system (Jackson, 1991). If systems are viewed from within the *interpretive paradigm*, they seem to be much ‘softer’, to elude easy identification and to possess a precarious existence, only as the creative constructions of human beings. Such systems can be understood only by trying to understand subjectively the points of view and the intentions of the human beings who construct them. The presence in the system of human beings possessing free will makes a profound difference to the form of analysis undertaken. It will not normally be possible to construct a quantitative model of such a system. Detailed information about the system must be acquired by getting involved in the activities of the system; by getting inside it (Jackson, 1991). In this research, the functionalist paradigm is used. Several variants of this paradigm exists. The next paragraph explains which variant is used in this research.
Jackson remarks that not all objectivists need to be positivists. A distinction can be made between positivists and realists (Jackson, 1991). This research is conducted from a realist perspective. Positivists focus on the patterns and regularities that are on the surface of the social world, the social facts. Their understanding of patterns and regularities is based on studying well-established regularities. Realists dig beneath the surface to discover ‘structures’ that determine the arrangements of the social facts. Their understanding of patterns and regularities is based on the causal mechanisms producing the observable patterns and regularities. For the realists, unlike the positivists, there is an important difference between explanation and prediction. For them, explanation must be pursued as the primary objective of science. To explain phenomena is not merely to show that they are instances of well-established regularities. Instead, a researcher must discover the necessary connections between the phenomena, by acquiring knowledge of the underlying structures and mechanisms at work. Often, this will mean postulating the existence of types of unobservable entities and processes that are unfamiliar: but it is only by doing this that the researcher goes beyond the ‘mere appearances’ of things, to their natures and essences. Thus, for the realists, a scientific theory is a description of structures and mechanisms, which causally generate the observable phenomena, a description that enables him to explain them (Jackson, 1991, referring to Keat and Urry, 1975). For a realist, there is more than the appearance of things; there is something behind the appearance that can explain it. Jackson calls the theoretical orientation based upon a realist epistemology ‘structuralism’. Structuralism is concerned with uncovering and understanding the structures, or systems, of relationships that generate the surface phenomena perceived in the world. It demands explanations of the phenomena available to our senses in terms of the underlying, unobservable mechanisms that generate them. Structuralists attempt to provide models of the causal processes at work at the deep structural level that produce observable phenomena and the relationships between surface elements (Jackson, 1991). Miles and Huberman when describing transcendental realism, give a view of the world that has much in common with structuralism from Jackson. From this perspective, it is assumed that social phenomena exist not only in the mind, but also in the objective world, and some lawful and reasonably stable relationships can be found among them. The lawfulness comes from the regularities and sequences that link phenomena together. From these patterns, constructs can be derived that underlie individual and social life. Social phenomena exist objectively in the world and exert a strong influence over human activities because people construe them in common ways. In this view, researchers look for a mechanism, or a structure, at the core of events that can be captured to provide a causal description of the forces at work. Social facts are embedded in social action, just as social meaning is constituted by what people do in everyday life. These meanings are most often discovered by hanging around, watching people carefully, and asking them why they do what they do (Miles & Huberman, 1994). This view agrees with interpretivists that knowledge is a social and historical product and that ‘facts’ come to people laden with theory. The importance of the subjective and meaning making in social life is affirmed. The aim is to register and ‘transcend’ these processes by building
theories to account for a real world that is both bounded and perceptually laden, another aim is to test these theories. These tests do no use covering laws or the deductive logic of classical positivism. Rather, explanations flow from an account of how differing structures produced the observed events. The researcher looks for a process, a mechanism at the core of events that can be captured to provide a causal description of the forces at work. This calls for both causal explanations and for the evidence to show that each entity or event is an instance of that explanation. Therefore, both an explanatory structure, and a grasp of the particular configuration are needed (Miles & Huberman, 1994).

A realist perspective is used to study social phenomena in this research. It is assumed that a researcher is able to describe and understand (parts of) the social life of the people he is observing. An important part of the research is the observation of phenomena in the world ‘out there’. Further, the researcher looks for a process, a mechanism at the core of the observed phenomena, that can explain the observed phenomena; he tries to construct a model with propositions on social life. This model is an interpretation of the observed phenomenon by the researcher. It consists of an explanation of the observed phenomena in terms of the underlying, unobservable mechanisms that generate them. By this model, social phenomena are understood. Further, a link exists between the research and future actions. Based on the understanding of the world developed in the research, insights are generated that can be used to guide future actions by people. This link between the research and future actions is reflected also in the goal of the research: to generate insights that can be used by organisations to realise incremental improvements. Figure 2-1 shows the view of the world used in this research.

Figure 2-1 highlights that an important aim of the research is to develop insights that can guide future practical actions by people. This implies that it is important to have ideas about whose actions should be guided by the ideas of the research. The research is about problems in improvement processes. People who may have interests in this research are: operations managers, quality managers, general managers of an organisation, people who have to co-ordinate and implement improvement teams, people working on the shop floor and in improvement teams. The perspectives, goals, and actions of these groups of people differ. Consequently, also the insights of the research might differ, according to the group of participants whose actions it wants to guide. Thus, it is an important choice in the research for whom it wants to develop insights and guidelines for action. The research focuses on the perspective of the people who have to manage improvement processes. The
research wants to develop a theory about incremental improvements that can help them in their actions. In the research, it is assumed that an organisation has the goal of realising as many improvements as possible; this goal not questioned in the research. Also the operational function of the organisation, performing transformation processes, is not questioned.

2.2. View of organisations: the process model

In this research, the realist view of the world is accompanied by a specific view of organisations: the process model (see Boer, 1993). The process model is not used simply because it is the only useful way of regarding organisations, or because it is the best way of thinking in general. It is used because it could give some useful new insights about specific questions of this research. This process model of organisations was developed by Hulshoff (1982), During (1984), Krabbendam (1988), Boer (1991), and Schuring (1997). In this section, this process model of organisations is described. First, the assumptions about functions of the organisation and effectiveness are considered. Then the model of the organisational configuration is discussed. Following this, the concept of consistency is discussed and definitions of the main concepts of the process model are given. Finally, based on literature on systems thinking in organisations, a reflection on the process model is offered and it is argued that the model is appropriate for this research.

2.2.1. Functions of the organisation

In the process model, an organisation is a whole of people and resources that tries to realise certain goals (Boer, 1993). Thus, the organisation has goals, it is a purposeful whole. An organisation will usually have multiple goals, serving different purposes, which at times may appear incompatible or conflicting, the goals are not given or fixed. The process model emphasises that, at the end of the day, it is management that must choose the goals they wish to pursue and decide which goals should be given less priority. This means that the starting point for the description of the goals in the process model are the goals of management as a dominant coalition (de Weerd-Nederhof, 1998). It is assumed that management as a dominant coalition sets the goals for the organisation as a whole.

In order to achieve its objectives, the organisation transforms inputs into outputs which are beneficial to the environment of the organisation (Boer, 1991). Organisations exist because they deliver goods or services that are demanded by their environment (Boer, 1993). In order to survive, the organisation must enter into transactions with its environment (Boer, 1991). In delivering goods to the environment, the organisation transforms inputs into outputs (Boer, 1993). This transformation of inputs into outputs is the function of the organisation; it is shown in Figure 2-2. The functions of the organisation are important in two ways: (1) They are important for the organisation
itself, to realise its goals. (2) They are important to satisfy the wishes of the environment of the organisation. To survive, the organisation must be able to perform the transformations that are requested by its environment.

2.2.2. The organisation as a system with processes

An organisation fulfils functions by transforming inputs into outputs. To transform inputs into outputs, activities are performed. A whole of activities focussed on transforming inputs into outputs is called a process (Boer, 1991). Thus, the organisation fulfils functions by performing processes. In the process model, the processes in an organisation are the basis for organising (Boer, 1993), and therefore the model is called a 'process model'. The constituent activities of a process are performed by people and/or resources (Krabbendam, 1988). In the process model, people are thus both objects that perform transformational activities, and subjects that have their own goals and values and make decisions based on these (Boer, 1993). The structure of an organisation is reflected in the organisational arrangements that divide and co-ordinate the constituent activities of the distinct processes (Boer, 1991). To perform a process, knowledge is needed. This knowledge is incorporated in people and resources and it is called technology. The whole of processes, people, resources, and arrangements is called the organisation or the organisational configuration. A schematic view of an organisation according to the process model is shown in Figure 2-3. The transformation processes that transform inputs into outputs, which are useful for the environment of the organisation, and by which the organisation achieves its goals, are called the primary processes of the organisation (Boer, 1991). Alongside these primary processes, organisations employ support (or maintenance) and management (or regulatory) processes. Maintenance processes focus on supporting the other processes of people, resources, and inputs that are needed to perform transformations (Boer, 1993). Management processes have as a goal letting the other processes perform in the desired way (Boer, 1993). The concepts of the process model are not only useful for organisations as a whole, they can be used at different levels of aggregation.

In the process model, an organisational configuration is seen as a system, and concepts of systems thinking are used to describe the organisation. The organisation exists because of the function it fulfils. The function of the system is to transform inputs into outputs. This is realised by performing processes. A system consists of elements and relationships between these elements; the elements of the system represent the content of the system. In the process model, the elements are the people and resources that perform the activities. The

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4 By resources, we do not mean the resources that are transformed themselves in the process; these resources are called ‘inputs’. Resources are used several times in transformational activities.
structure of the system consists of the organisational arrangements, which reflect the relationships between the elements of the system. Viewing the organisation as a system has several important consequences; these will be discussed at the end of this section.

2.2.3. Effectiveness of the organisation

The importance of the functions of an organisation is found using the concept of effectiveness. An organisation is effective if the functions, or transformations, it actually fulfils correspond with the functions that are desired by its environment and by the organisation itself. This is shown in Figure 2-4. Several remarks about effectiveness should be made. Firstly, effectiveness refers to the desired function of an organisational configuration. Which function is desired is not specified, thus the concept can be used for several different functions. Often effectiveness is operationalised for the production function of an organisation, but other functions could also be imagined. Secondly, different functions might be demanded of an organisation, possibly because the environment of the organisation asks many things. Effectiveness thus is a multi-dimensional concept, and several different functions might be requested from an organisation in order to be effective. Thirdly, effectiveness does not refer to absolute criteria on the performance of an organisational configuration. Effectiveness refers to the actual functions versus the desired functions, and is thus relative not absolute. This is in accordance with common sense, which tells us that it is never possible to get absolute insights into good performance; it is simply better than others with a lower performance. It is relatively good, not absolutely. If an organisation is effective, it does not imply that the organisation could not have performed more functions, or that the functions could not have been fulfilled better. Effectiveness refers to the actual performance versus the desired functions; it is not related to the capabilities of the organisation. Further, the performance of an organisation is good, or not, at a specific moment in time, in specific circumstances. However, the world changes and the world of tomorrow will be different from the world of yesterday. The high performer of yesterday could perform less well in this different world.

2.2.4. Consistency of the organisation

An organisation is effective if the functions, or transformations, it actually fulfils correspond with the functions that are desired. For an organisation to be effective, it must be consistent; it must perform the processes and have the organisational structure and elements that are needed to fulfil the desired function. In general, the word ‘consistency’ means the adjustment of several things to each other. In organisation theories, consistency refers, for example, to the alignment of general strategies and departmental strategies, the alignment of decisions, or the alignment of several organisational elements. In this research, consistency refers to two things:
1. Firstly, consistency refers to the alignment of processes to the functions that are desired. That is the processes perform the transformations that are desired. This consistency is called process-function consistency.

2. Secondly, consistency refers to the alignment of the elements and structure of the organisational configuration to the processes that must be performed. This consistency refers to the alignment of the characteristics of processes to the characteristics of people, resources, and arrangements. If consistent, the people, resources, and arrangements perform the desired processes. We call this consistency the structure-process consistency, although it does not only refer to the structure but also to the elements of the organisation.

Instead of the word consistency, the word ‘fit’ is also used. The concept of consistency is showed in Figure 2-5. The two types of consistency are represented by the two double arrows. In the concept of consistency used, consistency does not refer to the capabilities that an organisational configuration might have; it refers to its actual performance. If the organisational configuration has the capabilities to perform the desired functions, but this is not realised, then inconsistencies exist.

To understand the concept of consistency, the difference between function, process, and structure should be noted. The function of the organisation is the desired transformation; its structure is the organisational arrangements that reflect the relationships between the elements of the organisation. The difference between function and structure is important for the examination of effectiveness and consistency relationships. Katz and Kahn (1966) discussed the general principle that underlies open systems in that there does not have to be a single method for achieving an objective. Thus, several ways may exist to realise a function. Gresov and Drazin (1997) have discussed this in more detail. They argue that any particular structure may have many functions and any one function may be fulfilled by alternative structures or processes. Functional requirements do not determine a particular structure, but rather permit a range of structures that will fulfil the functions required. Demands exist at the level of functionality, and not at the level of specific social structures (Gresov and Drazin, 1997). Thus, demands of the environment or goals of the organisation do not directly influence its structure. The demands reflect the functions that must be fulfilled, and thus the transformations to be performed. This function then influences the processes that must be performed, and these processes then influence the structure and elements needed.
The relationships between function and process, and between process and structure are not deterministic. Functions, thus, do not determine which process is needed; they permit a range of satisfying processes. This is shown in Figure 2-6. The figure shows two desired functions: cost and quality. Costs are desired to be below a maximum level, while quality is desired to be above a minimum level. The figure also shows several different processes that perform the transformation. These processes are reflected by the white dots A to E. The figure shows that three processes do not perform both of the desired functions (C, D, and E), while two processes can fulfil the desired functions (A and B). The figure also shows that both A and B perform the desired transformations. Thus, A and B are both consistent with the desired function. The desired functions do not determine which process, A or B, should be performed. Both processes are satisfying, and both are permitted. The same can be argued for the relationship between processes and people, resources, and arrangements. Processes do not determine which people, resources, and arrangements are needed, they permit a range of satisfying options.

The process model does not show when consistency exists or otherwise. To be able to do that, the model must first be laden with theory. In earlier research (see for example Boer, 1991; Krabbendam 1988), insights from contingency theory were used to describe which characteristics of people, resources, and arrangements fitted to which characteristics of processes. In order to be most effective, according to contingency theory, organisational structures should be appropriate to the work performed and/or the environmental conditions facing the organisation (Schoonhoven, 1981). Contingency theorists have explored which structures are appropriate for what work and which environmental conditions. Although there is no discussion on the importance of consistency, several different definitions of fit and consistency are used in contingency theory (Drazin and Van de Ven, 1985). The definition used in the process model is the systems approach to fit. In this approach, fit results in a pattern of structure and process that matches the contextual setting and is internally consistent. In this approach, it is hypothesised that consistency within organisational design characteristics leads to performance (Drazin and Van de Ven, 1985). It is typical for this approach that consistency is not examined by looking at isolated characteristics of the organisation. Rather, fit is examined by looking at several different characteristics of the organisational system together with their relationship to performance.

### 2.2.5. The role of slack

Related to consistency and effectiveness, slack is an important concept. Different authors use the concept of slack in slightly different ways, although they all mean roughly the same. For Galbraith (1973), slack refers to reducing the required level of performance of
the organisation. Krabbendam (1993) states that organisations function well because they have extra stocks at different places, which is called ‘slack’. Based on Galbraith (1973), Boer (1991) gives some examples of slack; he mentions that slack resources are extended completion dates (time slack), raised budgets (financial slack), and lowered aspiration levels (quality slack). Thus, slack is related to the performance of an organisation; it is related to the functions that are fulfilled by the organisation.

In this research, a definition of slack is used that differs somewhat from the descriptions of slack used earlier. In this research, slack exists if the capabilities of the organisation are higher than its actual performance; that is when the level at which functions are fulfilled is lower than the level that could be fulfilled. Galbraith argues that slack refers to reducing the required level of performance of the organisation; and the definition of slack used in this research does not correspond fully with his ideas. Slack, as it is used in this research, is not always related to lowering the desired functions of an organisation; the desired function could be lowered without slack existing. It could be possible, for example, for the actual performance of an organisation to be the same as its capabilities, but the organisation could still anyhow not fulfil the desired functions. In such a situation, the requested performance of the organisation is higher than its capabilities; the organisation is not effective, while it is performing as best as it can. If the level of the desired functions is decreased in such a situation, slack does not exist.

The relationship between slack, consistency, and effectiveness will now be examined. An organisation is effective if the desired functions are fulfilled. Effectiveness refers to the actual performance of the organisation, and not to its capabilities. Consequently, the existence of slack is not relevant to effectiveness; an organisation can be effective while it contains slack. This can be illustrated by Figure 2-6. Assume that there is an organisational configuration that can perform process A and process B. The configuration is effective, because both processes fulfil the requested functions. However, the performance of process A is higher than that of process B, and thus when process B is performed slack exists in the organisation although the configuration is still effective.

2.2.6. Definitions of the main concepts
An overview of the most relevant concepts of the process model is given in Table 2-2.
2.2.7. Discussion of the process model

The process model of organisations is based on systems thinking. Jackson (1991) provides a classification of systems thinking that can be used to provide a precise appreciation of what is being taken for granted in each type of systems approach. Further, it shows that the choice of any systems approach is exceptionally committing in terms of the effects it brings in its wake (Jackson, 1991). Next, the classification of Jackson is discussed, and it is used to reflect upon the process model.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>An act or action.</td>
</tr>
<tr>
<td>Process</td>
<td>A whole of activities that transforms inputs into outputs.</td>
</tr>
<tr>
<td>People</td>
<td>The human actors who perform activities in a process.</td>
</tr>
<tr>
<td>Resources</td>
<td>The non-human means, which perform activities in a process.</td>
</tr>
<tr>
<td>Arrangements</td>
<td>The division and co-ordination of the activities in a process.</td>
</tr>
<tr>
<td>Organisational</td>
<td>The whole system of people, resources, and arrangements, with its transformational process.</td>
</tr>
<tr>
<td>configuration</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>The part of the world that is outside the configuration, and with which the configuration has an exchange relationship.</td>
</tr>
</tbody>
</table>

Function of the configuration | A transformation of input into output. |

Elements of the configuration | The people and resources of the organisational configuration. |

Structure of the configuration | The organisational arrangements that divide and co-ordinate the activities of the people and resources of the configuration. |

Characteristics | The relevant properties of the processes, people, resources, and arrangements. |

Performance | The transformations that are actually performed |

Capability | The transformations that can be potentially performed. |

Slack | The capabilities of an organisation are higher than its actual performance. When slack exists, the organisation could have fulfilled more functions than it did. |

Effectiveness | Correspondence between the performance and the desired transformations of an organisation. The desired functions are actually performed. |

Consistency | The processes, people, resources, and arrangements perform the desired functions. |

Inconsistency | The processes, people, resources, and arrangements do not perform the desired functions. |

Process-function consistency | The processes perform the desired transformations. |

Structure-process consistency | The organisational structure and elements (the people, resources, and arrangements) perform the desired processes. |

Fit | Consistency. |

Misfit | Inconsistency. |

Table 2-2: Definitions of the main concepts of the process model
Classification of systems thinking

In Jackson’s (1991) classification, the nature of the systems in which problems are located is relevant. Further, the nature of the relationships between the relevant participants in the system is relevant:

(1) The nature of the system in which problems are located can be classified on a continuum ranging from mechanical to systemic. **Mechanical problem contexts** contain systems that are relatively simple and are characterised by having a small number of elements with few, or regular, interactions between them. Such systems are likely to be governed by well-defined laws of behaviour, or to be largely closed to the environment, to be static over time, to be unaffected by behavioural influences, and to have subsystems that are passive and do not pursue their own goals. **Systemic problem contexts** contain systems that are complex and characterised by having a large number of elements that are highly interrelated. Such systems are probabilistic, open to the environment, evolve over time, are subject to behavioural influences, and have purposeful parts5 (Jackson, 1991).

(2) In the nature of the relationships between participants, the following characteristics are relevant: do participants agree about objectives, do they share common interests, do they have compatible values and beliefs, and do they all participate in decision making. The nature of the relationship between the participants in the system can be unitary, pluralist, or coercive. The problem context is called **unitary** if there is, in general, genuine agreement among the relevant participants. The problem context is called **pluralist** if the participants have divergent values and beliefs, and, to some extent, differing interests and objectives, but a genuine accommodation or compromise can be reached upon which all agree because their fundamental interests are not irreconcilable. A **coercive** problem context exists if there is little common interest between the participants, there is fundamental conflict, and the only consensus that can be achieved is through the exercise of power and through domination of one or more groups of participants over others (Jackson, 1991). Based on these distinctions, different types of systems thinking can be classified:

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5 If it is argued that a system has purposeful parts, it might be assumed that this implies that the system cannot be viewed as a **purposeful whole**. However, this is not the case. A system might have parts with their own goals that contribute to the realization of the goals of the system as a whole. ‘The system having purposeful parts’ therefore does not imply that there cannot also be one overall goal for the system as a whole.
The process model can be seen as a way of systems thinking that corresponds with the ‘organisations as systems’ approach. In this type of systems thinking, it is argued that the organisation should be seen as a whole system made up of interrelated parts; the organisation should be studied holistically, instead of reductionistically. Further, the organisation is seen as being an open system in constant interaction with its environment. Within the ‘organisations as systems’ approach, several approaches can be distinguished, such as the work of Barnard (1938), Selznick (1948), and Parsons (1960). A popular approach is ‘general systems theory’; this variant of systems thinking is based on the work of biologists (von Bertalanffy, 1950). Katz and Kahn (1966) use many of his ideas to study organisations. Another source of literature in the ‘organisations as systems’ approach, is contingency theory.

**Reflection upon the process model**

The process model can be classified into the field of ‘organisations as systems’. The process model uses many concepts that are also used in literature on this subject. Jackson shows several consequences of the organisations as systems approach. A strength is that the problem context is seen as systemic (complex) instead of mechanical (simple), which makes it possible to look at several subsystems of the organisation, their interrelationships, and the interactions between the subsystems and the environment. In the process model, much attention is paid to the interrelationships between subsystems and their contribution to the realisation of the desired functions of the organisations. The process model gives prerequisites for when an organisation can fulfil a function. It shows that, for a function to be fulfilled, the organisation must be consistent. Linked to with consistency theory, the process model can then explain, for example, if a function can be fulfilled. It can explain which characteristics of people, resources, and arrangements are needed to realise a desired process and a desired function. In this way, the process model combined with contingency theory can judge if the desired functions can be fulfilled. The process model also offers an explanation of why organisations survive: because they fulfil functions that are requested by their environment.

The process model discusses that organisations can have many goals; it also shows that different stakeholders of the organisation can have different goals that are important for the organisation. However, the process model sees an organisation as a whole (of people and resources) that tries to realise certain goals; the organisation as a whole is a purposeful system (Boer, 1991). The process model assumes that it is possible, and meaningful, to talk about the goals of the organisation as a whole. This can be realistic when there is a
dominant coalition that makes the decisions for the organisation as a whole. Thus, in the process model, participants are unitary according to Jackson’s categorisation. This has several consequences:

- Jackson shows that the organisations-as-systems approach is oriented towards serving the technical interest of prediction and control in the organisation. The *emancipatory interest in freedom from unnecessary constraints is ignored*. Progress is discerned in the rationalisation of increasingly complex systems, rather than the emancipation of the human subject. Everything is subsequent to the rational requirements of the systems, and individuals are dragged along in the wake of the systems (Jackson, 1991). In the process model, the focus is on the transformation processes that are relevant to the functioning of the organisational configuration as a whole. Attention is only given to the characteristics of the elements of the configuration if this is relevant for the functioning of the whole. If parts of an organisational configuration are relevant, they are considered as an organisational configuration with their own function and processes. The level of abstraction is then shifted down one level, and the same functional model is used to examine this lower level. In this way of viewing organisations, *elements are only relevant for consideration if they influence the functions of the organisational configuration*. The emancipatory interests of human beings are only relevant if they hinder the performance of the system. That is, people are only relevant for study if they influence the functions of the whole organisation. If this is not the case, they are irrelevant. This also applies to everything outside the organisation; these things are relevant only if they influence the functions of the organisation. For example, public opinions on environmental pollution, or the social responsibilities of the organisation, are only considered relevant if they harm the transformations of the company.

- In the organisations-as-systems approach, the organisation is seen as an integrated whole, the survival of which benefits all participants. The idea that there might be different groups in organisations pursuing their own rationalities, based on competing social and economic interests, and frequently coming into conflict is suppressed (Jackson, 1991). In the process model, these ideas are not fully suppressed; attention is paid to the fact that different stakeholders might have different goals. However, the function of the organisation as a whole is still the most important in the process model; the approach is very appropriate for examining whether this function can be realised. The model is *less appropriate for examining what happens if different functions are requested by different participants*. If different functions are requested, the process model can be used to examine each of these functions independently to see if they can be realised or not. However, not much attention has been paid to what happens in an organisation if different functions are requested by different participants. The process model gives no insights into how to describe, analyse, or design such organisational situations.
• The process model is accompanied by an objective view of the world. Differences in perceptions about the organisational world of different participants get no attention. In the process model, the organisation is seen as an objective entity. It is assumed that desired functions can be objectively determined. Further, it is assumed that the processes and elements of the organisational configuration can be objectively stated. No attention is given to the fact that different people might perceive different organisations; that different perceptions about ‘what the organisation is’ exist.

In addition to these remarks that refer to the consequences of the type of systems thinking used, several other remarks can be made that are somewhat less fundamental. These remarks stem from earlier research with the process model. The process model starts with the function that desired. However, several concerns with this function are unquestioned. In the process model, little attention is given as to why a function is requested. Consequently, it cannot explain why and how functions change. It cannot explain why the environment of the organisation changes, or the requested functions of the stakeholders change. For example, it cannot explain why customers ask for a higher quality, or a shorter delivery time. In addition, the process model examines if the available characteristics of people, resources, and arrangements fit to the functions that must be fulfilled, but it does not examine why this set of characteristics is available. It cannot explain why several characteristics are unavailable. It will not explain why people in an organisation do not have the required capabilities, or why needed arrangements do not exist.

2.2.8. The process model used in this research

The current use of the process model does not mean that it cannot be used in another way. An alternative, more subjective, process model could be possible that gives attention to differences in objectives and perceptions between participants. The consequences of changing the process model are however very large and beyond the scope of this research. One of the contributions of this research is that the view of the world that accompanies the process model has been explained, and the boundaries of the existing process model have been examined. These insights will be useful to other researchers who attempt to integrate the subjective view of the world into the process model. This research proposes to use the existing process model to examine improvement teams. The insights given by the existing process model are considered sufficient to be able to use the process model in this research.

The goal of this research, as was discussed in the previous chapter, is to develop a theory that explains incremental improvements by teams. In real organisations, teams do not work on incremental improvements without purpose. Organisations have goals with incremental improvements; organisations try to realise the desired improvement functions with incremental improvement processes performed by teams. The preceding sections have shown that the process model (supported by other theory) can be used to examine the realisation of desired functions in practice, and the requirements needed to fulfil a specific function. Thus the process model is appropriate for examining the realisation of the
functions of improvement processes by improvement teams. It could explain why these functions are fulfilled or otherwise and it might give insights into the requirements for fulfilling specific functions. However, in this research, it is also important to notice the limitations of the process model. These limitations have shown the problems that cannot easily be solved within the approach itself and it shows the limitations on the conclusions that can be formulated using the process model. Therefore, the discussion of the process model in the preceding section is important for the theoretical reflection on the research results at the end of the thesis. In following section, some insights obtained from the process model as to why improvement functions are fulfilled or not are considered in more detail.

2.3. Two configurations and fit: stating the problem

2.3.1. Fit requirements for an improvement process

In the first chapter it was stated that the goal of this research is to develop a theory that explains incremental improvements by teams. The process model can be used for this. Translated into terms of the process model, the goal of the research is to develop a theory that explains why the improvement functions of incremental improvement processes by improvement teams are realised or not.

To examine the realisation of improvement functions, the (in)consistencies in the improvement configuration must be examined. A scheme of the relevant consistency relationships is shown in Figure 2-8. It has to be determined which inconsistencies exist between the desired improvement functions and the improvement processes that are performed; which improvement processes that were needed to realise the desired improvement function were not performed (the process-function inconsistency). To determine why these processes were not performed, the inconsistencies between the desired processes, and the characteristics of the elements and structure of the organisation must be found. The inconsistency between the desired process, and the characteristics of the people, resources, and arrangements must be determined (the structure-process inconsistency). An important question is why the characteristics needed to fulfil the desired improvement functions are not available. This question cannot be answered directly using the existing ideas of the process model; additional theory is needed. In the following sections, this is considered in more detail.
2.3.2. Fit needed between the elements of two configurations

An improvement team is a group of people solving problems in their own work. In the process model, attention is given to the transformational functions that are fulfilled, thus to the activities and processes that take place. Two different types of transformational processes exist for the people in the improvement team: (1) the operational processes, which form the daily work of the team members, and (2) the improvement processes. This is shown in Figure 2-9. The figure shows that the operational and the improvement configurations have one common element: the people of the improvement team, while the other elements, the functions, and the structure of the two configurations may differ.

Based on the process model, it can be argued that, for an effective organisational configuration, the desired function must be fulfilled. Which functions can be performed, depends on the processes that are performed and the characteristics of the people, resources, and arrangements. Therefore, the processes, and the characteristics of the people, resources, and arrangements must fit the desired function. This is shown in Figure 2-8. This premise from the process model, extended with contingency theory, can be applied to operational and improvement processes. For both the improvement configuration and the operational configuration, the characteristics of the people, resources, and arrangements must fit the desired process and this in turn must fit the desired function. People in an improvement team work on operational and improvement processes. Consequently, for the two configurations to be effective, the people of the improvement team must fit with the improvement and the operational processes. This is shown in Figure 2-10. However, based on the theory offered by the process model, it can be questioned whether it will be possible for one group of people to perform two very different processes. It could be possible that the people do not fit one, or both, of the processes. This will result in functions that are not fulfilled, and ineffectiveness in one or two of the configurations.

That performing two very different processes can be problematic is shown by practical experiences with quality circles and innovations in organisations. Not only people from
improvement teams have to perform two different processes; quality circles also have to perform the two different processes of operations and improvement. Although quality circles were popular in the West during the 1980s, nowadays they have virtually disappeared. An important reason given for this is the lack of integration of the circles into the existing organisation. The hierarchy of quality circles was often parallel to, rather than integrated into, the existing organisational hierarchy (Hill, 1991). It was if two organisations had emerged: the ‘operational-processes organisation’, which was separated from the ‘quality-circles organisation’. Several problems between the two organisations arose. Often the implementation of quality circle ideas was a problem because the implementation had to be done by the people working in the ‘operational-processes organisation’, which was distinct from the ‘quality-circles organisation’ which had generated the improvement ideas. The people who had to implement the ideas were often faced with a choice between continuing their normal activities and picking-up on ideas that the quality circles had suggested. Unless these people were willing to put their regular duties aside, they would never implement the ideas (Lawler, 1985). Further, people in quality circles became uncomfortable with the distinction between the way they were treated in quality circle meetings and how they are treated in day-to-day operations (Aliange, 1992). Thus the people who had to perform operational as well as improvement activities faced problems. The desired functions of the quality circles were not realised, and the experiments with quality circles stopped resulting in quality circles no longer being part of organisational life.

The problem of performing improvement activities alongside operational activities are also mentioned in literature on innovations. Boer (1991) concludes that the characteristics of machine bureaucracies are at odds with the organisational characteristics needed to perform manufacturing innovation processes. Mintzberg (1979) observes that machine bureaucracies work best in stable environments because they have been designed for specific, predetermined missions. They are efficient in their own limited domain, but cannot easily adapt to any other. In the machine bureaucracy, change and operations are difficult to combine. The structure is focused on efficient operational processes at the expense of change and improvement. Kanter (1989) emphasises the differences between the ongoing processes in an organisation and the processes of renewal and innovation. Further she emphasises the problems that arise because of the difference in the characteristics of innovation and operational processes. Thus the problem of performing improvement and operational processes together is also recognised in literature on innovation.

The process model supported by concepts from contingency theory when applied to improvement teams suggests that the performance of two different processes by one group of people could be problematic. Experiences with quality circles and innovations in organisations illustrate this. Therefore, it can be questioned whether it is possible for an improvement team to perform improvement and operational processes, without loss of effectiveness. Hence, in this research, the focus is on this subject. In the following section,
literature which already exists on the fit between two different processes or configurations is discussed.

When the process model supported by concepts from contingency theory is applied to improvement teams, it appears that team members have to fit operational as well as improvement processes. It can be questioned whether it is possible for improvement teams to perform both processes effectively and to realise the requested improvement function.

2.4. Two configurations and fit: general theoretical framework based on literature

In this section, literature on fit with two different configurations is discussed. When the literature was searched, not much was found on performing both operational and improvement processes by shop floor people on an on-going basis. Therefore, the literature search was extended to a wider field and literature on realising two different functions and processes alongside each other was also examined. The literature that was found, is used to develop scenarios that describe what might happen with the fit between operational and improvement processes by an improvement team.

2.4.1. Introduction on different fit requirements

In the previous section it was discussed that when different functions exist in an organisation, operations and improvement, the characteristics needed to fulfil these functions might differ. Other authors have also discussed that processes within an organisation might have different characteristics. Gerwin (1979) showed that organisations have different tasks (such as acquiring resources, conversion of resources into products, and distribution of products) all with their own technology needed to accomplish that task. Different functions of an organisation each have their own means of converting inputs into outputs. He also showed that within one function different processes could be used. He illustrates this with an example from the research of Woodward. Gerwin says that, in her research, Woodward found that one fifth of her original sample of firms did not have a single dominant manufacturing process (Gerwin, 1979). Lillrank (1988) stresses the different needs in the process of improvement as performed by quality circles. He says that an organisational problem exists in (Japanese) quality circles, which have to be both innovative with spontaneous behaviour, and also highly systematic. In literature on organising learning, attention is paid to the difference between the operational work and the fit that is required. The relationship between learning systems and the operational system of an organisation has been examined (Van de Krogt, 1995); he notes that learning systems should fit to the work systems of an organisation. Poell (1998) examines how learning and work are related in learning projects; he shows that the type of learning project is related to the type of work with in which it is conducted, but that there is not a one-to-one relationship.
This research focuses on the problem of two different functions, which must be fulfilled by two different configurations (the improvement and the operational configuration) while sharing the same people. If this problem is examined from the view of the organisation as a whole, the organisation has to simultaneously fulfil two different functions. Several authors have discussed the fact that organisations might face multiple demands, although they usually only discuss multiple demands from the environment, and not multiple demands placed on the organisational configuration by the different processes within the organisation. Gerwin (1979) showed that achieving a good fit between the structure and the perceived contextual demands could be a problem because trade-offs between various demands might be needed. Also Gresov (1989) discussed this problem. He showed that multiple contingencies can each have an influence on the design of work units and that this can result in conflicting demands and a lower performance. Drazin and Van de Ven (1985) note that advocates of the systems approach to fit assert that the understanding of context-structure-performance relationships can only improve by addressing simultaneously the many contingencies, structural alternatives, and performance criteria that must be considered holistically to understand organisation design. The organisational implications of each contingency are unlikely to be the same, and will often be in conflict with each other. Consequently, trade-off decisions begin to emerge, and attempts to respond to multiple and conflicting contingencies are likely to create internal inconsistencies in the structural pattern of an organisation. The tasks for theorists adopting the systems definition of fit are to identify the feasible set of organisational structures and processes that are effective for different context configurations, and to understand which patterns of organisational structure and process are internally consistent and which are inconsistent (Drazin and Van de Ven, 1985). Gresov and Drazin (1997) discuss the design problems that arise if an organisation faces multiple requirements. They offer a theoretical framework about equifinality, which provides insights into the different design situations that an organisation faces and the possibilities of realising an optimal design. This framework is also relevant to the problem of the present research of meeting the requirements of the operational and the improvement processes. Therefore, this framework has an important place in this research and is discussed in the next section.

2.4.2. Ideas about equifinality

The framework of Gresov and Drazin is based on the difference between function and structure. They argue that any particular structure may have many functions, and any function may be fulfilled by alternative structures or processes. Functional requirements do not determine a particular structure, but rather permit a range of structures that will fulfil the functions required. Contingencies determine the functions that an organisation must perform, but not its specific structure, demands exist at the level of functionality and not at the level of specific social structures. Equifinality occurs when different structural alternatives yield the same functional effect (Gresov and Drazin, 1997). Gresov and Drazin thus define equifinality as the existence of different structures that can fulfil the same function, and they examine which forms equifinality might take. They propose that
organisations differ in the design situations they face, and that these differences are characterised by differences in:

- The set of functional demands imposed upon the organisation. All organisations must perform multiple functions, but the degree of conflict between these functional demands creates dramatically varying contexts that influence the organisational designs that emerge. The degree of conflict in functional demands might be high or low. A low conflict in functional demands can arise if one of the functions an organisation must perform dominates the others in terms of importance. Another reason for low conflict could be that the multiple functions may be relatively consistent with each other in their implications for organisational design (Gresov and Drazin, 1997). The concept of slack is not explicitly mentioned by Gresov and Drazin. However, it is incorporated in the situation where multiple functions are relatively consistent with each other in their implications for organisational design. When slack exists, different functions can be performed by one structure, and thus the functional demands are no longer conflicting. When the degree of conflict is high, the achievement of one function comes at the expense of not achieving another (Gresov and Drazin, 1997).

- The structural latitude available to deal with certain demands. Design options may be highly limited, or multiple avenues of design may be available. Design options might be limited because the design choices themselves are relatively simple, or because structural constraints are imposed on the designer by organisational inertia or institutionalisation (Gresov and Drazin, 1997).

Based on these classifications of the degree of conflict between functional requirements and the structural latitude, Gresov and Drazin (1997) construct four different design situations. They show that in three situations a specific form of equifinality will appear. This is shown in Figure 2-11. For each situation, they examine whether different structural alternatives can yield the same functional effect. In this way, they examine for each situation

<table>
<thead>
<tr>
<th>High Degree of conflict in functional demands</th>
<th>Suboptimal equifinality</th>
<th>Configurational equifinality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Latitude of structural options</td>
<td>Ideal profiles</td>
<td>Tradeoff equifinality</td>
</tr>
</tbody>
</table>

Figure 2-11: Classification of equifinality situations (Gresov and Drazin, 1997)

6 Conflicts in functional demands are not the same as different functional demands. Gresov and Drazin emphasise that several functions can be satisfied by one structure, thus different functional demands do not result in functional conflicts per se. They only result in a conflict if the different demands cannot be satisfied by one structure. So when Gresov and Drazin say the conflict between functional demands is high, they mean that there are different demands and there is not one structure available that can satisfy all the functional demands. In addition, when Gresov and Drazin say there is only one functional demand, they assume this demand will be optimally satisfied by the available structure(s).
whether the organisation can perform effectively. Before the different situations are explained, the applicability of Gresov and Drazin’s ideas to for this research is discussed.

2.4.3. Applicability of the ideas on equifinality

Although this research does not focus on situations of equifinality, some insights obtained from Gresov and Drazin are very important to this research. The classification of equifinality situations by Gresov and Drazin shows that, depending on the amount of conflict in functional demands and the structural latitude available, different design situations do exist. These design situations are used by Gresov and Drazin to show that equifinality is an important concept. For each design situation, they examine if different structural alternatives will yield the same functional effect. In this way, they examine, for each situation, if an organisation can perform effectively. Thus, their framework provides important insights into the possibilities of realising an effective organisational configuration when different requirements exist. These insights are very valuable to this research and therefore their classification is used to examine operational and improvement processes by an improvement team.

Some important differences exist between the research of Gresov and Drazin, and this research. Some adjustments are made to the framework, because this research focuses on the requirements arising from different internal processes, instead of from different environmental demands as Gresov and Drazin discussed. Further, some adjustments are made because, in this research, the concepts of function, process, and structure are distinguished, whereas Gresov and Drazin only discuss the relationships between function and structure. Gresov and Drazin show that conflicts between functional demands are relevant. Conflicts between functional demands exist where functional demands cannot be satisfied with by a single structure. For this research, the conflicts between the demands placed upon the people in the improvement team are relevant. These demands do not arise directly out of the functions that are demanded; conflicting demands arise because of the different processes the team members have to fulfil (see for example Figure 2-8). Therefore, it is especially important in this research to focus on the conflicting demands in the processes that people have to perform. The degree of conflict between demands can also be used for operational and improvement processes. For this research, functional conflicts are defined as follows: When functional conflicts exist between the demands placed upon the team members, they cannot perform both processes well; functional conflicts exist if performing one process is at the expense of an other. In addition, Gresov and Drazin show that the latitude of structural options is relevant. Structural possibilities may be very limited or many options may be available. In this research, structural latitude refers to the different organisational configurations that are possible. In the case of operational and improvement configurations, several elements of the configuration are more or less fixed, such as the people in the improvement team. Other elements, such as the arrangements and tools used and even the transformation process itself, could be...
varied. If design options are limited, only one configuration will exist. If the design options are unlimited, several configurations are possible.

2.4.4. Different fit situations

Next, each situation in the classification of Gresov and Drazin is discussed and each situation is adapted for operational and improvement processes. With the framework, additional literature from other authors about different requirements for an organisation is also discussed. This literature is integrated into the framework. Based on the framework, four different scenarios are developed. For each design situation, the possibilities for realising effectiveness in the operational and the improvement configurations are discussed.

**Situation 1: Ideal profiles**

In this situation the organisation faces a single or dominant functional demand and has only one or a limited number of structural options available to satisfy that demand. Most tests of contingency theory implicitly assume this situation. This type of design situation is relatively limited in practice. One possible circumstance in which this situation could occur is when the design situation has been parcelled out as part of a larger design problem, as is generally the case in the design of bottom-line work units (Gresov and Drazin, 1997).

Applied to operational and improvement processes, this situation equates to one in which there are no conflicts between the demands of the operational and the improvement processes placed upon the team members. In addition, only one structural alternative exists for both processes. The configuration is both an effective operational and an effective improvement configuration. Both the desired operational, and the desired improvement processes are performed.

<table>
<thead>
<tr>
<th>Scenario: one effective configuration for both processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No conflicts between demands of the operational and the improvement processes placed upon the team members. One configuration</td>
</tr>
<tr>
<td>Both configurations are consistent and effective. The configurations are the same. One configuration exists that is both an effective operational and an effective improvement configuration.</td>
</tr>
</tbody>
</table>

**Situation 2: Suboptimal equifinality**

In this situation, conflict between functional requirements is high and the structural alternatives available to deal with each demand are limited. An attempt to fully satisfy one functional demand means that the other demands must go unsatisfied. A misfit is inevitable. Equifinality in this situation arises from a trade off between functions; the function chosen as most important determines what the structure will look like. This type of equifinality is always sub optimal. An ideal profile is theoretically excluded and performance must always be low. In this situation, the problem of conflicting functions does not disappear because the designer emphasises one function over the others. With
respect to at least one function, the organisation will perform poorly. In anticipation of this, managers might claim that the one function they have chosen to emphasise is the most important one. Further they might attempt to manipulate the environment through norm setting to emphasise that function over the others (Gresov and Drazin, 1997); in this situation the context is regarded as a social construction that can be reconstructed (Gresov, 1989).

Applied to operational and improvement processes, this situation implies that the demands of the operational and the improvement processes placed upon the team members are conflicting and that they cannot be performed jointly. Consistency conflicts exist because the team members do not have the characteristics that are needed to perform both the operational and the improvement processes. Further, only one configuration is available. An attempt to satisfy the requirements for the internal consistency of one configuration will mean that the other configuration will not be internally consistent. Two ideal configurations are theoretically impossible and there is always inconsistency. In this situation, several possibilities exist:

- **Dominant operational configuration:** The operational process is performed well; the operational configuration is consistent and effective. The improvement configuration is the same, but the improvement process will not be performed well. The improvement configuration is neither internally consistent nor effective. It is possible that the improvement configuration is performing so badly that it will disappear in time.

- **Dominant improvement configuration:** The improvement process is performed well; the improvement configuration is consistent and effective. The operational process is not performed well. This scenario seems somewhat artificial, but in theory it is possible.

**Situation 3: Trade off equifinality**

This situation is characterised by low conflict in functional requirements and the structural choice is unlimited. Many structural alternatives are available that satisfy the
function. Functional equivalence of structures exists. As with suboptimal equifinality managers face trade offs, but in this case the trade offs are between structures and not between functions. In this situation, the choice as to which structure is appropriate is not governed by functional demands but by preferences for a certain approach. Managers may switch structures for several reasons. For example, in the short run one structural option might be constrained and then an alternative might be used to fulfil the desired function. Managers might have preferences among equally attractive alternatives based on their personal histories and experiences. High performance is possible and multiple structures can achieve this (Gresov and Drazin, 1997).

Related to operational and improvement processes, this situation implies that the demands placed upon the team members in the operational and the improvement process are the same. The elements of both configurations are consistent with each other and both configurations are effective. Further, several different consistent configurational alternatives exist. Both configurations could be the same, but they could also differ. Switching of configurations is possible without a loss of effectiveness.

**Scenario: several optimal configurations**

<table>
<thead>
<tr>
<th>No conflicts between demands of the operational and the improvement processes placed upon the team members. Several configurational alternatives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The configurations might be the same, but they might differ. Both processes are performed well. Both configurations are consistent and effective. Several configurations are both an effective operational and an effective improvement configuration. Switching between configurations is possible without a loss of effectiveness.</td>
</tr>
</tbody>
</table>

**Situation 4: Configurational equifinality**

In this case, the conflict between functional demands is high, but several structural alternatives are available. There are simultaneously trade offs between both structures and functions. It is expected that organisational performance, under these conditions, will result from identifying a subset of functional demands that minimises functional conflict, and matching these demands with a set of appropriate structural features that are internally consistent. These multiple functional-structural mappings will result in a number of design profiles that perform reasonably well and configurational equifinality will emerge. Once a set of functions is chosen, a structure can be designed to maximise these functions and a relatively high performance will result, but absolute performance on all functions is unlikely. As with suboptimal equifinality, the problem of conflicting functions persists, and the organisation will still perform poorly with respect to those functions it has chosen not to emphasise. Managers will compensate for this by making legitimacy claims for their chosen function-structure configuration. One possibility is that a series of distinct configurations will emerge that collectively perform the entire set of functions facing the population of organisations. The organisations will differentiate both functionally and structurally, the entire set of functions facing the population of organisations will never be satisfied by a single organisation. The concept of configurational equifinality implicitly
underpins several well known theories on organisational design (Gresov and Drazin, 1997), for example concepts about the importance of external consistency (this relates to the functional demands) and internal consistency (this relates to the structural choices available). Another possibility in this situation is that a unit facing conflicting contingencies might be buffered from contingencies by stocks or information (Gresov, 1989). Then slack starts to play role.

In the situation of configurational equifinality, the operational and the improvement processes demand conflicting characteristics of the team members. The elements of the two configurations are not consistent with each other. Further, different configurational alternatives are available. Several possibilities exist:

- **One configuration:** The demands placed upon the team members in the operational and in the improvement processes are examined, and a subset of the required characteristics is chosen that minimises inconsistencies between the two processes. These demands for internal consistency are then matched with an appropriate configuration. So one structure for both the operational and the improvement configurations is chosen. Neither configuration is effective, but reasonably good performance might be possible.

- **Two structures:** The organisation divides into two different parts. One part is focused on the operational process. This part satisfies the requirements for internal consistency in the operational configuration. The other part focuses on the improvement configuration and satisfies the requirements for consistency in this configuration. Both configurations can be consistent and effective. In this situation, both configurations are differentiated from each other. Consequently, the concept of an

<table>
<thead>
<tr>
<th>Scenario: one satisfying configuration</th>
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</thead>
<tbody>
<tr>
<td>Conflicts between demands of the operational and the improvement processes placed upon the team members. Several configurational alternatives.</td>
</tr>
</tbody>
</table>

| The demands placed upon the team members in the operational and the improvement process are matched with the configurational alternatives available. Both configurations are the same. Both configurations are not consistent and not effective, but the performance may be reasonably good. |

<table>
<thead>
<tr>
<th>Scenario: Differentiated configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflicts between demands of the operational and the improvement processes placed upon the team members. Several configurational alternatives.</td>
</tr>
</tbody>
</table>

| The organisation differentiates into two parts. One part satisfies the requirements for internal consistency of the operational configuration. The other part satisfies the requirements for internal consistency of the operational configuration. Both configurations are consistent and effective. Coordination of the two configurations is needed. A parallel structure can be easily realised but also easily dismantled. People can have problems functioning in two different configurations. In Japan the improvement organisation is highly structured and highly ceremonial while it has no decision power. In this way organisations can deal with bottom-up ideas in a structured way. |
improvement team working in both processes might no longer be applicable. A complicating factor with this alternative is that co-ordination of the two different configurations is required. This co-ordination has its own costs. The main question now becomes if these co-ordination costs outweigh the fall of in performance when the two configurations are not differentiated. Further, it can be questioned which design fits the requirements of the co-ordination-configuration.

Several authors have discussed organisational differentiation, and some of their insights are applicable to improvement teams performing two different processes. However, the different arguments given for differentiation in the literature must be first understood. For example, Thompson, and Lawrence and Lorsch, have said that the structure of an organisation should be differentiated based on the characteristics of the external environment of the organisation. Further, authors such as Pfeffer and Salancik have shown that resource dependency is the key determinant in the structure of internal exchange relationships within complex organisations (Ghoshal & Nohria, 1989). The need for the differentiation of operational and improvement processes of teams, as examined in this research, stems from different characteristics of the configurations, and this is not precisely the same as the arguments put forward in the references above.

Several authors discuss a differentiation of the configurations for operations and improvement, which can be regarded as an extensive discussion of the ‘differentiated configurations scenario’ of Gresov and Drazin. Zand (1974), for example, discusses the ‘collateral organisation’ as an organisational form for working on improvements. A collateral organisation is a supplement to the existing hierarchy for solving ill-structured problems that are not solved by the formal organisation. Within the collateral organisation the people from the existing hierarchy operate with different norms than in the existing hierarchy. Stein and Kanter (1980) discuss the parallel organisation, an attempt to institutionalise a set of externally and internally responsive, participatory, problem-solving structures alongside the conventional line organisation that carries out the routine tasks. The parallel organisation provides a means for managing change and providing flexibility and responsiveness. The main tasks of the parallel organisation are the continued re-examination of routines and to institutionalize change (Stein and Kanter, 1980). Also Kanter (1989) emphasises the differences between the ongoing processes in an organisation and the processes of renewal and innovation and she argues that different structures might be needed for the different processes.

Goldstein (1985) discusses the differentiation of operational and improvement processes with quality circles. He proposes that three structures exist (see also Goldstein, 1978, 1981). The rational structure is the structure of operations. It is crucially concerned with external and internal goal congruence. External congruence is the congruence of the goals of the rational system and those of whom it supplies the goods it produces to and, those of whom it receives its material inputs from. Internal congruence is the congruence of the goals of the rational system and those of its membership, and preferably it is secured by the genuine commitment to consistent values. Internal and external congruence contribute
significantly to short to medium-term continuity and effectiveness of the rational structure. Of the three systems, the rational structure is the most elaborate, and in large organisations it would have many subboundaries that are intricately related. The adaptive structure is the structure of adaptation (improvement). It is crucially concerned with qualitatively changing the whole system, that is changing the control and rational structures as well as its own. Its focus is on the qualitative improvement of the rational system. This is achieved through two processes: (1) Domain adaptation, a process which serves to improve the domain fit in relation to the organisational competencies and resources, (2) System improvement, a process which serves to improve internal and external goal congruence. The design options available for adaptive structures are much more limited than those for rational structures. This is because, being nonproductive systems, the resources that can be set aside for them are necessarily small. The control structure supports actual conditions of duality, ensuring that there is coexistence between the rational structure and the adaptive structure. The controlling function is to ensure that whole system does not run down or become discontinuous (Goldstein, 1985). The three structures discussed by Goldstein correlate with the differentiated operational and improvement configurations, and the coordination configuration needed to control the two. Several other authors also discuss differentiation of operational and improvement processes when they discuss quality circles. Lawler and Mohrman (1985) discuss one consequence of the differentiated structure: circle members often become uncomfortable with the split between the way they are treated in quality circle meetings and how they are treated in day-to-day operations of the organisation. As their desire for influence rises, they may ask for increased participation in managing the daily work of the organisation (Lawler and Mohrman, 1985). Baisier and Albertijn (1992) say circles are in essence a parallel organisation, they work alongside the normal hierarchical (operational) structure. An advantage of this parallel structure is that it is relatively easy to start to build a structure like this because fundamentally nothing is changed in the existing organisation. However, at the same time, this is a major disadvantage: it is easy to remove them from the organisation (Baisier and Albertijn, 1992).

Lillrank (1988) and Lillrank & Kano (1989) explore the characteristics of the differentiated structure of Japanese organisations that have quality circles. Lillrank says that, in Japan, quality circles are organised in a parallel organisation that lies between the formal and the informal organisation. In the quality circle, employees use a systematic procedure in which their ideas are refined and tested. When a theme is ready, it is placed on a suggestion form and submitted to the suggestion system. These suggestions then are evaluated by line management. The flow from quality circle activities to

![Figure 2-12: The suggestion system as interface between the formal and the parallel organisation](Lillrank, 1988)
the formal organisation is arranged through the suggestion system. This is shown in Figure 2-12. A suggestion that comes through this system has much more clout than a direct suggestion; using the formal system of the workers can get management’s ear more readily than directly during their daily work. Lillrank argues that Japanese quality circle activities are organised in a very specific way. Many of the operations in the Japanese quality movement are highly ceremonial, they are highly structured and ritualised. The key to these systems is that the informal process is highly systemised and ceremonial: if somebody wants to push an idea, the channels and procedures are there ready. Thus the informal organisation is not confined to mere corridor talk, but it has an organisation to support it (Lillrank, 1988; Lillrank & Kano, 1989).

2.4.5. Summary of the different scenarios

In the preceding sections, several scenarios were discussed, based on the conflicts between the demands of the operational and the improvement processes on the team members, and the structural latitude available. For each possible situation, it was discussed if the desired operational and improvement processes could be performed, and if an effective operational and improvement configuration could exist. Table 2-3 gives an overview of the different scenarios that were identified and Figure 2-13 presents a somewhat simpler summary.
Theory to explain improvements in teams

<table>
<thead>
<tr>
<th>Suboptimal equifinality: Conflicts between demands of the operational and the improvement processes placed upon the team members. One configuration.</th>
<th>Configurational equifinality: Conflicts between demands of the operational and the improvement processes placed upon the team members. Several configurational alternatives.</th>
</tr>
</thead>
</table>
| Scenario: dominant operational configuration
Both configurations are the same. The operational process is performed well; the operational configuration is consistent and effective. The improvement process is not performed well; the improvement configuration is not consistent and not effective. | Scenario: one satisfying configuration
The demands placed upon the team members in the operational and the improvement process are matched with the configurational alternatives available. Both configurations are the same. Both configurations are not consistent and not effective, but the performance may be reasonably good. |
| Scenario: dominant improvement configuration
Both configurations are the same. The improvement process is performed well; the improvement configuration is consistent and effective. The operational process is not performed well; the operational configuration is not consistent and not effective. | Scenario: Differentiated configuration
The organisation differentiates into two parts. One part satisfies the requirements for internal consistency of the operational configuration. The other part satisfies the requirements for internal consistency of the operational configuration. Both configurations are consistent and effective. Co-ordination of the two configurations is needed. A parallel structure can be easily realised but also easily dismantled. People can have problems functioning in two different configurations. In Japan the improvement organisation is highly structured and highly ceremonial while it has no decision power. In this way organisations can deal with bottom-up ideas in a structured way. |
| Ideal profiles: No conflicts between demands of the operational and the improvement processes placed upon the team members. One configuration | Trade-off equifinality: No conflicts between demands of the operational and the improvement processes placed upon the team members. Several configurational alternatives. |
| Scenario: one effective configuration for both processes
Both configurations are consistent and effective. The configurations are the same. One configuration exists that is both an effective operational and an effective improvement configuration. | Scenario: several optimal configurations
The configurations might be the same, but they might differ. Both processes are performed well. Both configurations are consistent and effective. Several configurations both well an effective operational and an effective improvement configuration. Switching between configurations is possible without a loss of effectiveness. |

Table 2-3: Overview of the different scenarios
Figure 2-13 summarises the different situations that can be distinguished. The oval figures reflect the configurations. An effective configuration is reflected by a ‘+’, and an ineffective one by a ‘-’. In the lower row of the figure, there are no conflicts in demands placed upon the team members. Therefore, although the team must perform two processes, both processes can be performed well and consequently both configurations are effective. One of the situations in the lower row has only one configurational alternative, while in the other situation several different configurational alternatives exist. In the upper row of the figure, there are conflicts in the demands placed upon the team members. In the left-hand column of this row, there is only one configuration. In the right-hand column, several configurations exist. In the event of configurational equifinality, two different situations exist. In the upper situation, both configurations are the same and neither is effective. In the lower situation, the two configurations are differentiated, and both could be effective.

2.5. Discussion and research questions

2.5.1. Discussion of the main theory

In the first chapter, the goal of this research, to develop a theory that explains incremental improvements by improvement teams, was discussed. The process model offers some useful insights for this. When the process model, supplemented with concepts from contingency theory, is applied to improvement teams, it shows that the team members have to fit to both the operational and the improvement processes. It can be questioned if it is possible for people in improvement teams to perform two different processes effectively and thus realise the requested improvement function. Literature was examined to gain some insight into what might happen. This showed that the problem of the different requirements for the operational and improvement processes has been recognised by several authors, but the solutions offered were rather limited. Most authors only discuss the solution of two differentiated designs to realise two different functions. This implies that different groups of people have to perform the operational and the improvement processes, and thus the concept of an improvement team that performs both processes effectively is not really applicable. Gresov and Drazin (1997) offer a more theoretical view with more subtleties in discussing the problem of the two different functions. They have shown that the degree of conflict between the demands placed upon the team members, and the amount of structural latitude available, is relevant for the effectiveness:
• If the demands placed upon team members are conflicting, problems with effectiveness in one or both of the configurations may arise. Several situations can be distinguished:
  (1) One process is performed well and this configuration is effective, while the other process is not performed well and this configuration is not effective. (2) Both processes are not performed well and neither configuration is effective, although both configurations might be performing reasonably well. (3) The two configurations are differentiated and both processes are performed by different groups of people. Both processes are performed well, and both configurations are effective.

• If the demands placed upon the team members are not conflicting then, theoretically, no problems will arise. Both the operational and the improvement processes can be performed well by a single group of people.

Gresov and Drazin show the importance of the conflicts resulting from two different functions being demanded. For this research on improvement teams, this means that attention must be given to the conflicts in demands placed upon the team members by the operational and the improvement processes. Functional conflicts will exist if performing one process is at the expense of the other. These conflicting demands might explain why improvement functions are not realised, and improvement configurations are not effective; they might explain why problems arise with improvement processes. Functional conflicts arise if differences between the operational and the improvement processes exist that cannot be performed by one group of people. If such differences exist problems could appear; if no such differences exist then problems should not be expected. This is a central idea of this research.

The differences and correspondences between operational and improvement processes might explain whether, and if so why, problems arise, or not, with improvement processes by improvement teams

It is important to recall that the way Gresov and Drazin use the concept of ‘conflict in demands’ is rather limited. They state that conflicts in demand exist when different functional demands create conflicting implications for the structure of an organisation. Thus, the differences in the desired functions are not relevant to them, what matters is if different and conflicting structures are needed to satisfy the functions; then conflicts in functional demands will exist. Thus, for example, if slack existed, different functions might be satisfied by one structure, and thus no conflicting requirements would exist. For this research on improvement teams, the concept of conflicting demands, as developed by Gresov and Drazin, implies that it is not sufficient to examine only the differences between the operational and improvement processes that are performed. It also must be determined if the differences between the operational and improvement processes that are performed result in conflicting characteristics demanded from the people in the team. The process model offers additional insights that can be used.
The process model shows that the relationship between the processes that must be fulfilled and the characteristics of the people in the team is rather complex (see Figure 2-14). It shows that differences between operational and improvement processes do not always have to result in conflicting demands. The process model offers several reasons why no problems might occur when differences between the two processes exist:

- The process model examines different characteristics of an organisation at the same time. It shows that the processes are not only related to the characteristics of the people. The required characteristics are also influenced by the resources and arrangements that are used. The whole of people-resources-arrangements influences the processes that are performed. Consequently, the whole of people-resources-arrangements must be examined to determine its relationship with the processes to be performed. If different processes have to be performed, the use of tools and arrangements might facilitate the different processes for one group of people and consequently no conflicting demands are placed upon the people. Thus, the use of tools and/or arrangements might prevent problems in improvement processes; they could prevent conflicting demands being placed upon the team members. In brief: the use of tools or arrangements might prevent problems occurring with improvement processes that differ from the operational processes of the team members.

- Problems that appear when people have to perform different tasks do not only depend on the characteristics of the tasks that are requested; they also depend on the capabilities of the people. Whether problems appear depends on the match between the characteristics of the tasks and the capabilities of the people. If people have slack capabilities, they might well be able to perform different tasks without problem. Consequently, if there is slack in the operational configuration, differences in them do not result in conflicts in the functional demands placed upon them. Thus: slack in the operational configuration might prevent problems with improvement processes, although they differ from the operational processes of the team members.

- The process model emphasises that the relationship between processes and functions is important. Problems emerge when the desired improvement function is not fulfilled. Thus, if improvement processes are performed well is determined by the function that is desired. Problems with an improvement function can be solved by adjusting the requested function in such ways that conflicting demands no longer exist. For example, the improvement function could be adjusted so that the improvement processes do not
have many differences to the operational processes. Further, the improvement function might be chosen in such a way that the improvement process that must be performed fits to the slack capabilities of the team members. An improvement function might be chosen so that the use of tools and/or arrangements in the process prevents conflicting demands being placed upon the team members. Thus: adjusting the improvement function might prevent problems with the improvement processes.

This shows that it is neither easy nor straightforward to determine whether differences between operational and improvement processes will cause problems for the team members. An organisation is a complex system where functions, processes, elements, and structure interact in a complex way with each other. The framework of Gresov and Drazin helps to classify the things that are going on somewhat; it shows that it is important to focus on conflicts in demands that are placed upon the team members. However, although they give some useful insights, their framework is not sufficient to examine the problems of improvement processes by improvement teams in depth. The process model shows that other forces may influence the conflicts in demands placed upon the team members; these should also be examined.

2.5.2. Research problem

In the first chapter, the goal of this research, to develop a theory that explains incremental improvements carried out by improvement teams, was discussed. Translated into terms of the process model, the goal of the research becomes to develop a theory that explains why improvement functions of improvement processes by improvement teams are realised or otherwise. The process model as applied to improvement teams, and the framework of Gresov and Drazin, have given some important insights. It has been shown that the realisation of the requested improvement function might be explained by the differences and the correspondences between the operational and the improvement processes that the team members have to perform. The differences between the processes the team members have to perform might well result in conflicting requirements being placed upon them, and therefore the requested improvement function might not be realised; problems in an improvement process might appear. In this research, it is investigated whether this difference between the two processes can explain the problems that arise, or not, with improvement processes carried out by improvement teams.

The main research problem is: To what extent do differences and correspondences between operational and improvement processes explain the problems that arise, or not, with improvement processes by improvement teams?

By using the process model, it has been shown that the differences between operational and improvement processes do not have to result in conflicting demands placed upon people. Other factors, such as slack, relaxing the requested improvement function, or use of different tools and arrangements, might prevent conflicts in demands and problems occurring. However, the theory so far developed is rather general. It is not clear what
would precisely happen with improvement processes by teams. It is, for example, not clear what differences between operational processes and improvement processes exist, and what problems result. In addition, it is not clear if differences between the processes will lead to problems, and if so which problems will appear. It is, for example, not clear if slack in capabilities, the use of tools or arrangements, or the adjustment of improvement functions can prevent problems. The theory that was developed in this chapter only gives general indications about what might happen and thus what is relevant to look for. This must be explored in more depth to be able to develop a theory that shows more specifically for operational and improvement processes by improvement teams what might happen. It is a goal of this research to achieve this.

In the research, it has to be explored which differences and correspondences between operational and improvement processes exist. In addition, it must be described how improvement processes were performed. It must be determined which things were problematic in the improvement process and which were not. Next, it must be determined what the reason was that problems occurred or did not. Then it can be analysed to what extent the differences and correspondences between operational and improvement processes explain the problems that arose. The research questions can now be formulated. In the next chapter, these research questions will be operationalised.

To be able to address the research problem, the following research questions must be answered:

1. **What are the differences and correspondences between operational and improvement processes?**
2. **What in the improvement process is problematic, and what is not?**
3. **What was the reason that problems occurred or did not?**
4. **To what extent do differences and correspondences between operational and improvement processes explain the problems that arise, or not arise, with improvement processes by improvement teams?**

The next chapter discusses the methods used to answer these questions.
Theory to explain improvements in teams
Chapter 3: Research method

This chapter discusses how the research was performed. The research methods used are discussed and it is explained why several choices were made. First, the general research methods that were used are discussed. Following this, the more concrete research design, and the ways in which the data were collected are discussed.

3.1. Research design

3.1.1. Case study research

The goal of the research is to develop a theory that explains incremental improvements as carried out by improvement teams. The research examines to what extent differences and correspondences between operational and improvement processes explain the problems that arise with the improvement processes by improvement teams. To explore this, the insights into consistency and effectiveness offered by the process model are very relevant. The process

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7 Unofficial translation: In front of the Golden Wall it is an improvised shambles, there the rabble are swarming in the noisy chaos of daily life, and that not everything is a mess one must thank the world behind the Golden Wall. As the eye of the world, there lays the world of power, in mysterious silence, controlled, reliable, orderly as a chessboard: a kind of cleansed world of platonian ideas. This at least is the image the powerless in front of the Golden Wall have. But those who have been behind the Golden Wall know that this is only an appearance, and that in making decisions it is just as much an improvised shambles as in front of it, at home with the people. If someone permeates the Golden Wall, what does he see? Nothing special. Ordinary things with ordinary people, nothing more special and no different in nature than that of the powerless. They do not exercise the power in some ‘powerful’ inevitability, as if it were a mathematical certainty, as the powerless think, but in just as messy and improvised way as every powerless person in arranging his things.
model showed that in order to examine this, many factors must be examined together, such as the desired functions, the processes performed, the existence of slack, and the characteristics of the people, resources, tools, and arrangements. In such a situation, case study research is very appropriate, since it is focused on the study of a phenomenon in such a way that the links between the relevant factors stays intact (Hutjes & van Buren, 1992). The major research question of this research cannot be answered directly. Several relevant factors about the differences between operational and improvement processes are as yet unknown and several explorative questions must first be answered. Eisenhardt (1989) argues that when little is known about a phenomenon during the first stages of research, theory building based on case study research is appropriate. For this reason also case study research is appropriate for this research.

Authors often claim that in case study research, the ideal is not to have any theory under consideration and no hypotheses to test. The researcher should have a clean slate, although it is recognised that in practice this is hard to achieve (Eisenhardt, 1989). Strauss and Corbin (1990) state that it makes no sense to start with received theories of variables because these are likely to inhibit or impede the development of new theoretical formulations. Contrary to these ideals, it can be assumed that every researcher, because of his education, professional background, and life experience, has many assumptions about his research subject before he starts his research. Therefore, the clean slate is an illusion. Moreover, the discovery of new ideas is still possible if a researcher has prior knowledge of a subject. A clean slate is not necessary to make a discovery. Gummesson (1991) recommends using preunderstanding in research, but not to be its slave. When using preunderstanding in an appropriate way, it is very important to make the existing theoretical propositions of the researcher explicit. Then the theoretical framework can be questioned, and additional or rival frameworks can be proposed. This can also lead to the discovery of new theories. If researchers are told that they should be clean, they are encouraged to deny the existence of their, often implicit, assumptions. Consequently, they will never be able to explore their implicit assumptions and they cannot look for rival theories. Thus, for the sake of unbiased explorative research, it is important to explain all the theoretical assumptions of the researcher as far as possible, rather than pretend to be theoretically clean. The assumptions on the subject of this research were explained in the preceding chapters. In the first chapter, an overview was given of the literature that formed the main inspiration for this research. Many themes in this literature were influential on this research, for example the illustration of the importance of incremental innovations, the attention to using the knowledge of shop floor people, and the attention to structures and tools that facilitate incremental improvements. In the second chapter, some of the assumptions that guided this research were made explicit. The chapter showed that a structuralist approach could be used to examine problems in organisations. Further, it highlighted the choice of seeing organisations as a purposeful whole, and it focussed attention on effectiveness and consistency in organisations.

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8 It might be interesting to know if Strauss and Corbin were theoretically clean in regard of research methodologies when they ‘discovered’ grounded theory.
3.1.2. Unit of analysis

The definition of the unit of analysis is related to the way the initial research questions are defined (Yin, 1994). For this research, the unit of analysis is the improvement process and not the improvement team. Of course, teams play an important role in the case descriptions, because the improvement processes can only be studied by studying the activities of the improvement team. In the research, each improvement process by an improvement team is considered as a case. Because an improvement team works on several improvement processes, the different cases might thus have common explanatory factors. However, these explanatory factors can also change, because the team members change over time. For example, team members might gain experience during early improvement processes, which might be used in later processes. In this way, each case influences the characteristics of the team members, which might then influence a later case.

3.1.3. Selection of cases: shop floor people in batch production processes

Selecting the cases is an important aspect of building theory from case studies. The cases in this research are improvement processes as performed by improvement teams. In the first chapter, it was discussed why this choice was made. An additional choice is to limit examination to improvement teams consisting only of people from the shop floor involved with repetitive batch production.

- **Generalizability of the results**: The first reason to focus on improvement teams consisting of shop floor people in repetitive production is the generalizability of the results of the research. In practice, improvement teams are often used at the shop floor level for repetitive production processes, this type of improvement team is very popular. Thus, the type of improvement team selected for this research is in practice very common. By examining this type of team, the research is expected to give insights that can be generalized to many teams of the same type as used in many companies.

- **Gaining access**: Before the research was started, several managers from companies with batch production processes were wanting to start improvement teams with shop floor people. They wanted to explore what happened when they used these teams. Thus it was fairly easy to gain access to their companies in exchange for advice about teams. For the research, much effort was needed from the people in the company and the commitment of the managers to the research helped greatly in this. It illustrated to the people of the company that the research was regarded as important by their management. During the whole period of the research, the people involved with the improvement programmes never complained about the research activities and this greatly supported the research.

3.1.4. Action research

To answer the research questions, action research was used. Action research always involves two goals: to solve a problem for the client and to contribute to science. This means that you must be both a management consultant and an academic researcher at the same time (Gummeson, 1991). The basis of the relationship between the researcher and the researched is
their common concern, which usually starts with the presentation of a problem. This problem is gradually translated and developed into a project through a process of collaboration, increased joint involvement, and shared responsibility. It is a process in which the knowledge and experience of the researcher and the local and tacit knowledge of the researched combine in a process of joint learning (Van Beinum, 1993). Action research was appropriate for this research for several reasons:

In action research, the researcher/consultant is expected to produce “usable research”, defined as research that could be applied in real life situations and be helpful to the practitioner. The quality of the research is assessed in relation to the way the research results are perceived to facilitate the solution of an actual problem (Gummeson, 1991). The goal of this research is to develop theory that can explain incremental improvements as carried out by improvement teams. When the perspective of the research was discussed (see the section on ‘view of the world’ in the previous chapter), it was shown that it is important that the insights gained from the research can be used to guide future actions. Action research also contains this objective because it aims to generate models that can be used to guide future actions. Therefore, action research fits the realistic perspective of the research and its goal to contribute to solving practical problems.

A second reason for using action research is that the managers of the companies wanted to explore what happens in their companies and to receive advice about teams. Hence, the dual role of researcher and consultant was required and action research is a method that fits this role. During the research, the companies were assisted with the improvement teams. At the same time, a theory based on the experiences within the companies was developed.

To understand how improvement processes evolve, it must be understood why people do the things they do. For example, the motivation of team members in doing things is relevant to understanding the improvement processes they perform. People have action theories that underlay their actions. These action theories are an important aspect of social complexity in the research. These action theories are not totally explicit, often large parts of an action theory are implicit and taken for granted. This makes it hard for a researcher to describe and examine action theories fully. However, the parts of action theories that actors actually use in the processes can be examined. This can be best done if the researcher gets actively involved in the processes, if the researcher becomes part of the social network. By doing action research, the researcher has the possibility of getting to understand the action theories used by the actors, and to understand the social complexities. Therefore, action research is an appropriate method for this research.

It is important to note that the goals of the researched companies and of the researcher were not totally the same. The researched companies were interested in using the knowledge of the shop floor people through implementing improvement teams. One of the problems that arose during the implementation was the problem of conflicting demands placed upon the workers. The two processes of production and improvement had both to be performed by the people in the improvement team and this sometimes caused problems. The was research focussed on
this specific subject. The goal of the companies was broader: they wanted to solve all the problems that arose around the improvement teams. Another difference was that the goal of the researcher was to develop theory, while the organisations wanted their practical problems to be solved. Therefore, the goals of the researcher and the researched companies were slightly different. However, this did not cause any problems in the research.

3.1.5. The use of theory in action research

Action research first requires the establishment of a client structure. Then five phases are iterated around: (1) diagnosis, the identification of the primary problems that are the underlying causes of the organisation's desire for change; (2) action planning, guided by a theoretical framework which indicates some desired future state for the organisation and the changes that would achieve such a state; (3) action taking where researchers and practitioners collaborate in the active intervention; (4) evaluating the outcomes of the change; and (5) specific learning (Baskerville & Heje, 1993). One key aspect of action research is the role of theory. On the basis of paradigms and preunderstanding, and from access to empirical data via their role as change agent, action scientists develop an understanding of the specific process in the cases with which they are involved. They generate a specific (local) theory, which is then tested, and modified through action. When beginning the research, researchers draw upon existing theory as the foundations upon which to plan and take action. Following the evaluation of the outcomes of each cycle, the existing theoretical framework may be reinforced, withdrawn or modified to reflect the realities of action taken (Gummeson, 1991; Baskerville & Heje, 1993). The interaction between the role of academic researcher and the role of management consultant can also help the scientist to generate a more general theory. This theory becomes an instrument for increased theoretical sensitivity and an improved ability to act in a social context. The theory is never finalised but is continually being transcended (Gummeson, 1991). It is this evolution of theory that constitutes the scientific contribution of action research (Baskerville & Heje, 1993). An essential feature of theory building research is comparison of the emerging concepts with the existing literature. A key to this process is the consideration of a broad range of literature. Tying the emerging theory to existing literature enhances the internal validity, generalizability, and theoretical level of theory building from case study research (Eisenhardt, 1989).

In this research, literature had important roles at different moments during the research. The first time literature became important, was during the first visits to the companies wanting to start with improvement teams. Based on the existing prescriptive literature, together with the people from the companies, a structure for improvement teams was developed. Secondly, literature was important in formulating the research questions. The research could be made
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more specific by using theory on equifinality and the process model. An answer to the research questions was sought by exploring what happened in practice. The practical experiences were compared with theory and reflected upon. Thus at the end of the research, the theory will again have an important role.

3.2. Framework for case analysis

People who have been critical to case studies often point to the fact that a case study investigator fails to develop a sufficiently operational set of measures and that subjective judgements are used to collect the data. Construct validity refers to establishing correct operational measures for the concepts under study (Yin, 1994). In this research, the construct validity is increased by the use of a framework for describing the cases. A framework was developed that guided the collection of the data, the description, and the analysis of each case. In the following sections, this framework is discussed. The framework is based on the research questions, formulated in the previous chapter, that are needed to answer the research problem. In the following sections, each of these general questions is operationalised in detail.

3.2.1. Operationalisation of differences between operational and improvement processes

The first research question was: what are the differences and correspondences between operational and improvement processes? This section discusses how this question is examined in the research.

To compare operational and improvement processes, a rather detailed description of the processes is needed. To describe improvement processes, a distinction is made between improvement activities and tasks. Improvement activities refer to phases of the improvement processes in which things are done to realise an improvement. Appendix 1 discusses, based on literature, which improvement activities can be distinguished; an overview of these activities is shown in Figure 3-2. However, the categorisation of improvement activities does not indicate if these activities correspond or differ from the things people do in the operational processes. The things people do during an improvement activity must be described in more detail; this description is called the improvement task. The description of the improvement task for each activity indicates exactly which things are done. In this way, it shows if the activity corresponds, or differs, from the things done in the operational processes, and thus the introduction of the ‘task’ concept facilitates the description of the differences between the two processes. If during one improvement activity, several different tasks were performed, the activity will be repeatedly mentioned, for each task it is mentioned once. Thus, to indicate the differences and correspondences between operational and improvement processes, improvement tasks can be described.

**Improvement activities**
- Identify the problem
- Analyse the problem
- Develop a solution
- Test the solution
- Authorise the solution
- Implement the solution
- Standardise the solution
- Evaluate the solution

Figure 3-2: Activities that are distinguished (for a discussion, see Appendix 1).
It had to be examined in detail if the improvement tasks people performed, differed or corresponded with their operational tasks. However, it is not known in advance which improvement activities and tasks will be performed. It might be known roughly what teams are expected to do. However, the problems at hand, and the organisational setting in which improvement processes are performed, determine much of the details of the improvement activities and tasks. Therefore, it is not possible to determine the relevant differences and correspondences between operational and improvement tasks in advance, that is before the research is performed. The relevant differences cannot be an input into the research; they must be an outcome of the research. It is only possible to describe the characteristics of the operational tasks of the team members in advance. Based on this description, it is then possible to determine during the research whether each improvement task differed or corresponded with the operational tasks. During the research, the major differences and correspondences between the operational and improvement tasks will become clear. The major characteristics of the operational tasks are now discussed. An overview of the major differences between the operational and the improvement tasks will be discussed alongside the data analysis in chapter 5.

For the research, five improvement teams of two companies were examined. All the teams consisted of people who worked on the shop floor in a batch production process. The coaches of the teams were mainly young people with a higher education level than the team members; they worked in office departments such as planning, quality control, and industrial engineering. All the team members worked as operators in batch production processes. They produced physical products using machines and tools. The operational tasks differed somewhat for the two companies. In the first company Aircomp, the operators made products with their hands; in the second company, Boxprint, operators mainly set up and operated machines. In both companies, the tasks that had to be performed to make the products were determined by the production processes and the products that must be made. With every product, more or less the same routine tasks were performed. A planning department decided which products where to made; the planner or supervisor of the department communicates this to the workers. Operators could sometimes choose a sequence for making the products. During the production processes, problems could occur that had to be solved by the operators. These problems often had a routine character and familiar information had to be analysed to understand the problem. Problems for the operators to solve are, for example, correcting small problems in local operational processes caused by bad inputs, or problems related to setting up a machine. If problems were more complex, other people, for example supervisors or people from the quality department, were needed to solve them. From their (internal and/or external) education and experience, the operators had learnt to perform operational tasks, and they had learnt a set of solutions to solve problems. Most of the operators, in both companies, had several years of experience in their company. The operators had to record routine process information and problems that appeared. The communication performed by operators was on routine subjects. Operators made products alone, or in a group of two; little communication with others was needed during the production processes. If problems appeared in the processes, or with inputs, communication was sometimes needed with the supervisor or
supplying departments; this communication was mostly about routine problems. Most of the operators liked their operational work and they were proud of delivering good quality products. They liked it if the products are were quickly and they hated disturbances or delays in the production process.

<table>
<thead>
<tr>
<th>Major operational tasks</th>
<th>Make physical products, set up and operate machines, use tools. Solve routine operational problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and control</td>
<td>The operational processes determine which tasks must be performed. The supervisor and planner decide who produces which product at which moment.</td>
</tr>
<tr>
<td>Education and experience</td>
<td>Operators have several years of education and on-the-job training focussed on performing the operational tasks and solving routine problems. Most operators have several years of experience in the company.</td>
</tr>
<tr>
<td>Communication</td>
<td>Operators communicate with each other about routine operational tasks. They communicate with people of supplying departments or with their supervisor about routine problems.</td>
</tr>
<tr>
<td>Motivation</td>
<td>People found it important to produce good quality products efficiently.</td>
</tr>
</tbody>
</table>

**Figure 3-3: Characteristics of the operational tasks of the team members.**

### 3.2.2. Operationalisation of problems that arose or not arose in the improvement process

The second general research question was: What in the improvement process is problematic, and what is not? This section discusses how this question is examined in the research.

Based on the process model, the previous chapter gave clear insights into what a problem is. These insights were reflected in a figure that is repeated in Figure 3-4. *Problems in an improvement process occur if a desired function is not realised*, thus if the organisation is not effective. Thus, to determine if problems in the improvement process will appear, an improvement function must be formulated first. Then, it must be determined whether this function is realised or not; if it is not realised, problems in the improvement process exist. If it is realised, problems do not exist.

A function is realised by performing a process, which is the whole set of activities performed by people and/or resources. Problems with improvement processes are reflected in the improvement activities that are performed. If problems exist in the improvement process, the activities needed to fulfil a desired function are not performed well, and therefore the required transformation is not realised; thus, improvement activities can cause problems, they can be problematic. *An improvement activity is problematic if it hinders the realisation of the desired function of the improvement process.* An improvement activity is not problematic if it does not
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...hinder the realisation of the desired improvement function. Based on an improvement function, as formulated by the team members, the researcher has to determine if an improvement activity is considered problematic or not. Not all the problematic improvement activities have to result in problematic processes, for example because activities are corrected later in performing other activities. Therefore, it is important to distinguish explicitly between problems with improvement activities and problems with improvement processes; only the latter result in functions that are not fulfilled. This research, however, is performed at the level of activities; all the improvement activities that are performed in improvement processes are examined. Both the problematic and the non-problematic improvement activities are examined. It is investigated if it can be explained why activities were problematic or not by referring to the differences and correspondences with the operational activities. Thus, to examine how improvement processes were performed, improvement activities are described; it is determined whether improvement activities were problematic or not. In this way, the second research question is operationalised.

3.2.3. Reasons for problems or otherwise in improvements

The third research question was: what was the reason that problems occurred or did not? This section discusses how this question is investigated in the research. Together with this question, the last question, (To what extent do differences and correspondences between operational and improvement processes explain the problems that arise, or not arise, with improvement processes by improvement teams?) will be examined.

Gresov and Drazin show that if two different functions have to be fulfilled, then problems might appear in both functions; both functions might not be fulfilled because of the conflicts in requirements. In this research, the focus is on the misfits in the improvement configuration. By choosing the cases selectively, this focus can be easily achieved. In this research, cases were studied where organisations were introducing improvement teams. In these cases, the operational processes were already performed for a long time. Therefore, it can be assumed that the people in the team already fit to the characteristics of the operational processes. Misfits, because of conflicting requirements, are most likely to occur with the improvement configuration.

To determine the reasons for problems with improvement activities in depth, and to examine if problems with the incremental improvement processes by an improvement team can be explained by referring to the differences with the operational processes, the improvement activities are categorised. It is determined if an

<table>
<thead>
<tr>
<th>Type</th>
<th>Different from operational task</th>
<th>Problematic</th>
<th>Who performed activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Different</td>
<td>Problematic</td>
<td>Team</td>
</tr>
<tr>
<td>2</td>
<td>Not different</td>
<td>Problematic</td>
<td>Team</td>
</tr>
<tr>
<td>3</td>
<td>Different</td>
<td>Not problematic</td>
<td>Team</td>
</tr>
<tr>
<td>4</td>
<td>Not different</td>
<td>Not problematic</td>
<td>Team</td>
</tr>
<tr>
<td>5</td>
<td>Problematic</td>
<td></td>
<td>People outside team</td>
</tr>
<tr>
<td>6</td>
<td>Not problematic</td>
<td></td>
<td>People outside team</td>
</tr>
</tbody>
</table>

Table 3-1: Categories of improvement activities
improvement task differed or corresponded with the operational tasks, if it was problematic or not, and if it was performed by the team or not. Based on this, six types of improvement activities are distinguished. Focus in the research is on the activities that were performed by the teams, and therefore the team activities had to be distinguished from the activities performed by people outside of the team. For activities performed by people outside of the team, it is not relevant to determine if they differed from the operational tasks. All the different types of improvement activities are shown in Table 3-1.

The process model offers insights that can be used to examine the reasons that problems appeared (see Figure 3-4 where the major relationships are shown):

- When an activity is problematic, it hinders the realisation of the desired function; the process required to fulfil a desired function was not performed well. A process-function inconsistency exists. To perform a desired process, structure-process consistency must exist; the whole set of people-resources-arrangements must be appropriate for performing the required process. When activities are problematic, the whole set of people-resources-arrangements does not have the characteristics needed to perform the required process; structure-process inconsistencies exist. This has to be examined, it must be determined which inconsistency exists. It must be determined if the problematic activity was caused by the people, the resources, the arrangements, or by a combination. Then, it must be examined why the inconsistency existed. A reason for an inconsistency could be conflicting requirements, since people have to perform tasks other than the tasks in the operational configuration, they do not fit to those tasks and problems could appear. However, other possible reasons for inconsistencies exist. Table 3-2 shows the steps used in the analysis of problematic activities; this analysis is performed for activities of type 1 and 2.

- When an activity is not problematic, the realisation of the desired function is not hindered by it; the required process to fulfil the desired function is performed well. No process-function inconsistency exists. Because the required process is fulfilled, the whole set of people-resources-arrangements is apparently consistent with the required process; structure-process consistency exists. This can also be examined, why did the consistency exist. If the activity is of type 4, then it corresponds with the operational tasks. The people have to perform the same tasks as in the operational configuration and therefore no misfits will appear, and this explains why no problems appear. If the activity is of type 3, the consistency cannot be explained by a
correspondence with the operational tasks. However, apparently, conflicting demands do not exist and other explanations must be sought. The process model offers several explanations why inconsistencies did not appear: slack in the capabilities of the team members, the use of different tools, or the use of different arrangements. Table 3-3 shows the steps used in the analysis of the non-problematic activities. In this research, this analysis is performed for activities of type 3 and 4.

In the research, the insights offered by the process model are used to explore the reasons why improvement activities were problematic or not. In this way, it can be investigated whether improvement processes can be explained by referring to the differences to the operational processes.

3.2.4. Analysis of the cases

Improvement processes of different improvement teams were examined. All the cases are described and analysed in the same way:

1. First, all the activities of each improvement team that were mentioned in research reports were clustered into improvement processes. A process is a set of activities focussed on transforming inputs into outputs (Boer, 1991). An improvement process, then, is a set of activities focussed on transforming an existing situation into a more desirable situation. The research showed that, in some cases the definition of an improvement process was somewhat arbitrary. These cases consisted of several sub-problems, which could all regarded as separate improvement processes or could together be considered as one process. However, to the team members, the distinction between the different improvement processes was often very clear. The team members gave the different processes different names that were used in the team reports and during the team meetings. The distinctions made by the team members were used in the research to determine what was considered as a single process.

2. For each process, a proposed improvement (the function of the process) was formulated clarifying which concrete improvement is to be realised by the process. This proposed improvement was based on the descriptions used by the team members when they referred to the improvement process. These descriptions often contained clues about the proposed improvement, for example a team stated that the floor is damaged by the wheels of a pallet car and a waste basket. The improvement functions is thus to prevent damage to the floor.

3. All the research notes on each improvement process were collected. Based on the description of the activities in the research notes, and the clustering of activities into processes, the improvement process was described in a narrative way. The activities that were performed to fulfil the desired function are described narratively.

4. Then, it is determined if the desired function of the process was realised or not. It is determined if the proposed function was realised or not. In some cases improvements were only partly realised; the extent to which the improvement function was realised determined if the process as a whole was considered successful. If the desired
improvement was substantially realised, the function was fulfilled. If some partial improvements were made, the improvement function was considered unfulfilled. In the case of the problem with the damaged floor, for example, the floor was damaged by a pallet car and a wastebasket. The major damage was caused by the pallet car. The team only solved this problem, but the damage to the floor was decreased to such an extent that the whole improvement function was assumed to be realised.

5. Next, based on the narrative description, the main activities of the improvement process were distinguished. It was determined which improvement activity from Figure 3-2 was performed, and a description of what took place was added to the description of the activity. An activity is only distinguished in this research if it was described explicitly by the team, or in research reports. In many cases, activities were performed implicitly by the team members during their daily work (for example, the evaluation of a solution), or inside their heads (for example, the development of a solution). These activities are not mentioned in team reports and therefore could not be measured with the methodology used. Therefore, they could not be described and analysed in this research.

6. Each activity that was distinguished was categorised. For each improvement activity, the improvement task that was performed was described; it was determined if the improvement task corresponded with the operational tasks. In addition, it was investigated if the activity was problematic or not, and if it was performed by the team or not. Based on this, the activity was categorised into one of the six types of Table 3-1. Activities were considered problematic if they hindered the realisation of a desired improvement function. If an activity was problematic, it was determined how it hindered the realisation of the desired function. If an improvement process was not realised, it was described which activity hindered the realisation of the improvement; these activities are called ‘critical activities’. This label makes it possible to identify easily which activities caused the failure in the improvement process. By the categorisation of the improvement activities, it was clarified which differences or correspondences to the operational activities existed.

7. The activities were then analysed using the insights of the process model discussed in section 3.2.3. The major reasons why problems appeared or not were described. Different formats were used for the analysis of the problematic and the non-problematic activities. For activities that were not problematic, it was described why they were not problematic. For problematic activities, the relevant inconsistency was described, and it was explored why this inconsistency existed. All the improvement processes and their activities were compiled into a database. Two forms were used that contained the main case data. One form describes the improvement process with its activities. This form consists of one part where the process as a whole is described, and another part that describes each improvement activity. The other form contains the analysis of each individual improvement activity. On this form, the description of the activity is copied from the process-form. Next, the main difference or correspondence with the operational activities is described. Then, the form is split into two parts. One part contains the fields that are relevant for analysing problematic activities. The other part contains the fields
that are relevant for analysing activities that were not problematic. The database also contains several fields that were not directly relevant to the analysis of the cases, but which gave interesting information. For example, fields are added that indicate if the efforts and benefits of an improvement process were large or small. The database made it possible to analyse a large number of improvement activities in a structured way (73 improvement processes and 735 improvement activities). Further, the database made it possible to combine narrative descriptions with a more closed and structured analysis. This greatly facilitated the structured analysis of such a large amount of data in a qualitative way.

3.3. Collecting the data

Theory building researchers typically combine multiple data collection methods (Eisenhardt, 1989) and in this research, multiple sources of evidence have also been used. To collect data on improvement processes, action research, participatory observation, unstructured interviews, and document analysis have been used. Data were collected on improvement processes for five improvement teams in two companies. For each improvement team, data on their production process were collected by participatory observation. How the data were collected is discussed below.

3.3.1. Main periods of data collection

During the research the importance of action research changed and the collection of data can be characterised by three periods:

1. The first period is the first eight months of the research. In this period, visits to company A (Aircomp) started. The unit manager and a facilitator from the staff of Aircomp had discussed improvement teams some time. They decided to initiate improvement teams and they had clear ideas about how these teams should function. They prepared a course for the teams, and after several lessons, the teams were supposed to work on improvement projects on their own. When the company was first visited by the researcher, this course was prepared and the first lesson given. From that moment, action research started: the company was visited weekly. The researcher participated in the improvement program of the company and discussed with the facilitator what the improvement program should look like. During the course it became clear that the ideal situation, of teams working on their own, could not be realised. Each team needed additional support, teams did not function well without the help of a coach. Based on these insights the team courses were changed. Teams were to work on improvements from the start, and while working on improvements, they would get additional training from their coach. Several teams started to work on improvements. Then, about six months after the first course, the unit’s headquarters decided that the unit had to move to another part of the country. This caused great unrest among the employees, which resulted in all the improvement teams stopping their activities. For a period of eighteen months, no improvement teams existed in company A. During this period, the researcher and the facilitator in the company did try to restart the teams, but this was unsuccessful until production at the new location started. Up to this
Research method

restart, the company had worked with teams for six months. During this period the research was very broad. The initial experiences at company A were very influential on ideas about incremental improvements and working with improvement teams. The experiences lead to the formulation of the main research question. During this first six months, the research questions were not defined as they now exist, and data was not collected in such a way that it fitted the final research. Further, the teams only performed very few improvement processes that could be described. Therefore, the data collected in this period was not used in the formal analysis of improvement processes. This period can be considered as preparation for the rest of the research.

2. The second period of the research took place in company B (Boxprint). The visits to the company started when the owner/general manager of the company, and the head of the quality department agreed that they wanted to make better use of the knowledge of the shop floor people. Therefore, they were attracted to improvement teams. At that point, no clear plans yet existed about how to start improvement teams. Together with the head of the quality department, a plan was developed by the researcher on how to work with improvement teams. The plan was based on the experiences with the course in company A. It was decided to let team members work on improvements right from the beginning, and additional training would be given by the coach if needed. This plan was discussed with the general manager and he agreed with it. Five months after the first meeting, the first improvement team was set up, and the researcher became the coach of this team. After two months another team was started, and the researcher attended the meetings of this team, sometimes giving support. Further many discussions were held with the head of the quality department about how the teams were functioning and which actions were needed in the near future. The researcher’s team stopped after six months because the team became too small after people left the organisation.

3. At the end of the second period, it was decided by the researcher to put less effort into the teams, because otherwise her role would become too large and the teams would not become embedded in the company. The role as consultant became less important, it was only fulfilled if people from the companies asked for advice. Decisions about what to do in the improvement program were increasingly made by people of the company. This period can be characterised more as participative observation rather than action research. During this period, two more teams were started in company B and these were also observed. In company A teams were started up again. The role of the researcher was the same as in company B: discussions with the facilitator of the improvement teams, visiting team meetings, and sometimes discussing with and assisting the team’s coach.
Table 3-4 shows the three different periods of the research. The research questions are inspired by the first period of action research in company A. The collection of data took place during the second half of period 2 and during period 3 in both companies A and B. Only these data are used in the final thesis. The data collection in period 2 was by action research, while in period 3 the influence of the researcher in the improvement organisations became less prominent.

<table>
<thead>
<tr>
<th>Date and period</th>
<th>1-9-94</th>
<th>1-4-95</th>
<th>1-10-95</th>
<th>1-7-96</th>
<th>1-10-97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>Formulation of main research question, based on experiences action research in company A</td>
<td>Data collection and data analysis. Development of the descriptive framework</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company Aircomp</td>
<td>Action research, six month experience with several teams</td>
<td>Planning to start with teams again, no teams actually started</td>
<td>Less action by researcher, observation of existing teams, assisting coaches.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company Boxprint</td>
<td>Planning to start with teams</td>
<td>Action research, coaching a team, observing a team</td>
<td>Less action by researcher, observation of existing teams, assisting coaches.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3-4: Overview of the different periods of time in the research

3.3.2. Collecting data and gaining an understanding of the situation

The action research during the first two periods of the research contributed greatly to the understanding of improvement teams. For example, during the first period, several coaches were observed while they worked with improvement teams and the problems they had with motivating the team members were observed. Often, it was assumed that the coach was to blame for the problems. During the second period, the researcher herself was a coach of an improvement team and the problems of motivating people were really experienced. It was realised that the coaches could not be blamed for all the problems and it was realised that there were more fundamental issues. The periods of action research gave many insights that might have been missed if this research method had not been used. The social complexities of the situations were hard to interpret and examine without personal participation in the situation.

To examine the processes, people in an improvement team must be observed while they work on the improvement process. Improvement teams often work on improvements in team meetings. To collect the data needed for the research, these team meetings were attended on a regular base. It was not possible to attend all meetings, for example because different teams had their meetings at the same time, but at least half of all the team meetings of each team were attended. At these meetings, notes were made for research purposes and a team member also always made a report. Further the team members were often asked, after the meeting, about their opinions on the meetings. By interviewing the coach or team members, data were collected on the meetings that were not attended. This information was also recorded in the
personal reports of the researcher. Further, all the documents the teams produced on the different improvement projects were collected. Based on the personal reports and the team documents, each improvement process was described.

A striking feature of research designed to build theory from case studies is the frequent overlap of data analysis and data collection. One key aspect of using field notes is to write down whatever impressions occur, to react rather than to filter out what may as seem important, because it is often difficult to know what will or will not be useful in the future (Eisenhardt, 1989). This procedure was followed during this research. To conclude the personal reports of the team meetings, different impressions were recorded, also observations, and intuitive ideas. Further, during the whole period of research, all kinds of ideas and experiences were recorded in internal reports, papers, and personal memos and these ideas were discussed with other researchers. All these documents and the comments of other researchers were stored by date, so that an overview of the development of the ideas was available. Yin recommends having two separate collections of documents: (1) the data, and (2) the reports of the investigator. Too often, case study data are synonymous with the evidence presented in the case study reports, and a critical reader has no recourse if he or she wants to inspect the data that led to the case study conclusions. A case study database markedly increases the reliability of the entire case study (Yin, 1994). In this research, the reports of the improvement team’s meetings were always separated from personal opinions, and the description of the cases in the final database.

Data on the production processes of the team members of each team were collected by participative observation. The researcher worked with the people in each team for at least two days and compiled an extensive report on their work. This report was discussed with the facilitator of the improvement teams, and the comments from the facilitators were used to modify the report on the production process. Based on these reports, a short description of the main characteristics of the operational tasks of the team members was made.

The next chapter discusses the relevant context of the improvement teams. This context might well influence the processes and activities that were performed by the teams. Thus, to be able to understand the research findings, it is important to understand the context in which the improvement teams worked.
Chapter 4: Context of the improvement teams

In the following sections, the relevant organisation of the improvement teams in the companies that were examined is described.

4.1. Company A: Aircomp

4.1.1. Main customers, products and activities

Aircomp is a department of a company that produces capital goods. Aircomp produces aircraft components for several different aircraft producers.

The main activities within the company are participation in the design of components, preparation for the production, and the production and assembly of components. Technical specialists, in project teams, prepare the production. Shop floor people produce and assemble the components. They were trained within the company to perform these activities. Different levels of shop floor people are distinguished, depending on the amount of education and experience they have. Very experienced people can become members of a project team that prepares for the production of new components. Several groups of staff support the production activities, such as quality assurance, technical specialists in several fields, planning, and management specialists.

4.1.2. Importance of quality assurance and improvements

In the aircraft industry, strict rules guide the production of aeroplanes and components. Regularly, government institutions audit the production processes and check if the existing rules are followed. Changes in the production processes are sometimes hard to implement because the governmental institutions have to agree with them and improvement ideas must well defined with much technical detail. This can block small improvements, because it is only worth changing production if the advantages of changes are moderate to high.

4.1.3. Developments during the research period

During the research period, Aircomp underwent several very large changes:

Firstly, after improvement teams had existed for about six months, the management of the mother company decided to shut down the site were Aircomp performed its activities, and Aircomp had to relocate to another factory in another part of the country. This resulted in a lot of resistance throughout the whole department; only about 30% of the employees decided to move with Aircomp to the new location, the rest to leave the department and the facilitator of the improvement teams was one of these. A student who wrote a Kaizen-plan became head of the quality department, and a student who had studied rewarding improvement teams and suggestions within the company became the new facilitator. Over the next year, about half of the employees were very unmotivated in their work, while the other half put much efforts into preparing for the move of the company. The facilitator was also busy with planning the move of Aircomp. During this period, not much energy was available for additional improvements.
Context of the improvement teams

One year after Aircomp’s mother company had decided that it had to move to another part of the country, the mother went bankrupt (see also Ros, 1997b). Following the bankruptcy, another company bought some parts of the company including the factory where Aircomp was moving to. Therefore, Aircomp could continue its activities. A significant number of Aircomp’s products was no longer required because these were sold to the mother company, but new orders came in and Aircomp had enough work to continue.

Shortly after Aircomp was bought, it moved to its new location. The factory at this new location had excessive employees, and some employees were transferred to Aircomp. In this way, Aircomp quickly acquired experienced employees. After Aircomp moved to the new location, improvement activities were very important, and improvement teams were soon started up again. Some of the people in these new teams had been in the earlier teams at the other location but for most of them improvement teams were new.

At the new location, Aircomp increasingly integrated into the factory that existed there already. After several months, the managing director of Aircomp left, and Aircomp and the other factory were integrated.

<table>
<thead>
<tr>
<th>1-8-94</th>
<th>1-2-95</th>
<th>1-2-96</th>
<th>1-6-96</th>
<th>1-8-96</th>
<th>1-6-97</th>
<th>1-7-97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of the research.</td>
<td>Aircomp has to move to another part of the country.</td>
<td>Mother company of A goes bankrupt. A becomes part of another company.</td>
<td>Aircomp moves to another part of the country.</td>
<td>Start with new teams.</td>
<td>Managing director leaves Aircomp.</td>
<td>End of the research at Aircomp.</td>
</tr>
</tbody>
</table>

Figure 4-1: Time frame of the major developments at Aircomp during the research

4.1.4. History of organising improvements

Quality assurance and managing improvements traditionally received much attention within Aircomp. In the recent past, the company has worked with quality circles to involve people from the shop floor in problem solving and several people recalled this. Further, the company has made several attempts to involve shop floor people in other tasks than their direct work, for example they were involved in preparing for the production of new components. Thus, Aircomp has considerable experiences with organising improvements by shop floor people.

4.1.5. Organisation around improvement teams

The organisation that was built around the improvement processes in Aircomp is now discussed. During the research, this organisation changed, because of early experiences with organising incremental improvements, the changing context and the developments that took place. The major changes in the improvement organisation are also discussed.

Strategic management of the improvement process: Strategic management refers to the formulation of the goals of processes. The managing director was the main actor in the strategic management of the improvement processes. He was the first to use the concept of Kaizen at Aircomp. He wanted to implement some Kaizen ideas in the company, such as a clean company, policy deployment, and improvement teams.
Adaptive management of the improvement process: Adaptive management refers to the management of the configuration of people, resources, and processes in such a way that the goals can be realised. The managing director instructed the management specialist within Aircomp to develop a plan to implement his Kaizen ideas. A student was involved to assist the management specialist and together they developed the ideas of the managing director in more detail and they made a Kaizen plan. The management team discussed the plan and they agreed with the planned actions. During these discussions, the researcher became involved with the company. The Kaizen plan contained several major subjects:

- **Policy deployment**: One action proposed in the plan was to start a process of policy deployment, in which the general goals for Aircomp were formulated and translated for each department. For several months the management team was busy with this and when they had reached the point where the plans were to be communicated to the departmental people, the management of the mother company decided to move the factory, and policy deployment lost priority.

- **Clean company**: Another action that was proposed in the plan was to improve the cleanliness of the company. To achieve this, each week a (changing) group of three people would inspect the whole company and each department got a grade. These actions were also mostly stopped when it was decided to move the company.

- **Improvement teams**: The third action that was proposed in the plan was to start to work with improvement teams. This is discussed in more detail below.

Several roles and rules were important in the organisation of the improvement teams and these are discussed below:

**Team members**: Problem solving was regarded as important for everyone in the organisation; everybody had to think about improvements in their own work. Therefore, improvement teams were not only implemented on the shop floor, but also in staff departments when the company first introduced teams. One of these staff teams did not want to use the tools that were developed by the student and the facilitator, and they were regarded as an unofficial ‘wild’ team. When teams were introduced at the new location, only people from the shop floor were involved. The staff departments were much smaller and less concentrated, so it was less useful to discuss common problems among staff.

**Instructor**: Because of the attention paid to a structured approach in problem solving by Imai, it was assumed that the team members had to learn to solve problems in a structured way and to use problem solving tools. To explain this, a course was prepared. The course was developed and given by the student. It was proposed that the team members would solve one or two practical problems during the course, and then they would be able to solve problems without additional help. In the first meeting, the instructor told the team what they were supposed to do. He explained what an improvement team is, and what was expected of the team members. A major rule was that the team had to work only on problems that they solve could mainly themselves. Several other rules existed, such as: listen to each other, take each other seriously, etc. After several team meetings, it became clear that it was wrong to think
that teams could solve problems in a structured way without additional help. It was decided that the role of instructor was changed into the role of a coach to permanently assist the team. The team members did not like the course, they found it too theoretical, and they wanted to work on real problems immediately. Therefore, it was decided that the coach would in the future start to solve problems with the team from the first meeting, and while a team was solving problems, the coach would introduce a structured approach and the relevant improvement tools. The role of instructor disappeared and the role of coach was introduced.

**Coach**: In the first instance, the student and the facilitator became coaches of a team. Two supervisors from a staff department became coaches for teams from their departments. Later, staff specialists also coached teams of people from the shop floor. The coach was seen as a facilitator for the team members who had to take care of the operational and the adaptive management of the improvement processes by his team.

**Facilitator and student**: The facilitator and the student co-ordinated the improvement teams. They planned new teams and discussed these with the supervisors, supported the teams and coaches with tools, and discussed the progression of the teams.

**Researcher**: The researcher entered the process when the Kaizen plan was under discussion within the management team. In the first instance, the main role of the researcher was to observe what the company was doing and to discuss her findings with the facilitator. Later, the researcher became more of a consultant and sparring partner of the facilitator, and they then together developed plans on how to organise incremental improvements. The researcher had close contact with one or two teams, while the other teams were followed from more of a distance during the first period.

**Managing director**: In the first instance, the facilitator and the student regularly discussed with the managing director the improvement organisation. In the new location, the managing director worked at more of a distance, and the facilitator and the researcher mostly organised the improvement processes themselves.

A scheme of the main roles in the improvement organisation is shown in Figure 4-3. Some people performed more than one role in the improvement organisation; for example the facilitator and the student were also coaches of an improvement team.
Alongside the roles, several organisational arrangements were important in the improvement organisation. These are discussed next:

**Rewarding improvements**: Aircomp had a suggestion box linked to a reward system. After some months, during a team meeting, one of the team members did not participate in a discussion about a certain problem, and then afterwards he put a brilliant solution to the problem that the team had discussed in the suggestion box. In this way, he hoped for a financial reward. He did not discuss the solution in the team, because the team did not get any financial rewards. After this had happened, a student developed a new reward system for suggestions and teams. When this was about to be implemented the improvement activities were stopped because of the factory move, but when the factory restarted again at the new location the new reward system was implemented. Then, teams as well as individual suggestions got financial rewards. In the reward system, the focus was on quick feedback, and the participation of the person who suggested the idea in the implementation of the idea. Response to the reward system was positive from shop floor people, supervisors, and management (see also Schuring, 1998 for more details).

**Spreading information**: In first instance, the facilitator and the student were at the core of the improvement organisation. They developed the Kaizen plan, discussed with the management team on organising improvements and how to realise the ideas in the plan, developed and gave the courses, introduced new teams, and attended all the team meetings. Regularly, they reported their findings to the managing director. Later, the facilitator and the student both got new jobs and a new facilitator was introduced; the researcher assisted him. The facilitator, alone, was at the core of the improvement organisation. He discussed it with the managing director from time to time, and together with the researcher, he discussed how to organise the improvement organisation. Improvement activities of the teams were monitored regularly by the researcher and the facilitator. During the team meetings, each team had to make notes, and these notes were given to each team member, the facilitator, the other
Context of the improvement teams

coaches, and the researcher. In this way, everyone knew what the team was working on. Further, the facilitator regularly attended the team meetings regularly and he discussed with the coaches the progression of their teams. Within Aircomp, a newsletter was produced that contained recent information about all the developments that took place. The facilitator of the improvement organisation was one of the editors of this newspaper, and sometimes he wrote about improvements in it.

Implementation of improvement teams: In the first instance, two teams with people from the shop floor were introduced and these teams received a course on problem solving. After several weeks, two teams with people from a staff department also began. One of these teams was an unofficial team. The staff teams did not follow the course, but their coaches tried to teach them the relevant tools. After a while, two further teams with people from the shop floor were started. When these teams started to get used to their tasks, it was decided to move the factory, and all the teams stopped their activities. One team did continue for several weeks, and they then tried to use the tools they had learned to influence the decision of the management of the mother company to move the factory. When this did not work, they also stopped. After the company moved, one improvement team started again and after several weeks a second team was started. More teams were planned, but because of a lack of good coaches this did not take place.

Operational management of the improvement process: The coach and the team members together formed an improvement team, but their roles were different. The major role of the coach was to manage the improvement processes that the team worked on. When the team worked on a problem, the coach took care of the general planning of the improvement process. Further, the coach was responsible for ensuring that the team asked for authorisation for the solutions in time. The coach sometimes suggested asking more experienced people for help when the team did not have enough knowledge to solve a problem.

Performing the improvement process: The teams met once a week, or once every two weeks, for about an hour during working time in a room that was distinct from their working place. During this hour they discussed the problems that they had worked upon. Teams were not guided in the improvements that they should perform, they were able to choose the improvements they regarded as most important, and they were supposed to perform the main improvement activities themselves. In practice, they sometimes needed people from outside the team to assist them; for example to judge if a solution would work, to authorise a solution, or to implement (parts of) a solution.

4.2. Company B: Boxprint

4.2.1. Main customers, products and activities

Boxprint produces several paperboard products for industrial clients. The main products are printed boxes, instructions about how to use medicines, labels for medicine boxes, and annual reports or writing paper for other organisations. The major customers are in the
pharmaceutical industry, the cosmetic industry, banks, producers of bulbs, and producers in the food industry.

Major activities within the company are printing and finishing paperboard. Finishing paperboard includes cutting boxes into their final form and putting glue on the printed boxes. Further, they fold pharmaceutical instructions. The main production activities, such as printing, gluing, cutting and folding the paperboard, are performed by operators using machines. Alongside the production tasks, several other tasks are necessary at Boxprint, such as visiting customers, registration, planning, and warehousing of the orders, and checking the quality of the product.

4.2.2. Importance of quality assurance and improvements

The customers from the pharmaceutical industry in particular have several strict needs regarding assurance of the quality of the product according to Good Manufacturing Principles to assure the safety and health of users of their medicines. Therefore, traditionally, quality control has received much attention within Boxprint. A major element of quality control is checking the produced products and operational processes. The machine operators check their own products as they produce. All operators are trained to use their machines during several years of schooling and during in-company education. All operators know the requirements of the products they produce, and they are able to check the products they produce. Further, the Quality Control department checks the in-process controls and final products. The operators and Quality Control do not check all the products, only a sample is checked.

During recent years, the costs in the pharmaceutical industry have had to decrease dramatically because of governmental measures, and therefore the prices of suppliers have also had to decrease. Consequently, it is vital for Boxprint to improve its performance and decrease its costs.

4.2.3. Developments during the research period

During the research period, one of the main pharmaceutical customers wanted Boxprint to become a certified supplier according to their own company standards. The customer performed several audits to check the production processes and several times these audits showed shortcomings at Boxprint. Further, complaints arose because some mistakes were made repeatedly which resulted in unsatisfactory final products. Several of those mistakes arose because Boxprint was based in an old building that was not sufficiently sophisticated. During the research period, Boxprint moved to a brand new building with several new installations. In addition mistakes arose because the technology used in parts of the operational processes had rapidly changed. However, these were not the operational processes of the improvement teams.

4.2.4. History of organising improvements

Up to several years ago, the main task of Quality Control was to check products and to decide if an order could be passed on to clients or if rework was needed; Quality Control did not
really solve problems. Sometimes the supervisors of the production departments solved the problems, but they have other important supporting tasks within their department. The supervisors prepare orders, and they collect the materials that are needed to produce them, so they do not have much time to solve problems. Further, most of the supervisors are not trained to solve problems. Therefore, problems were often only solved in the quick rough way, or they were not really solved at all. Several years ago, the Quality Control department was restructured somewhat. A new head of department was employed and one of his tasks became to solve problems in a more structured way. He started to analyse the customer and in-process complaints and in this way, Boxprint got more insights into the major problems. The next step was to solve these problems in an improved manner. This was organised in several ways:

**Supervisors:** The managing director and the head of the quality department discussed registering the main problems on a regularly basis with all the supervisors. In this way, the supervisors of the departments were forced to pay more attention to problem solving. Further, attention was paid to the social skills of the supervisors: all of them attended a course on managing and problem solving.

**Shop floor:** Alongside the attempts to organise improvement processes at the level of the supervisors, more attention was paid to problem solving by the shop floor people. A major goal was to use the knowledge of the shop floor people better and to develop their problem solving skills. The principle director and the head of the quality department discussed this at length with some university researchers. Together, they decided that the concept of improvement teams fitted to Boxprint, and it was decided to start work with improvement teams on the shop floor.

The organisation that was built around improvement teams at Boxprint is discussed below.

### 4.2.5. Organisation around improvement teams

The improvement structure that was used at Boxprint was mainly based on the experiences from Aircomp.

**Strategic management of the improvement process:** Strategic management refers to the formulation of the goals of the operational processes. At Boxprint, the managing director performed the strategic management of the improvement process, and the facilitator and the researcher discussed this with him on several occasions. The goals of the improvement processes were: (1) to develop the skills of the shop floor people, and (2) to solve problems in a structured way. The managing director expressed several times that the first goal was the most important. The goals of the improvement process were not changed during the research.

**Adaptive management of the improvement process:** Adaptive management refers to the management of the configuration of people, resources, and processes in such a way that the goals can be realised. The managing director, the facilitator, and the researcher took the major decisions on the improvement organisation. These decisions were strongly based on the experiences of the researcher with Aircomp. In first instance, they all discussed what the improvement organisation should look like. Later, the facilitator and the researcher took the
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major decisions, and the facilitator kept the managing director informed. The major decisions taken on the improvement organisation were:

**Team members:** Only people from the shop floor would be the members of a team. It was assumed that it would be better if the supervisors were not part of the teams and that they did not coach the teams. Reasons for this were that they were very directive and dominant, and they had a short-time based perspective on of problems.

**Coach:** A coach would assist each team. Several young people with a relatively high education level became coaches of a the teams and one of the researchers also coached a team. The coaches were told to let the team members perform the improvement activities themselves wherever possible; the coach was seen as a facilitator for the team members who had to take care of the operational and the adaptive management of the improvement processes for his team.

**Facilitator and researcher:** A facilitator co-ordinated all the improvement teams. He introduced new teams and discussed them with the supervisors, supported the teams and coaches with tools, and discussed the progression of the teams with the coaches. A researcher from the university assisted the facilitator.

**Managing director:** Both the facilitator and the researcher discussed periodically with the managing director the progression and future plans regarding teams.

A scheme of the main roles in the improvement organisation is shown in Figure 4-3. Some people performed more than one role in the improvement organisation; for example the facilitator and the researcher were also coaches of improvement teams.

![Figure 4-3: Distribution of operational and management tasks between the people in the improvement process at Boxprint](image)

Alongside the roles, several organisational arrangements were important in the improvement organisation. These are discussed below:
Team rules: In the first meeting, the coach told the team what they were supposed to do. The coach explained what an improvement team is, and what was expected of the team members. A major rule was that the team had to only work on problems that they could mainly solve themselves. Another important rule was that the team members were responsible for communication with their supervisor on what the team was doing. Several other rules existed, such as: listen to each other, take each other seriously.

Teaching problem solving skills: The managing director, the facilitator and the researcher agreed that it was important that the teams solved problems in a structured way. The most appropriate way to teach teams problem solving skills and the use of relevant tools seemed to be on-the-job, and an important task of the coach was to teach his team how to solve problems in a structured way, and to teach the relevant problem solving tools. No special training sessions were used for this, the coaches demonstrated the tools while working on a specific problem. The facilitator and the researcher assisted the coaches in this. They demonstrated the tools to the coaches and suggested that the coaches use these tools if they seemed relevant during an improvement process.

Rewarding improvements: Teams did not get financial rewards for the improvements they achieved. Team members found it stimulating if they produced important improvements. They were very committed to the operational processes, and they found it very stimulating to solve problems in these processes. Further they wanted to be acknowledged by the other people in the organisation, but often they were not satisfied in this.

Spreading information: Each team had to make notes of each meeting, and these notes were given to each team member, the facilitator, and the researcher. In this way, they all knew what the team was working on. Further, the researcher attended most of the team meetings. She discussed the main events of the meetings with the facilitator and in some cases, she asked him to intervene in the improvement process of a team. Sometimes, the facilitator also attended a team meeting. After the team meetings, the researcher often discussed with the coaches the progression of their teams and how to manage the teams. Improvement activities by the teams were monitored regularly by the researcher and the facilitator. The facilitator and the researcher produced a small newspaper on incremental improvements and quality to spread information to all the people in the company. In the newspaper, they explained the goals of improvement teams, and discussed the activities of the teams. Information on customer complaints and quality was also discussed. The newspaper was placed on publication boards throughout the company. It was supposed to be updated about every three weeks, but this was realised on only about three or four occasions. In total, about eight newspapers appeared during the research period.

Implementation of improvement teams: It was decided to implement improvement teams in a gradual way. First, one or two teams would be implemented, and based on the results with these teams, more teams would be introduced. The first teams would consist of people from only one department of the shop floor and they would be based in departments where only moderate problems were expected. The researcher was the coach of the first team, since she had sufficient time to coach a team at that point. One month after the first team started, a
second team was introduced. A representative from the planning department coached this team. The third team started eight months, and the fourth team started 12 months after the first team.

Adaptive management of the improvement process is focussed on the design of the improvement organisation. Alongside this adaptive management, the more concrete operational management and the operations in the improvement process itself are also important.

Operational management of the improvement process: The coach and the team members together formed an improvement team, but their roles were different. The major role of the coach was to manage the improvement processes that the team worked on. When the team worked on a problem, the coach took care of the general planning of the improvement process. Further, the coach was responsible for ensuring that the team asked for authorisation for the solutions in time. The coach sometimes suggested asking more experienced people for help when the team did not have enough knowledge to solve a problem.

Performing the improvement process: The teams met once a week for about an hour during working time in a room that was separated from their working place. During this hour, they discussed the problems that they had worked on. Teams were not guided in the improvements they should perform, they were able to choose improvements that they regarded as most important, and they were supposed to perform the main improvement activities themselves. In practice, they sometimes needed people from outside the team to assist them; for example, to judge if a solution would work, to authorise a solution, to deliver information, or to implement (parts of) a solution.

4.3. Conclusion

In practice, different ways exist of working with improvement teams. In this chapter, the ways used by the companies in this research were discussed. This information could be used by other organisations that want to work with improvement teams. However, it should be noted that many others ways of working with improvement teams might also be possible.

To understand the improvement processes performed by an improvement team, it is important to understand the context in which these improvement processes take place. It is important, for example, to know which vision or goals guide the improvement processes, how improvement tasks are divided between the existing people, and which tasks are performed in improvement processes. This chapter has shown the relevant context of the improvement teams that were examined. Knowledge on this context is relevant in order to be able to analyse the research data. In the following two chapters, the analysis of the research data is discussed. The first of these analysis chapters discusses the analysis of the different improvement activities that were performed by the teams. The second analysis chapter focuses on the correspondences and differences with the operational tasks. It discusses the improvement tasks that differed and those that corresponded with the operational tasks, and it gives reasons when problems appeared with tasks. The final chapter, chapter 7, contains
Context of the improvement teams

theoretical reflections on the different analyses; this shows that the context of the teams, as was discussed in this chapter, is very important for understanding the research findings.
Chapter 5: Analysis of improvement activities

"Kunnen we alsjeblieft niet een beetje doorlopen?" zei ze tegen Kassiopeia. "Hoe langzamer, hoe vlugger" was het antwoord van de schildpad. Ze kroop verder, haast nog langzamer dan daarnet. En Momo ontdekte dat ze daardoor juist sneller vooruitkwamen. Het leek bijna of de straat onder hen door gleed, steeds sneller, hoe langzamer ze liepen. Want dit was het geheim van het witte stadsdeel: Hoe langzamer je liep, hoe sneller je vooruit kwam. En hoe meer je je haastte, hoe minder je opschoot. (Momo en de tijdspaarders, Ende, p. 188) .

In this chapter, some of the data from the different cases are analysed. First, some explanations are given about the analysis of the improvement activities. Next, the major differences and correspondences that were found between the operational and the improvement tasks are discussed. In this section, attention also is given to the relationship between improvement activities and improvement tasks. Each improvement activity is then discussed in depth. It is explored how often activities were performed, if they were problematic or not, and the correspondences and differences with the operational activities are examined. Further, it is investigated why improvement activities were problematic or not.

5.1. Introduction to the analysis of the improvement activities

To answer the research question, several choices had to be made in describing the improvement activities. To understand the analysis of the research data, it is important to know these choices. Sometimes a team had to perform different tasks to perform one improvement activity. For example, to develop a solution, team members had to think about a proper solution, and they had to talk to others about this solution. These tasks were very different. To be able to compare them with the operational tasks, they had to be distinguished as separate improvement activities. Thus, although only one solution was developed, the development of that solution has to be mentioned twice. In addition, to be able to show how often activities were problematic, it is important to describe improvement activities each time they occurred. It is, for example, important to show that standardisation activities were frequently performed well, and only a few times did problems appear. To be able to measure this, the activities must be noted each and every time that they were performed, even though it is all about the standardisation of one solution. Further, it was important to distinguish the activities performed by the team from the activities performed by people outside of the team. This was another reason that one activity sometimes had to be mentioned several times. These choices have important influences on the number of times that activities are mentioned within

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9 Unofficial translation: “Can we please move on?” she said to Kassiopeia. “The slower, the quicker” was the answer of the turtle. She crawled forward, almost slower than before. And Momo discovered that in this way they were proceeding more quickly. It seemed as if the streets were floating beneath them, ever quicker, the slower they walked. Because this was the secret of the white section of the city: the slower you walked, the quicker you proceeded. And the more you hurried, the slower you proceeded.
one improvement process. The number of times activities are mentioned does not always refer to the number of times the activity took place in the improvement process. For example, if the development of a solution is mentioned six times in an improvement process, this does not mean that six solutions were developed. It means that: (1) the team had to perform different tasks to develop a solution, or (2) that activities to develop a solution were performed several times, or (3) that different people within and outside the team performed activities, or (4) that several different solutions were developed. The number of times an activity was measured in the research is a yardstick of the energy that it took the organisation to perform the activity. It indicates how involved people were with the activity, and it makes it possible to examine how frequently attempts to perform activities were problematic. This is very relevant in answering the research question; it is more relevant for this research than, for example, knowing how many solutions were developed to solve one problem.

The activities of the improvement processes were categorised into six types, based on the difference or correspondence with the operational process, the problems that appeared in performing the activity, and the people (team members, or people outside of the team) who performed the activity. An overview of the categories is shown in Table 5-1. The next table shows how often each type of activity occurred in the improvement process.

<table>
<thead>
<tr>
<th>Type</th>
<th>Different from operational task</th>
<th>Problematic</th>
<th>Who performed activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Different</td>
<td>Problematic</td>
<td>Team</td>
</tr>
<tr>
<td>2</td>
<td>Not different</td>
<td>Problematic</td>
<td>Team</td>
</tr>
<tr>
<td>3</td>
<td>Different</td>
<td>Not problematic</td>
<td>Team</td>
</tr>
<tr>
<td>4</td>
<td>Not different</td>
<td>Not problematic</td>
<td>Team</td>
</tr>
<tr>
<td>5</td>
<td>Problematic</td>
<td></td>
<td>People outside team</td>
</tr>
<tr>
<td>6</td>
<td>Not problematic</td>
<td></td>
<td>People outside team</td>
</tr>
</tbody>
</table>

Table 5-1: Categories of improvement activities

<table>
<thead>
<tr>
<th>Activities performed by the team</th>
<th>Total Team</th>
<th>Outside Team</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify a problem</td>
<td>154</td>
<td>13</td>
</tr>
<tr>
<td>Analyze the problem</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>252</td>
<td>13</td>
</tr>
<tr>
<td>Test a solution</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Authorize the solution</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>60</td>
<td>19</td>
</tr>
<tr>
<td>Standardize the solution</td>
<td>47</td>
<td>3</td>
</tr>
<tr>
<td>Evaluate the solution</td>
<td>15</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5-2: Activities in the improvement process per type
Table 5-2 shows that many improvement activities differ from the operational activities of the team members (78%). Only 22% of the improvement activities had the same characteristics as the operational activities. The table also shows that from the group of activities that corresponded with the operational activities, most were not problematic (only 3% of the activities are of type 2, while 19% of the activities are of type 4). In addition, the table shows that many improvement activities that differ from the operational activities also were not problematic (68% of the activities were of type 3). Only 10% of the activities differed from the operational activities and were problematic. These percentages are also shown in Figure 5-1.

To examine the findings of the research in depth, each activity will be discussed separately in this chapter. For each activity, the major differences and correspondences with the operational activities are discussed, and it is further discussed if the differences and correspondences led to problems or not. If differences did not lead to problems, it is examined why. Before each activity is discussed, the relevant correspondences and differences between operational and improvement processes are first discussed.

5.2. Improvement activities and tasks

5.2.1. Comparing operational and improvement tasks

Because it was not clear in advance which improvement tasks were performed, the differences between the operational and the improvement tasks could not be described before the actual research was performed. In this section, the major differences between the operational and improvement tasks that appeared during the research will be described. In this discussion, the difference between ‘tasks’ and ‘activities’ is relevant. The word ‘activity’ is used to refer to specific phases in the improvement process. Examples of activities are, identifying a problem, developing a solution, implementing a solution; these activities were summarised in the operationalisation of the research in chapter 3. The word ‘task’ is introduced to refer more specifically to the differences and correspondences with the things people do in the operational process. Examples of tasks are position new tools, or ask the supervisor to do something. Improvement activities consist of one or more tasks that are performed. The tasks that were distinguished during the research are summarised in Table 5-3. The table also shows which tasks differed and which corresponded with the operational tasks of the team members.
In the following sections, each of the tasks summarised in the table is discussed.

**Corresponding tasks**

Improvement tasks that were performed, and corresponded with tasks in the operational processes, are discussed below. Each task is briefly described.

**Identify or communicate problems with the input:** People must identify mistakes with their inputs that will hinder the next stage of the operational process. In addition, they are supposed to communicate these mistakes to others. Communication may be required with the department where the inputs were produced. In some instances, communication is required with a ‘middleman’ who communicates to the producer the inputs, for example a supervisor or the quality department. This happens for example, when another company produces the inputs. Frequently, people tell or show others what went wrong.

**Identify or communicate problems with the process:** People must not only identify mistakes with the input, but also problems that appear in the processes that they perform themselves. Many small problems can be corrected without help, for example problems with setting up a machine. However, when problems arise often, and seem to have a more fundamental cause, these mistakes should be communicated to others, such the supervisor, mechanics, or the quality department. People frequently tell or show others what went wrong.

**Register problems when they appear in the operational process:** A specific part of the identification and communication of problems with inputs and processes is that people sometimes have to write down, or register, when or which problems appeared. In addition, people have to write down information about the operational processes. For example, they have to write down which orders they produced or the identification codes of the materials they used.
Ask the supervisor to do things: Supervisors performed many activities in controlling and supporting the operational processes. Often, people that perform operational processes have to ask their supervisor to do things for them. They may ask him, for example, to explain the things going on in the organisation, to solve a problem, or to collect materials.

Team informs the supervisor: To be able to support and control the operational processes, the supervisors need information from the people who perform the operational processes. Therefore, people inform their supervisor about the things they do and the main things going on in their operational processes.

Supervisor informs the team: A part of the support and control activity of the supervisor is that he informs the people that perform the operational processes. The supervisor might inform people, for example, about how problems are solved, and what things are going on in the organisation.

Use tools or machines: To perform their operational tasks, people have to use tools and machines. They set up and operate a machine to make products.

Different tasks
Next, improvement tasks that were performed, and that differed from the tasks in the operational processes, are discussed. Each task is briefly described and how it differs from operational tasks is explained.

Identify an improvement opportunity: To identify a problem, the team has to recognise that the existing situation does not correspond with the desired situation; they have to identify an improvement situation. However, in an operational configuration people do not have to think about the existing situation or consider alternatives that are more satisfying. In the operational configuration they are simply supposed to perform activities. It is important to recognise the difference between the identification of an improvement situation (a task that differs from the operational tasks), and the identification of problems with inputs or problems in the process (a task that corresponds with the operational tasks). The identification of problems with inputs, or problems in the process, is concerned with activities to maintain the status quo, to correct disturbances in the status quo. These disturbances must be solved to perform the operational processes. The identification of an improvement situation is more the general identification that something might be changed. In this situation, there are no concrete problems that must be immediately solved to allow the operational process to go on. These activities do not have to be performed by the team members in their daily work.

Decide to focus on one problem: An important difference between operational activities, and the activities that were performed to develop a solution in an improvement process was that the team explicitly had to decide to focus on one problem. In the operational configuration, other people plan the production process and decide which tasks must be performed. Further, the problems that people must solve in the operational configuration also depend on the production planning, and problems that occur, for example, with machines during the production process. The people cannot decide for themselves which problems they are going
Analysis of improvement activities

to solve at any specific moment, they are guided by the process itself. In the improvement process, the team members must decide for themselves which problems they are going to focus on.

**Develop a solution for an unfamiliar problem:** One of the tasks of the people in the operational configuration is to solve problems. However, in the operational configuration, the people only have to solve routine problems; they do not have to solve problems that are totally unfamiliar to them. They face a fixed set of problems, for example with setting up the machines, that they must solve. Further, the people are trained to solve the problems of the operational configuration and they have much experience in solving them. Often, there is a more or less fixed set of solutions from which one solution can be chosen. In the improvement processes, the team members must find solutions for unfamiliar problems and in some cases the team members will never before have to solve these kind of problems. Further, the team members have not been trained to solve some of these problems.

**Analyse unfamiliar information:** Another difference between the tasks in the operational and the improvement configurations is that team members have to analyse unfamiliar information. In the operational configuration, people are confronted mainly with familiar problems that can be solved by a well-known set of solutions that the team members have learnt during their education and from earlier experience. Not much analysis is needed to identify the cause of the problems. In the improvement configuration however, most problems are unfamiliar. Sometimes the causes of the problems are immediately clear, but in other instances they are not. Then there is a need to analyse the causes of the problem.

**Approve a solution:** In the operational processes, people solve familiar problems by choosing one solution from a more or less fixed set of solutions. Therefore, it is mostly unnecessary to approve the solution each time it is used; it is unnecessary to consider its consequences explicitly and to decide if this solution can be implemented. In the improvement processes, people have also to develop solutions, but then they cannot choose from a fixed set of solutions. They have to develop new and unfamiliar solutions and sometimes it is harder to see the consequences of such a solution. The solution must be approved of in advance; it must be decided explicitly whether the solution can be implemented.

**Evaluate a changed situation:** In the improvement process, the team members have to evaluate a change in an existing situation. The team members have to evaluate in many cases if a proposed change in the existing situation has been achieved and if the change improved the situation. In the operational processes, the team members do not have to change a situation; they only have to change the characteristics of inputs to make the outputs, and they sometimes have to correct disturbances to the status quo. The difference between determining mistakes in input, and the evaluation of changes in the existing situation is rather small. However, identifying mistakes in input is more limited; the team members know exactly what the standards for the input are, and they have clear guidelines to judge if the input is in accordance with these standards. In the evaluation of changed situations, the standards on which to judge are less clear, and thus, more uncertainty accompanies this activity. This is the major difference between the two activities.
Communicate within the team: Another difference between the tasks in the operational and the improvement processes is the amount of communication needed to perform tasks. In the operational configuration, the team members can analyse problems alone or perhaps with one other person. In the improvement configuration, the team members have to work together in a larger group and they have to communicate within the team, for example to analyse a problem.

Communicate with people outside of the team: A difference between the tasks in the operational configuration and the improvement tasks is that the team has to communicate with people outside their own department. People have to communicate with people outside of the team, for example, to ask for approval of a solution, or to explain a proposed solution to other people who are involved in it. In the operational configuration, this is not necessary because the supervisor mostly takes care of this. Communication with people outside of the team does not refer to the communication between a team and their supervisor; this communication is distinguished using other tasks focussed on the communication between the supervisor and the team.

Remind the supervisor to do things: In the operational process, the senior people in the hierarchy usually decide what the supervisors must do; this is not one of the tasks of the people on the shop floor. Sometimes shop floor people ask their supervisor to do things, but the functioning of the department is the responsibility of their supervisor and he has the responsibility for doing the things asked of him. It is not one of the tasks of shop floor people to discuss the functioning of their supervisor; that is the task of management. However, in the improvement processes, the team is responsible for the improvement processes. If they ask their supervisor to do something, they must manage this and reminding the supervisor about the things he promised to do. Thus, remind the supervisor about the things he has to do differs from the operational activities.

Write a report: Another difference with the operational activities is that the team has to write a report or structure information. In their operational work, most team members register or read information, but they do not have to structure information and produce a report.

Initiate tasks: Another difference between the operational and the improvement processes is that team members have to initiate tasks themselves without direct stimuli, for example tasks that are needed to test a solution. In the operational configuration, people get direct stimuli to perform a specific task. They get instructions that tell them when they have to produce which orders. In the improvement process, this is not the case; the team has to perform tasks without a direct stimulus.

Position new tools: An important difference to the operational process of the people was that the team had to position tools, for example to implement a solution. In the operational configuration, the team only has to use tools or machines, they do not have to position or change the existing tools.

In the following section, the relationship between the tasks and activities that were performed is discussed.
5.2.2. Relationship between activities and tasks

The research showed that one improvement activity could consist of different tasks in each case. In one case, the implementation of the solution might consist of the use of tools or machines, while in another case implementation might take place by initiating tasks. The following table shows how often each task occurred within each improvement activity. Further, the table shows how often each task was problematic or otherwise in the improvement process\textsuperscript{10}.

\textsuperscript{10} In the discussion, the focus is on the activities that were performed by team members. The improvement activities that were performed by people outside the team are not discussed.
### Analysis of improvement activities

<table>
<thead>
<tr>
<th>Problems Identified</th>
<th>Amount Problematic/Non Problematic</th>
<th>Identify a Problem</th>
<th>Analyse the Problem</th>
<th>Develop a Solution</th>
<th>Test the Solution</th>
<th>Authorise the Solution</th>
<th>Implement the Solution</th>
<th>Standardise the Solution</th>
<th>Evaluate the Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Register problems when they appear in operational process</strong></td>
<td>39</td>
<td>P: 5 13</td>
<td>NP: 34 87</td>
<td>1</td>
<td>8</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Identify or communicate problems with the process</strong></td>
<td>24</td>
<td>P: 0 0</td>
<td>NP: 24 100</td>
<td>22</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Identify or communicate problems with the input</strong></td>
<td>21</td>
<td>P: 0 0</td>
<td>NP: 21 100</td>
<td>15</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ask the supervisor to do things</strong></td>
<td>17</td>
<td>P: 2 12</td>
<td>NP: 15 88</td>
<td>8</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use tools or machines</strong></td>
<td>15</td>
<td>P: 3 20</td>
<td>NP: 12 80</td>
<td>1 1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Team informs the supervisor</strong></td>
<td>9</td>
<td>P: 4 44</td>
<td>NP: 5 56</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supervisor informs the team</strong></td>
<td>4</td>
<td>P: 1 25</td>
<td>NP: 3 75</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tasks that differed from operational tasks</strong></td>
<td>117</td>
<td>P: 0 0</td>
<td>NP: 117 100</td>
<td>117</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Identify an improvement opportunity</strong></td>
<td>105</td>
<td>P: 20 19</td>
<td>NP: 85 81</td>
<td>85</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Develop a solution for an unfamiliar problem</strong></td>
<td>73</td>
<td>P: 6 8</td>
<td>NP: 67 92</td>
<td>39 6 11 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communicate with people outside of the team</strong></td>
<td>51</td>
<td>P: 4 8</td>
<td>NP: 47 92</td>
<td>32 1 6 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Write a report</strong></td>
<td>27</td>
<td>P: 18 67</td>
<td>NP: 9 33</td>
<td>3 1 5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Initiate tasks</strong></td>
<td>23</td>
<td>P: 3 13</td>
<td>NP: 20 87</td>
<td>16 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analyse unfamiliar information</strong></td>
<td>18</td>
<td>P: 0 0</td>
<td>NP: 18 100</td>
<td>18</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Decide to focus on one problem</strong></td>
<td>18</td>
<td>P: 5 27</td>
<td>NP: 13 73</td>
<td>11 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communicate within the team</strong></td>
<td>10</td>
<td>P: 0 0</td>
<td>NP: 10 100</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Position new tools</strong></td>
<td>10</td>
<td>P: 0 0</td>
<td>NP: 10 100</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaluate a changed situation</strong></td>
<td>3</td>
<td>P: 2 67</td>
<td>NP: 1 33</td>
<td>1 1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remind the supervisor to do things</strong></td>
<td>2</td>
<td>P: 0 0</td>
<td>NP: 2 100</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-4: Correspondences and differences between operational and improvement activities
The table shows which tasks were performed at specific improvement activities, and it shows whether these tasks differed or corresponded with the operational tasks. This gives more detailed insights into the correspondences and differences between the operational and improvement processes. The table shows which tasks were performed many times, and which ones were performed only rarely in the improvement processes:

- Tasks that were performed *often*, and *corresponded* with the operational activities, were the registration of a problem that appeared in the operational processes, and the identification or communication of problems in the operational processes or its input.

- Tasks that were performed *less often* in the improvement processes, and *corresponded* with the operational tasks, were communication with the supervisor, and using tools or machines.

- Tasks that were performed *often*, and *differed* from the operational activities, were the identification of a problem, the development of a solution, communication with people outside of the team, writing a report, taking the initiative in performing tasks, analysing unfamiliar information, deciding to focus on one problem, and communicating within the team.

- Tasks that were performed *less often* and *differed* from the operational activities, were: positioning new tools, evaluating a changed situation, reminding the supervisor to do things, and approving a solution.

The table shows that some tasks were performed in many different improvement activities, while others were related to one or two specific improvement activities:

- The table shows that of the tasks that *corresponded* with the operational tasks, using tools and machines, and asking the supervisor to do things were performed during many improvement activities, while other tasks were performed mostly within one or two specific improvement activities. Communication about problems in the operational processes and in the input to the operational processes was often performed during the identification of a problem in the improvement process. The registration of problems in the operational process, on the other hand, was seldom part of the identification of the problem; this task was often part of the implementation and standardisation of the solution. Communication between the team and the supervisor mostly took place during the development and the implementation of a solution.

- The table also shows that of the tasks that *differed* from the operational tasks, communication with people outside of the team was performed during many improvement activities. It was performed during the analysis of the problem, and during the development, testing, authorisation, implementation, and standardisation of the solution. Writing a report and taking the initiative to perform tasks were also performed during many improvement activities. Writing a report occurred during the development, authorisation, implementation, and standardisation of solutions. Taking the initiative to perform tasks occurred during the development, testing, authorisation, and
implementation stages of the solution. Other tasks corresponded more with specific improvement activities. Such tasks were: the identification of a problem, the decision to focus on one specific problem, the development of a solution to an unfamiliar problem, the approval of a solution, placing new tools, or the evaluation of a changed situation. Some tasks did not correspond with specific improvement activities, although they were mostly performed with one activity. Such tasks were, remind the supervisor to do something (carried out during the development and the authorisation of a solution), and analyse unfamiliar information (during the analysis of the problem and the development of a solution).

The table also shows which tasks were performed with specific improvement activities. It shows that the development and the implementation of a solution involved many different tasks. On the other hand, the identification of the problem, and the evaluation of the solution required only a few tasks. Thus, the heterogeneity of tasks that are performed with these activities is much smaller than with the development or implementation of the solution.

In the following sections, each of the improvement activities is discussed in depth.

**5.3. Identify the problem**

**5.3.1. Definition of the activity**

The identification of problems are those activities where people express a situation to be undesirable, a situation that should be improved. In practice, it was sometimes hard to distinguish the identification of a problem from the development of a solution, because both activities were intertwined. Team members would directly offer a solution to a problem, without explicitly identifying the problem. However, analytically the two activities could be distinguished. The development of a solution is more focussed on the activities that must be performed to solve the problem, while the identification of the problem is more about activities focussed on the recognition of an undesired situation. Although the identification of a problem and the development of a solution were sometimes performed together in practice, they were always distinguished as separate activities in the research.

In the research, the identification of a problem was only analysed if it was part of a larger improvement process. If the improvement process was very small (if it consisted only of the identification of a problem, for example) it was not analysed in more depth. The teams mentioned many problems that did not become part of a larger improvement process; the identification of these problems was not analysed.

Several improvement processes had as a goal the registration of problems that appeared in the operational process. In these improvement processes, activities related to the identification of a problem were only those activities when the team identified that the problems had not been registered. The identification and registration of the problems in the operational processes were not considered part of the identification phase of the improvement process. These activities were part of the standardisation of the solution.
5.3.2. Occurrence of the activity

The identification of a problem took place almost 170 times in the seventy-three improvement processes. In the vast majority of cases, the people in the improvement team identified the problem. Only on eleven occasions did people outside of the team identify the problem, for example a supervisor or people from the quality department that checked the output of the operational process. In those cases the team members imported the problem, identified by someone outside the team, into the team meetings.

Table 5-5 shows that in almost 60% of the improvement processes, activities to identify the problem were performed only once. In the other 40% of the improvement processes, activities to identify the problem were performed up to 13 times. In these cases, a problem was brought up during several team meetings before the team started to work on them. Reasons for the repetition of the activities to identify a problem were:

- **Problems were not selected for immediate solution.** The team would focus on one or two improvements after a brainstorming session. After these problems were solved, they would start with a new brainstorming session and several problems could be brought up again. Activities to identify the problem therefore took place more than once (processes 1; 9; 12; 34; 40; 53; 54; 57; 58; 59; 60; 64; 66; 67; 70; 71; 72; 73). Some of these problems would be identified several times, because they were never solved during the research period. One team member of a team made a list during his daily work of about thirty problems that the team might solve. Several of these problems were not solved immediately, but they were referred to several times after they were placed on the list. Further, some of the problems on the list had been mentioned earlier. In this way, activities to identify a problem could be performed several times (processes 2; 6).

- **The problem has different aspects that are identified separately.** In some cases, different aspects of a problem are identified (processes 41; 59; 70) and hence activities to identify a problem are performed more than once.

- **Problems reappeared after the first solution was implemented.** In some cases, a problem was identified and a solution was implemented, but after the implementation of the solution, problems again appeared (processes 30; 31; 46; 47; 49; 52; 54; 57; 59; 67; 69; 70; 73). In some of these cases, the team again developed and implemented a solution. In several cases, the solution was not fully implemented, and therefore after some time

<table>
<thead>
<tr>
<th>The activity was performed</th>
<th>In … processes</th>
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<tbody>
<tr>
<td>… times</td>
<td></td>
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<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>43</td>
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<td>2</td>
<td>14</td>
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<td>1</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5-5: Number of times that activities were performed to identify a problem in an improvement process (N=73).

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11 The numbers refer to the unique identification number of each improvement process that is mentioned in the case descriptions on the Internet.
problems again appeared (process 37; 56). Hence, activities to identify a problem were performed more than once.

In several cases, activities to identify a problem were performed more than once. Reasons for this were: (1) Problems were identified several times before they were selected for solution. (2) The problem had different aspects that were identified separately. (3) Problems reappeared after a first solution was implemented.

5.3.3. Problems with the activity and consequences of it for the whole process

The identification of a problem, was far less problematic than the rest of the activities. This is not surprising, because it is implied by the research method. In the research, only improvement processes where the problem was identified were examined. If a problem was not identified, the improvement process was not identified. Thus, using this research method, it is impossible to recognise problems with the identification of a problem. Therefore, it is not possible to analyse if problems with the identification caused problems in an improvement process as a whole.

The identification of problems in the activities to identify a problem was not covered by the research.

5.3.4. Differences and correspondences with the operational activities

Table 5-21 shows that on 24% of the occasions when a problem was identified, the activity corresponded with operational activities. Further, the table shows that although activities to identify problems were performed many times, only a few different types of activities were performed. While reading the next sections, it is important to recall that the research method excluded problems that the team did not identify; thus whether more problems could have been identified is unknown.

<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of Probl</th>
<th>No probl</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify an improvement situation</td>
<td>0</td>
<td>117</td>
<td>Experiences in op. conf.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High commitment of team</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Use of improvement tools</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Help of the coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Experiences in impr. conf.</td>
</tr>
<tr>
<td>No diff</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Identify/communic. input problems</td>
<td>0</td>
<td>15</td>
<td>Correspondence with o.p.</td>
</tr>
<tr>
<td>Identify/communic. process problems</td>
<td>0</td>
<td>22</td>
<td>Correspondence with o.p.</td>
</tr>
</tbody>
</table>

Table 5-6: Differences and correspondences between the operational process and the identification of a problem (N=152)

The main correspondence between the tasks in the operational configuration, and the activities that were performed to identify a problem, was that the team members had to **identify whether problems appeared in the input or in the processes they perform**. In the improvement process, this task was performed many times (37) to identify a problem. In no
case did problems appear when the activity was performed. The main reason that problems did not appear with this task could be that the tasks in the operational and the improvement configurations are the same, and thus no functional conflict existed.

The main correspondence between the operational tasks and the identification of the problem was that the team members had to identify whether problems appeared in the input or in the processes they perform. These activities were never problematic because of the correspondence with the operational tasks.

Between the operational activities, and the activities that were performed to identify a problem, one difference did exist. To identify a problem, the team had to identify an improvement situation. On many occasions in the improvement process the teams identified improvement situations (117 times). Although the activity differed from the operational activities, it was never problematic. Several reasons exist for the lack of problems. The major reason is that the team members have much experience in the operational configuration, and this experience helps them to identify problems. Further, in many cases, the team members were very committed to performing their operational activities, and they disliked situations where they could not perform their work well. Therefore, they were very motivated to identify situations that could be improved. On 62% of the occasions that activities were performed to identify an improvement situation, one or both of these reasons were relevant (72 times). Another important reason for the lack of problems was that the teams used brainstorming sessions to identify problems. In a brainstorming session, the team members brought up many problems (often more than thirty problems), and made a list of them. All the improvement teams used brainstorming sessions from time to time. In 30% (35 times) of the improvement situations identified, brainstorming sessions were used. The combination of brainstorming sessions, the high commitment of the team members to identifying problems, and the experience of the team members in the operational configuration largely contributed to the identification of problems. The identification of the problem was further helped by earlier experience of improvement processes in 4% of the cases (5 times). In some cases, problems were identified during discussions about another problem (process 23; 68), thus experience from the other improvement processes facilitated the identification of problems. The help of the coach facilitated identifying a problem in 4% of the improvement situations identified (5 times). In one case, the coach asked the team about the problems they had (process 56). On three occasions, the coach identified the problem (process 63; process 7 act 674, 677).

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12 This does not mean that thirty-five brainstorm sessions were held. In many of these sessions, several problems were identified.
The major difference between operational tasks, and the identification of the problem, was that the team members had to identify an improvement situation. These activities were never problematic. Problems did not occur because of: the experience of the team members in the operational configuration; the high commitment of the team to identifying problems; the use of improvement tools (brainstorming sessions); experience in the improvement configuration; and the help of the coach.

Although the identification of general improvement situations does not correspond with the operational activities, the operational configuration is very important when performing an activity. It is important, because the team members have much experience about what goes on in the operational configuration; they build up this experience during their daily work. This experience helps them with the identification of problems in the improvement process.

5.4. Analyse the problem

5.4.1. Definition of the activity

The analysis of a problem includes those activities needed to explore a problem in more depth, such as describing what the real problem is, searching for the causes of the problem, or describing different aspects of a problem. Activities connected to developing a solution to a problem are not part of the analysis of a problem. However, often the analysis of a problem partly takes place during the development of a solution and then the two activities are hard to distinguish. In addition, analysis of a problem can also take place during the identification of the problem. It was, for example, often mentioned why the problem was important, and which aspects were part of it; these activities are analysis activities. Analysis of the problem was mentioned separately from the identification of the problem where analysis activities were explicitly mentioned in the team reports or research diaries.

5.4.2. Occurrence of the activity

Only in 23% of the improvement processes (seventeen processes) was the problem analysed explicitly. People from outside the team performed the analysis of a problem less then 10% of the times that the activity was performed. The major reason for the little amount of external analysis is that the teams focussed on problems where they could perform most of the activities themselves. In some cases, help was needed with the authorisation or implementation of a solution, but the teams were especially supposed to do the analysis of a problem and development of a solution themselves. In most cases when people outside of the team performed analysis activities, these people were technical experts used to analyse machines or other technical tools. In one case, the researcher examined information for the team.
In total, problems were analysed in thirty-four improvement processes. Table 5-7 shows how often activities to analyse a problem were performed in the processes. Reasons for the repetition of activities to analyse the problem were:

- **The problem was identified and analysed more then once** (process 26).

- **The cause of the problem could not be found, and therefore the situation was analysed several times** (process 18; 73). In one improvement process, the main goal of the improvement process was to analyse the problem (process 3). In this case, the improvement activities that were performed by the team were part of a larger improvement process that was performed by supervisors of several departments.

- **Parts of the analysis were problematic, while other parts were not problematic.** Where parts of the analysis were problematic and other parts were not, they had to be mentioned separately (process 54).

Although the analysis of the problem is repeated in some processes, in most improvement processes no analysis of the problem takes place at all.

In only 23% of improvement processes is the problem analysed.

It is surprising that the problem is not analysed in more of the improvement processes, since a proper problem analysis was regarded as very important when the organisations started to work with improvement teams and much attention was paid to it. All the team coaches learned a problem solving method in which much attention was paid to the analysis of problems, and they were supposed to teach the teams this approach. When the teams decided to solve a problem, the coaches encouraged them to analyse the problem in a structured way, but often the team members were not motivated to do this. They complained that a structured analysis of the problem only resulted in much useless paperwork, and they said that they did not have to learn how to solve problems because they have to do this all the time during their daily work. Because of the resistance by the team members, the coaches stopped putting emphasis on a structured analysis after a while, and only asked the team to use it with more complicated problems.

Team members were not self-motivated to analyse problems explicitly by using a structured approach, although the coaches tried to teach them the importance of it.

### 5.4.3. Problems with the activity and consequences of it for the whole process

The analysis of the problem was problematic in 20% of the cases where the activity was performed (seven times). In one case, someone outside the team was supposed to analyse a problem, but did not perform the activity (process 9). On six occasions, the team had problems with the analysis. In three cases there were communication problems between
people (process 3; 26; 73). On one occasion, the supervisor did not like it that the coach had analysed a problem with the team, and twice the team began to argue were analysing a problem. In one case (process 7), the team members did not recognise that they needed to analyse the causes of the problem in more depth, and because of this lack of analysis, they implemented an incorrect solution. In one case (process 54 act 572), a team member was not motivated to analyse the problem. In another case, the team performed a test to analyse what the real problem was, but the results of the test were not clear. The problem was that, although a test was performed, the analysis did not show the causes of the problem (process 54 act. 592).

**Most problems in the analysis of a problem arose because of communication problems between people; these problems did not necessary result in unrealised improvements. One improvement was not realised because the team members did not recognise that they needed to analyse the problem, and because of this lack of analysis, an incorrect wrong solution was implemented.**

With most improvement processes, it did not seem to be problematic that the problem was not analysed in a formal and structured way. A major reason for this was that the problems that the teams selected were rather simple and not very complicated. Often, the team knew immediately what the real problem was, and an in-depth analysis of the problem did not seem to be useful. Each team was confronted with only a few improvement processes where an in-depth analysis of the problem was needed. With such more complicated improvement processes, it was often not clear what the real problem was, and therefore it was often hard to develop a satisfying solution. These processes are discussed in more depth when the activity ‘develop a solution’ is discussed.

**In most cases, it did not create problems that no analysis of the problem took place, because the problem was not complicated and an in-depth analysis of the problem did not seem to be useful.**

### 5.4.4. Differences and correspondences with the operational activities

Table 5-8 shows that in most cases, the analysis of the problem had different characteristics to the operational tasks of the team members, while only in a few cases did the characteristics correspond.
Analysis of improvement activities

In one instance the correspondence between the tasks in the operational configuration, and the analysis of the problem in the improvement configuration was that people had to use machines to analyse the problem. In this case, no problems with the activity occurred (process 73). The main reason that problems did not appear with the task could be that the tasks in the operational and the improvement configuration are the same, and thus no functional conflicts arose.

Another correspondence with the operational tasks was that a team had to register process information (process 3). Again no problems appeared because it corresponded with the operational tasks.

In one case, problems arose because the supervisor was not informed about what the team was doing, even though this activity corresponded with operational activities. In one case (process 3), problems arose because the supervisor of the department did not like the coach of the team having discussions with the team. However, he did not know what the team had discussed and if he had known this, he would not have been angry. A lack of communication between the team and the supervisor had caused the problems. In the operational configuration, the supervisor has to be informed about what the people in his department do and thus the activity in the improvement configuration is the same as the activities performed in the operational configuration. Despite the activity not differing from the operational tasks it was still problematic. The main reason for this was an imported misfit. In the operational configuration, although communication was needed, not much communication between the supervisor and the people from the department actually took place; a misfit already existed in the operational configuration. This misfit was imported into the improvement configuration. In the improvement configuration, the problems arose because of the miscommunication between the supervisor and the team.

<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of Probl</th>
<th>No probl</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate within team</td>
<td>2</td>
<td>0</td>
<td>Functional conflict</td>
</tr>
<tr>
<td>Communicate with people outside team</td>
<td></td>
<td>3</td>
<td>Help of coach and Experience in impr.p.</td>
</tr>
<tr>
<td>Analyse unfamiliar information</td>
<td>0</td>
<td>16</td>
<td>Functional conflict</td>
</tr>
<tr>
<td>Team informs the supervisor</td>
<td>1</td>
<td>0</td>
<td>Imported misfit</td>
</tr>
<tr>
<td>Use tools/machines</td>
<td>0</td>
<td>1</td>
<td>Correspondence with o.p.</td>
</tr>
<tr>
<td>Register process information</td>
<td>0</td>
<td>1</td>
<td>Correspondence with o.p.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Number of Differences/correspondences in the characteristics of the processes</th>
<th>Number of</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate within team</td>
<td>Probl</td>
<td>No probl</td>
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<tr>
<td>Communicate with people outside team</td>
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<tr>
<td>Analyse unfamiliar information</td>
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<tr>
<td>Team informs the supervisor</td>
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<tr>
<td>Use tools/machines</td>
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<tr>
<td>Register process information</td>
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</table>

Table 5-8: Differences and correspondences between the operational process and the analysis of the problem (N=27)

In one instance the correspondence between the tasks in the operational configuration, and the analysis of the problem in the improvement configuration was that people had to use machines to analyse the problem. In this case, no problems with the activity occurred (process 73). The main reason that problems did not appear with the task could be that the tasks in the operational and the improvement configuration are the same, and thus no functional conflicts arose.

Another correspondence with the operational tasks was that a team had to register process information (process 3). Again no problems appeared because it corresponded with the operational tasks.

In one case, problems arose because the supervisor was not informed about what the team was doing, even though this activity corresponded with operational activities. In one case (process 3), problems arose because the supervisor of the department did not like the coach of the team having discussions with the team. However, he did not know what the team had discussed and if he had known this, he would not have been angry. A lack of communication between the team and the supervisor had caused the problems. In the operational configuration, the supervisor has to be informed about what the people in his department do and thus the activity in the improvement configuration is the same as the activities performed in the operational configuration. Despite the activity not differing from the operational tasks it was still problematic. The main reason for this was an imported misfit. In the operational configuration, although communication was needed, not much communication between the supervisor and the people from the department actually took place; a misfit already existed in the operational configuration. This misfit was imported into the improvement configuration. In the improvement configuration, the problems arose because of the miscommunication between the supervisor and the team.

A correspondence that occurred between the analysis of the problem and the operational activities was that a team had to use tools or machines; this activity was never problematic because of the correspondence with the operational tasks.
The major difference between the tasks in the operational and the improvement configurations was that the team members had to analyse unfamiliar information. In some cases, the different ways of analysis that were needed caused problems. In one improvement process, the team members had a solution available when they identified the problem, and they implemented this solution. However, they did not recognize that this solution was unsuitable and that further analysis of the problem was needed (process 7). In another case (process 54 act 572), one of the team members did not want to analyse the problem in a formal structured way, as the coach had proposed. He considered that they did not have to learn how to solve problems because they solve problems in the daily work, and they can do it very well without such a method. In one case, the problems with the analysis could not directly be explained by referring to the daily work of the team members. In this case, the team member had analysed the results of a test, but no clear results were obtained (process 54 act 592). With these three cases, the differences with the operational tasks might be an explanation for the problems that appeared. In several other cases, the teams had to analyse different information, but problems did not appear. The major reason for the lack of problems was that the coach helped the team analyse the information. In some cases, the coach structured the discussion of the team members and used improvement tools (process 22; 26; 31; 40; 73 act 689). In other cases, the coach searched for the cause of the problem (process 60; 66), and gave the team feedback on the analysis (process 3). In one case, the team members did not understand the use of the analysis of the problem. They did not see that their (implicit) knowledge on how to set up the machines could be improved by analysis and that this might help them solve the problem. The coach of the team must tell them this, and more or less forces them to analyse the problem (process 54 act 571). In one case, the co-ordinator of the improvement teams helped a team to analyse a problem by using improvement tools (process 73 act 705). On several occasions the different analyses that were needed in the improvement process did not cause problems and a mix of reasons seemed to be relevant (process 13, 16; 47; 54; 58; 73 act 699). In these cases, the coach discussed with the team the causes of the problem; thus, the help of the coach was important. In addition, the experience of the team members in the operational configuration was relevant because in their daily work, the team members learned about possible causes of problems and this facilitated in the analysis of problems. In one of these cases, the analysis that had to be performed was rather straightforward (process 47).

A difference between the tasks in the operational configuration and the improvement tasks was that, in the latter, the team had to communicate with people outside their department. Although the task differed from the operational tasks of the team members, problems never appeared. One reason for the lack of problems with this activity was that the coach helped the team; the coach communicated with the people outside of the team about the causes of the problem and this prevented problems (process 70). Another reason for the lack of problems was that people had developed new capabilities from earlier improvement processes, thus the
experience gained in earlier improvement processes prevented problems. One coach asked his team on many occasions to ask people outside of the team to do something for the team. After a while, the team no longer had problems in asking people outside of the team for assistance (process 18 act 114 and 116).

Another difference between the tasks in the operational configuration and the improvement processes was that people have to communicate within the team to analyse a problem. In some cases, this difference caused problems. In two cases, the team members argued about the analysis of a problem. In one case when they discussed the real causes of the problem, one team member blamed another one for not knowing how to do her work. The other person got very angry, and there was nearly a fight in a team meeting (process 73 act 706). In another case, a team disagreed about the importance of the problem (process 26). In both cases, the problems in the improvement process might be caused by the differences to the activities in the operational configuration.

The major difference between the operational activities and the analysis of a problem was that in the latter the team had to analyse information that was much more unfamiliar. However, only three times did this cause a problem, in many cases, the analysis of unfamiliar information was not problematic. Problems arose because the team forgot to analyse, they refused to analyse, or no clear results were obtained from the analysis; these problems might be caused by the differences to the operational tasks. One reason for the lack of problems was the help of the coach, and the use of improvement tools taught by the coach to analyse the problem. Another reason was that the team discussions were very effective, because several different forces to prevent problems (assistance of the coach, the use of the knowledge on the operational process by the team members, taking advantage of the motivation of the team members and the use of their extra capabilities) could be combined.

Another difference with the operational tasks was that the team had to have discussions within the team to identify a problem. Problems with this activity arose because team members blamed each other for the problems or they disagreed about the importance of the problem. These problems might be a result of the differences between this task and the operational tasks.

Another important difference between the improvement and the operational activities was that the team had to communicate with people outside of the team. Problems did not appear with this activity because the team members learned how to perform this activity in earlier improvement processes, and the coach on some occasions performed the activity for the team.

5.5. Develop a solution

5.5.1. Definition of the activity

The activity of ‘development of a solution’ is rather broad. It contains all the activities that are focussed on the development of a solution to a problem. Development of a solution is distinguished from the analysis of a problem. If activities were focussed purely on analysis of
a problem, without considering the solution, they would not be considered part of the development of a solution. However, often the two activities were intertwined; during the development of a solution the problem would be analysed in more depth. Development of a solution must also be distinguished from the implementation of a solution. Development of a solution concerns all the activities around considering, discussing and preparing a possible solution, while the implementation of a solution is about concrete changes to the existing situation. Making plans for the implementation is thus part of the development of a solution. Evaluating developments in the implementation activities is part of the implementation process. However, if the evaluation of the implementation plan is negative, and new plans for the implementation are made, this is then again part of the development of a solution. In some cases, the development of a solution was so minor and so integrated with the implementation of a solution, that it was impossible to describe it as a separate activity.

5.5.2. Occurrence of the activity
Activities to develop a solution were the most often performed activity. On average, in each improvement process, activities develop a solution were performed on few occasions. People from outside the team performed such activities forty-two occasions during thirty improvement processes. The people included supervisors, the co-ordinator of the improvement teams, suppliers of parts that were needed to solve the problem, staff specialists, and the researcher. When people from outside the team performed activities to develop a solution, the activity was problematic on one fourth of the occasions (ten times). In three-fourth of the occasions (thirty-two times), it was not problematic. Reasons for problems with the development of the solution were: suppliers could not provide the information that was needed for the solution of the problem (process 4, 35, 58); suppliers did not answer a question (process 9, 35); specialists did not know how to solve a problem (process 43, 49); supervisors (department of the team, quality department) performed a task only after a delay (process 31, 37) or they did not develop a solution as promised (process 46, 48).
However, Table 5-9 shows that the simple average number of times the development of a solution activity was given a wrong impression of how often activities to develop a solution were performed. The research shows that it is not useful to examine the average number of activities to develop a solution. Better insights can be developed if a distinction is made between two types of improvement processes. Below, both types of improvement processes are discussed13:

1. **Improvement processes where only a few (0-3) activities were performed in developing a solution** (62% of all the improvement processes). In these improvement processes, activities to develop a solution took place on no more than three occasions. In these improvement processes, not many activities were needed to develop a solution, and the development of a solution did not take much time. In twenty-four cases, the solution was directly given at the start of the improvement process. In fifteen cases, the solution had to be developed with somewhat more detail after the recognition of the problem. In five other occasions, a solution had to be searched out, but it was found quickly (process 18, 25, 44, 48). In two cases, it was hard to develop a solution because much technical knowledge on the production processes was needed to develop a solution (process 39, 49). However, the team members did have this knowledge, and they were able to develop solutions fairly quickly. Therefore, not many activities were needed to develop the solution. In one case, no solution to the problem was found, and the team did not perform further activities to solve the problem (process 71).

2. **Improvement processes where many (>3) activities were performed to develop a solution** (36% of all the improvement processes). The second type of improvement processes includes the remaining 36% of the improvement processes and in these cases (twenty-four processes), many activities were needed to develop a solution. In three cases, the solution was readily available. In twelve cases, the solution had to be developed in more detail. In five cases, an extensive search for a solution was needed, and in six cases no solution to the problem was found at all. Several reasons for the repeating development of a solution exist:

   • **Different groups of people were involved.** When different groups of people were involved, different activities had to be distinguished to agree with the research method. In four cases, the large number of activities (process 13, 30, 31, 36) was

<table>
<thead>
<tr>
<th>The activity was performed</th>
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<tr>
<td>8</td>
<td>1</td>
<td></td>
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<tr>
<td>11</td>
<td>1</td>
<td></td>
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<tr>
<td>13</td>
<td>2</td>
<td></td>
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<td>14</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-9: Number of times that activities were performed to develop a solution in an improvement process (N=73).

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13 One type of activities that were performed to develop a solution, were the activities that the team performed to decide to focus on a specific problem. These activities are excluded from the table and from the following discussion on the number of activities to develop a solution.
caused by the fact that different groups of people (the team and also several people outside of the team) performed activities to develop a solution.

- **The solution was implemented with delay or not implemented at all.** In some cases, the implementation of the solution was delayed. During this period, the problems would arise again and the team would again discussed them (process 47, 56, 63, 64). This caused a repetition of the activities linked to the development of a solution. The team, would, for example, made new plans about how to implement a solution, because the former plans apparently did not seem to work. In one case, the proposed solution was not authorised nor implemented, and the problem was not solved (process 59). Proposed solutions for the problem were repeatedly mentioned.

- **It took much effort to develop a solution.** Another reason for the repetition of activities linked to developing a solution is that much effort was needed to develop a solution. In some cases, the team had to search for a solution and to repeatedly discuss possible solutions before a satisfying one was implemented (process 40, 41, 46, 54, 58, 73). In several cases, a solution was developed, but later, as more details about the solution became clear, the solution had to be developed in more detail (process 26, 50, 60, 70). Chains of activities existed, to develop a solution in increasing detail. In one case, a proposed solution did not work, and a new solution had to be developed (process 35). In some other cases, a team could not develop a solution even though they discussed the issue on several occasions (process 1, 4, 34, 43, 66).

### Based on the development of a solution, two types of improvement processes can be distinguished:

1. **Improvement processes where only a few (three or less) activities were performed in developing a solution (about sixty-five percent of the cases).** In these cases, a solution was at hand immediately, before the problem was identified, or easy to develop.

2. **Improvement processes where more activities were performed in order to develop a solution (about thirty-five percent of the cases).** Common reasons for the large number of activities needed to develop a solution were: (a) it took much effort to develop a satisfying solution for the problem; (b) the team discussed the solution several times because the implementation of the solution was delayed.

### 5.5.3. Problems with the activity and consequences of it for the whole process

The development of a solution was the activity that was most often problematic in absolute terms (56 occasions, 19% of the times the activity was performed). 79% of the problematic activities were performed by the team (44 occasions), while people outside of the team were involved in 21% of the problematic activities (12 occasions). It is striking that despite the number of times problems appeared with the development of a solution, only on a few occasions was the improvement process as a whole unsuccessful. A reason for this is that in several cases it took several attempts before a proper solution was developed. In the first instance, the development of a solution was unsuccessful, but after some unsuccessful
Analysis of improvement activities

attempts, finally a successful solution was developed. Three main problems appeared with the development of a solution:

- In 54% of the occasions (thirty times) when the development of a solution was problematic, problems arose because no satisfactory solution was developed. In these cases, although the team searched for a solution, nothing was found and it is not clear why this happened. No clear reasons for the problems in developing a solution could be found; maybe the problem was just too hard to be solved? This could be an important reason, because in some cases, other companies also had no valid solution to the problem (act. 3, 111, 224, 227, 439, 585). In some cases, technical specialists inside the company also did not know a good solution (act. 264, 271, 295, 323, 325, 390, 518, 524, 528, 591, 597, 774). Further, the solution that was developed sometimes had unforeseen consequences or was unsatisfactory (act. 123, 192, 276, 280, 710, 719, 752). However, the problems with the development of a solution cannot be fully predicted by the difficulty of the problem. Some rather complicated problems were solved efficiently because the team members developed a very good solution quickly (see for example process 39; 49).

- 25% of the times (fourteen times) that problems arose with the development of a solution, the problems arose because people who had to carry out action did nothing. In some cases, the team abandons the problem without further development of a solution (act. 62, 145, 281, 291, 508). Further, in some cases a team member did not develop a solution, although he had promised to do so (act. 49, 278, 293, 545, 546). In some cases, people outside of the team did not develop a solution, although they promised to do so (act. 44, 241, 770, 772). In some cases, no solution was developed because the team members were not sufficiently motivated. In some of these cases, a team was no longer motivated to work on improvements (act. 218; 262). Another reason that a team was not motivated to develop a solution was a problem with the functioning of the supervisor, which was a very delicate subject (act. 775). In some cases, the team did not want to implement the solution that the coach suggested (act. 678, 679), because the suggested solution was that they had to make reports of the team meetings, which they refused to do.

- On 21% of the occasions (twelve times) that problems arose with the development of a solution, it was because of communication problems between groups of people. Several types of miscommunication appeared: between the team and their supervisor (act. 5, 41, 45, 475); between the team and a supervisor from another department (act. 153, 311, 396); between the team and specialists (act. 13); between colleagues of the team and the team (act. 168); and miscommunication within the team itself (act. 48, 146, 296).

Major problems with the development of a solution were: (1) The problem was very difficult and hard to solve; (2) People who must perform actions to develop a solution do things too late or they do nothing; (3) Miscommunication between the team and other people cause problems with the development of a proper solution.

The problems that appeared with developing a solution were not equally divided over all improvement processes. Table 5-10 shows that with the improvement processes that required
many activities to develop a solution, it was often harder to develop a solution than with the processes where only a few activities were performed in developing a solution. On the other hand, problems with communication arose more often in processes where only a few activities were performed to develop a solution. The other causes of problems with the development of a solution exist equally with the processes with a few and the processes with many activities to develop a solution. It is not clear why this should be so.

Problems associated with activities to develop a solution were influential on the whole improvement process several times. An important reason that improvements were not realised was that the team could not develop an appropriate solution. In seven of the twenty-five unsuccessful improvement processes (28% of the unsuccessful processes), the problematic development of a solution by the team was the cause of the failure of the whole improvement process, while in four processes (16% of the unsuccessful processes), people outside of the team did not develop a solution. What were the main causes of the problems with the development of a solution by the team? In one of these improvement processes, a solution was proposed, but it was not authorised, and the team did not develop another solution (process 12). In some other processes, there was no clear solution (process 34, 66, 71). In some cases, although other companies in the industry had coped with the problem; they also lacked a proper solution (process 1, 4, 23). Thus, although three different problems appeared in activities for developing a solution, only one of these three hindered several improvement processes as a whole. Two common reasons (communication problems, and people doing nothing) could be successfully overcome during the improvement process, however not finding a solution for a problem was a reason for the failure of the whole process in several cases. However, in seven improvement processes, the process did not fail although it had been hard to develop a solution in first instance (process 20; 39; 41; 53; 54; 60; 73). It was not clear what caused these difference.

<table>
<thead>
<tr>
<th>Problematic activities:</th>
<th>In process with few activities to develop solution</th>
<th>In process with many activities to develop solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for problems:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• It was hard to develop a solution</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>• Problems with communication</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>• People did not do things (that were promised)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>• People were not motivated</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>• Activity performed by people outside of the team</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 5-10: Problems with the development of a solution for processes needing many activities to develop a solution, and processes with only a few activities to develop a solution.
In 24% of the unsuccessful improvement processes, the reason for the failure was that no proper solution to the problem could be found by the team. Problems linked to activities to develop a solution that were caused by communication problems and people doing nothing hardly ever resulted in the failure of the whole improvement process.

5.5.4. Differences and correspondences with the operational activities

The research shows that the activities that were performed to develop a solution were very variable. Several times, the main aspect of the activity was that a solution had to be developed for an unfamiliar problem, but also many other aspects were important in the development of a solution. For example, the analysis of information, taking the initiative in performing tasks, and communication with people outside of the team and especially the supervisor, were also important.
<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of processes</th>
<th>Number of Probl</th>
<th>Number of No probl</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remind the supervisor about tasks</td>
<td>1</td>
<td>0</td>
<td>Functional conflict</td>
</tr>
</tbody>
</table>
| Initiate tasks | 9 | 0 | Functional conflicts  
People were not motivated  
Operational work gets more priority  
People forget to perform task |
| Communicate within team | 3 | 0 | Functional conflict  
Solution is not discussed |
| Communicate with people outside team | 5 | 0 | Functional conflict |
| Analyse unfamiliar information | 0 | 4 | Help of the coach  
Help of other people |
| Write a report | 2 | 0 | Functional conflict  
Help of the coach  
People have more capab.  
Help of other people |
| Decide to focus on one problem | 0 | 18 | Help of the coach  
Use of improvement tools |
| Develop solution for unfamiliar probl. | 20 | 0 | Hard to find a solution  
Team was not motivated  
Functional conflicts |
| Team informs the supervisor | 2 | 0 | Imported misfit |
| Ask things to the supervisor | 0 | 8 | Help of coincidence  
Supervisor visits team meeting |
| Supervisor informs the team | 1 | 0 | Imported misfit  
Team asks supervisor to communicate. |
| Identify/commun. process problems | 0 | 2 | Correspondence with o.p. |
| Use tools/machines | 1 | 0 | Team forgets procedure |

Table 5-11: Differences and correspondences between the operational process and the development of a solution (N=252)
The major correspondence between the operational configuration and the activities to develop a solution was that the team had to *ask the supervisor to do things*. The team asked the supervisor to do things on eight occasions, and the activity was never problematic. The team asked their supervisor to repair a machine and to order new inputs (process 17; 28; 73) and to place an extra water tap (process 7). In three cases, problems did not appear because the coach communicated with the supervisor (process 59; 67; 69). It is noteworthy that although the team members have to communicate with their supervisor in their operational work, they let the coach help them with the communication in the improvement process.

In several cases, communication between the team and the supervisor is needed. In the operational configuration, the *supervisor has to inform the people*. Although the activity must also be performed in the operational configuration, problems appear in the improvement activities. In one case, the team complained that the supervisor ordered new tools that were not needed; the team complained that the supervisor was very stupid to do this (process 1). Later, however, it turned out that the tools were needed because the way the department worked was to change and therefore the new tools were needed. A reason for the problems could be that the communication between the supervisor and the workers is not good in the operational configuration and thus an operational misfit was imported. Twice, problems did not appear and the supervisor kept the team well informed. These instances both took place in one case (process 34). In this case, the team twice asked their supervisor for more information, and both times the supervisor discussed the desired information with the team.

On five occasions, the *supervisor had to be informed about what the team is doing*. Although this activity also took place in the operational tasks, it was twice problematic. In one case, both the supervisor and the team tried to solve a problem, but they did not communicate with each other about it some time (process 8). In another case, the team complained that problems existed with the machines. The coach reported this to the supervisor, but he responded that he did not know about these problems since they were not communicated to him (process 59). Three problems with communication between the team and the supervisor (from supervisor to team and from team to supervisor) all involved one supervisor. The main reason for the communication problems was an imported misfit. In the operational configuration, little communication between the supervisor and the people from his departments took place; there was a misfit in the operational configuration already. This misfit was imported into the improvement configuration. In the improvement configuration, problems also arose because of miscommunication between the supervisor and the team. On three occasions, a team informed its supervisor clearly about what they are doing and then problems did not appear. Twice, communication was not problematic, despite it being the same supervisor involved as with the problematic activities (process 4; 5). In these cases, the team discussed the problem in their department, and the supervisor heard about it by chance. In these cases, the team communicated to the supervisor by coincidence. In one case, with another supervisor (process 28), the communication was not problematic, because the supervisor attended a team meeting, and there the team and the supervisor discussed the development of a solution.
A correspondence between the tasks in the operational configuration, and the tasks to develop a solution in the improvement configuration was that people had to use tools to analyse a problem. In one case, the team members had to use a specific procedure with inputs of a bad quality. This procedure was developed during the improvement process, and the coach explained it to the team. However, after one week, the team had forgotten about it already, and they had to ask again what they had to do (process 60). Although they had to regularly use these procedures in their work, they had forgotten about it within a week. In another case, the use of tools was not problematic. In this case (process 26), the team decided that they had to clean their own working place and this activity did not differ much from the operational tasks that the team perform where they also had to take care that their department was clean.

Another correspondence between the tasks in the operational configuration, and the standardisation of the solution in the improvement configuration, was that the team members had to communicate problems in the process. In the development of a solution in the improvement process, the team had to discuss which problems with the machines should be reported to the mechanic when he visited their department (process 59). This is also part of the operational activities of the team members. The activity was performed twice and neither time was it problematic.

The major correspondence between the operational tasks and the tasks performed to develop a solution is that communication between the team and the supervisor takes place. Several times, the teams place requests with their supervisor; this activity was never problematic. Problems did not appear because of the help of the coach, and the correspondence with the tasks in the operational process. Further, the teams informed the supervisors about the development of solutions. This activity was problematic twice because of an imported misfit; communication problems in the operational configuration carried over to the improvement configuration. On three occasions problems did not appear with the activity; in two of these cases, problems did not appear because communication took place by coincidence. Another communicational activity associated with the development of a solution is that supervisor informing the team. This activity was problematic on one occasion because the supervisor did not tell the team why he ordered new tools. On two occasions the communication from the supervisor to the team was not problematic because the supervisor communicated when the teams requested it.

Another correspondence between the operational activities and the development of a solution was that the team used tools or machines. On one occasion this was problematic because the team forget the procedure they had to use. On another occasion the activity was not problematic because of the correspondence with the operational tasks.

Another correspondence was that the team had to communicate about problems in their production process; this activity was not problematic because of the correspondence with the operational tasks.

The major difference between the operational activities and the activities that were performed to develop a solution, was that the team had to develop a solution for an unfamiliar problem.
Several times (24 times) when the team had to develop a solution for an unfamiliar problem, the activity was problematic. In many cases, it was just very hard to develop a satisfying solution for the problem at hand (15 times). In several of these cases, people outside of the team, like technical experts or suppliers could also not develop a solution, thus in these cases the team members could not be blamed for the problems with developing a solution (process 1; 39; 41 act 264, 271, 276; process 53; 54 act 585, 591, 597; process 60 act 518, 524, 528; process 66; 73 act 710, 719). In some cases (four times), it was also hard to develop a solution for a problem, but in addition the team was not motivated to do this. In some of these cases, they had to solve problems with the functioning of the supervisor and they were afraid that discussing these problems with their supervisor would only result in more problems (process 34 act 218, 752; process 71 act 775). In another case, the team was not motivated at all any more to work on improvements because they had problems with their supervisor. Therefore, they did not try to find a solution for a problem (process 40). In several of these cases, the problems that arose were social, and team members were not used to solving this kind of problems; functional conflicts existed. In one other case, the team developed a solution but a better one is suggested later by the supervisor of the team (process 20). In many cases (85 times), problems did not appear with the development of a solution. Reasons for the lack of problems differed:

- In several cases (38 times), the *experience of the team members with the operational configuration* helped them to develop a solution and therefore the development of a solution was not problematic. In some cases, the experiences with the operational configuration helped the team members to make up which solutions would be appropriate (process 4; 6; 8; 19; 21; 24; 34 act 210 and 217; 38; 40; 43; 44; 50; 54 act 567, 570, 577, 588, 593, 596, 765; process 55; 57; 58 act 430, 437; process 59; 62; 63; 64 act 553, 555, 559; process 73 act 686, 692, 717). In other cases, the team members knew about solutions that were used by making other products or by other departments already (process 37; 41).

- Several times (22 times), the *help of the coach* prevented problems with the development of a solution. On several occasions, the coach structured the discussion about a solution or he asked the team to clarify a solution in more depth (process 5; 16; 22; 26; 31; 53; 67; 73). In some of these cases, the experience of the team members with their operational work also facilitated the development of a solution. In some other cases, the coach suggested a solution to the team (process 12; 30; 36; 51; 52; 54; 59 act 469 and 474; 63; 68; 71) or explained to the team why a solution, developed by people outside of the team, is appropriate (process 54; 66). In two cases, the coach assisted the team with the development of the solution (process 42; 50).

- On thirteen occasions, problems with the development of a solution did not appear, because the *team members had more capabilities* than which were needed to perform their operational tasks. The extra capabilities facilitated the development of a solution in the improvement process. Team members were for example very well able to make a lay out for their department (process 50), to develop another way to store tools (process 47), to
write down which information was needed (process 13), to develop a new method to make products with less problems (process 35 act 222 and 225; process 49; 58 act 434) or to use materials or tools in a different way (process 2; 39). In one case (process 31), a team member learned a solution for a problem during his education which he used to solve a problem. In all cases where the extra capabilities of the team members facilitated the development of a solution, the high motivation of the team members to find a solution and their experience with the operational configuration facilitated the activities also.

- On seven occasions, the development of a solution was not problematic because ideas from earlier improvement processes were used (process 15; 30; 33; 36; 59 act 461 and 464; 60). All these solutions were about registration of the problems that appear or registration of activities that must be performed in the operational process.

- In three cases, the suggested solutions were very simple and therefore problems did not appear; most effort that was needed was to hit upon the idea (process 17; 27; 60).

- In two cases, the team members were able to perform activities to develop a solution because of their high commitment to solve the problem. In these cases, team members performed extra activities to search for a solution. In one of these cases, a team member initiated a test to develop a solution with a product with the supervisor of another department (process 73). In another case, a team member remembered the problem when he saw a commercial of a machine at home on television. He told about this machine in the company and therefore this machine was bought and it solved the problem well (process 58).

An important difference between the operational activities, and the activities that were performed to develop a solution in the improvement process was that the team explicitly decided to focus on one problem. Although the activities that were needed to plan and control the improvement process differed from the operational activities, they were never problematic. The main reason for the lack of problems was that the coaches wanted the teams to work on a few problems at the time, and they let the teams focus on one or two problems. Further, in several cases the coaches let the team use simple improvement tools, like scored lists, to select a problem. The help of the coaches and the use of these tools prevented problems with the planning and control activities.

Another difference between the operational configuration, and the activities needed to develop a solution was that the team members had to initiate tasks that were needed to develop a solution. In four cases, problems with the development of a solution appeared because the team failed to initiate necessary tasks. In these cases, the team members had to test a solution on a machine, check an information list, or they had to ask people outside of the team about a solution (process 10; 41; 63 act 545, 546). In all these cases, it took a lot of time before they performed these activities. Reasons for the problems were that the operational configuration got more priority or that team members were no longer motivated to perform the required activities. In three cases, the teams suggested several solutions, but did not examine them further (process 39; 42; 43). In another case, the solution that the team
proposed was not authorised, and the team did not take initiatives to develop another solution (process 12). In one case, the problem did not reappear for sometime and therefore the team stopped the development of a solution (process 23). The major reason for this problem is a functional conflict; the team members were not able to determine a good solution together. On three occasions, problems did not appear even though the team had to initiate tasks to develop a solution. Problems were prevented because the team members were very motivated to check if the information in the archives was still correct (process 63; 64; 66).

Another difference between the tasks in the operational configuration and the improvement tasks was that the team had to communicate with people outside of the team. On five occasions there were problems with communication with people outside of the team. In two cases, communication with a supervisor from another department was problematic. In one of these cases, a team member asked the supervisor of another department to give her some tools, but he only reacted to the request when the coach of the team asked him about it again (process 55). In the other case, the team wanted to suggest to the supervisor of another department a different way of maintaining tools and they give him a report that described how the tools should be maintained. However, it appeared that the supervisor never used it, and that the communication about the solution was not sufficient (process 46). In two cases, the team had to discuss problems that were caused by other people, but they were reluctant to tell other people about it. In one of these cases, the team needed other people to bring and collect the tools they used and they often had a long wait. One of the team members had to talk with them who to solve the problem. However, he preferred to solve the problem by bringing the tools himself rather than discussing the problem with other people (process 27). In the other case (process 25), the team complained that people from another department were not doing their job well. However, during a discussion with the supervisor of this department, they did not dare talk to him about it. In a further case, the team wanted a staff specialist to judge if an improvement was permitted, but they did not clearly express to him what was needed. Therefore, he did not react to their request until the coach explained to him what the team expected from him (process 2). In all these cases, functional conflicts were important. The team was not used to performing the communicational tasks that were required in the improvement configuration, because these tasks differed from the operational tasks. On 38 occasions there were no problems with communication with people from outside the team:

- On 21 occasions, the coach helped the team communicate with people outside of the team. In most of these cases, the coach communicated with the people outside of the team (process 28; 31; 52 act 355 and 364; process 53; 54 act 398 and 582; 56 act 398 and 405; process 58; 60 act 499 and 502; 61; 63; 64 act 556 and 560; process 66; 70). In most of these cases, the coach communicated with the supervisor of the department that made the inputs for the operational process of the team members. In two cases, the coach helped the team to prepare for a discussion with the managing director and he explained the most important things to the managing director (process 56 act 409; process 60 act 512). In another case, the coach showed the team a solution that was used by another team (process 32). It is striking that of the 21 times that the coach performed the
communication with people outside of the team, 18 times it took place with the team from the label department. It seemed that the assistance of the coach to communicate was needed less with other teams.

• On six occasions, the team members learned new capabilities for communicating with people outside of the team through the help of the coach and their experience in earlier improvement processes. In these latter cases, the coach had taught the team communicational skills in earlier improvement processes and therefore problems did not appear (process 16; 26 act 159 and 160; 27). All these cases were from one team (Govy). In some other cases by another team, the team members had learnt to ask things from the supervisor of the quality department during earlier improvement processes (process 60; 70).

• On seven occasions, the team members had more capabilities than were needed for communication in the operational configuration. This prevented problems with communication in the improvement process because (some of) the team members were well able to communicate. In these cases, the team communicated with a supplier of machines (process 35; 73), a supplier of tools (process 4), salesmen of the company (process 66), a mechanic (process 53), the managing director of the company (process 9), a company a team member had worked in before (process 1). In several of these cases, problems were also prevented because the team members were very motivated to solve the problems and, apparently, this helped them to overcome their communication problems.

• On four occasions, the communicational tasks were simple and therefore problems did not appear. In one case, the team members had to ask someone for a key (process 69). In the other cases, someone else structured the information for the team and this made the communicational task very simple (process 40 act 259, 261; process 70).

Another difference between the tasks in the operational configuration and those in the improvement processes was that the people had to communicate within the team to develop a solution. In some cases, this difference caused problems. In one case (process 10), the team had long discussions about how they should reach a solution, but it is not clear why the discussion was needed and what the team members wanted to say. In another case (process 23), the supervisor of the department wanted better standard production times, and he asked the team to provide information. The team did not do this for several weeks. When the coach asked them about it, they told him that they had discussed the subject several times in the group, but that they could not agree on what were reasonable times. The major reason for the communication problems in these two cases was that team members were not used to performing these tasks in the operational process. Therefore they had problems with it in the improvement process; thus, functional conflicts existed. In another case (process 43), the team had to examine if other tools could be used, and information on several other tools was collected. This information was added to the team report, but no further explanation was given; the solution was not discussed again. Several times, communication problems within the team did not arise. Reasons for this were:
• The help of the coach prevented problems with communication within the team in several cases. The coach often assisted the team with discussions about possible solutions (process 1; 4; 32; 59 act 466; 70). Further, in some cases, the coach wrote down before a team discussion what had to be discussed and this made the team discussions easier (process 13; 36; 56; 59 act 468). In one case, the communication was very easy because the coach only had to give a team member a list of information that he had assembled (process 66).

• On two occasions, the communication task that was performed by the team was very simple. In one instance, a team member asked if a supplier had yet reacted to a request for information (process 60). In another case, a team member reported that some information on a list was not correct (process 63).

Another difference to the operational activities was that the team had to write a report or structure information to implement a solution. On two occasions, in one case, problems with writing a report appeared. In this case (process 72), the coach had asked the team to write a report of the team meetings, but some of the team members refused to do this. For almost eighteen months, the coach made the reports. Finally, two team members started to make the reports, but three others still refused to do this. A reason for the problem might be that a functional conflict existed. The team members do not have to make reports in their operational work, and they might not be able to do it. In many cases (32 occasions), problems did not appear with writing a report or structuring information. The main reasons for the lack of problems were:

• The coach helped the team to structure information (19 occasions). In some cases the coach made a draft form that the team can use to enter information (process 33; 36 act 233; process 59 act 467; 60) or to check information (process 63 act 540 and 543). In some cases, the team members were well able, with some help from the coach, to draw up an explanation of the solution (process 2; 14; 51). In some cases, the coach made a report that was used in a discussion (process 25; 46 act 308; process 47 act 315; process 48 act 319; process 56 act 408). In several cases, the coach gathered, structured, and wrote down information on specifications for the team (process 13 act 72 and 73; process 70 act 649). In one case, the coach assisted the team in a discussion where they made a list of the major problems and their solutions (process 56 act 399 and 400).

• On eleven occasions, the team members had higher capabilities to structure information than was required for their operational tasks. In some cases, the team members were well able to draw up an explanation of the solution (process 1; 4; 45; 46 act 310). In one case, the coach complained that the team was not doing much work in the improvement process. Then two team members offered to make the team reports in the future so that the coach did not have to do this any more (process 72). In some cases, the team members were well able to gather, structure, and write down the information that was needed to solve the problem (process 8; 13 act 74 and 75; process 40; 59 act 465; process 70 act 666).
On two occasions, people outside of the team assisted the team. In one case, people outside of the team (the supervisor of the quality department) helped the team to structure the information that was needed (process 36 act 232). In another case, the researcher helped the team to write down how to perform their work (process 73 act 707). In one case, the team had to remind the supervisor to do things. This activity differed from the operational activities of the team members. Problems appeared when the team had to remind their supervisor to do something (process 9). The supervisor had to ask about the costs of extra lights for the department, but had not done it after some weeks. The coach asked the team to remind the supervisor about it, but the team said that the managing director of the company should ask the supervisor about it. They did not regard it as one of their tasks and therefore they did not want to perform this activity. A reason for the problem might be a functional conflict. In their operational work, the team members do not have to remind their supervisor to do things, and therefore they might not be able or motivated to perform this task in the improvement process.

A major difference between the tasks in the operational and the improvement configurations was that the team members had to analyse unfamiliar information in order to develop a solution. On four occasions, the team had to analyse unfamiliar information, but in all these cases, problems did not appear with the activity. Twice, this was because of the help from the coach, the team members did not understand information and the coach explained it to them (process 63 act 547 and 549). In two other cases, the information that had to be analysed was structured already by the supervisor of the quality department, and this made the resulting analysis tasks for the team simple (process 29; 30).

A major difference between the operational tasks and the tasks performed to develop a solution is that a solution must be developed for an unfamiliar problem. In about 20% of the instances a solution for an unfamiliar problem had to be developed, problems with the activity arose. The major reason for the problems was that it was simply very hard to develop a solution for the problem at hand; often, people outside of the team, such as experts, did not know how to solve the problems too. In some cases, problems appeared because the team was no longer motivated any more to look for a solution to the problem, or because functional conflicts arose. In about 80% of these activities, problems did not appear. Problems were avoided because the experience of the team members with their operational work helped them to develop solutions. Further, the help of the coach prevented problems. Problems were also avoided because people had more capabilities for developing solutions to an unfamiliar problem than were required for their operational tasks. Further, although a solution for an unfamiliar problem had to be developed, in some cases it was very simple to develop such a solution. The commitment of the team members also helped in developing solutions to unfamiliar problem.
Another major difference to the operational tasks was that the team had to communicate with people outside of the team when developing a solution. In 11% of the cases where communication with people outside of the team was needed, problems appeared. A major problem was that supervisors of other departments and experts did not understand what the team wanted from them. Further, a problem was that team members were reluctant to talk about problems that were caused by others. These problems could be due to by functional conflicts. In 89% of the instances, no problems in communicating with people outside of the team appeared. Problems were prevented because the coach helped the team communicate, or the coach performed the communication activities himself. Further, problems were prevented because the team members had more communicational skills than were needed for their daily work, or the coach taught them new capabilities. In several cases, the communicational tasks were very simple, which prevented problems.

A difference to the operational tasks was that the team had to focus on one problem with the development of a solution. These activities were never problematic because of the help of the coach and the use of improvement tools.

Another difference between the operational tasks and the activities performed to develop a solution was that the team had to write reports. In 6% of these activities problems appeared. The major reason for the problems was that the team members refused to make a report due to functional conflicts. In 94% of the cases, problems did not appear. Problems were prevented because the coach helped the team with report writing or the coach performed the activity. Further, in several cases team members had more capabilities to write a report than were needed in their operational work. In some cases, other people than the coach assisted the team in writing a report.

Another difference to the operational tasks was that the team members had to communicate with each other to develop a solution. In 20% of the instances that this activity was performed, problems arose. Problems were that functional conflicts appeared, or that the team did not discuss a subject at all. In the other 80% of the occasions that the activity was performed, problems did not arise. Reasons for the lack of problems were that the coach structured or prepared the team discussions and that some communicational tasks were very simple.

Another difference to operational activities was that the team members had to initiate tasks themselves in the development of a solution. In 75% of the instances where the team had to initiate tasks, problems appeared. Reasons for the problems were, functional conflicts appeared, the team was no longer motivated to perform the activities, operational work got higher priority, or the problem disappeared without developing solution for it. In 25% of the instances, problems did not appear. This was because the team members were very committed to developing a solution and they performed extra tasks to find a solution.

A further difference was that the team had to analyse unfamiliar information to develop a solution. No problems occurred with the activity because the coach and the supervisor of the quality department assisted the team with these activities.
5.6. Test the solution

5.6.1. Definition of the activity

Testing a solution includes all those activities that have as a goal determining if a proposed solution works well in practice before it is implemented. Often the testing of a solution is integrated with implementation, and then the activity of testing the solution is not distinguished. In these cases, the testing of the solution is not mentioned as a separate activity.

5.6.2. Occurrence of the activity

Activities to test a solution were performed explicitly fourteen times in eight cases (11% of the cases). In three instances, people outside of the team performed the tests (process 18, 49, 54 act. 601); in two of these, a technical specialist was used. The team members performed activities to test a solution eleven times in six different improvement processes.

Table 5-12 shows how often activities were performed to test a solution in a process. When a solution was tested, the development of the solution had specific characteristics. In 79% of the instances that a solution was tested, the development of the solution consisted of a search for a solution, and in 14% of the instances, a solution had to be further developed. In the cases where a solution was tested, the solution was never directly given at the start of the improvement process. This indicates that the extent of testing of a solution was related to the difficulty in finding a solution. If it was hard to develop a solution, and the team had to search for a solution, then in several instances parts of the solution were tested. In this way, the team found out if the solution that was developed would work in practice (process 5, 18, 39, 41, 49, 54, 58, 73).

In three instances, a solution was tested to ease the authorisation of the solution. In two cases, the solution was not hard to develop but the team tested the solution to convince technical specialists that they should authorise the solution (process 39, 49). In another case, the team tested the solution in order to ask a customer to authorise the solution (process 54).

Solutions were tested for two reasons: (1) because it was hard to find a solution and the team wanted to test if a developed solution would work in practice; (2) because the team wanted to convince people who had to authorise the solution with a test that it would work.

It is striking that in about 90% of the cases, the solutions were not explicitly tested. One reason for this is that often the solutions were simple and cheap, only small changes in the existing situation and not many consequences. In these situations, the risks of implementing a solution that was less successful than expected were rather small. In such cases, testing a solution would take extra time, while the advantages of tests would be limited.
In about ninety percent of the cases, solutions were not tested before they were implemented, because they were simple and had only small risks. The advantages of testing such a solution did not outweigh the extra work that was needed.

5.6.3. Problems with the activity and consequences of it for the whole process

In 21% of the instances where the team performed activities to test a solution, the activity was problematic (three times in two processes). In one case, problems first appeared because the team needed special ink to do a test (process 54). The team asked their supervisor to order this ink, but it took a long time before the supervisor ordered it and the test was delayed by several months. Further, the supervisor ordered the wrong ink because the team did not explain sufficiently well why they needed special ink. Therefore, the test could not be performed well. Other problems appeared when a team forgot to test a solution, they were not motivated to test a solution because they thought that it would not work (process 73).

Problems with testing the solution never resulted in an unrealised improvement. However, it cannot be measured if other problems in the implementation of solutions would have been prevented if solutions had been tested more. It is possible that testing solutions on a small scale would have prevented some problems in the implementation of solutions.

Problems in the testing of a solution were that a supervisor did not order tools for some time, and that he then ordered the wrong tools. Another problem was that a team was not motivated to test a solution. These problems did not lead to unrealised improvements.

5.6.4. Differences and correspondences with the operational activities

Table 5-13 shows that, in most cases, the activities that were performed to test a solution had the same characteristics as activities in the operational configuration.

<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Probl</td>
<td>No probl</td>
</tr>
<tr>
<td>Initiate tasks</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Functional conflict</td>
<td></td>
<td>High commitment</td>
</tr>
<tr>
<td>Communicate with people outside team</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Help coach</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ask things to the supervisor</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Imported misfit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use tools/machines</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Team was not motivated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Correspondence with o.p.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-13: Differences and correspondences between the operational process and the testing of the solution (N= 10)

The major correspondence between the activities of the operational configuration and the activities to test a solution in the improvement process was that in both processes, the people had to use tools or machines. In one case, a problem with testing the solution appeared because the team members were not motivated to perform the test. The coach had suggested a different way of working that might solve some problems. The team members did not believe
that the solution would work and therefore they were not motivated to test it (process 73 act 702). In most cases, the use of tools or machines was not problematic. In several cases, the team members had to make a test product to see if a solution would work. They performed the activity without problems (process 39; 54 act. 578, 583, 587). In another case, they had to test new materials, and again problems did not appear (process 58). In these five cases, problems did not arise because the activity corresponded with their operational tasks.

Another correspondence between the operational configuration and the activities to test a solution was that the team had to ask the supervisor to do things. Although the activity did not differ from the operational tasks, it was problematic. The main reason for this was that a misfit from the operational configuration was imported into the improvement configuration. In the operational configuration not much communication between the supervisor and the people from the department took place thus a misfit already existed in the operational configuration. This misfit was imported into the improvement configuration and so, in the improvement configuration problems also arose because of a miscommunication between the supervisor and the team (process 54 act 854). The team had asked the supervisor to order a specific type of ink, but the supervisor ordered different ink that was not so appropriate for the test.

Many activities in testing the solution were the same as operational activities since the team members had to produce test products using their machines or test materials. In most of these cases, problems did not arise because the activities corresponded with operational tasks. One problem appeared, because team members were not motivated to perform a test.

Another correspondence with the operational work was that the team had to ask their supervisor to do things. With this activity, problems appeared because a misfit in the operational configuration was imported into the improvement configuration.

A difference between the operational configuration, and the activities needed to test a solution was that the team members had to initiate tasks that were needed to test a solution. This activity in the improvement configuration was problematic. Because the team did not get a direct order to test a solution, they forget to test the solution (process 73 act 700). The problem might be caused by a functional conflict; people were not used to performing tasks without direct orders in the operational process. In another case, the tasks that the team had to initiate were not problematic, although the characteristics of the task differed from the operational tasks. In this case, a salesman from a supplier suggested a solution. One of the team members took the initiative to test this solution. The commitment of the team members helped in performing the activity; further orders to perform it were not needed (process 41).

Another difference between the operational tasks and the tasks needed to test a solution was that the team needed to communicate with people outside of the team. In one case, the team needed materials to print a test label. In this case, the coach helped the team, and he ordered the needed materials (process 54 act 586). Although the activity differed from the operational tasks, problems did not appear because of the help of the coach.
5.7. Authorise the solution

5.7.1. Definition of the activity

The authorisation of a solution includes those activities that are performed in the improvement process in deciding if a solution is approved of or not.

5.7.2. Occurrence of the activity

Activities to authorise a solution were performed in about one-third of all the improvement processes. These activities were performed thirty-three times in twenty-two improvement processes. In 63% of these instances, the team performed the activity (twenty-one occasions). In some of these cases (five), the team discussed the authorisation of the solution, or they prepared it. In the other cases (sixteen), the team talked with someone outside the team to authorise the solution. People outside of the team authorised a solution on twelve occasions. The team discussed the approval of a solution for several different reasons:

- The team had to ask approval from their supervisor for certain investments. In some cases, the team wanted to buy new tools (process 5; 19; 20; 45; 62; 69). In another case, the team wanted one of them to follow a course (process 38).

- The team had to obtain approval for changing the working method (process 2; 12; 21; 39; 41; 50; 57; 58). In one case, the supervisor of another department had to agree with the solution that the team had proposed (process 51). In another case, the managing director had to agree with the solution (process 56). The managing director had to agree with the solution in another case, but the team did not ask him (process 6). In one case the major customer had to agree with a change in the product characteristics (process 54).

- The team informed others about the solution they wanted to implement. In these cases, the team did not ask officially for approval of the solution, rather they told someone else that they wanted to implement a solution. They did this because they wanted to involve the other person in the solution, or they wanted to explore if the other person had strong objections to the proposed solution. In one case, the team discussed the solution with their supervisor to involve him more in the team activities (process 36). In another case, the team told the supervisor of another department that they had started to register problems that were caused by his department (process 52). In another case, a team member wanted to inform his coach that he was wasting materials (process 67).

This shows that activities to authorise a solution were not performed in every improvement process. They were only performed explicitly under specific circumstances: if the team had to
ask approval for a solution, or if the team wanted to inform other people about a solution. If these circumstances did not exist, the authorisation of the solution was not discussed explicitly in the team meetings and the solution was implemented without any explicit authorisation activities.

Activities to authorise the solution were performed in only 33% of the improvement processes. The activities were performed because: (1) The team had to seek approval from their supervisor for some investments; (2) the team had to ask approval from someone to change the working method; (3) The team informed someone else about the solutions they wanted to implement in order to involve others in the solution, or to explore if others had large objections to the proposed solution.

Table 5-14 shows that the activities linked to authorising a solution occurred once or twice in most processes, however, in some processes they were repeated a few times. These activities were repeated because:

(a) The person who had to authorise the solution did not react (process 12, 39, 45).

(b) Authorisation was performed by different groups of people, for example by the coach of the team as well as by the supervisor (process 2, 6, 38, 69).

(c) The authorisation was discussed at different times by the team (process 41, 54).

<table>
<thead>
<tr>
<th>The activity was performed</th>
<th>In … processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>… times</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5-14: Number of times that activities were performed to authorise a solution in an improvement process (N=73).

5.7.3. Problems with the activity and consequences of it for the whole process

The authorisation of the solution was problematic in 30% of the instances that the activity was performed (ten occasions). Half of the times the activity was problematic it was performed by the team and the other half by people outside of the team. In the cases where the team performed the activity, there were different reasons for the problems:

- Communication problems between the team and others. In one case (process 6 act 34), the team decided on a space to store reject work, but the managing director wanted to determine this, and the team did not communicate with him about it. In another case problems appeared because a supervisor did not react to a proposed solution. The team wanted to communicate with him about this by giving him the report of their team meetings where the proposal was discussed. They did not recognise that closer communication with him was needed (process 39 act 287).

- The team forgot that authorisation was needed. In one improvement process, the team decided to implement a solution, but they did not recognise that others had to authorise the solution because they could not see the consequences of the solution themselves. That is, they might implement a solution that did not solve the problem properly (process 39 act 283).
The authorisation was never concluded. In one case (process 2 act 12), problems occurred because the team wrote a proposal for their supervisor and the managing director, but they never planned a meeting to discuss it, because the team no longer had meetings. In another case (process 12 act 61), the solution that the team developed was not authorised, but the team just forgot about the problem and the problem was never solved.

| Major problems with the authorisation linked activities that were performed by the team were: (1) communication problems between the team and others; (2) the team forgot that authorisation was needed, and (3) the authorisation was never concluded. |

In the cases where people outside of the team performed the authorisation, the major problems were:

- It took a lot of time before the solution was authorised. In one case, the team no longer met when the solution was authorised, and therefore the solution was never implemented (process 2, act. 10). In another case, the solution was not authorised during the research period, and therefore the solution was not be implemented and the problem was not solved (process 39, act. 286). Partly because of slow authorisation, proposed solutions were never implemented, and because of this both improvement processes failed.

- The solution is not authorised. In two cases, the solution that was proposed by the team was rejected (process 12 act. 60, process 69). In another case, the managing director did not allow anyone to develop a solution, because he wanted to do it himself. However, he did not do it, so no authorised solution was developed (process 6, act. 32). It is striking that of the improvement processes where the solution was not authorised, only one failed (process 12). In the other two cases, the team implemented the solution even though it was not authorised. Afterwards, there were no complaints about the unauthorised implementation.

In 3% of the cases (2 cases), the improvement process failed because of problems with the authorisation of the solution. In one of these cases, the solution was not authorised and the team did not reseek for authorisation, nor did they search for another solution (process 12). In the other case, the supervisor did not react to a request to authorise the solution during the research period (process 39). In another case (process 2), it was a long time before the solution was authorised, and then the team did not implement the solution. In this case, the late authorisation partly caused the failure of the improvement process. In one case, the supervisor did not authorise a solution, but the coach of the team then authorised it, because the costs of the solution were very low (process 69). Because of the actions of the coach, the improvement was realised. In another case, the managing director did not react to a proposal by the team, and the team decided to implement a solution without authorisation (process 6); because of this action, the improvement was also realised.

It is striking that of the three improvement processes that were not authorised and directly rejected, only one failed, while the two improvement processes where the authorisation was given after a lot of time failed. A major reason for this is that when the authorisation took a
long time, the team forgot about the solution they wanted to implement. When the solution was rejected quickly, the team was still very motivated to solve the problem and they were not bothered by the fact that the solution was not authorised; they just went on with the improvement process. This shows that a quick authorisation is important to realise an improvement. Further, it suggests that if people want to prevent a solution being implemented, it is far more effective to delay the authorisation than to reject the solution directly.

Major problems with the authorisation linked activities that were performed by people outside of the team were: (1) The authorisation took a lot of time, which resulted in the failure of these improvement processes. (2) The proposed solution was rejected; however, in two-thirds of the cases where this happened, the unauthorised solution was implemented and this did not give any problems. This shows that a quick authorisation is very important to realise an improvement.

5.7.4. Differences and correspondences with the operational activities

Table 5-15 shows that the tasks linked to the authorisation of the solution differed from operational tasks in 75% of the instances that they were performed and in 25% they corresponded with the operational activities.

<table>
<thead>
<tr>
<th>Difference</th>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Initiate task</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Remind supervisor about task</td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Communicate with people outside team</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Approve a solution</td>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Write a report</td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No diff</td>
<td>Ask things to the supervisor</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 5-15: Differences and correspondences between the operational process and the authorisation of the solution (N= 21)

When the authorisation of the solution corresponded with the operational activities, the main activity was to ask things to the supervisor of the department. In the improvement processes, the activity was never problematic (process 19; 20; 21; 36; 62). The main reason for the lack of problems with the activity in the improvement process could be that the tasks in the operational and the improvement configuration are the same, and thus no functional conflicts arise. In one case, problems did not appear because the coach performed the activity (process 58).
In several cases, the activities that were needed to authorise a solution were the same as the activities in the operational configuration; with all these cases the team asked their supervisor to do things. This activity was never problematic because of the correspondence with the operational activities or because the coach performed it.

In two cases, the supervisor did not react to a request to authorise a solution, and the team had to remind the supervisor. The teams had to remind their supervisor about the things he had promised to do on two occasions. In one of those cases, problems appeared. The supervisor had to authorise the solution but he did not react to a team proposal. The team wanted to remind their supervisor about the task by sending him the report of the team meeting where the problem was discussed. They did not recognise that more direct communication was needed to remind him to authorise the solution (process 39). The team did not have to remind others to do things in their operational work and thus functional conflicts might explain the problems that arose. In another case, problems did not appear because of the help of the coach. The supervisor did not react and one team member got very angry about it. The coach explained the situation to him and this help of the coach prevented problems (process 45).

An important difference between the tasks in the operational configuration and the improvement tasks was that the team had to communicate with people outside their department. Although this task differed from the operational tasks of the team members, hardly any problems appeared with it. The main reason for the lack of problems with this activity was that the coach helped the team with it; the coach communicated with the people outside of the team and this prevented problems (process 38; 51; 52; 56; 57). In one case a team needed to communicate with someone outside the team, and they had to initiate that communication and the communication was problematic. In this case, the team developed a solution that should have been authorised by the managing director of the company, but the team never asked him for authorisation; they just implemented the solution without authorisation. A reason for the lack of communication might be that the team did not recognise that they had to discuss the solution with the managing director; they thought that the problem had been solved in a proper way. Therefore, their coach also did not perform the activity for the team (process 6). In another case, the team wanted to change the working methods, but they needed the authorisation of the quality department to realise this. They had to convince the people from the other department that their solution was a proper one, and they had to take initiatives to get the solution authorised. Although the team did not have much experience in authorising a solution, they foresaw problems with the quality department. The team tried to prevent problems by involving the quality department in official tests; thus, they had the capabilities to foresee problems and to find a proper solution for the problems with the quality department. This shows that they had more capabilities then the capabilities needed for their daily work. Further, the experiences in their daily work helped them perform the activity without problems (process 41).

Next to communication with people outside of the team, the coach also assisted the team with other activities that were needed to authorise a solution, and that differed from operational tasks. On one occasion, a coach wrote a report that was given to a supervisor to authorise the
solution (process 39). Twice, a coach approved a solution by his team himself (process 67; 69), although in one of these cases the supervisor had rejected the solution. Because the costs of the solution were very low, and the team complained a lot about the problem, the coach gave the team the money that was needed to implement the solution. These activities by the coaches helped the teams to perform the activities and they prevented problems.

The major cause of problems with the authorisation of solutions was that the team had to initiate tasks to authorise the solution. In three cases, problems with the authorisation of the solution appeared because the needed tasks were not initiated. In one case, the team needed to discuss with the managing director and the supervisor the authorisation of a solution, but the team did not meet for some time and then they forget to plan the meeting (process 2). In another case a solution was not authorised, but the coach suggested asking about it again but nobody did. A reason for this might be that the subject had disappeared from the team agenda, and no one was stimulated to ask about it (process 12). In another case, the team wanted to implement a solution, but they forget to ask others to authorise it in first instance (process 39). All these problems could be explained by functional conflicts with the operational tasks; in the operational processes people do not have to perform these tasks.

Several activities linked to authorising a solution differed from operational activities, but on most occasions problems did not appear. A major difference was that the team needed to communicate with people outside of the team. The main reason for the lack of problems was that the coaches assisted the teams; often they performed the required activities themselves. Most problems with the authorisation of a solution appeared because the team had to initiate tasks to authorise the solution, something they did not have to do in their daily work. Problems arise because functional conflicts existed.

The teams had problems with reminding their supervisors about the tasks they had promised to do; they did not need to do this in the operational configuration.

5.8. Implement the solution

5.8.1. Definition of the activity
Implementation of the solution is the change of an existing situation with the goal of realising a more satisfying situation.

5.8.2. Occurrence of the activity
Implementation activities were performed one hundred and eighteen, times in 84% of the improvement processes (sixty-one processes). In 51% of the instances that the activity was performed, it was performed by the team members (sixty times), while people outside of the team performed it on the other occasions (fifty-eight times).
Table 5-16 shows how often activities to implement a solution were performed in each process. In most cases, only a few activities were performed to implement a solution. The reason for this is that often solutions were simple; therefore, they could be implemented very quickly. However, in some cases many activities were needed to implement a solution. Based on the number of implementation activities, three types of improvement processes can be distinguished:

1. **Improvement processes where no activities to implement a solution were performed** (21% of all the cases). In several cases no implementation activities were performed. Reasons for this were, the problem was not analysed and therefore no solution was developed (process 9), no solution for the problem was found (process 1; 4; 23; 40; 43; 46; 48; 71), or that the solution was not authorised (process 12; 39). Further, in one case, implementation was not relevant to the improvement process, because the improvement process was only the analysis of a problem that the supervisors had tried to solve (process 3). In 5% of the cases, the implementation of the solution was problematic because no implementation activities were performed. In these cases, problems did not occur because of problems with other activities preceding the implementation. In these cases, problems appeared because the implementation activities were not performed at all, which was problematic (process 2; 27; 29; 44).

2. **Improvement processes where only one or two activities were performed to implement the solution** (61% of all the cases). In most cases, implementation activities were performed only once or twice. Reasons for the small number of implementation activities were:
   - In most cases, it was easy to implement the solution; it could be implemented quickly without many problems.
   - In some cases, one activity was performed to implement a solution, but no real solution to the problem had been developed, so no further implementation was performed and the implementation was cancelled (process 34; 66).

3. **Improvement processes where many (>3) activities were performed to implement the solution** (18% of all the cases). In several cases, three or more activities to implement a solution were performed (process 16; 17; 21; 31; 37; 56; 57; 58; 64; 67; 70; 72; 73). Reasons for the large number of activities to implement a solution were:
   - People outside of the team (other department, supplier, technical specialist, the managing director) had to perform activities to implement a solution, but they did not do this. Therefore, the team discussed many times the implementation of a solution (process 17; 21; 31; 37; 56; 57; 58). In one case, the team members themselves did not
implement a solution for a while, and therefore it was discussed several times (process 72).

- Several solutions had to be implemented to solve one problem and thus several implementation activities were performed (process 56; 58, 73). In some cases the solution was developed with more detail after some implementation activities were performed; then further implementation activities were needed (process 64; 67).

- Different people performed implementation activities and therefore several implementation activities were distinguished (process 16; 31).

In about 20% of the cases, no implementation activities took place at all. In about 60% of the cases, three or more activities to implement the solution were performed. Reasons for a large number of implementation activities were: (1) People did not implement the solution and therefore many activities were performed where the implementation was discussed; (2) Several different solutions were implemented, or after a time extra implementation activities were performed because the solution was developed with more detail; (3) Different people performed implementation activities.

5.8.3. Problems with the activity and consequences of it for the whole process

Activities for implementing a solution were problematic in 24% of the instances that the activity was performed (twenty-nine times). In 34% of these problematic activities, the team members faced problems (ten times), while people outside of the team had faced problems in 66% of the instances (nineteen times). Reasons for problems with the activities linked to implementing a solution by the team members were:

- The team members did not perform the activities that were needed to implement a solution. In one case, the team did not implement the solution because they no longer met when the solution was authorised (process 2). In another case, a coach promised to make a list of the required information, but it took some time before he did this (process 22). In one case, the team only discussed solutions, but they did not implement them (process 44). In another case, the coach and the researcher promised to look for additional tools that the team had asked for. However, after a period when the problems did not appear, the tool was never bought. In the same case, the team also forgot to use a solution after some time (process 73).

- The team was not motivated to implement the solution. On some occasions, the team just did not want to use the solution that was agreed upon at an earlier meeting (process 16; 72). In another case, the team anticipated problems because there were not enough quality inspectors. However, the supervisor of the quality department said that he did not expect any more problems. As a consequence the team members were no longer motivated to implement further solutions (process 28). In another instance, the team wanted further information from another department, but when this was not provided, the team lost motivation for implementing other solutions (process 53).
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- **Communication problems between the team and the supervisor.** The team members did not tell their supervisor that they wanted to implement a solution on one occasion (process 34). With another case, a team asked their supervisor to order materials, but the supervisor did not do this, because he wanted to see if the team really needed the materials. However, he does not tell the team this (process 58).

The problems linked with the activities to implement a solution by the team members were:
1. The team members just did not perform the activities that were needed to implement the solution;
2. The team was not motivated any more to implement the solution;
3. Communication problems between the team and the supervisor arose.

In several instances, the team members were not able or authorised to implement solutions, they needed the help of people outside of the team. An important reason for problems in implementing solutions was that people outside of the team did not implement solutions that were suggested by the team. Several types of problems can be distinguished:

- Problems often appeared because people from another department did not implement a solution. In one case, they knew about the solution that was developed by the team, but they did not perform the actions that were needed to implement it (process 17, act. 107). In another case, people outside of the team did not correct wrong information although they had promised to do so (process 21 act. 135). In another case, someone from another department had to work on a solution after normal working hours, and he had no time to do this for several weeks (process 31). In another case, people from another department had to adapt new orders, but they did not have enough time to do this for several months (process 37). With some cases, problems appeared because the co-ordinator of the improvement teams promised to implement a solution, but this took a lot of time. In one case, the co-ordinator wanted to solve problems with a machine because no one else had solved them, but some time later they still existed (process 57 act. 427). The co-ordinator promised to make a registration form in another case, but this took a lot of time (process 73 act. 697). Further, the co-ordinator has to adapt a form, but after nine months this was not yet done (process 29). Problems also appeared because the managing director of the company or the supervisor of the department of the team did not act. In one case, the team asked their supervisor to order new parts and repair a machine, but it took a lot of time before this was done (process 73 act. 725). In another case, some supervisors and the co-ordinator had to act to solve problems with difficult orders. However, during the research period no actions were taken by them (process 54). In another case, the managing director had to organise improvements in a new building, but this took a long time (process 56).

- Materials that were needed to implement a solution were not delivered because of problems at the supplier. In one case, a supplier could not deliver materials that were needed to implement the solution and this delayed the implementation (process 17, act. 102 and act. 104). In another case, materials from the old plant were needed, but they were hard to obtain because the old plant was now part of a bankrupt company (process 41). Problems with a machine existed in one case because some parts did not function
well (process 57). New parts were ordered, but the mechanic of the supplier did not install them (act. 422). Then, the parts were sent back to the supplier, where they get lost for a long period (act. 423 and 426).

- *The implementation is delayed because other things must be done first.* In one case, people outside of the team had to implement the solution, but they had to first finish a course (process 21 act. 133). In another case, the implementation was delayed because new tools had to arrive before the solution could be implemented (process 27).

The main problems with implementation by people outside of the team were: (1) These people (people from another department, the co-ordinator, supervisors, and the managing director) simply did not perform the actions that were needed; (2) Materials that are needed are not delivered because of problems at the supplier; (3) The implementation is delayed because other things must be done before the solution can be implemented.

In several cases, problems with the implementation hindered the realisation of the proposed improvement function as a whole. In 10% of the total cases (seven cases), problems appeared because activities to implement a solution were problematic. With 71% of these cases (five cases), people outside of the team caused the problems and only in two cases did the team members cause problems. The major reason that improvement processes failed due to the activities by the team was that the team did not perform the activities that were needed (process 2; 44). In one case, the team did not implement the solution, because they no longer met when the solution was authorised (process 2). In the other case, the team only discussed solutions, they did not implement them (process 44). However, the motivation of the team, and the communication with the supervisor, avoided the failure of the whole improvement process.

Where improvement processes failed because of activities by people outside of the team, the reasons differed. Problems were caused by people outside of the team not performing the needed activities, such as people from another department (process 21), or the co-ordinator (process 29, 57). Further, a supplier who could not deliver materials (process 17) caused the failure of an improvement process. In one case, the implementation of the solution did not take place during the research period because new tools had to arrive before the solution could be implemented (process 27).

In 10% of the cases, problems occurred because activities to implement a solution were problematic. In 71% of these cases people outside of the team caused the problems and only in 29% of the cases did the team members cause problems.

5.8.4. Differences and correspondences with the operational activities

Table 5-17 shows that the activities that were performed to implement a solution had various characteristics. Some activities corresponded with the operational activities, while most activities differed.
An important correspondence between the operational tasks and the implementation of a solution was that the team used tools or machines to implement a solution that were also used in the operational configuration. Only once, was the use of tools/machines problematic. In that case, a solution to the problem was that people had to change tools regularly. Changing tools was a normal task in the operational configuration. However, the team members still forgot to do it in time, and therefore the solution was not implemented and problems arose in the production process (process 73 act. 721). In most cases, problems did not appear with the activity. In one case, the solution was that the team had to check the due date of materials before they used them (process 22). They also had to check several other characteristics of the materials during their daily work and thus this activity did not differ from the operational tasks; it was not problematic. The implementation of the solution in one case was that the

<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of Probl</th>
<th>No probl</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiate tasks</td>
<td>5</td>
<td>0</td>
<td><strong>Functional conflicts</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Problems disappeared</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td><strong>Team is not motivated</strong></td>
</tr>
<tr>
<td>Communicate within team</td>
<td>0</td>
<td>2</td>
<td><strong>Help of the coach</strong></td>
</tr>
<tr>
<td>Communicate with people outside team</td>
<td>0</td>
<td>11</td>
<td><strong>Help of coach</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>People have more capabil.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>High commitment of team</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Experience in impr.p.</strong></td>
</tr>
<tr>
<td>Write a report</td>
<td>2</td>
<td>0</td>
<td><strong>Team forgot to perform task</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Functional conflict</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td><strong>High commitment of team</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Experience in op config.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Help of the coach</strong></td>
</tr>
<tr>
<td>Position new tools</td>
<td>0</td>
<td>10</td>
<td><strong>Simple task</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Help of the coach</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>High commitment of team</strong></td>
</tr>
<tr>
<td>Team informs the supervisor</td>
<td>1</td>
<td>0</td>
<td><strong>Imported misfit</strong></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
<td><strong>Supervisor visits team meeting</strong></td>
</tr>
<tr>
<td>Ask things to the supervisor</td>
<td>1</td>
<td>0</td>
<td><strong>Imported misfit</strong></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td><strong>Correspondence with o.p.</strong></td>
</tr>
<tr>
<td>Supervisor informs the team</td>
<td>0</td>
<td>1</td>
<td><strong>Supervisor visits team meeting</strong></td>
</tr>
<tr>
<td>Use tools/machines</td>
<td>1</td>
<td>0</td>
<td><strong>Team forgot to perform task</strong></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>4</td>
<td><strong>Correspondence with o.p.</strong></td>
</tr>
<tr>
<td>Register problems/process information</td>
<td>0</td>
<td>8</td>
<td><strong>Correspondence with o.p.</strong></td>
</tr>
</tbody>
</table>

Table 5-17: Differences and correspondences between the operational process and the implementation of the solution (N= 60)
team slightly changed the way they used tools (on a machine). The activity corresponded with the operational activities because using tools (on a machines) was also part of the operational work. No problems with this activity arose (process 35; 58). In one case, the team had to test if a tool could be used on two machines, and they had to communicate the results to another department. The person who performed the test and communicated the results was one of the foremen of the department, and the tasks he had to perform in the improvement process were the same as tasks in his daily work. No problems with the task arose (process 10).

Another correspondence with the operational tasks was that team members had to register process information. In several cases, the solution of the problem involved team members filling in a form. In their operational work, they have to fill in forms if they make a product and thus this activity was familiar (process 14; 15; 32; 36; 54; 60; 67; 68). In all these cases, problems did not appear because the task corresponded with the operational tasks.

Another correspondence between the operational tasks, and the tasks to implement a solution was that team members communicated with the supervisor. One element of this was that the team informed the supervisor about what they were doing. In two cases, the team told their supervisor that a solution was not yet implemented, because they hoped that he could do something about it (process 17; 21). In both cases, communication with the supervisor was not problematic because the supervisor attended a team meeting and the communication took place during that meeting. In one case, however, communication was problematic. The team did not explain to their supervisor that they wanted to change the way they registered production times and the supervisor became angry when he heard that the team had changed it (process 34). In the operational configuration, communication between the supervisor and his team was also sometimes problematic, thus an imported misfit existed.

Another element in communication with the supervisor was that the team asked the supervisor to do things. This activity also corresponded with tasks in the operational configuration. In one case, the team asked their supervisor to arrange for someone to clean the department (process 26); this activity was not problematic because the activity corresponded with operational tasks. In another case, the team asked their supervisor to order extra materials that were needed for a new machine. However, the supervisor did not order this for a while and therefore the team could not use the new machine (process 58). Although the activity did not differ from operational tasks, it was problematic. The main reason for this was that a misfit from the operational configuration was imported into the improvement configuration.

Another part of communication with the supervisor is the supervisor informing the team. This activity also corresponds with operational activities. In one case, the team was worried that they could not achieve the proposed production times because they had extra tasks that took a lot of time. They discussed the problem with the supervisor and he told them that the extra activity was part of their work. Further, he did tell them that planning was to incorporate the extra activities in the production times. After this meeting, one of the team members said that they had created a problem that did not exist; if they get additional time to perform the additional tasks there was no problem (process 25). The communication from the supervisor
Analysis of improvement activities

to the team thus solved the problem. Further, the communication activity itself was not problematic, because it took place during a team meeting.

A major correspondence between the implementation of a solution and the operational configuration was that the team had to register process information. This activity was never problematic because it corresponded with the operational tasks.

Another correspondence was that people had to use tools and machines. In most cases, the use of tools was not problematic because the task corresponded with operational tasks. In one case, problems appeared because the team forgot to change tools more regularly.

Another correspondence between the implementation of the solution and the operational configuration was that the team had to communicate with the supervisor. In some cases, the team informed the supervisor. Twice, this was not problematic because the supervisor attended the team meeting. On one occasion problems appeared because the team forgot to discuss a solution with their supervisor; this was caused by an imported misfit. Another element of communication with the supervisor is that supervisor informing the team. This activity was not problematic because the supervisor attended the team meeting. Further, the team asked the supervisor to do things. This was problematic on one occasion because the supervisor did not order the things the team asked; this was caused by an imported misfit. In another case, problems did not arise with the activity because of the high commitment of the team.

An important difference to the operational activities of the people was that the team had to position tools to implement a solution in the improvement process. In several cases the team members placed lists with information in their department or close to their machines (process 59; 60; 70 act 664 and 667) or they passed a list with information to another department (process 67). In another case, the team members bought keys for a door, to prevent the department getting very cold (process 69). In all these cases, the activity that the team had to perform to position the tools was very simple, and therefore problems did not appear. Further, with some of these cases the coach helped the team store the information in the correct way. In one case, the activity that had to be performed was not so simple; one team member marked a space to store reject materials (process 6). In this case, the high commitment of the team member prevented problems. In other cases several other problems were prevented because the coach performed the activity for the team. In one case, the coach gave an information list to another department (process 63) and in another to gave a list with information to the department of the team (process 70 act 665). In another case, the coach provided binders to store the team reports (process 61).

An important difference between the tasks in the operational configuration and the improvement tasks was that the teams had to communicate with people outside their department. Although the task differed from the operational tasks of the team members, problems never appeared with it. An important reason for the lack of problems was that the coach helped. In several cases, the coach communicated with the people outside of the team
and this prevented problems (process 55, 64; 73 act 698). In one case, the team had to communicate with their colleagues about new order information. They wanted to put the specifications on paper and pass this to everybody. The coach has to convince them that this was not sufficient and that it was necessary to explain it to their colleagues (process 13 act 76). In this case, the help of the coach prevented problems. Later, in the same case, the team members explained new order information very clearly to their colleagues (process 13 act 77). Although they did not have to perform this task in the operational configuration, they were able to perform it in the improvement configuration. A reason for this is that the information they explained was structured and written down on paper by the coach, and this facilitated the explanation. Thus, the help of the coach facilitated the communication activity in the improvement process. Another explanation could be that the team members have more communicational capabilities than are required in their daily work. In one case, a team member asked the supervisor of the quality department about new tools and there were no problems (process 11). Clearly, the team member was able to perform this activity although it was not needed in his daily work. A reason for the lack of problems might be that he had more communicational capabilities than were needed for his daily work. In another case, someone outside the team had to adapt information in the computer system to solve a problem. The team wanted to ask him when he would finish it (process 21). In another case, the team asked someone outside the team to order new tools (process 17 act 101) and when this did not happen they reminded him about it (process 17 act 103). Later, in the same case, the team assumed that not all the required tools had been ordered, and they again contacted the people of the other department (process 17 act. 105). This team learned how to ask others to do things for them in a small workshop given by their coach. Thus, they had learned new capabilities in earlier improvement processes, and the help of the coach facilitated this. This prevented problems with communication. In another case, the team members were told that the supervisors were trying to solve a problem, but they did not want to wait until this was realised, because they thought that it would take too long. Therefore, they contacted someone who could order the tools that were required to solve the problem (process 5). In this case, the high motivation of the team members prevented problems with the communication.

Another difference between the tasks in the operational configuration and the implementation of the solution in the improvement processes was that the people had to communicate within the team to analyse the problem. Although the team members did not have to communicate much in the operational configuration, no problems with this activity appeared in the improvement process. In one case, the team discussed the work methods that were needed to use a specific machine. The coach structured this discussion. Further, the discussion was structured because the researcher had made a list of the major tasks in the work method (process 73 act 713). Because of the list, and the assistance of the coach, problems did not appear with the team discussion. In another case, the coach gave the team information about new customer wishes; thus the coach had performed the communication that was needed and this prevented problems.
A further difference between the operational configuration, and the activities needed to test the solution was that the team members had to **initiate tasks** that were needed to test the solution. The initiation of tasks was problematic on about half of the occasions. In one case, the team members agreed to change the products they made on a regular basis, but after a while they had still not changed (process 16). In another case, the team discussed several solutions for a problem, but none of them were implemented (process 44). In another case, the team no longer met when a solution was finally authorised, and therefore they did not implement the solution (process 2.). With all these cases, the team members did not have a direct stimulus to perform the activity, and this was the major reason for the problems. This differed from the tasks that had to be performed in the operational configuration; the difference between the operational and the improvement configuration caused the problems. However, several problems were not caused by the difference between the two processes; in these cases there were different reasons. In one case, the researcher and the coach promised to look for a new tool. However, after a while, the problems disappeared and they did not buy the new tool (process 73 act 718). In this case, no solution was implemented because the problem disappeared and a solution was not needed. In one case, the team expected problems because there were not enough quality inspectors and they regarded the supervisor of the quality department as responsible for the problems. However, the supervisor of the quality department foresaw no problems. Because the supervisor did not want to take any actions, the team was no longer motivated to implement solutions (process 28). In this case, no solution was implemented because the team was motivated no longer. In several cases, there were no problems with the initiation of tasks. In one case, the team members did not like the way materials were stored untidily and they restructure the way they were stored (process 24). In one case, a team member had to check the tools that were stored, and he did this without problems (process 67). A reason for this direct action in both cases might be that the team was very motivated to have a nice clean department. In another case, a team member had worked out a better way to indicate that things had to be changed and he immediately implemented this (process 65). In another case, a team member worked out a way to treat tools so that they could be used more often; he also immediately implemented this solution (process 41). In another case, the problem was very serious, and the team members knew this from their experience in the operational configuration. Therefore, they were very motivated to solve the problem and implement a proper solution (process 66). In all of these cases, the major reason for the lack of problems was that the team members were very motivated to implement a solution.

Another difference to the operational activities was that the team had to **write a report**, or structure information, to implement a solution. In two cases, problems appeared. In one case, problems appeared because a coach did not produce a list that the team could use to register information (process 22). In another case, problems appeared because the team members refused on several occasions to make a report of the team meetings (process 72 act 681). The cause of the problems was that people did not have to perform this task in the operational process; functional conflicts existed. However, in many other cases problems did not appear with report writing. After two years, some of the team members that had refused to make a
report began to make reports. The main reason for this change was that the coach had shown his disappointment with the lack of enthusiasm by the team members, and the team members wanted to show him that they were motivated to work on improvements (process 72 act 680 and 683). However, three of the team members still refused to make reports. It never became clear exactly why they did not want to report. Some people inside the company suggested that their writing capabilities might not be very high and that they were insecure in writing a report. In several other cases, problems did not appear with writing a report or writing down information. In one case, the team members complained that the input they got from another department often contained mistakes. The coach suggested registering these problems and communicating them to the other department and the team was very enthusiastic about this. During this discussion, the team meeting ended before the team had developed a format to use for the registration of the problem. However, by the next meeting, the team showed that they had made a simple format themselves, and that they had registered the problems that appeared during that week already (process 52). In another case, the team members started to register how to set up a machine without additional help from the coach or other people in structuring the required information (process 33 act 205). In these cases, the team members were very motivated to solve the problems and the high commitment of the team members prevented problems with the registration. Further, their experience in the operational configuration helped them to judge which information was relevant and which was not. This prevented problems with the activity. In one of the earlier mentioned cases, the coach made the final form for the team members, (process 33 act 207), and the help of the coach prevented problems. In another case, the coach made a list for the team stating which people have to produce which products (process 16), and again in this case the help of the coach prevented problems.

An important difference with the operational tasks was that the team had to position tools to implement a solution. Although the activity differed from the operational tasks, no problems with it appeared. Problems were prevented because the activities were very simple, and the team was very committed to perform them. Further, the coach performed several activities, which helped prevent problems with placing new tools.

Another important difference with the operational tasks was that the team had to communicate with people outside of the team to implement the solution. With this activity too, problems did not appear. Reasons for the lack of problems were either that the coach performed the communication, the coach structured the communication, or the coach taught the team how to communicate with others in a small workshop. The high commitment of the team members also helped to prevent problems. Further, in some cases, it appeared that some team members had more communicational skills than were required for their daily work.
A difference with the operational configuration was that the team members had to initiate tasks themselves to implement a solution. About half of the times the team had to initiate tasks, problems appeared. The major reasons for the problems were that the team forgot to perform the activity because of functional conflicts, or they were no longer motivated to implement a solution. In several cases, the team had no problems in initiating tasks. The major reason for the lack of problems was that the team was very motivated to solve a problem and very committed to implementing a solution.

Another important difference was that the teams had to write reports or structure information to implement solutions. In two cases, the activity was problematic, however, only once was a misfit with the capabilities of the team the reason for the problems. In several cases, problems did not appear with writing a report. Major reasons for the lack of problems were the high commitment of the team to solving problems and their experience in the operational configuration which helped them to identify which information was relevant. Further, the help of the coach prevented problems with writing down information in many cases.

Another difference was that the team members had to communicate much more with each other than in the operational configuration. The communication within the team was not problematic because the coach structured the discussions; this help of the coach prevented problems.

5.9. Standardise the solution

5.9.1. Definition of the activity

Standardisation of a solution concerns the use of a solution after it is implemented. It was only included in the research if it was mentioned during the team meetings. Often solutions were used, but no longer mentioned by the team; the activity was then not described in the research.

5.9.2. Occurrence of the activity

Activities to standardise a solution were performed 57 times in 9 different improvement processes. The team performed the activity 47 times, while people outside of the teams performed it 10 times.
Table 5-18 shows how often activities to standardise a solution were performed in each improvement process. It is striking that the activity was performed very often in two improvement processes: namely 16 and 29 times (process 52; 60). Both improvement processes were performed by the same team, and they both have as a goal to register faulty inputs (paper and films). The team members did not have any regular meetings with their department or the supervisor where they could discuss these problems and therefore the activity was often discussed in the team meetings. The team was very disciplined in this registration and they performed it over a long period; and this is the reason the activity was performed so often.

Standardisation of a solution took place in only 12% of the cases (9 cases). Several reasons for this exist:

- In 33% of the cases (24), *no solution was implemented*; thus no standardisation of the solution could take place.
- In 55% of the cases (40 cases), *the solution was implemented, but it was not discussed any more* in the team meetings. In these cases the standardisation of the solution does not form part of the research. However, many of these solutions were implemented successfully and they were used over a long period (process 5; 6; 8; 11; 13; 16; 18; 19; 20; 22; 24; 25; 28; 30; 31; 35; 37; 38; 41; 42; 45; 47; 49; 50; 53; 55; 56; 58; 59; 61; 62; 63; 64; 65; 67; 69; 70; 72). With most of these cases, the solutions were completed when they were implemented; the major part of the solution was the investment in new tools. After the tools were bought, they were used without problems. For example, in one case, the team ordered new wheels for a pallet car because the floor got dirty from the old wheels. When the wheels arrived, they were put on the old cars, and in this way the solution was standardised. The same happened in many other cases; not much effort was needed once the solution was implemented; standardisation of the solution was more or less automatic.

```
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<tr>
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<td>4</td>
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<tr>
<td>2</td>
<td>1</td>
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<td>2</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
</tr>
</tbody>
</table>
```

Table 5-18: Number of times that activities were performed to standardise a solution in an improvement process (N=73).

5.9.3. Problems with the activity and consequences of it for the whole process

Problems with the standardisation of the solution occurred five times (process 32; 36; 52 act. 365; 60 act. 530; 68). In all of these cases, the main problem was that the team no longer filled in a form after a time. In two cases, no form was completed any more because other solutions to the problem were developed outside the team meetings. In one of these cases, the proposed improvement was not realised (process 68), while in the other case (process 36) the improvement was realised although the standardisation of the solution was somewhat problematic. In some cases, the team forgot to fill in the forms, and the coach reminded them.
that it was very important to do this; after the comments by the coach the team filled in the forms again (process 52, 60). In one case, the coach never raised the subject that the team did not use the forms any more (process 32) and in this case, the proposed improvement was not realised because of the problems with the standardisation of the solution.

Problems with the standardisation of the solution outside the team occurred three times (cf 14 act. 83; 51 act. 347-348). The main reason for these problems was that people outside of the team were supposed to correct information that was used with repetitive orders. The team members identified when information had to be changed, but the people outside of the team no longer corrected the information after a time.

**Problems with the standardisation of a solution were:** (1) Team members had to fill in a form, which they did not do any more after a time; (2) People outside of the team did not correct wrong information in order systems after a time. Problems with the standardisation of the solution resulted in unrealised improvements in less than 5% of the cases. The main reason for the failure of these processes was that the team members forgot to fill in forms after a time.

Although it is often suggested that standardisation of a solution is very important and that this might be often problematic (Imai, 1986), this was not the case with the improvement processes in this research. Less than 5% of the improvement processes failed because of problems with the standardisation of the solution. A reason for this is the minor importance of the standardisation in many cases. The standardisation of the solution was only relevant in 12% of the cases (nine cases), and of these cases, only two failed because of problems with standardisation. Thus, in the cases where standardisation activities were relevant, 22% failed because of problems that arose with the standardisation.

### 5.9.4. Differences and correspondences with the operational activities

Table 5-19 shows that 68% of the activities that were performed to standardise a solution did not differ from the tasks in the operational configuration (32 of the 47 activities).

<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Probl</td>
</tr>
<tr>
<td><strong>Diffe-</strong></td>
<td>Communicate with people outside team</td>
<td>0</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Write a report</td>
<td>0</td>
</tr>
<tr>
<td><strong>diff</strong></td>
<td>Use tools/machines</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Register problems/process information</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify/commun. input problems</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5-19: Differences and correspondences between the operational process and the standardisation of the solution (N= 47)
The major correspondence between the tasks of the operational configuration and the standardisation of the solution in the improvement process was that the team members had to register process information. In 83% of the instances the team members had to register process information, problems did not appear (25 times). In these unproblematic activities the team registered, for example, problems that appeared in their own processes (process 73), problems with the inputs they got from others (process 14; 52; 60), or they registered how they set up machines (process 33). The correspondence with the operational tasks could explain why problems did not appear. In 17% of the instances the team registered information, problems appeared (5 times). In two cases, problems appeared because the team members forgot to register the problems with their inputs after a while (process 52 act 365; process 60 act 530). In another case, the team members stopped registering the problems in their department, but it is not clear why (process 32 act 202). In another case, team members did not register when they maintained their machines, because another solution had been installed and the registration of the maintenance then was no longer needed (process 36 act 238). In the other case, the team members did not register all the problems in their department on a single form any more, because after the team had existed for some time they started to register different problems on different forms (process 68 act 638). Although in these last two cases the proposed solution was not standardised, no real problems appeared, because another was employed.

Another correspondence between the tasks in the operational configuration, and the standardisation of the solution in the improvement configuration was that people had to use machines or tools to standardise the solution. In one case the team used information on how to set up a machine (process 33 act 208). In this case, there were no problems with the activity. The main reason for the lack of problems could be that the tasks in the operational and the improvement configuration are the same, and thus no functional conflicts arise.

Another correspondence between the tasks in the operational configuration and the standardisation of the solution in the improvement configuration was that the team members had to communicate mistakes in the input. In one improvement process, the team members return inputs from another department that contain mistakes back to the department (process 52 act 375). This activity was performed without problems and a reason for the lack of problems could be the correspondence of the improvement activity with the operational activity.

Most activities that were performed to standardise a solution corresponded with operational activities. Correspondences were that the team members had to register process information, they had to use tools, and they had to communicate mistakes in the input. Most of these activities were unproblematic because they corresponded with operational activities. However, on 16% of the occasions the team performed registration activities, problems appeared, because the team forgot to register or because another solution was already implemented and registration was less important.
A difference between the tasks in the operational configuration and the improvement tasks was that the team had to communicate with people outside their department. Although this task differed from the operational tasks of the team members, the eight times that the activity had to be performed, problems did not appear. Seven times, the coach of the team communicated with the people outside of the team (process 52 act 358, 361, 368; 60 act 484, 492, 521) and this prevented problems. In one case, the team asked someone who had to adapt software when he would finish this. In this case, the communication with someone outside the team was not problematic; the team was well able to ask the person about a deadline. They learned this in a small workshop given by their coach. Thus, the people learned new capabilities in earlier improvement processes and with the help of the coach.

Another difference with the operational activities was that the teams had to write a report or structure information to implement a solution. The teams had to make a report eight times in the improvement processes (process 52 act 357, 360, 367, 370, 379; process 60 act 483, 493, 503). In all these cases problems did not occur because the coach of the team wrote the report. Thus, the help of the coach prevented problems.

Differences between the activities of the operational configuration and the activities to standardise a solution were that the teams had to communicate with people outside of the teams, and they had to write reports. These activities were never problematic. Problems were prevented because the coach performed the communication, and the coach made the reports. Further, the coach taught team members how to communicate with people outside of the team.

5.10. Evaluate the solution

5.10.1. Definition of the activity

Evaluation of a solution includes the activities used to check if the desired results have been realised; they take place after a solution has been implemented. In some cases, the problem was identified several times, even after a solution has been implemented. In these instances, the evaluation of a solution was difficult to distinguish from the identification of a problem. A team activity was considered to be the identification of a problem if the team discussion was mostly about the problems that appeared and the undesired situation. The activity of the team was considered to be the evaluation of a solution if the team discussion was mostly about the functioning of the solution. In some cases, the team discussed a solution before it was implemented and this was considered part of the development of a solution and not part of the evaluation of a solution.

5.10.2. Occurrence of the activity

Activities to evaluate a solution were performed in 16% of the improvement processes (twelve processes), and performed a total of sixteen times. Several reasons exist for the small number of activities linked to evaluating a solution. One reason is that, in several cases, no solution was implemented and thus a solution could not be evaluated. Another reason is that
the evaluation of a solution only took place if the team explicitly discussed the solution during a team meeting and if this evaluation was noted in team or research reports. Some improvements were evaluated implicitly during the daily work, and the evaluation activities were so minor that they were never reported. However, this does indicate that not much deliberate evaluation of solutions took place in the cases that were examined. Solutions were evaluated for several reasons:

- **Coaches of the teams evaluated solutions because they wanted to know if implemented solutions worked well.** In several instances, coaches asked the team if the solution worked (process 33; 52 58 act. 445; process 59; 68; 70). In another case, the coach noticed that the team solved the wrong problem and she discussed this with the team (process 7). Where the coach asked the team if the solution worked the evaluation took place by discussions within the team.

- The solution was evaluated, because **problems appeared again** and new solutions were offered. In some cases, the team members noticed in their daily work that the solution did not work well (process 15; 51; process 58 act 446; process 60 act. 787). Then they evaluated why the solution did not work well and which actions were needed to improve it. The cases where the solution was evaluated because problems reappeared correspond with the instances the evaluation took place by adapting materials.

- In one case, a solution was very successful and to **celebrate this success**, the co-ordinator of the improvement teams gives the team cake (process 60 act. 514). In this way, emphasis was placed on a positive evaluation of the process.

In 84% of the improvement processes, no activities were performed to explicitly evaluate the solution. Solutions were evaluated for several reasons: (1) Coaches wanted to know if an implemented solution worked well and they asked the team about it; (2) The team members noticed during their daily work that the implemented solution was not satisfactory. (3) To celebrate the success of an implemented solution.

It is striking that the team members never evaluated solutions when the solution was satisfying. One reason is that evaluation did happen, but it could not be measured during the research. It can be assumed that team members evaluated successful as well as unsuccessful solutions during their daily work. However, they did not mention the successful ones, while the unsuccessful ones were raised again during a team meeting. This shows that the evaluation of a solution often did not take place during the team meetings; it took place during the daily work of the team members. If the results of this evaluation were negative, the team members remembered and raised it during the meetings. The coaches were not able to evaluate solutions during their daily work, because they did not use them during their daily work. Therefore, they needed to ask team members about the solution; they needed the evaluation to take place during the team meeting. This shows that an explicit evaluation of a solution is only needed if the person who has to evaluate the success of a change is not the same as the user of it. If the evaluator and the user are the same person, evaluation can take place implicitly while the solution is used.
Analysis of improvement activities

**Solutions were only evaluated explicitly: (1) If the solution did not work well, (2) If someone other than the user of the solution wanted it to be evaluated.**

In almost all cases, the team evaluated the solution; people outside of the team evaluated it only once (process 60). Reasons for this are:

- Improvements were often small and local and they did not influence many people outside of the team. Therefore, only the team members evaluated the solution.
- Efforts to improve the situation were not communicated in a structured way to people outside of the team. Only the team members knew about them. Therefore, people outside of the team could also not evaluate if an improvement was realised.

**Hardly ever did people outside the team evaluate a solution.**

Table 5-20 shows how often the activity was performed in a process.

<table>
<thead>
<tr>
<th>The activity was performed</th>
<th>In … processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>… times</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Table 5-20: Number of times that activities were performed to evaluate a solution in an improvement process (N=73).

**5.10.3. Problems with the activity and consequences of it for the whole process**

In the evaluation of solutions, problems did not appear. All evaluation activities were performed well. However, it was not determined in the research if more evaluation activities should have been undertaken. Thus, it could be possible that problems appeared because solutions were not evaluated. This, however, cannot be examined with the chosen research method. Because problems did not appear, also no consequences of the activity for the improvement process as a whole existed. No improvement process failed because of problems with the evaluation of the solution.

The activities to evaluate a solution were never problematic.

**5.10.4. Differences and correspondences with the operational activities**

Table 5-21 shows that most activities that were performed to evaluate a solution differed from the activities in the operational configuration.

<table>
<thead>
<tr>
<th>Differences/correspondences in the characteristics of the processes</th>
<th>Number of Probl</th>
<th>Number of No probl</th>
<th>Reason for problems or no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate a changed situation</td>
<td>0</td>
<td>10</td>
<td>Help of the coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Experiences in oper. conf.</td>
</tr>
<tr>
<td>Identify/communic. input problems</td>
<td>0</td>
<td>5</td>
<td>Correspondence with o.p.</td>
</tr>
</tbody>
</table>

Table 5-21: Differences and correspondences between the operational process and the evaluation of the solution (N=15)
The major correspondence between the activities that were performed to evaluate the solution and the activities of the operational configuration was that the team members *communicated about mistakes in their input*. In four improvement processes, the team members had to communicate mistakes in their inputs to evaluate the improvement process (process 14 act 777, 778; process 15; 51 act 784, 785). With these activities problems did not appear because they corresponded with the operational tasks.

**The major correspondence between the activities to evaluate the solution and the operational activities was that the team members had to communicate mistakes in their input. These activities were not problematic because they corresponded with the operational tasks.**

The major difference between the operational activities and the activities that were performed to evaluate the solution was that the team members had to *evaluate a change in an existing situation*. The difference between communication about mistakes in the input, and the evaluation of changes in the existing situation is rather small. However, identifying mistakes in the input is more limited; the team members know exactly what the standards for the input are, and they have clear guidelines to judge if the input does not meet these standards. With the evaluation of changed situations, the standards on which to judge are less clear; thus, more uncertainty accompanies this activity. This is the major difference between the two activities. In the improvement process, the team members had to evaluate in several cases if a proposed change in the existing situation had been realised, and if the change improved the situation. In the operational processes, the team members do not have to change a situation, they only have to change the characteristics of inputs to make outputs. In 60% of the instances (nine times) that a solution was evaluated, the main activities that had to be performed were that an existing situation had to be evaluated (process 7; 16; 33; 52; 58; 59; 60; 68; 70). Although the activity to evaluate the change in this situation differed from the operational activities, problems did not appear. One reason for the lack of problems was that the coach performed some of the evaluation activities. In several cases, the coaches initiated the evaluation and asked the teams if a proposed change was realised. The experiences in the operational configuration often helped the team members to evaluate the proposed change (process 16; 33; 52; 58; 59; 60; 68; 70). Most improvements were about changes in the daily work of the team members and thus from their daily work they knew if a change was realised and if it worked well. In one case the coach saw the team members using a solution, and she saw that the solution did not work well. In this case, the coach had performed all the evaluation activities (process 7).

**The major difference between the activities to evaluate a solution and the operational activities was that the team members had to evaluate a change in an existing situation. These activities were not problematic because of the help of the coach and the experience with the operational configuration of the team members.**
5.11. Conclusion

In this chapter, several observations about the different improvement activities were described. The chapter discussed many observations for each improvement activity in great detail. However, this makes it hard to get an overview of the main results of the research, especially about the correspondences and differences between the operational and the improvement processes. In the next chapter, attention is focussed on the major correspondences and differences between the operational and the improvement tasks and the problems that were caused by this. In addition, the reasons why problems did not arise are discussed.
Chapter 6: Further analysis of the research findings

The goal of the research is to develop a theory that explains incremental improvements by improvement teams. In the research, it had to be examined to what extent the differences and correspondences between operational and improvement tasks explained the problems that arose, or did not arise, during improvement activities by improvement teams. Chapter 5 described the activities in improvement processes which were problematic or not, and which correspondences and differences between operational and the improvement tasks were found. For each activity, the reasons why problems appeared, or otherwise, were given. This chapter examines these findings further, and now the focus is on the improvement tasks, which are discussed in depth. This chapter is in two parts. In the first part, the major findings are summarised for each improvement task. The second part of this chapter analyses the major reasons why tasks were problematic or not. The question ‘what was the reason that an improvement task was problematic (or not)?’ is discussed in theoretical terms, and it is examined whether improvement activities can be explained by referring to the differences and correspondences with the operational tasks. The goal of this second part of this chapter is to develop a tentative theory that explains why improvement activities are problematic, or not, by formulating testable theoretical propositions. These hypotheses that are formulated throughout the second part of this chapter, accompany the theoretical reflections. The following chapter reflects upon the findings discussed in this chapter.

6.1. Analysis of improvement tasks

In the following sections, the improvement tasks that were performed by the teams are discussed. It is examined why tasks were problematic or not. First, the tasks that corresponded with those in the operational configuration are discussed. Following this, the tasks that differed are discussed. For each task, some general information about the task is first given, then the different reasons for problems appeared are discussed. While reading the next sections, it should be recalled that the research method used influenced the number of times that activities and tasks could be measured. Consequently, some very common tasks (such as communication within a team) were measured only a few times. This might seem surprising, but it is a consequence of the research method used, as was explained in the previous chapter.

6.1.1. Explaining corresponding tasks

Next, the improvement tasks that corresponded with the operational tasks are discussed. In explaining why these tasks were problematic or not, there can be more than one relevant reason. In the following sections, it is indicated using tables how often tasks were performed, and which reasons for problems, or lack of, were relevant. The number of times that a task was performed is printed in bold, while the number of times each reasons appeared is printed in italics. If the number of times a task was performed and the number of times a reason was relevant are the same, then the number is printed in bold and italics.
Register problems when they appear in the operational process

Problems were registered 39 times in 11 different improvement processes. The task was performed during the analysis of the problem, and during the implementation, and the standardisation of the solution. 13% of the times that the task was performed, the task was problematic, while in 87% of the instances problems did not appear. All the problems occurred during the standardisation of the solution phase. Table 6-1 lists the key points in the registration of problems.

**Reasons for no problems:** In most cases, the registration of problems was not problematic. The main reason that problems did not appear was that the task corresponded with tasks in the operational processes that the team members have to perform. Therefore, the team members were well able to perform the task.

**Reasons for problems:** In two cases, the team stopped registering problems because, outside of the improvement process, other measures were taken and the registering of problems was no longer needed to solve the problem. In these two cases, it could be argued that the problem was solved, and thus it was not problematic that the team did not register problems any more. However, the fact that the team stopped the registration did not contribute to the realisation of the desired improvement function, and thus, because of the research method used, the task was considered problematic, although in practice it did not obstruct the realisation of the desired improvement function. In three other cases, the team members did not register problems after a time because they forgot that registration was needed. It was not clear why they forgot to register the problems. A common element between these problematic tasks was that there was no direct stimulus to perform the activity; the activities were not directly needed to realise an operational process in the short run, nor were they needed to realise an improvement that had been discussed recently within the team. People had to remember the activity and they had to initiate tasks themselves in order to perform the activity. It could be possible that this initiation of tasks by the team was the cause of the problems. The analysis of

<table>
<thead>
<tr>
<th>Task: Register problems when they appear in the operational process</th>
<th>Performed:</th>
<th>39 times in 11 different processes</th>
</tr>
</thead>
<tbody>
<tr>
<td># of times task was performed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysed the problem</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Implemented the solution</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Standardised the solution</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Percentage</td>
<td>13%</td>
<td>87%</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>34</td>
</tr>
</tbody>
</table>

Table 6-1: Number of times that problems in the operational processes were registered.

---

14 The total refers to the number of times that a task was problematic or not. In several tasks, more than one reason might be relevant, and thus the total number of times that a task was problematic or not need not be the same as the sum of the column with reasons for (no) problems.
the improvement tasks that differed from the operational tasks also shows that initiation of tasks by the team was frequently problematic.

87% of the times that team members had to register problems, there were no problems because the task corresponded with the tasks of the team members in the operational processes. Problems with the registration appeared in a few cases (8%), because the team members did not have a direct stimulus to register problems and therefore they forgot to perform the task. In addition, the registration was defined as problematic in other cases (5%) because the team stopped the registration because it was no longer really needed any more.

### Identify or communicate problems with the process

The identification of problems with the process was performed 24 times in 7 different processes. The task was performed during the identification of the problem, and during the development of the solution phases. The task was never problematic. Table 6-2 shows the key information on identification and communication of problems with the processes.

**Reasons for no problems:** In all the cases, the identification of problems in the process was never problematic. The main reason that problems did not appear was that the task corresponded with the tasks the team members perform in the operational processes. Therefore, the team members were well able to perform the task.

<table>
<thead>
<tr>
<th>Task: Identify or communicate problems with the process</th>
<th>Performed: 24 times in 7 different processes</th>
</tr>
</thead>
<tbody>
<tr>
<td># of times task was</td>
<td>Probl</td>
</tr>
<tr>
<td>Identify the problem</td>
<td>0</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 6-2: Number of times that problems in processes were identified or communicated**

On every occasion that the team members had to identify or communicate problems in processes, problems did not appear because the task corresponded with the tasks of the team members in the operational processes.
Further analysis of the research findings

**Identify or communicate problems with the input**

The identification of problems with the input was performed 21 times in 8 different processes. The task was performed during the identification of the problem, and during the standardisation, and the evaluation of the solution phases. The task was never problematic. Table 6-3 shows the key information on the identification and communication of problems with the input.

**Reasons for no problems:** In all the cases, the identification of problems with the input was not problematic. The main reason that problems did not appear was that the task corresponded with the tasks the team members perform in the operational processes. Therefore, the team members were well able to perform this task.

On every occasion that the team members had to identify or communicate problems with the input, problems did not appear because the task corresponded with tasks in the operational processes carried out by the team members.

**Use tools or machines**

Using tools or machines was performed 15 times in 10 different improvement processes. The task was performed during the analysis of the problem, and during the development, testing, implementation, and standardisation of a solution. 20%
Further analysis of the research findings

of the times the task was performed, it was problematic, while in 80% problems did not appear. Problems appeared during the development, testing and implementation of the solution phase. Table 6-4 shows the key information on using tools or machines.

**Reasons for no problems:** In most of the cases (80%), the use of tools or machines was not problematic. The main reason that problems did not appear was that the task corresponded with tasks the team members performed in the operational processes.

**Reasons for problems:** In three cases (20%), problems appeared with the use of tools or machines. In one case, problems appeared because the team members forgot a procedure that was explained the week before by the coach. In another case, the team forgot to reposition tools when required. In the third case, the coach proposed testing a solution on a machine but since the team members did not believe that the solution would work, they did not perform the test for some time.

80% of the times that the team members had to use tools or machines, problems did not appear because the task corresponded with the tasks in the operational processes carried out by the team members. Problems with using tools or machines that did appear were because the team forgot a procedure or they forgot to reposition tools (13%) and because the team was not motivated to test a solution because they did not think that the solution would work (7%).

**Ask the supervisor to do things**

<table>
<thead>
<tr>
<th>Task: Ask the supervisor to do things</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed: 17 times in 14 different processes</td>
<td></td>
</tr>
<tr>
<td># of times task was</td>
<td># of times task was</td>
</tr>
<tr>
<td>Probl</td>
<td>Not probl</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Test the solution</td>
<td>1</td>
</tr>
<tr>
<td>Authorise the solution</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>12%</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 6-5: Number of times that the supervisor was asked to do things

Asking the supervisor to do things was performed 17 times in 14 different improvement processes. The task was performed during the development, testing, authorisation, and implementation of a solution phases. 12% of the times the task was performed, it was problematic, while in 88% problems did not appear. Problems appeared during the testing and implementation of the solution. Table 6-5 shows the key information on asking the supervisor to do things.

**Reasons for no problems:** In most of the cases, asking the supervisor to do things was not problematic. The main reason that problems did not appear was that the task corresponded
Further analysis of the research findings

with tasks in the operational processes the team members perform. However, in several cases the help of the coach was needed to prevent problems.

**Reasons for problems:** Twice, there were problems in asking the supervisor to do things. In both cases, problems occurred when a team asked their supervisor to order materials that were needed to realise an improvement. In one case, the supervisor ordered different materials than the team members had asked for. In the other case, the supervisor did not order the materials because he thought that the team could do without them for a while. Both problems arose between the same team and the same supervisor. The same people also had communication problems in the operational processes. The team members often complained that their supervisor was not taking their department seriously and did not pay much attention to them. The supervisor also complained about the team members; he said that they always complained about everything, and thus he was not taking all their complaints seriously any more. Apparently, it was difficult for the supervisor to judge what the team really needed, and it was hard for the team to express their needs clearly to their supervisor. There was no effective communication about the needs of the department between the workers and their supervisor. This misfit had existed already in the operational configuration and it went on to influence the improvement processes. Problems when asking the supervisor to do things did not occur every time this team had to perform the task. The team had to ask their supervisor to do things on ten occasions. Twice problems appeared as discussed earlier, four times problems were prevented because the coach assisted the team, and four times problems did not appear when the team performed the activity alone.

**In 88% of the cases, asking the supervisor to do things was not problematic. In most cases (64%), problems did not appear because the task corresponded with tasks the team members perform in the operational processes. However, in several cases (24%) the help of the coach was needed to prevent problems. Problems with the task appeared in a few cases (12%), because of an imported misfit. In both the operational and the improvement configuration there was a lack of clear communication about the needs of the department between the workers and their supervisor.**
Further analysis of the research findings

Team informs supervisor

Various teams informed their supervisor on 9 occasions in 9 different improvement processes. The task was performed during the analysis of the problem, and during the development, and implementation of a solution phases. 44% of the times the task was performed, it was problematic, while in 56% of the instances problems did not appear. Problems appeared during the analysis of the problem, and during the development and implementation of the solution. Table 6-6 shows the key information on the team informing the supervisor.

Reasons for no problems: In a relatively small number of cases (44%), informing the supervisor was not problematic. It is striking that the major reason that problems did not appear was not the correspondence with the operational tasks. Table 6-6 shows that when problems did not appear, specific things happened. One reason that problems did not appear was that communication took place when the supervisor attended a team meeting. Another reason that problems did not appear was that communication took place by coincidence. In the next chapter, these findings will be discussed in more depth.

Reasons for problems: When problems did not appear with informing the supervisor, the communication channels between the team and their supervisor were created by inviting the supervisor to a team meeting, or they arose by coincidence. However, if this was not done, then no channels existed for communication between a team and its supervisor. Consequently, on several occasions, communication did not take place, and this resulted in problems. This problem also existed in the operational processes of several teams; in the operational processes there was also a lack of communication linkages between the supervisor and the workers. In one company, formal meetings with the supervisor were held only once every two months. Additional communication between the workers and their supervisor only took place when urgent matters arose during the operational processes. In another company, meetings with the supervisor involved the whole production department and then about 50 people were present. Additional communication with supervisors mostly took place during operational processes. Subjects that were discussed were urgent operational problems, materials that needed to be ordered, or tasks needed to finish a specific operational process. There was no communication channel to discuss more general or less urgent subjects. This can be regarded

<table>
<thead>
<tr>
<th>Task: Team informs supervisor</th>
<th># of times task was</th>
<th>Reason for (no) problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed: 9 times in 9 different processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyse the problem</td>
<td>Probl</td>
<td>Not probl</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Percentage</td>
<td>44%</td>
<td>56%</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 6-6: Number of times that the team informs the supervisor
Further analysis of the research findings

as a misfit in the operational configuration, which is imported into the improvement configuration and causes problems with improvement tasks.

In 55.5% of the occasions that the team members had to inform their supervisor, problems did not appear. Problems were prevented because the supervisor attended the team meetings (33%), or the communication took place by coincidence (22%). Problems in informing the supervisor arose because appropriate communication channels did not exist (44%). This misfit also existed in the operational configuration, and thus it was imported into the improvement configuration.

### Supervisor informs the team

Teams were informed by their supervisor 4 times in 3 different improvement processes. The task was performed during the development and implementation of the solution phases. 25% of the times that the task was performed, it was problematic, while in the other 75% of the times the task was performed problems did not appear. Problems appeared during the development of the solution phase. Table 6-7 shows the key information on the team being informed by the supervisor.

### Reasons for no problems

In 75% of the cases, the task of the supervisor informing the team was not problematic. It is striking that the major reason that problems did not appear is not the correspondence with operational tasks. Table 6-7 shows that when problems did not appear, specific things happened. One reason for no problems is that the communication took place when the supervisor attended the team meeting. Another reason for problems not occuring is that communication took place by coincidence. In the next chapter, these findings will be discussed in more depth.

### Reasons for problems

In only one case were there problems with the supervisor informing the team, a supervisor did not tell his team why he ordered some materials, and the team regarded it as very stupid of him to have ordered these materials. The reason for the problem is the same as with the problems in the team informing the supervisor: a lack of communication channels in the operational configuration that is imported into the improvement configuration.

<table>
<thead>
<tr>
<th>Task: Supervisor informs the team</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed:</td>
<td>4 times in 3 different processes</td>
</tr>
<tr>
<td># of times task was</td>
<td></td>
</tr>
<tr>
<td>Probl</td>
<td>0</td>
</tr>
<tr>
<td>Not probl</td>
<td>2</td>
</tr>
<tr>
<td>Reason for (no) problems</td>
<td></td>
</tr>
<tr>
<td>Develop a solution</td>
<td>Imported misfit</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>Team asks supervisor to communicate</td>
</tr>
<tr>
<td>Percentage</td>
<td>25% 75%</td>
</tr>
<tr>
<td>Total</td>
<td>1 3</td>
</tr>
</tbody>
</table>

Table 6-7: Number of times that the supervisor informed the team.
75% of the occasions when the team members needed to be informed by their supervisor, problems did not appear. Problems were prevented because the supervisor attended the team meeting (25%), or the team asked the supervisor explicitly to communicate (50%). Problems with informing the supervisor arose because no communication channels existed for this communication (25%). This misfit also existed in the operational configuration, and it was imported into the improvement configuration.

6.1.2. Explaining different tasks

Next, improvement tasks that differed from the operational tasks are discussed.

**Identify an improvement opportunity**

<table>
<thead>
<tr>
<th>Task: Identify an improvement opportunity</th>
<th>117 times in 67 different processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed:</td>
<td># of times task was</td>
</tr>
<tr>
<td></td>
<td>Probl</td>
</tr>
<tr>
<td>Identify the problem</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6-8: Number of times that the team identified an improvement opportunity

**Reasons for no problems:** The identification of an improvement opportunity was never problematic. The major reason that no problems appeared was that if problems occurred with identifying an improvement opportunity, it could not be recorded with the research method used. However, the research findings also suggested several other reasons why problems did not appear. One reason for the lack of problems was that the team members gained much knowledge about improvement opportunities during their daily work. This knowledge is not needed to perform the operational activities, but is very useful in the identification of improvement opportunities. The strong motivation of the team members contributed to the use of this ‘surplus’ knowledge in the identification of improvement opportunities. Team members saw it as very important to perform their operational tasks well, and therefore they were very motivated to identify improvement opportunities and use their knowledge about operational problems to perform this task. The improvement team seems to be an appropriate concept to use this knowledge, for example through team meetings and during brainstorming sessions. During brainstorming sessions, the team members start to activate their extra knowledge; they begin to remember problems that were relevant to them. Often team
Further analysis of the research findings

members prompt each others memory about problems. When one person mentioned a problem, others remembered other related subjects and a long list of different problems emerged. In this way, the brainstorming sessions were effective in activating the knowledge of the team members. Alongside these causes, the identification of improvement opportunities was facilitated on five occasions when improvements were identified during other improvement processes; then the experience in other improvement processes facilitated the identification of further improvement opportunities. Coaches did not help much in the identification of improvement opportunities. Team members had sufficient extra knowledge of problems to perform this activity themselves. Coaches were only needed to explain the concept of the brainstorming sessions, and chair these sessions. Only on four occasions did the coach identify problems for the teams.

The identification of improvement opportunities was never problematic. Problems with the task were prevented by the extra knowledge of the team members on problems in the operational processes. The use of this ‘surplus’ knowledge in the improvement process was facilitated by the strong motivation of the team members to perform their operational tasks well and to identify improvement opportunities; team members were very motivated to use their knowledge on operational problems to perform the task well. The brainstorming sessions were effective in activating and registering the extra knowledge of the team members.

### Decide to focus on one problem

The team decided to focus on one specific problem 18 times in 18 different improvement processes. The task was only performed during the development of a solution phase. The task was never problematic. Table 6-8 shows the key information on deciding to focus on one problem.

<table>
<thead>
<tr>
<th>Task:</th>
<th>Decide to focus on one problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed:</td>
<td>18 times in 18 different processes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># of times task was</th>
<th>Probl</th>
<th>Not probl</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a solution</td>
<td>0</td>
<td>18</td>
<td>Help of coach</td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
<td>100%</td>
<td>Use of improvement tools</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-9: Number of times that the team decided to focus on one problem

Reasons for no problems: Problems with the decision to focus on one problem were prevented because of the assistance of the coach. In all the cases the team decided explicitly to focus on one problem, and the coach initiated this task and helped the team to focus. Before the first team meeting, it was explained to the coaches that the teams were not supposed to work on many improvements simultaneously. The coaches used these guidelines in the improvement processes and they asked their teams on several occasions to focus on one or two problems. In several cases, improvement tools, such as rankings, were used to help in selecting problems. The coaches also initiated the use of such tools.
The decision to focus on one problem was never problematic. Problems were prevented because the coach initiated the task and helped the team to choose only one or two problems. In some cases, tools were used that helped in selecting problems.

**Analyse unfamiliar information**

The teams analysed unfamiliar information 23 times in 17 different improvement processes. The task was performed during the analysis of the problem and the development of a solution stage. The task was problematic 13% of the instances it was performed, while in 87% of the occasions problems did not appear. Problems appeared during the analysis of the problem. Table 6-10 shows the key information on the analysis of unfamiliar information by the teams.

**Reasons for no problems:** Many problems with the analysis of unfamiliar information were prevented because the coach performed many of the required analytic activities. In addition, in several cases the use of improvement tools, such as fishbone diagrams, facilitated the analysis. The coach, or the co-ordinator, of the teams suggested to the teams that they use these tools and helped the team in using them. In several cases, the experience of the team members with the operational processes helped them to perform the required analysis activities. However, in most of these cases the assistance of the coach was also very relevant. Further, some analysis tasks were so simple that the team members had adequate capabilities to perform them. The tasks for the team members were often simple because others, such as the coach or the co-ordinator of the teams, had performed the more complex parts of the analysis.

**Reasons for problems:** In three cases, problems with the analysis of unfamiliar information occurred. In one case the reason for problems was that the team did not analyse the problem, and therefore the wrong solution was implemented. In this case, the coach also did not analyse the problem because she also thought that the team had produced a proper solution. In another case the reason was that a team member refused to perform analysis activities when the coach...
Further analysis of the research findings suggested doing this because he did not regard them useful. Further, in the third case problems arose because a test done by the team members did not provide clear results. The underlying cause of all these problems was that team members did not perform the required analysis activities. In their operational processes, the team members do not have to perform these kinds of analyses, and thus functional conflicts could cause the problem. Problems with the analysis of unfamiliar information occurred when the team members performed the activity leading to functional conflicts. When the coach performed, or helped with, the major part of the analysis, problems did not arise; the help of the coach prevented functional conflicts occurring.

The analysis of unfamiliar information was not problematic in 87% of the instances that the activity was performed. Problems were prevented because the coach performed the analysis task or someone outside the team assisted with the analysis. In some alongside the help of the coach, or someone outside of the team, the use of improvement tools, the use of extra capabilities, or the simplicity of the task also prevented problems. Problems with the analysis of unfamiliar information arose because team members did not perform the required analysis due to the existence of functional conflicts (13%).

**Develop a solution for an unfamiliar problem**

The teams developed solutions for unfamiliar problems 105 times in 42 different improvement processes. The task was performed during the development of a solution phase. The task was problematic 19% of the instances it was performed, while in the other 81% of the instances problems did not appear. Table 6-11 shows the key information on the development of a solution for an unfamiliar problem.

<table>
<thead>
<tr>
<th>Task: Develop a solution for an unfamiliar problem</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed: 105 times in 42 different processes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Develop a solution</th>
<th># of times task was</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Probl</td>
<td>Not probl</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28</td>
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<td></td>
<td>21</td>
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<tr>
<td></td>
<td>14</td>
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<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentage</th>
<th>19%</th>
<th>81%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>20</td>
<td>85</td>
</tr>
</tbody>
</table>

Table 6-11: Number of times that the team developed a solution for an unfamiliar problem.

Reasons for no problems: In many cases, problems did not appear in the development of a solution. Problems with the development of a solution for an unfamiliar problem often did not occur because of the extra knowledge of the team members about the operational processes.
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When team members perform operational tasks, they learn much about problems; often they also know about possible solutions. This knowledge helped them in developing solutions to problems. In addition, team members were very motivated to develop solutions to problems, and this stimulated them to use their extra knowledge. Further, problems were avoided because team members had more capabilities of developing solutions than were needed to perform their operational tasks; these extra capabilities also helped in developing solutions. In addition, in several cases, problems were prevented because the coach helped the team with the development of a solution, or the coach developed a solution by himself. Further, in several cases, experience gained from earlier improvement processes facilitated the development of solutions. In these cases, solutions that were used in other improvement processes could be applied to the new problem at hand. In addition, in several cases the tasks required to develop a solution were very simple, and team members had significant extra capabilities to be able to perform these tasks.

Reasons for problems: In five cases, functional conflicts were the cause of the problems in developing a solution. In three of these cases, the team was also no longer motivated to look for a solution, because the improvement process concerned problems with their supervisor, and they were afraid that discussing the subject would only make the problems worse. In these cases, functional conflicts were also relevant, because the team members did not have to solve such social problems in their operational processes, there they focus on technical problems. Once when functional conflicts arose, the problems with the development of a solution occurred because the team forgot about the consequences for other departments. In this case also functional conflicts were relevant, because the team members did not have to think about the consequences of solutions for other departments in their tasks in the operational process. In one other case, where functional conflicts arose, the development of a solution by the team was not satisfying because a supervisor suggested a better solution. Again in this case, functional conflicts were relevant, because the supervisor had more experience in performing the task, and therefore he suggested a better solution. In rather many cases (15), problems in developing a solution to an unfamiliar problem arose because no satisfying solution could be found. It can be questioned if functional conflicts were relevant in all the cases where it was hard to develop a solution. In these 15 cases, the teams were not able to find a satisfying solution, and it could be argued that the team members were not sufficiently capable of developing a proper solution because the task differed from the operational tasks, and thus functional conflicts existed. However, in several of these cases, other people, including technical specialists and even other companies, had no solution to the problem. For these cases, it is not possible to argue that the team members would have been able to find a solution if they performed these kinds of tasks in their operational process. Therefore, these cases were explicitly distinguished and functional conflicts was not put forward as an explanation. In one case, the team was not motivated to solve a problem, because the supervisor of the department that was responsible for the problems had said that measures had been taken to solve the problem. Although the team did not really believe that the problems were solved, they were no longer motivated to solve the problem themselves. In some cases, people had extra capabilities that helped them to develop a solution for an
unfamiliar problem, while in other cases this activity was problematic. Apparently, some teams lacked the capability to deal with social and interdepartmental problems; consequently in these cases functional conflicts emerged. In other cases functional conflicts did not occur.

In 81% of the instances that a team had to develop a solution for an unfamiliar problem, no problems arose. Problems were prevented because team members had extra knowledge or capabilities that helped them in developing a solution and their strong motivation encouraged them to use this knowledge and capabilities. In addition, problems were prevented because in some cases the coaches performed the activity, or they assisted the teams in doing so. Further, problems were prevented because solutions that were developed in other improvement processes could be reapplied. In 19% of the instances where a solution to an unfamiliar problem had to be developed, problems arose. The main cause of the problems was that it was simply very hard to find a satisfying solution to the problem. In some cases, problems arose because the team members lacked the extra capabilities needed to solve social or interdepartmental problems; thus functional conflicts arose. Further, on one occasion problems appeared because team members were no longer motivated to find a solution.

### Approve a solution

The teams performed explicit activities to approve a solution only twice, in two different improvement processes. The task was performed during the authorisation of the solution phase. The task was never problematic. Table 6-12 shows the key information on approving a solution.

<table>
<thead>
<tr>
<th>Task: Approve a solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed: 2 times in 2 different processes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Authorise the solution</th>
<th>Probl</th>
<th>Not probl</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>2%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-12: Number of times that the team approved a solution

**Reasons for no problems:** Twice did the teams perform explicit activities to approve a solution, in other cases the solution was approved by people from outside the team or it was not discussed explicitly. In both relevant cases, the coach approved of the solution and no problems appeared in this activity.
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Position new tools
The team positioned new tools on 10 occasions in 8 different improvement processes. The task was performed during the implementation of the solution phase and was never problematic. Table 6-13 shows the key information on placing new tools:

**Reasons for no problems:** The task of placing new tools, and changing the existing situation was never problematic. Reasons for the lack of problems included the help of the coach. In addition, problems did not arise because many tasks the team had to do were very simple. For example, in several cases, in order to position new tools, it was only necessary to give lists of information to people, or to give people new tools. In one case, a team member was very committed to changing the existing situation, which facilitated the activity.

```
<table>
<thead>
<tr>
<th>Task</th>
<th>Perform</th>
<th># of times task was</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Probl</td>
<td>Not prob</td>
</tr>
<tr>
<td>Implement the solution</td>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>
```

Table 6-13: Number of times that the team positioned new tools.

Evaluate a changed situation
The team evaluated a changed situation 10 times in 9 different improvement processes. The task was performed during the evaluation of the solution phase and it was never problematic. Table 6-14 shows the key information on the evaluation of a changed situation:

**Reasons for no problems:** Only in a few cases, did explicit evaluation of a changed situation take place. In many cases, evaluation took place while considering alternatives (then the task was part of the ‘develop a solution for an unfamiliar problem’ stage), or while discussing why the situation is unsatisfactory (then the task is part of the ‘identification of an improvement opportunity’ stage). Explicit activities to evaluate a changed situation were virtually only

```
<table>
<thead>
<tr>
<th>Task</th>
<th>Perform</th>
<th># of times task was</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Probl</td>
<td>Not prob</td>
</tr>
<tr>
<td>Evaluate the solution</td>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>
```

Table 6-14: Number of times that the team evaluated a changed situation.
performed when the coach initiated them. Only once, did a team evaluate a solution; and then they concluded that it was not appropriate.

*Problems in the evaluation of a changed situation did not occur, primarily because the coach performed most of the activities.*

### Write a report

The team wrote a report or structured unfamiliar information 51 times in 26 different improvement processes. The task was performed during the development, authorisation, implementation, and standardisation of the solution phase. The task was problematic only 8% of the times it was performed, while in the other 92% of instances problems did not appear. Table 6-15 shows the key information on writing a report.

<table>
<thead>
<tr>
<th>Reason for no problem:</th>
<th>8%</th>
<th>92%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help of the coach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience in the o.p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People have more capab.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High commitment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple task</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 6-15: Number of times that the team writes a report or structures unfamiliar information.
helped them in writing the report. Sometimes the team members were very motivated to make a report, and this also facilitated the activity, since they were very willing to use all their extra capabilities. Further, in several cases the team members had clearly more capabilities to structure information than were required for their operational tasks. These extra capabilities facilitated structuring and writing down information.

**Reasons for problems:** Problems with writing a report arose in one team, because the team members refused to make a report of the team meetings and the coach did not want to do it anymore. Team members refused to make a report because it ‘was not one of their tasks, there were other people to do this kind of thing’. In this case, the team members did not have, or they refused to use, their extra capabilities to make a report. Further, on one occasion problems arose because the coach simply forgot to make a report. Thus, problems with writing a report arose when team members did not have, or did not use, the extra capabilities needed to make a report, and the coach did not perform the activity for them. In some cases, people had the extra capabilities needed to write reports, while in other cases this activity was problematic. A reason for this is that the extra capabilities differ for each team member. Problems with writing a report arose with three members of one team, while two other members of the same team did write reports. Thus, apparently, the two members who did write the reports had and wanted to use their extra capabilities, while the other three did not have or did not want to use, these extra capabilities.

| 91% of the times that a team had to write a report or structure information, no problems arose. Most problems were prevented because the coaches performed the activity, or they assisted the teams in doing so. In addition, in several cases, problems were prevented because team members had extra knowledge on what should be in the report, or they had extra capabilities in writing reports. Problems with writing a report arose in 9% of the instances that the task was performed. Problems arose when the team members did not have, or chose not to use, the extra capabilities needed to make a report (then functional conflicts arose) and when the coach refused to perform the activity. Problems because of functional conflicts arose only in a few cases, when some team members did not have, or did not want to use, the extra capabilities needed to write a report. Only with certain team members did these functional conflicts arise. |
**Initiate tasks**

The team initiated tasks 27 times in 18 different improvement processes. The task was performed during the development, testing, authorisation, and implementation of the solution phase. The task was problematic 67% of the times it was performed, while in 33% of the cases problems did not appear. Table 6-16 shows the key information on initiating tasks.

**Reasons for no problems:** In several cases, problems did not occur with the initiation of tasks, because certain team members were very motivated to perform the task. In some of these cases they had worked out a solution themselves, and they were so enthusiastic about it, that they initiated activities before discussing it with the team. In some cases where the team members were very motivated to initiate tasks, their experience in the operational processes also helped facilitate the activity.

**Reasons for problems:** In initiating tasks, relatively many problems occurred. The most important reason for the problems was that the team members forgot to perform activities that had been discussed in team meetings. For example, they forgot to plan a meeting, or to implement a solution. In other cases they did not recognise that an activity, for example the authorisation of the solution, was needed. In the operational processes, people do not often have to take initiatives to perform tasks. What they do is guided by the orders they have to produce, and the machines they use. Thus, functional conflicts could explain why problems arose. Another reason for problems was that the team was not motivated to carry out the required tasks, for example because they were not motivated to work on improvement.

---

<table>
<thead>
<tr>
<th>Task: Initiate tasks</th>
<th>Performed: 27 times in 18 different processes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a solution</td>
<td># of times task was</td>
<td>Reason for (no) problem</td>
</tr>
<tr>
<td></td>
<td>Probl</td>
<td>Not probl</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>Functional conflict</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Op. conf. got more priority</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Team was not motivated</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>High commitment</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Experiences in the o.p.</td>
</tr>
<tr>
<td>Test the solution</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>High commitment</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorise the solution</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implement the solution</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Team was not motivated</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Problem disappeared</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>High commitment</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Experiences in the o.p.</td>
</tr>
<tr>
<td>Percentage</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>9</td>
</tr>
</tbody>
</table>
Further analysis of the research findings

processes. The reasons for the lack of motivation differed. In two cases, individual team members were less motivated for a time, in another case a team was no longer motivated because a supervisor who was also responsible for the problem did not do anything to solve it. Further problems occurred because the team members did not perform needed activities during a period when their operational activities got more priority, or because the problems disappeared. When the team members were very enthusiastic about an improvement, they were often very motivated to perform the required activities, and then there were no problems in the initiation of tasks. However, when they were not very motivated, problems in initiating tasks quickly arose; team members forgot to carry out tasks. Thus, with the initiation of tasks, problems of functional conflicts were related to the motivation of the team members. When they were very motivated functional conflicts were prevented, in other situations functional conflicts often appeared because the team members forgot to perform the task.

In 33% of the instances that a team had to initiate tasks, problems did not appear. They were avoided because the team members were very motivated to perform a task. On relatively many occasions when a team had to initiate tasks, problems occurred (67%). The main reason for the problems was that the team forgot to perform the activities due to functional conflicts. In addition several activities were not performed because the team was no longer motivated to work on the improvement process. Problems in the initiation of tasks were related to the motivation of the team members. When team members were very motivated, functional conflicts did not arise and there were no problems. In other instances, functional conflicts led to problems.
Further analysis of the research findings

Communicate with people outside of the team

The teams communicated with people outside of the teams 73 times in 40 different improvement processes. The task was performed during the analysis of the problem, and during the development, testing, authorisation, implementation, and standardisation of the solution phase. The task was only problematic in 8% of the instances it was performed, while in 92% of the cases problems did not appear. Problems appeared during the development and the authorisation of the solution stage.

Table 6-17 shows the key information on communication with people outside of the team.

<table>
<thead>
<tr>
<th>Task:</th>
<th>Communicate with people outside of the team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed:</td>
<td>73 times in 40 different processes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th># of times task was</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Probl</td>
<td>Not prob</td>
</tr>
<tr>
<td>Analyse the problem</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Test the solution</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Authorise the solution</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
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<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Standardise the solution</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td>8%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

Table 6-17: Number of times that the team communicates with people outside of the team.

Reasons for no problems: The majority of times that the team had to communicate with people outside of the team (92%), the task was not problematic. Most problems were avoided through the help of the coach. In many cases the coach performed the communication activities himself, the coach then was an intermediate between the team and the rest of the organisation. In addition, in many cases, the coaches helped the teams to structure the required communication in advance. The team members then performed the communication,
but the help of the coach greatly facilitated it. After the help of the coach, the communication activities for the team members became rather simple; moreover communication tasks were very simple to start with and this too prevented problems. Further problems were prevented because team members learned new communication capabilities through a short workshop given by a coach. The coach taught them, for example, how to ask others for deadlines to finish their activities, and he taught them to take the initiative in asking questions to others. During improvement processes, the team members gained more and more experience in these things, which also helped prevent problems in communicating with others. Some team members also reported that they had learned to take the initiative in asking questions to others in the team. Problems in communicating were also avoided because team members knew much about the subject that they wanted to discuss, through their experience in the operational configuration. Problems were also prevented because some team members had more capabilities in communicating than those required for their operational tasks. These team members would perform the communication tasks for the team. Further, in several cases, team members were very motivated to solve a problem and they took initiatives to communicate themselves and in this situation communication was never problematic.

**Reasons for problems:** Problems in communicating with people outside of the team arose for different reasons. Problems arose with supervisors of other departments because the supervisor did not take a request for different materials from a team member seriously because team members did not tell a supervisor their real concerns, and because a supervisor did not use the information given to him by a team member. In operational processes, team members do not need to communicate with supervisors of other departments to solve problems, thus functional conflicts might be a cause of these problems. Communication problems also arose because team members hesitated to ask others to do something, or the team forgot to communicate about a solution, or the team did not get an answer because they did not state their question clearly. In these cases, the team did not communicate well. The cause of these problems might also be functional conflicts because, in their operational processes, team members do not have to communicate that often about ill-structured problems. Thus, all the problems that arose with communicating with people outside of the team could be distributed to functional conflicts. Communication with people outside of the team was rather difficult for many team members. Many problems were prevented because the coaches performed the required communicational activities, or because the coaches heavily assisted the team members. When coaches did not intermediate between the team and others, for example with supervisors of other departments, problems did appear in some cases. Coaches were not able to prevent all the problems.
Further analysis of the research findings

In the vast majority of cases where the team had to communicate with people outside of the team the task was not problematic (92%). Most problems were avoided by the coach performing the task. In addition the coaches assisted the team in communicating and they taught the team some communicational skills. Further, problems were prevented because some communication tasks were very simple, or team members were very motivated. Several team members had greater communicational capabilities than others, and they then performed the required communication on behalf of the team. The problems in communicating with people outside of the team that did arise (8%) were because people do not have to perform this task during their operational processes, and thus functional conflicts occurred. The problems that did appear in communicating with others can be explained by the fact that the coaches did not assist with, or perform the communication. Without this help problems appeared in some instances.

Communicate within the team

The teams communicated within themselves explicitly 18 times in 15 different improvement processes. The task was performed during the analysis of the problem, and during the development and implementation of the solution phase. The task was problematic 27% of the times it was performed. Table 6-18 shows the key information on communication within a team.

<table>
<thead>
<tr>
<th>Task: Communicate within the team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed: 18 times in 15 different processes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task</th>
<th># of times task was performed</th>
<th>Reason for (no) problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Probl</td>
<td>Not probl</td>
</tr>
<tr>
<td>Analyse the problem</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implement the solution</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>27%</td>
<td>73%</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 6-18: Number of times that the team communicated within the team

Reasons for no problems: 73% of the times that a team had to communicate within the team, no problems arose. Problems were prevented in almost all cases by the help of the coach. The coaches structured the discussions about solutions within the team, or they kept the team informed about what was going on in the rest of the company. In one case the required communication task was very simple, and this prevented problems.

Reasons for problems: Problems in communicating within the team arose because team members argued with each other, discussed problems for a long time without good reason, or
disagreed about the importance of a solution. In all of these cases, it seemed like these communication problems could have been avoided. It appeared that the team members did not have enough capabilities to discuss these subjects with each other in a proper way. In the operational processes, the team members do not have to discuss things as a group and thus functional conflicts might explain the problems that arose. In one case, problems arose because the team forgot to discuss a subject. Problems with communication within a team could not be totally prevented by the coaches. In one case the coach was absent when the team discussed a subject, but in three cases problems appeared during team meetings even though the coaches were present. Although the coaches tried to prevent problems, they were not able to do so. This suggests that the help that a coach can provide with communication is limited; coaches cannot prevent or solve all communication problems.

73% of the times that a team had to communicate within the team, problems did not appear. Problems were prevented by the help of the coaches; coaches assisted in many discussions within a team. The coach cannot prevent all communication problems within his team. Problems arose (27%) because team members were not able to discuss subjects together; functional conflicts were relevant in these cases.

**Remind the supervisor to do things**

The teams had to remind their supervisors to do things on 3 occasions in 3 different improvement processes. The task was performed during the development and authorisation of a solution phase. The task was problematic in 67% of the times it was performed. Problems appeared during the development and authorisation of the solution. Table 6-19 shows the key information on reminding the supervisor to do things.

<table>
<thead>
<tr>
<th>Task:</th>
<th>Remind the supervisor to do things.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed:</td>
<td>3 times in 3 different processes</td>
</tr>
<tr>
<td># of times task was</td>
<td>Probl</td>
</tr>
<tr>
<td>Develop a solution 1</td>
<td>1</td>
</tr>
<tr>
<td>Authorise the solution 1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Percentage** | 67% | 33% |
|**Total**      | 2   | 1   |

Table 6-19: Number of times that a team had to remind the supervisor to do things.

**Reasons for no problems:** In one case (33%), problems did not arise with reminding the supervisor to do things. Problems were avoided because the coach explained to the team that this was not only a fault of the supervisor, and that the team members should put more effort into asking him to do things.

**Reasons for problems:** In two cases, problems appeared with reminding the supervisor to do things, because the team members did not want to fulfil this task. In one case, they even argued that the boss of their supervisor should do this task. In the operational processes, the
supervisor is responsible for the work of the people, they are not responsible for the things their supervisor does. This difference in needs may result in functional conflicts that hinder the improvement process. The coaches of the teams recognised the problems the team members had in asking their supervisor to do things. Therefore, they tried to explain to the teams how to convince others, and that it was not so strange that their supervisor could forgot about things that he had to do. However, this did not prevent problems occurring, because the opinions of the team members about how their supervisor should do his work were deeply rooted.

In one case (33%), problems did not arose with reminding the supervisor to do things. Problems were prevented with the help of the coach. Problems with reminding the supervisor to do things arose (67%), because the team members did not want to speak to their supervisor about things that he had not yet done; this was due to functional conflicts. Coaches could not prevent all the problems with asking supervisors to do things, because the views of team members on how their supervisor should function were too deeply rooted.

6.1.3. Conclusion

In this section, all the improvement tasks that were performed by teams have been analysed. It was discussed whether the tasks corresponded with the operational tasks or not, if tasks were problematic or not, and what the reasons were why problems appeared or did not appear. The next section analyses the major reasons why tasks were problematic, or not, and hypotheses on the main reasons are formulated.

6.2. Analysis of reasons for (no) problems with improvement tasks

This section analyses the major reasons why tasks were problematic or not. First, an overview of the major reasons why problems appeared, or did not, is discussed. Following this, the different reasons for problems or otherwise are discussed in depth. Throughout the section, hypotheses will be formulated. It is important to note that the hypotheses are only valid in similar situations and contexts as those in the research; in totally different situations, the hypotheses might not be valid. The fourth chapter of the thesis described the major aspects in the context of teams and in so doing, the chapter gives a proper indication of the contexts in which the hypotheses are valid. In chapter 7, the major aspects of the context that seem to be relevant to the findings of the research will be emphasised.

6.2.1. Overview of reasons for problems or no problems

This section provides an overview of the major findings on the reasons for problems or otherwise, for the improvement tasks that corresponded with the operational tasks, as well as the improvement tasks that differed from the operational tasks. First the tasks that were problematic are discussed, followed by the non-problematic ones.
Overview of problematic tasks

Table 6-20 lists the reasons why problems occurred in both the differing and the corresponding tasks that were given in the previous chapter. The reasons that problems appeared with tasks were:

- *Imported misfit:* The reason for problems with the task is that the task is also problematic in the operational process; in the operational process misfits already exist. These misfits are imported into the improvement process and the improvement task is thus also problematic.

- *Functional conflict:* Functional conflicts exist if performing one process is at the expense of another one. Thus, when functional conflicts exist, the reason for the problems with a task is that people are not able to perform it, apparently because of the difference between the improvement task and the operational tasks.

- *Hard to develop a solution:* The reason for the problems with the task was that it was simply very difficult to develop a solution. The problems could not be justified by referring to the difference with the operational activities and hence a functional conflict.

- *People forget to perform tasks:* The reason for problems with a task is that people forget to perform the task. These problems can not be explained by referring to the difference with the operational activities and a functional conflict. A lack of motivation to perform the task did not seem to be the underlying reason.

- *Team was not motivated:* The reason for the problems with a task is that the team is not motivated to perform the task. These problems could not be explained by referring to the difference with the operational activities and a functional conflict.

- *Problems disappeared:* The reason for the problems with a task was that the problem that had to be solved disappeared after a while, and therefore the proposed task was not performed.

First the tasks that corresponded with operational tasks are discussed, followed by the tasks that differed. The tasks are given in the order of the number of times that they were performed; the task that was performed the most is given first.
Further analysis of the research findings

<table>
<thead>
<tr>
<th>Problematic/Non Probl.</th>
<th>Number Problematic</th>
<th>Percentage Problematic</th>
<th>Import</th>
<th>Conflict</th>
<th>Hard to develop</th>
<th>Team was not motivated</th>
<th>More priority</th>
<th>Operational configuration</th>
<th>Problems disappeared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Corresponding tasks**

<table>
<thead>
<tr>
<th>Task</th>
<th>Number Problematic</th>
<th>Percentage Problematic</th>
<th>Import</th>
<th>Conflict</th>
<th>Hard to develop</th>
<th>Team was not motivated</th>
<th>More priority</th>
<th>Operational configuration</th>
<th>Problems disappeared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register problems when they appear in the operational process</td>
<td>P: 5, NP: 34</td>
<td>13%</td>
<td>87%</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify or communicate problems with the process</td>
<td>P: 0, NP: 24</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify or communicate problems with the input</td>
<td>P: 0, NP: 21</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask the supervisor to do things</td>
<td>P: 2, NP: 15</td>
<td>12%</td>
<td>88%</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use tools or machines</td>
<td>P: 3, NP: 12</td>
<td>20%</td>
<td>80%</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Team informs the supervisor</td>
<td>P: 4, NP: 5</td>
<td>44%</td>
<td>56%</td>
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<td></td>
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</tr>
<tr>
<td>Supervisor informs the team</td>
<td>P: 1, NP: 3</td>
<td>25%</td>
<td>75%</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Different tasks**

<table>
<thead>
<tr>
<th>Task</th>
<th>Number Problematic</th>
<th>Percentage Problematic</th>
<th>Import</th>
<th>Conflict</th>
<th>Hard to develop</th>
<th>Team was not motivated</th>
<th>More priority</th>
<th>Operational configuration</th>
<th>Problems disappeared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify an improvement opportunity</td>
<td>P: 0, NP: 117</td>
<td>0%</td>
<td>100%</td>
<td>35</td>
<td>15</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Develop a solution for an unfamiliar problem</td>
<td>P: 20, NP: 85</td>
<td>19%</td>
<td>81%</td>
<td>5</td>
<td>15</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate with people outside of the team</td>
<td>P: 6, NP: 67</td>
<td>8%</td>
<td>92%</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write a report</td>
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<td>8%</td>
<td>92%</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiate tasks</td>
<td>P: 18, NP: 9</td>
<td>66%</td>
<td>34%</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyse unfamiliar information</td>
<td>P: 3, NP: 20</td>
<td>13%</td>
<td>87%</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decide to focus on one problem</td>
<td>P: 0, NP: 18</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate within the team</td>
<td>P: 5, NP: 13</td>
<td>27%</td>
<td>73%</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position new tools</td>
<td>P: 0, NP: 10</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate a changed situation</td>
<td>P: 0, NP: 10</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remind the supervisor to do things</td>
<td>P: 2, NP: 1</td>
<td>66%</td>
<td>34%</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approve a solution</td>
<td>P: 0, NP: 2</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table 6-20: Number of times that reasons caused problems with different and corresponding tasks
**Overview of non-problematic tasks**

Table 6-21 lists the reasons why problems did not appear in the differing and the corresponding tasks. The reasons why problems did not appear with tasks were:

- **Correspondence with operational tasks:** Problems with the task did not appear because the tasks corresponded with operational tasks and the team was well able to perform it.

- **Communication was deliberately organised:** This column represents two different, but closely related, reasons for a lack of problems with communication tasks that were discussed in the previous chapter. (1) *Supervisor visits team:* There were no problems with communication with the supervisor because the supervisor attended the team meeting, and therefore the communication could be performed. (2) *Team asks supervisor to communicate:* No problems with communication with the supervisor arose because the team asked the supervisor explicitly to explain things to them.

- **Communication by coincidence:** Problems with communication with the supervisor did not arise because the supervisor and the team communicated by coincidence.

- **Experience in the operational configuration:** Problems with the task did not arise because of the team members’ experiences in the operational configuration. Although team members did not have to perform the task in the operational configuration, their experiences in the operational configuration helped them to perform it.

- **High commitment of team members:** Problems with the task did not arise because of the commitment of the team members to perform the task.

- **People have more capabilities:** There were no problems with the task because some of the team members had more capabilities than were needed to perform the operational tasks. These team members used these extra capabilities to perform the improvement tasks for the whole team.

- **Experience in the improvement configuration:** There were no problems with the task because of the experience gained in earlier improvement processes. This earlier experience could be used to perform the improvement task.

- **Simple task:** Problems with the task did not arise because the task was very simple. Moreover, the reason that the task was simple to perform was not that people have more capabilities, that they were very committed, or that they had earlier experiences that could be used. The overriding reason for the lack of problems was that, although the improvement task differed from the operational tasks, the task was very simple to perform.

- **Help of the coach:** There were no problems with the task because the coach helped the team. In several of such cases, the coach actually performed the task for the team.

- **Use of improvement tools:** There were no problems with the improvement task because the team used tools that facilitated the task.
Further analysis of the research findings

<table>
<thead>
<tr>
<th>Corresponding tasks</th>
<th>Number</th>
<th>Percentage</th>
<th>Correspondence with operational tasks</th>
<th>Communication was deliberately organised</th>
<th>Communication was coincidence</th>
<th>Experience in the operational configuration</th>
<th>Experience in the high commitment team</th>
<th>People have more capabilities</th>
<th>People have more experience in the improvement configuration</th>
<th>Simple task</th>
<th>Use of improvement tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register problems when they appear in the operational process</td>
<td>P: 5</td>
<td>13%</td>
<td>102</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 34</td>
<td>87%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify or communicate problems with the process</td>
<td>P: 0</td>
<td>0%</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 24</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify or communicate problems with the input</td>
<td>P: 0</td>
<td>0%</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 21</td>
<td>100%</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Ask the supervisor to do things</td>
<td>P: 2</td>
<td>12%</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 15</td>
<td>88%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use tools or machines</td>
<td>P: 3</td>
<td>20%</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 12</td>
<td>80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team informs the supervisor</td>
<td>P: 4</td>
<td>44%</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 5</td>
<td>56%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisor informs the team</td>
<td>P: 1</td>
<td>25%</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>NP: 3</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Different tasks

<table>
<thead>
<tr>
<th>Total</th>
<th>206</th>
<th>128</th>
<th>37</th>
<th>25</th>
<th>24</th>
<th>173</th>
<th>51</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify an improvement opportunity</td>
<td>P: 0</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 117</td>
<td>100%</td>
<td>112</td>
<td>86</td>
<td>5</td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>Develop a solution for an unfamiliar problem</td>
<td>P: 20</td>
<td>19%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 85</td>
<td>81%</td>
<td>59</td>
<td>21</td>
<td>14</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Communicate with people outside the team</td>
<td>P: 6</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 67</td>
<td>92%</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Write a report</td>
<td>P: 4</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 47</td>
<td>92%</td>
<td>14</td>
<td>5</td>
<td>13</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Initiate tasks</td>
<td>P: 18</td>
<td>67%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 9</td>
<td>33%</td>
<td>2</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyse unfamiliar information</td>
<td>P: 3</td>
<td>13%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 20</td>
<td>87%</td>
<td>6</td>
<td>3</td>
<td>16</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Decide to focus on one problem</td>
<td>P: 0</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 18</td>
<td>100%</td>
<td>18</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate within the team</td>
<td>P: 5</td>
<td>27%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 13</td>
<td>73%</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Position new tools</td>
<td>P: 0</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 10</td>
<td>100%</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate a changed situation</td>
<td>P: 0</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 10</td>
<td>100%</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remind the supervisor to do things</td>
<td>P: 2</td>
<td>67%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 1</td>
<td>33%</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approve a solution</td>
<td>P: 0</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NP: 2</td>
<td>100%</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6-21: Number of times that reasons prevented problems with different and corresponding tasks
The following sections reflect upon the reasons why problems arose or did not. The major reasons for problems or otherwise are summarised in theoretical terms, and testable hypotheses are formulated. First the problematic tasks are discussed followed by the non-problematic tasks.

6.2.2. Reasons for problems in differing tasks

In this section, the reasons for problems that arose specifically in improvement tasks that differed from operational tasks are discussed.

**Functional conflicts**

As asserted in the second chapter, functional conflicts exist if performing one process is at the expense of another one. When functional conflicts arise with improvement tasks, then performing the operational tasks is at the expense of performing the improvement tasks. In such a case, operational and improvement tasks differ from each other, they require different characteristics of the people, people are not able to perform both tasks, and problems arise with performing the improvement task. Table 6-20 shows that improvement tasks that differed from operational tasks were often problematic because of functional conflicts between the operational and improvement tasks.

Table 6-22 shows where functional conflicts appeared.
Further analysis of the research findings

<table>
<thead>
<tr>
<th>Task</th>
<th>Functional conflicts appeared …</th>
<th>No problems of functional conflicts</th>
<th>Reason for funct. confl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a solution to an unfamiliar problem</td>
<td>Team had to solve a social problem. Team had to solve a problem where another department was involved. Supervisor knew a better solution.</td>
<td>Team members had extra knowledge or capabilities, they were highly motivated, the coach helped the team, or earlier solutions could be re-applied.</td>
<td>Type of problem: social problem or other department involved</td>
</tr>
<tr>
<td>Communicate with people outside of the team</td>
<td>People do not take a request from a team seriously. People do not use the information given by the team. Team does not state a clear question. Team does not explain their real concerns. Team hesitates to ask things. Team forgets to communicate about a solution.</td>
<td>Coach assisted with communication, or communication was very simple. Help of coach could not prevent all problems.</td>
<td>Help of coach was not sufficient</td>
</tr>
<tr>
<td>Write a report</td>
<td>Coach and team members all refused to perform the activity.</td>
<td>Coach made report or team members were motivated to use their extra capabilities.</td>
<td>Coach did not perform task and team was not motivated to use (extra) capabilities.</td>
</tr>
<tr>
<td>Initiate tasks</td>
<td>Team forgot to perform task.</td>
<td>Team was very motivated</td>
<td>Team was not very motivated</td>
</tr>
<tr>
<td>Analyse unfamiliar information</td>
<td>Team forgot to analyse problem. Team refused to analyse information. Test did not offer clear results because information was not well analysed during the test by the team.</td>
<td>Coach or someone outside the team performed or assisted the team with the analysis.</td>
<td>Coach did not perform task</td>
</tr>
<tr>
<td>Communicate within the team</td>
<td>Team members argue. Team members discuss at length without good reason. Team members disagree about the importance of solution.</td>
<td>Coach helped with communication, but help of coach could not prevent all problems.</td>
<td>Help of coach was not sufficient</td>
</tr>
<tr>
<td>Remind the supervisor to do things</td>
<td>Team members do not want to remind their supervisor about things he was supposed to do.</td>
<td>Coach helped with communication, but help of coach could not prevent all problems.</td>
<td>Help of coach was not sufficient</td>
</tr>
</tbody>
</table>

Table 6-22: Reasons for functional conflicts with improvement tasks that differed from the operational tasks.

Table 6-20 and Table 6-22 show that functional conflicts appeared with specific tasks. These tasks can be clustered into three groups: (1) communication tasks (communicate with people outside of the team, communicate within the team, and remind the supervisor to do things), (2) cognitive tasks (develop a solution, analyse information, structure and write down...
Further analysis of the research findings

information), and (3) taking the initiative to perform tasks. Table 6-22 gives the different reasons why functional conflicts occurred:

- With **cognitive tasks** different reasons for functional conflicts existed. In *developing a solution* for an unfamiliar problem, functional conflicts arose when the team had to solve specific types of problems; functional conflicts appeared when the team had to solve a social problem, or a problem where other departments were involved. In their operational processes, team members mostly had to solve technical problems only within their own department; they did not have to solve social problems, and problems concerning other departments. The research showed that especially with these types of problems functional conflicts appeared.

Hypothesis 1: *Functional conflicts in developing a solution to an unfamiliar problem are likely to arise if a solution is required for a social problem, or for a problem that involves other departments.*

Functional conflicts in *analysing unfamiliar information, and in structuring and writing down information* occurred when the team was not assisted by the coach or someone from outside the team in performing the tasks; problems appeared in almost all cases where the team members had to perform the tasks.

Hypothesis 2: *Functional conflicts in analysing unfamiliar information are unlikely to arise if the team is assisted with the task.*

Hypothesis 3: *Functional conflicts with structuring and writing down information are unlikely to arise if the team is assisted with the task.*

- With **communication tasks**, functional conflicts occurred because the help of the coach was not sufficient to prevent all the problems. Sometimes, when communicational tasks were performed, the help of the coach did prevent problems; however, other times this was not sufficient to prevent problems and functional conflicts resulted.

Hypothesis 4: *Functional conflicts in communication tasks are less likely to arise if the team is assisted with the task.*

- With **taking the initiative** to perform tasks, functional conflicts appeared when the team was not sufficiently motivated to perform the task.

Hypothesis 5: *Functional conflicts in taking the initiative to perform tasks are likely to arise if the team members are not motivated to perform the required task.*

Thus, the research has shown that functional conflicts are likely to arise with social problems, and with problems where several departments are involved. In addition, the research highlighted several cases where functional conflicts were prevented, for example by the help of a coach, or through the strong motivation of the team members. The research shows that these reasons for problems not arising were very important; and they will receive more attention in the following sections.
Further analysis of the research findings

Hard to develop a solution

Another reason for problems with improvement tasks was that it was very difficult in several cases to develop a solution. This reason for problems occurring only arose with one task: the development of a solution to an unfamiliar problem. In the development of a solution for an unfamiliar problem, there were several causes for the problems: the team was not motivated to find a solution, or functional conflicts existed. However, there was another reason for the problems in several cases: it was simply very hard to develop a solution, no other reasons for the problems could be identified. In several of these cases, people outside of the team, such as technical experts, could also not find a solution to the problem. It appears that there was no adequate solution to the problem.

Problems in developing a solution to an unfamiliar problem arose because it was difficult to develop a solution for the problem and therefore no solution was found.

The difficulties with finding a solution indicate that, for several problems, the team members could not be blamed for not finding a solution; people outside of the team also had problems with determining a solution. It seemed that no proper solution existed, and this indicates that it is not certain that solutions can always be found to problems. Finding a solution is a creative task and it is not obvious that solutions can always be created; some problems might be unsolvable. That a solution cannot be found is problematic in such cases, because it does not contribute to the fulfilment of the desired improvement function. However, in such cases, no one might be at fault for not realising the desired improvement function; it cannot, for example, be argued that team members lack the skills to solve such problems.

Operational configuration got higher priority

With some improvement tasks, that differed from the operational tasks, problems arose because the operational tasks got higher priority than the improvement tasks, and therefore problems arose with the improvement tasks. This happened twice when initiating tasks. In both cases, team members and their coach had to take initiatives to check information on a list, but it was a long time before this was done. A reason for the time it took was that checking the information could not be done during a team meeting; it had to be done during the normal working time, and operational tasks then got more priority. This shows that taking an initiative to perform tasks can be problematic, because the tasks have to be performed outside the team meetings and operational tasks then get more priority.

Problems with taking the initiative to perform tasks arose because the tasks had to be performed outside the team meetings and then the operational processes got higher priority.

Hypothesis 6: Taking an initiative to perform improvement tasks is likely to be problematic if the tasks have to be performed outside the team meetings and operational processes have higher priority.
6.2.3. Reasons for problems with corresponding tasks

Table 6-20 showed that with several of the tasks that corresponded with operational tasks, problems still appeared. In this section, the reasons for these problems are discussed.

**Imported misfits**

The main explanation for problems with tasks that corresponded with operational tasks is that misfits also existed in the operational configuration, and these misfits were imported into the improvement configuration. This took place with communication between a team and its supervisor. In the operational configuration, problems with communication between the people and their supervisor already existed, and these problems then arose in the improvement processes.

| Problems with communication between a team and its supervisor arose because the task was also problematic in the operational configuration. |
| Hypothesis 7: Communication between a team and its supervisor is likely to be problematic if the task is also problematic in the operational configuration. |

The findings on the communication problems in the operational as well as the improvement configuration suggest that misfits in the operational configuration can be imported into the improvement configuration and cause problems where improvement tasks correspond with operational tasks. Improvement tasks that correspond with problematic operational tasks can be problematic.

Hypothesis 8: Improvement tasks that correspond with problematic operational tasks are more likely to be problematic than improvement tasks that correspond with non-problematic operational tasks.

The research showed that asking a supervisor to do something was less often problematic than just informing him. This could be seen as surprising since asking a supervisor to do something is also part of the communication between a team and its supervisor. However, there is an important difference between the two tasks. When a team asks the supervisor to do something there is a clear reason for the communication; there is something in the improvement process that needs to be done by the supervisor. In addition, in this type of communication, linkages existed with the operational configuration. Most supervisors went to the people in their departments regularly during working hours to discuss operational matters. Then the team members took the opportunity to ask their supervisor to do something. Informing the supervisor was often less urgent, the progress of the improvement process was not blocked directly if the task is not performed. In the brief informal meetings between team and supervisor, less urgent subjects were often forgotten. In addition, there were not many additional opportunities where the team and the supervisor could discuss less urgent matters. Thus, for less urgent communication between a team and its supervisor, good communicational linkages did not exist in the operational configuration, and consequently less urgent communication between a team and its supervisor was problematic. However, for more urgent communication (such as asking the supervisor to do something) linkages did
exist, and consequently this task was less often problematic; it was only problematic in 20% of the times it was performed with one team and not with all the others.

| Communication between a team and its supervisor about less urgent subjects was more problematic than communication about urgent matters. |

The research showed that communication between a team and its supervisor was poor. The coaches and the co-ordinator recognised this, but it was difficult to find appropriate ways to deal with it. If coaches performed the communication tasks themselves problems were often prevented, but it was difficult to enable the team members to communicate with their supervisor. Coaches asked the team members to communicate with their supervisor about the subjects discussed in the team meetings but there were no clear communication channels to do this. Several teams just gave their supervisor the reports from the team meetings, but this was also not a good solution because only people who had been at the meeting could understand the reports. Although coaches tried, they could not overcome the lack of priority that was given to communication between team members and their supervisors.

| Help from the coach could not overcome the problems with communication between team members and their supervisors. |

6.2.4. General reasons for problems

Table 6-20 shows that some reasons for problems only appeared with improvement tasks that differed from the operational tasks, while others only appeared with tasks that corresponded with the operational tasks. However, the research also showed that several reasons appeared with both differing and corresponding improvement tasks. These reasons thus seem to be unrelated to the difference or correspondence with the operational task; they are ‘general’ reasons for problems. In this section, the most important general reasons for problems are discussed.

People forget tasks

One reason for problems was that teams forgot to perform tasks. This reason led to problems in both corresponding and the differing tasks:

- With the differing tasks, this problem occurred with writing a report, and with communication within the team. In writing a report, a coach forgot for several weeks to make a form that the team could use. With communication within the team, a team member collected some information that could be used in solving a problem, but the information was only added to a team report, it was not discussed in the team meeting. In both cases, it is not clear exactly why people forgot to perform the task.

- With the corresponding tasks, the problem arose with the registration of problems and with using tools or machines. In the registration of problems, the major reason for forgetting to perform the task seemed to be that people were not directly reminded or instructed to perform the task; they had to take initiatives themselves to perform the task. With using tools or machines, in one case the reason for the problems was also that people
had to initiate the task themselves after a certain time. However, in another case, they forgot the contents of a procedure within a week.

This shows that people must not only be able to perform a task, they must also remind that they have to do it; problems can appear when people forgot to perform a task. Thus, a prerequisite for successfully performing improvement tasks is that the team reminds the required tasks. If a team does not remember the tasks they have to perform, problems can occur with the task; ability and motivation alone are not sufficient. If people are able and motivated to perform tasks they still have to remember to do them to realise the improvement.

Problems with improvement tasks that differed and with tasks that corresponded with operational tasks arose because the team members forgot to perform the required tasks.

Hypothesis 9: Improvement tasks are likely to be problematic if a team forgets the required tasks.

Team is not motivated to perform a task

Another reason for problems was that the team members were not motivated to perform a task. This reason appeared with both the corresponding, and differing tasks:

- Problems because of the lack of motivation of team members occurred four times with tasks that differed from operational tasks; problems appeared with developing a solution for an unfamiliar problem, and with initiating tasks. In developing a solution, team members were not co-operative in finding a solution, most of the time they only want to complain about the things that bothered them. They were not really motivated to find a solution for the problem. In initiating tasks, in one case a team has to develop a solution, but the team members were no longer motivated to solve a problem because the supervisor of the department that was responsible for the problems said that measures had been taken to solve the problem. Although the team did not believe that the problems were really solved, they were no longer motivated to solve the problem themselves. Further, in two cases, individual team members had to develop a solution or discuss with others the problem, but they did not perform the required task. In both cases, the team member who had to perform the task seemed to lack motivation to work in the team anymore. It was not clear why this happened.

- Problems with the motivation of the team appeared only once with a corresponding task, namely with using tools or machines. In this case, a problem arose because the team was well able to perform a test, but were are not motivated to perform it because they did not believe that the solution they had to test would work.

This shows that people must not only be able to perform a task; they must also want to perform it. Thus, a prerequisite for successfully performing improvement tasks is that the team is motivated to perform the required tasks. If a team is not motivated to perform the required tasks, problems may occur with the task. This reason is often cited in literature. It is well known that if people are motivated that they perform tasks better and that fewer
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problems appear. Thus, the finding that the motivation of the team members is important should not be considered as surprising.

Problems with improvement tasks that differed and with tasks that corresponded with the operational tasks arose because team members were not motivated to perform the required tasks.

Hypothesis 10: Improvement tasks are likely to be problematic if the team is not motivated to perform the required tasks.

Problem disappeared

In three cases, tasks were no longer performed, because other solutions had been implemented and the task was no longer needed. This occurred with both corresponding tasks and differing tasks:

- With tasks that differed from the operational tasks the problem ceased to exist on one occasion. This happened with initiating tasks. The coach and the researcher had promised the team a new clock, which was needed to solve the problem. However, the problem was solved by other measures, and the clock was never ordered.

- Problems ceased to exist with tasks that corresponded with the operational tasks on two occasions; both linked with the registration of problems. In both cases, the team stopped registering problems because other measures were taken and problem registration was no longer needed to solve the problem.

This shows that the need for an improvement task can change during the improvement process, depending on other improvement processes performed by the team, or others. Activities performed in one process might influence the realisation of the desired improvement function in other processes. If an improvement function is achieved through another improvement process, then there is no longer a need to perform the tasks; consequently a team might not perform a task. However, with the current research method, the task is still considered problematic. Problems with improvement tasks that correspond with operational tasks can arise if the desired improvement function is already realised through another improvement process.
6.2.5. Reasons for problems not occurring with different tasks

In this section, the reasons that problems did not occur with improvement tasks that differed from operational tasks are discussed. Table 6-21 gave an overview of the different reasons why problems did not arise as was discussed in the previous chapter. The reasons given in Table 6-21 can also be considered in the theoretical terms of the process model discussed in the second chapter. Major insights gained from the model were that problems with improvement activities that differ from the operational activities might not occur because of: (1) the use of different tools or arrangements in the improvement configuration; (2) slack in the operational configuration that can be used to perform improvement activities; (3) lowering the requested improvement function. Table 6-23 gives an explanation, in theoretical terms, of the different reasons that problems did not occur. In the following sections, the first two reasons given in the second chapter, slack and the use of tools and arrangements, are explained and discussed in depth. The third theoretical reason, lowering the requested improvement function, is not discussed in this section; special attention is given to this reason in the next chapter. The different reasons for a lack of problems are discussed below.

**Slack**

In several cases, problems did not appear because slack existed in the operational configuration. This slack was used to perform improvement tasks that differed from operational tasks. Table 6-21 shows that slack in the operational configuration was important with the most often performed improvement tasks, such as identifying an improvement opportunity and developing a solution to an unfamiliar problem. Operators had significant knowledge about problems in the operational processes, and this slack knowledge helped them in identifying problems. In addition, operators often were aware of solutions for problems and they could well judge if solutions were appropriate or not, thus their slack knowledge also helped them with the development of solutions.

Hypothesis 11: Improvement tasks that differ from operational tasks are less likely to be problematic if the team has slack in the operational configuration that can be used to perform the tasks.
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The research highlighted several reasons why the team members have slack capabilities they can use to perform improvement tasks:

- **While performing operational tasks, team members gain slack knowledge.** One reason for the existence of slack was that while people perform operational activities, they gain a lot of experience about the operational processes and they can use this experience to perform improvement activities; in this way, automatically, slack knowledge on the operational process emerges. For example, people learn which problems exist in the operational process. This slack knowledge is not needed to perform the operational tasks, but it can be very helpful with several improvement tasks. Table 6-21 showed that the experience gained by the team members in the operational processes was very relevant with the identification of improvement opportunities, the development of solutions for unfamiliar problems, and the evaluation of changed situations. Further, the experience of the team members was somewhat less relevant, but still important, with writing a report, initiating tasks, analysing unfamiliar information, and communicating within the team.

  **Hypothesis 12:** While performing operational tasks, team members gain slack knowledge that can be used to perform improvement tasks that differ from operational tasks.

- **Another reason that problems did not appear in the improvement processes was that the team members were very committed to perform a task, and therefore they were able to perform it without problems.** In these cases, it can be said that the high commitment of the team members helped them to release slack knowledge and capabilities that would otherwise not have been used.

  **Hypothesis 13:** If team members are very committed, they are more willing to use their slack capabilities to perform improvement tasks that differ from operational tasks.

- **Another reason that a team can perform improvement processes is that the different team members have different capabilities and, combining these, the team has extra capabilities to perform the improvement process.** Problems were prevented because individual people have more capabilities than they need to perform their operational tasks. There was slack in the capabilities of the people that could be used within the team to perform improvement tasks. Often, each team member has only a few extra capabilities, and an individual was therefore not able to perform the whole improvement process. Other team members were needed with additional capabilities. Together, a team could have the capabilities needed to perform a complete improvement process. In this sense, the concept of problem solving by group seemed to be an effective way to combine the different slack capabilities of the individual team members to perform a complete improvement process. Table 6-21 shows that the extra capabilities of individual team members were relevant in developing a solution to an unfamiliar problem, communicating with people outside of the team, and with writing a report.
Hypothesis 14: By problem solving as a group, the different slack capabilities of the individual team members are combined and the team has more capabilities to perform improvement tasks that differ from the operational tasks than the individual team members have.

- Another reason that people are able to perform improvement tasks is that slack is developed during earlier improvement processes. In several cases, experience with other improvement processes facilitated further improvement activities. These experiences are slack in terms of the operational processes, but they facilitate improvement tasks. For example, people learned about problems during initial improvement processes, which facilitated the identification of problems in later improvement processes. In several cases, the development of a solution and communication with people outside of the team were also facilitated by experiences in earlier improvement processes.

Hypothesis 15: While performing improvement tasks, team members gain slack knowledge that can be used to perform improvement tasks in later improvement processes that differ from operational tasks.

- Further, several improvement tasks were not problematic because they were rather simple to perform. These tasks differed from operational tasks, but they were so simple that no functional conflicts emerged. The team members had sufficient capabilities to perform these slightly different tasks, thus also with these tasks there was slack in the operational configuration that could be used to perform the improvement tasks.

**Help of the coach**

Alongside slack, the help of the coach also prevented problems with improvement tasks that differed from operational tasks. In many cases the coach performed some of the required improvement tasks. The team members performed the operational tasks while the coach performed some of the improvement tasks. Thus, in these cases two different organisations existed: one with the team members to perform the activities in the operational process, and one with the coach to perform the activities of the improvement process. Each process has its own configuration and each configuration fits a specific process. One group of people no longer performs both the operational and improvement processes; a differentiated design has emerged. This situation was also discussed as part of the theoretical framework in the second chapter; it is the situation of configurational equifinality with a differentiated design, as shown in Figure 6-1.

Table 6-21 highlights the importance of the coach in avoiding problems with improvement activities. Apart from in the identification of improvement opportunities, the development of solutions, and the initiation of tasks, the help of the coach was very relevant with all the other
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improvement tasks. Coaches performed many improvement tasks themselves, or they assisted the teams with the tasks. This help of the coach was important often in preventing problems with improvement tasks that differed from operational tasks.

**Improvement tasks that differed from the operational tasks were not problematic because the coach helped the team members.**

Hypothesis 16: Improvement tasks that differ from operational tasks are less likely to be problematic if the coach helps the team with the tasks.

**The use of tools**

Another reason that problems did not appear with the improvement tasks that differed from the operational tasks is that, in the improvement process, tools were used. Improvement tools are a resource that can be used in the improvement process; examples being brainstorming sessions, diagrams, and methods to structure causes and effects. These improvement tools contain knowledge on performing improvement tasks. By using these tools, this knowledge is transferred into the improvement process and it is added to the existing knowledge of the team. In this way, tools enlarge the existing knowledge of the people and can thus facilitate the tasks performed by the team. Because tools are used, the demands placed upon the team members might be less and, consequently, the demands of the two different configurations might become less conflicting. The research showed, for example, that the team members had to decide on which problem to focus. In the operational process, the team members do not have to make such decisions and therefore problems might be expected. However, one team used yardsticks to rank problems and because of this, it becomes very easy for them to select a problem and therefore the activity was not problematic.

Table 6-21 and Table 6-24 show that in the identification of improvement opportunities, the analysis of unfamiliar information, and the decision to focus on one problem, the use of tools prevented problems. To identify improvement opportunities, brainstorming sessions were used. To analyse problems, fishbone diagrams were mainly used. With a the fishbone diagram, the influences of several factors on the problem are analysed, for example the influences of the people, the resources, and the work methods. To decide on which problems to focus, scores were given to each problem by a team. This was based on the importance of the problem, the possibility to solve it within the team, and the possibility of solving it quickly. The problems with the highest score were selected to be the first to be solved.

**Improvement tasks that differed from the operational tasks were not problematic because teams used tools.**

Hypothesis 17: Improvement tasks that differ from operational tasks are less likely to be problematic if tools are used to facilitate the tasks.
6.2.6. Reasons for problems not arising with corresponding tasks

Corresponding tasks

Table 6-21 shows that most of the corresponding tasks were not problematic. The major reason that problems did not appear was that the tasks corresponded with operational tasks and therefore the team members were well able to perform them. When team members were able to perform the improvement tasks, in most cases problems did not appear. An exception must be made for the tasks that were problematic due to the general reasons discussed earlier. Most tasks that corresponded to operational tasks, and that were performed successfully in the operational processes, were not problematic in the improvement processes.

Hypothesis 18: Improvement tasks that correspond with operational tasks are not likely to be problematic if the corresponding operational task is not problematic and none of the general reasons for problems exists.

Help of coach, and specific reasons for communication

Table 6-21 shows that when imported misfits exist with tasks, i.e. when tasks were already problematic in the operational process, specific reasons exist as to why the task is not problematic. In the companies researched, imported misfits existed with communication tasks. However, these tasks were not problematic on every occasion that they were performed; in several cases where communication tasks were carried out, problems did not arise because additional reasons prevented problems. This suggests that improvement tasks that correspond with problematic operational tasks do not need to be problematic; as with tasks that differ from the operational tasks, several different factors can prevent problems. In some cases, the help of the coach prevented problems in that he performed the communication activity. The research indicated that coaches cannot overcome the lack of priority given to communication between the team and their supervisor by the team members, but they can decrease the problems that appear in the communication by communicating with the supervisors themselves. This might not only be relevant to communication tasks, but also to other tasks that are problematic in the operational processes. However, in the companies researched, no other misfits apart from communicational misfits were imported, and thus the research cannot lead to further comment. Additional research is needed to examine this point.

Hypothesis 19: Communication between a team and its supervisor is less likely to be problematic due to imported misfits if the coach performs the task.

In some cases, problems were prevented because the team members explicitly asked their supervisor to explain something to them, or because the supervisor attended a team meeting. In these cases, communication channels were created deliberately for the specific communication task that had to be performed. This shows that communication problems can be prevented by deliberately shaping communication channels, that is by correcting existing misfits. In other cases, problems in communicating with a supervisor were avoided because the required communication took place by coincidence when a supervisor fell into a discussion with the team members about the problem. Thus problems in improvement tasks
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that correspond with problematic operational tasks can be prevented by coincidence; that is
the misfits are corrected by chance.

Hypothesis 20: Communication between the team and the supervisor is less likely to be
problematic if communication channels are deliberately or coincidentally created.

Hypothesis 21: Improvement tasks that correspond with problematic operational tasks are
less likely to be problematic if the existing misfits are deliberately or coincidentally
corrected.

The main research problem was: To what extent do differences and correspondences between
operational and improvement processes explain the problems that arose, or did not arise, with
improvement processes by improvement teams? In the preceding sections, the reasons that
were found in this research for problems occurring or not with improvement tasks have been
discussed in depth. The next section analyses the consequences of problems in improvement
tasks and activities on complete improvement processes.

6.3. Analysis of the problems in the complete improvement process

In the preceding sections, most attention was given to problems with improvement activities
and tasks. However, not all problematic improvement activities have to result in a failure of a
complete improvement process. In many cases, problematic activities were corrected later, or
their influence on the complete process was only limited. In these cases the problematic
activities did not result in a failure of the whole process. In this section, the consequences of
problematic activities for the whole improvement process are discussed. Because the major
research questions are about problems with improvement activities, and not about problems
with improvement processes, the analyses in this section are limited.

In the research, 73 improvement processes were examined. Of these processes, 34% were not successful (25 processes) and in the other 66% of the processes, the proposed improvement was (mostly) realised (48 processes). These results are summarised in Table 6-25.

<table>
<thead>
<tr>
<th>Problematic</th>
<th>Not problematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>33%</td>
<td>67%</td>
</tr>
</tbody>
</table>

Table 6-25: Total number of processes
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If an improvement process was not successful, then at least one of the improvement activities was problematic. Table 6-26 shows how often each activity caused the failure of the whole improvement process. The table also shows how often team members performed the problematic activity and how often people outside of the team performed it. The table shows that two activities were important causes of failures in the improvement processes: the development of a solution by the team, and the implementation of the solution by people external to the team. These activities are discussed below.

Table 6-27 lists the activities performed by the team members which caused the failure of whole improvement processes. It shows the tasks that had to be performed in these activities, and the major reasons for the problems.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Task</th>
<th>Cause of problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify a problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyse the problem</td>
<td>Analyse unfamiliar information</td>
<td>Functional conflict</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>Develop solution to unfamiliar problem</td>
<td>Hard to develop solution</td>
</tr>
<tr>
<td></td>
<td>Develop solution to unfamiliar problem</td>
<td>Hard to develop solution</td>
</tr>
<tr>
<td></td>
<td>Develop solution to unfamiliar problem</td>
<td>Team was not motivated</td>
</tr>
<tr>
<td></td>
<td>Develop solution to unfamiliar problem</td>
<td>Team was not motivated</td>
</tr>
<tr>
<td></td>
<td>Initiate tasks</td>
<td>Functional conflict</td>
</tr>
<tr>
<td></td>
<td>Initiate tasks</td>
<td>Functional conflict</td>
</tr>
<tr>
<td>Test the solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorise the solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implement the solution</td>
<td>Initiate tasks</td>
<td>Functional conflict</td>
</tr>
<tr>
<td></td>
<td>Initiate tasks</td>
<td>Functional conflict</td>
</tr>
<tr>
<td>Standardise the solution</td>
<td>Register problems or process information</td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>Register problems or process information</td>
<td>People did not perform task</td>
</tr>
<tr>
<td>Evaluate the solution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6-26: Number of times an activity caused the failure of the whole improvement processes (N=73).

Table 6-27: Activities performed by the team members that resulted in a failure of a complete improvement process (12 processes out of 73 failed because of activities by team members).

The table shows that there were two reasons for problems with the processes: (1) functional conflicts because people had to initiate tasks or analyse unfamiliar information, and (2) the

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15 The total number of problems in the table is not exactly the same as the total number of problematic processes, because in one case, two activities caused the failure of a process. In that case, someone outside the team did not authorise the solution, and the team did not develop an alternative solution afterwards, thus the authorisation of the solution as well as the development of the solution were problematic.
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fact that it was simply very hard in several cases to find a solution to a problem. In the latter cases, the real cause of the problem could not be identified; it was not always clear why a team could not find a solution.

Problems in improvement processes due to activities performed by the team members arose mainly because of functional conflicts in initiating tasks and analysing information, and because it was sometimes very hard to find a satisfying solution to a problem.

Table 6-28 shows the causes of the problems with activities performed by people outside of the team.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cause of problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify a problem</td>
<td></td>
</tr>
<tr>
<td>Analyse the problem</td>
<td>People did not perform task</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>No satisfactory solution could be developed</td>
</tr>
<tr>
<td></td>
<td>No satisfactory solution could be developed</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td>Test the solution</td>
<td></td>
</tr>
<tr>
<td>Authorise the solution</td>
<td>It was a long time before a solution was authorised</td>
</tr>
<tr>
<td></td>
<td>It was a long time before a solution was authorised</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>People did not perform task (people from another department, supervisor, co-ordinator, supplier).</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>People did not perform task</td>
</tr>
<tr>
<td></td>
<td>Tools that were needed did not arrive.</td>
</tr>
<tr>
<td>Standardise the solution</td>
<td></td>
</tr>
<tr>
<td>Evaluate the solution</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-28: Overview of the activities performed by people outside of the team that resulted in a failure of the whole improvement process (14 processes out of 73 failed because of activities by people outside of the team).

The table shows that a major cause of the problems with activities performed by people outside of the team was that people did not perform the required activities. Problems with people outside of teams not implementing solutions are not unique to improvement teams. In the quality circles used in the Western world during the 1970s and 1980s, these problems also appeared (Lawler, 1985; Hill, 1991). Apparently, the improvement teams of the 1990s still lack mechanisms to solve these problems. In the next chapter, some reasons for this are suggested.

Problems with improvement processes due to activities performed by people outside of the team arose mainly because people outside of the team did not perform the required tasks.
6.4. Summary and conclusion

The main problem of this research is: To what extent do differences and correspondences between operational and improvement processes explain the problems that arose, or not arise, with improvement processes by improvement teams? When operationalising the major research questions, it was decided to focus on the influence of correspondences and differences in the improvement activities that were performed, rather than on the improvement processes. In this chapter, the major reasons for problems or otherwise in all the improvement tasks were presented. The research indicated that some relationships exist between problems that arise, and the differences and correspondences with the operational tasks:

- The research findings show some general reasons for problems: they occur in both operational and improvement tasks. These reasons were relevant in 15 of the 63 problematic improvement tasks performed by the teams. One general reason for problems with improvement tasks was that the problem disappeared because it was solved by activities outside of the improvement process. Another reason for problems is that team members were not motivated to perform the required tasks. A further reason for problems was that people forget to perform the required tasks. This illustrates that not all problems that appear in improvement processes by improvement teams are related to the correspondences and differences between the operational and the improvement tasks. Some types of problems appear with improvement tasks, irrespective of the difference or correspondence with operational tasks. The research also showed that these general reasons for problems occurred only in a very few improvement tasks.

- The research showed that several tasks that differ from the operational tasks are problematic. This group contained 58 tasks (10% of the improvement tasks performed by the team, see Figure 6-2). For most of these tasks (51 of the 58 tasks), there was no general reason for the problems that appeared; there were different reasons for the problems. The main reason for the problems was that functional conflicts existed. However, there were other reasons for the problems; although these appeared far less often than functional conflicts. One other reason for problems was that it was simply very difficult to develop a solution in several cases. Another reason for problems was that the operational tasks had higher priority and therefore improvement tasks that had to be performed outside the team meetings were delayed.

- Improvement tasks that corresponded with the operational tasks could also be problematic. This group contained 15 tasks (3% of the improvement tasks performed by the team, see Figure 6-2). In about half of these tasks (7 of the 15 tasks), no general reason
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for problems appeared to exist; another reason for the problems was applicable. One reason for such problems was identified: imported misfits. In the operational configuration, misfits already exist, and these misfits are imported into the improvement configuration. Consequently, improvement tasks that correspond with these operational tasks are also problematic. In this research, imported misfits arose only in communication between a team and its supervisor. The number of times that imported misfits arose were very limited.

- Many improvement tasks that differed from the operational tasks were not problematic. This group contained 339 tasks (68 % of the improvement tasks performed by the team, see Figure 6-2). Several reasons for the lack of problems existed. One important reason was that there was slack in the operational configuration, that could be used to perform improvement tasks successfully. Another important reason that problems did not appear was the help of the coach with the improvement tasks, often coaches performed many activities themselves. Further, the use of improvement tools sometimes prevented problems.

- Most improvement tasks that corresponded with operational tasks were not problematic. This group contained 114 tasks (19% of the improvement tasks performed by the team, see Figure 6-2). The major reason that problems did not appear was that the improvement tasks corresponded with the operational tasks, and thus the team members were well able to perform them. However, this was not the only reason that problems did not appear. With communication tasks, problems were prevented by the help of the coach and the fact that communication was deliberately organised or that it took place by coincidence. These reasons also avoided problems arising with tasks that were problematic in the operational configuration; they prevented imported misfits causing problems with the improvement tasks.

The research shows that the correspondence or difference between operational and improvement tasks is relevant in explaining improvement processes. However, it is not possible to argue that improvement tasks that differ from the operational tasks will be problematic, while corresponding tasks will not. The relationships between the difference or correspondence, and the problems that appear, are somewhat more complicated:

- The research shows that most improvement tasks that corresponded with operational tasks were not problematic; if they were problematic, then there was a clear reason for the problems: the corresponding operational tasks were also problematic, or a more general reason for the problems existed.

- The research also showed that problematic improvement tasks could be explained by their difference to operational tasks, or by their correspondence with problematic operational tasks, or by a more general reason for problems.

The research also failed to find evidence of suggested relationships:
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- It was not found that non-problematic improvement tasks always correspond with operational tasks; the research showed that many improvement tasks that were not problematic differed from the operational tasks.

- It cannot be argued that improvement tasks that differ from the operational tasks are always problematic. In these tasks, problems were often avoided due to specific reasons, for example the help of a coach or the use of tools.

- In addition, it also cannot be argued that improvement tasks that correspond with problematic operational tasks will always be problematic. The research showed that some of these improvement tasks were not problematic, because specific reasons prevented problems, for example because of the help of the coach.

The major relationships supported by the research are shown in Figure 6-3. The research also highlighted three more general reasons for problems: people are not motivated to perform a task, they forget to perform a task, or the problems disappeared. These reasons for problems appeared in both corresponding and differing improvement tasks; they are not incorporated in the figure. It is important to recall that the research also showed that many improvement activities that were problematic did not result in problems with the improvement process as a whole. In addition, the research also showed that it is not sufficient to examine only the differences and correspondences between the operational tasks and the improvement tasks, more things are relevant. Insights into fit that were developed in the second chapter, by using the process model, were highly useful in explaining what is going on with improvement processes by improvement teams. The research showed that the process model was very satisfactory in explaining why improvement tasks that differed from operational tasks were not problematic. Based on insights from the process model, it can be argued that slack, the help of the coach, and the use of tools were relevant in preventing problems.

The next chapter reflects on the findings that were discussed in this chapter; it will explain some of the findings of the research in more depth.
Chapter 7: Discussion of the major findings

The solutions all are simple – after you have arrived at them. But they’re simple only when you know already what they are (Zen and the art of motorcycle maintenance, Pirsig, Pp. 290-291).

This chapter reflects upon the findings discussed in the preceding chapters. In the preceding chapter, it was analysed whether correspondences and differences between the operational and the improvement tasks of improvement teams could explain why improvement activities were problematic or not. This chapter discusses the findings of the previous chapter in more depth, and relationships with the context in which the improvement teams were introduced are suggested. Further, the chapter briefly discusses findings on activities performed by people external to the team. The chapter ends with a reflection upon the overall research and suggested directions for further research.

7.1. Discussion of reasons for problems

In this section, several reasons for problems that were analysed in the previous chapter are discussed in more depth.

7.1.1. The concept of functional conflict

When the degree of functional conflict is high, achieving one function must come at the expense of not achieving another (Gresov and Drazin, 1997). When functional conflicts exist, two different functions cannot be realised by one configuration. Translated to the situation of operational and improvement processes, functional conflicts imply that one group of people cannot perform both the operational and the improvement tasks; performing operational tasks is at the expense of performing improvement tasks. In this research, the concept of functional conflicts was introduced as a possible explanation for the problems that arose with improvement processes by improvement teams and it was investigated whether the concept was relevant in practice. The research indicated that functional conflicts are an important explanation for the problems that appeared with improvement tasks that differed from the operational tasks, although other reasons for problems also existed. One of the contributions of this research has been that the concept of functional conflicts was described and applied to improvement teams.

However, some comments on the concept of functional conflicts can also be made. Where functional conflicts arise, operational and improvement tasks differ from each other, they require different characteristics of the people. People are not able to perform both tasks and consequently problems arise in performing the improvement task. Thus, functional conflicts between operational and improvement tasks are not the same as differences between the two tasks. Functional conflicts only arise if a difference exists which results into problems with the tasks. This makes the whole concept of functional conflicts somewhat difficult to use. Functional conflicts can only be detected after a task has been performed because, for a
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Functional conflict to exist, the task must differ from the operational task and be problematic. Only after a task has been performed, can it be detected if it was problematic. If a task differed and it was problematic and no other obvious reasons for the problems were clear, then apparently functional conflicts existed. In first instance the concept of functional conflicts might seem a very useful theoretical construct. However, if the above points are considered, then the usefulness of the concept becomes somewhat questionable. A functional conflict can only be detected after a task has been performed, and then nothing more is known than that the task differed and was problematic, which was already well known by that time. Thus, the concept of functional conflict that was developed, based on the ideas of Gresov and Drazin, was little more than a theoretical label that could be used to classify a phenomenon.

However, it might also be argued that the start of the development of new theories is often a proper identification and classification of phenomena. In this regard, the insights into the concept of functional conflict might not be considered disappointing at all: a new theoretical phenomenon was developed, and the research indicated that the concept was also relevant in practice. In addition, the research provided several other insights into functional conflicts that seem to be useful. An interesting finding from the research was that many differences between tasks do not lead to problems or conflicts. This indicates that functional conflicts do not have to occur with all improvement tasks that differ from operational tasks; it also indicates how they might be prevented. The research showed, for example, that the help of the coach and the use of slack prevented many problems with improvement tasks that differed from the operational tasks. However, although this research gave several insights into functional conflicts between tasks performed by improvement teams, many questions cannot be answered at this stage of theory development. It cannot, for example, be predicted in advance whether differences between tasks will lead to problems. This research only makes some first steps in the development of a theory on functional conflicts in improvement processes by improvement teams. Additional research is needed to further develop such a theory and to answer the remaining questions.

7.1.2. Problems disappeared

The research showed that some improvement tasks were problematic because the problem was already solved in performing another task, or during another improvement process. That problems are solved before improvement activities are performed indicates that problems are not only solved in a single improvement process by a team. Improvements are sometimes also realised as a side effect of other improvement processes. In that case the different improvement processes are not independent. Further, a team sometimes plans several different actions to solve a single problem. If the problem is solved by one set of the actions, then the others might not be needed. In addition other people, such as the supervisor of a department, also know about some common problems and they might perform activities that solve the problems. Thus, external to one specific improvement process, other improvement activities may be going on and these activities can influence the activities in the improvement processes of the teams. It is
important to consider improvement activities going on outside of improvement processes to be able to understand improvement processes.

7.1.3. Operational tasks get more priority

In initiating tasks, problems arose because the improvement tasks could not be performed during the team meeting, and outside of the team meeting the operational tasks got more priority. During this research these problems did not arise with improvement tasks that corresponded with operational tasks. A reason for this might be that if tasks corresponded with the operational tasks, and they had to be performed outside the team meetings, that they could be performed easily during the operational processes with which they corresponded. This happened with some tasks in practice, for example in testing a solution on a machine; these tests could be performed during the operational processes. However, if tasks differed from the operational tasks, time must be found for them during the operational processes and this requires more effort and thus problems are more likely to appear. Thus, problems might be less likely with tasks that have to be performed outside the team meetings and that correspond with the operational tasks compared with tasks that differ from the operational tasks.

: Improvement tasks that have to be performed outside the team meeting and correspond with operational tasks will be less frequently problematic than improvement tasks that have to be performed outside the team meeting and differ from operational tasks.

Team meetings appear to be an important facilitator for performing improvement tasks that differ from operational tasks, especially where operational tasks get a high priority. During team meetings, the improvement tasks receive top priority, and they will not be overruled by operational tasks. However, outside of team meetings, operational tasks get priority and improvement tasks may be neglected. This shows the importance of regular team meetings where the team has time to carry out improvement tasks that differ from operational tasks. If such meetings do not occur, it is likely that the operational tasks will take priority and improvement tasks will be neglected.

: Team meetings are likely to facilitate people in making time to perform improvement tasks that differ from operational tasks.

The research also showed that not all improvement tasks can be performed during team meetings. For example, people have to perform tests on a machine, or they have to ask for information from others; such tasks often had to be performed by one of the team members outside of the team meeting. It could be suggested that improvement tasks that cannot be performed during a team meeting, and that differ from the operational tasks, will be more often problematic than other improvement tasks. During this research, no explicit distinction was made between improvement tasks that were performed during team meetings, and tasks that were performed outside of team meetings. Therefore, the research cannot much insight into this, and additional research is needed to examine it. Based on this research only hypotheses can be formulated.

: Improvement tasks that differ from operational tasks, and have to be performed outside of the team meetings will be more often problematic than improvement tasks that differ from operational tasks but that can be performed during a team meeting.
7.1.4. Imported misfit: problems with communication between team and supervisor

Imported misfits were relevant to the communication problems between teams and supervisors (asking the supervisor to do things, team informs the supervisor, and supervisor informs team); these tasks were also problematic in the operational configuration. One reason for the communication problems might be that the link between the teams and the supervisors was deliberately chosen to be not too close in the companies studied. Management, and the coordinators of the teams, were afraid that if the supervisors became too close to the teams, the team members would not feel free to discuss ideas and explore solutions. They feared that the supervisors would be too dominant if they became part of the team. However, in practice, the opposite occurred; the supervisors were not sufficiently involved in the teams, and communication problems between the teams and their supervisors arose.

Another reason for the lack of communication might be that the people in the operational processes are very much focussed on the efficiency of the operational process. People in the companies seemed to regard time spent on supportive activities as less useful than performing operational tasks. Often, they saw performing operational activities as their ‘real work’ and they felt more comfortable when they were performing operational activities than when they were communicating, for example with their supervisor. Consequently, they tended to put less effort into communication. The practical consequences were that regular meetings were frequently interrupted by operational problems, they become less regular, and finally they were only held if urgent problems arose. Consequently, communication only concerned urgent subjects, and communication about less urgent subjects took place infrequently. This problem, of a lack of communication, is imported from the operational configuration into the improvement configuration, because the same people perform both the operational and the improvement tasks. In both configurations these people pay little attention to communication.

Thus, problems in communication between the teams and their supervisors arise because (1) the link between the teams and their supervisor is deliberately kept wide, and (2) people in the organisations give more priority to performing operational tasks than to communicating about non-urgent matters. The major reasons for the communication problems are thus related to structural and cultural characteristics of the organisations studied in the research. A structural characteristic is the decision to make the link between the team and their supervisor not too close. A cultural characteristic is that people give priority to operational tasks\(^\text{16}\). The research indicates that a combination of structural and cultural characteristics of the organisation explains the problems in communication between the team and their supervisor. It might be suggested that if the structure, or the culture, had been different, then the problems would have been less. For example, even if people give low priority to communication, a good structure for communication may reduce the number of problems that arise. Alternatively, if people give priority to communication, but only a weak structure exists, problems may also not arise.

\(^{16}\) This cultural characteristic might have been influenced by other structural characteristics, like the way people are rewarded or the way the operational performance is measured. However, such an examination goes too far for this discussion.
However, in practice the structural and cultural characteristics combined with each other and this increased the communication problems.

*If team members give more priority to performing their operational tasks, than to communicating about less urgent subjects with their supervisor, and there is no good structure for communication, then communication is likely to be problematic in the improvement processes.*

The research showed that improvement tasks that corresponded with problematic operational tasks (such as communication with the supervisor) can also be problematic. In this way, the research showed that in order to explain the problems in improvement tasks, it is necessary to examine whether operational tasks are problematic. It is important to recall that, in this research, it was not explicitly determined whether problems existed in the operational processes. It was assumed that the operational tasks were not problematic (as was argued in chapter 3). The research findings suggest that this assumption was incorrect; problems in the operational process did exist, and they were relevant in explaining the problems with the improvement tasks. This was discovered during the research when problems with improvement tasks that corresponded with operational tasks were identified. It was then explored how such problems could arise. During discussions with people from the organisations taking part in the research, it was found out that these problems also existed with the operational tasks. However, the fit to the operational processes was not extensively examined because the relevance of this fit was not found until the research was well underway, when it was too late to include it. Therefore, the findings of this research are only tentative. Additional research is needed to explore the fit to the operational processes and its relevance to improvement tasks in much more depth.

### 7.1.5. Problematic activities performed by people external to the team

In the research, most attention was paid to the improvement tasks performed by improvement teams. However, the research findings also indicated that 23% of the improvement tasks were performed by people outside of the team. Further, the research also indicated that several problems in improvement processes were caused by the activities performed by these people (see the previous chapter). In this section, the problematic activities as performed by people outside of the team are discussed. Because the major research questions concern improvement tasks performed by improvement teams, the discussion in this section is relatively short.

Table 7-1 shows the number of (problematic) activities performed by the teams and by people outside of the team. The table shows that the activities performed by people outside of the team are relatively more often problematic than activities performed by the team. In addition, the activities

<table>
<thead>
<tr>
<th>Activities performed</th>
<th>Team</th>
<th>People outside team</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of activities</td>
<td>586</td>
<td>149</td>
<td>735</td>
</tr>
<tr>
<td>Problematic activities</td>
<td>73</td>
<td>41</td>
<td>114</td>
</tr>
<tr>
<td>related to total number</td>
<td>12%</td>
<td>28%</td>
<td>16%</td>
</tr>
<tr>
<td>Result in failure of process</td>
<td>12</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>related to total number</td>
<td>2%</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>related to problematic act.</td>
<td>16%</td>
<td>34%</td>
<td>22%</td>
</tr>
</tbody>
</table>

*Table 7-1: Problematic activities performed by the team and by people outside of the team.*
performed by people outside of the team more often result in a failure of the complete improvement process. Some explanations of these observations are suggested below.

An explanation for the relatively large number of problematic activities might be that the teams are supposed to perform most improvement activities themselves, and only if teams face activities that are too difficult for them, do they ask people outside of the team to perform them. The teams themselves will therefore always perform the relatively easy activities while people outside of the team only have to perform activities that are too difficult for the team. Thus, the people outside of the team perform relatively more difficult activities, and it is likely that relatively more of these will be problematic.

: People outside of the team perform more difficult activities than the team members.

Another explanation for the relatively large number of problems with activities performed by people outside of the team is that communication problems arose between the team and people outside of the team. Often people outside of the team did not hear about the improvement process until the team asked them to do something. In many cases this was the only connection they had with the improvement process; they did not attend the team meetings, nor did they get the team reports. If the team members did not ask them again, they were not reminded about the things that they had to do, and because they had many other things to do they quickly forgot about the tasks. Further, if nobody asked about the activity, the people outside of the team assumed that the priority was not that high. Consequently the activity was not performed, and in several cases, the improvement was never realised. Thus, activities performed by people outside of the team were relatively often problematic, due to communication problems between the team and the people outside of the team. The team members did not remind the people outside of the team of the activities they had to perform and consequently the people outside of the team did not perform the required activities.

: Improvement activities performed by people outside of the team are likely to be problematic if the team does not remind them about the activities they have to perform.

One reason for the communication problems was a lack of good structural mechanisms for organising the required communication. The companies had as a goal that the teams should be able to solve problems without much additional help. Consequently, the teams tended to work rather independently of the rest of the organisation on problem solving; the connections with the rest of the organisation were loose. In many improvement processes, no links with other parts of the organisation were directly needed to successfully perform the improvement activities. However, when people outside of the team had to become involved in an improvement process, closer connections were needed. The teams lacked structural mechanisms to co-ordinate these temporarily closer connections and consequently communication problems arose.

: It is likely that a team will not remind people outside of the team about the activities they have to perform if a good structure for communication with people outside of the team does not exist.

The research showed that communication between the supervisors and the teams was also problematic; reasons for these problems were the absence of a good structure for this communication, and a culture where communication received little attention. The preceding
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section showed that the lack of a good communication structure was also a reason for the problems with tasks performed by people outside of the team. The culture is also an explanation for the problems with communication between the team and the people outside of the team. People give more attention to performing their operational tasks than to communication with people outside of the team, and hence communication problems arise.

: It is likely that a team will not remind people outside of the team about the activities they have to perform if the team gives more priority to performing operational tasks than to communicating with people outside of the team.

An additional reason for the communication problems is the difference in hierarchical level between the team members and the people outside of the team who had to perform activities for them. Often the people who had to perform activities were higher up in the organisational hierarchy than the team members. If these people did not perform an activity, the team members hesitated before asking a senior person about it. Several coaches identified the communication problems, and they tried to convince the team members that they should remind others about the things they had to do. However, the team members then decided it was not their task to do this. In several cases they even became demotivated to work on improvements any more, because they concluded that if others, who were higher in the hierarchy, 'were not doing anything, why should we then work so hard to realise improvements'. Thus, the lack of structural co-ordination was not corrected by informal actions because the team members were not motivated to put much effort into this co-ordination. They were not motivated because they regarded it a failure of others that they did not do the things they promised to do, and they did not feel responsible for correcting the failures of people higher in the hierarchy. Consequently, communication problems arose, which resulted in serious problems in the improvement processes.

: It is likely that the team will not remind people outside of the team about the activities they have to perform if the team feels that it is not their task to remind people higher in the organisational hierarchy about activities they have to perform.

The research showed that problematic activities performed by people outside of the team resulted more often in a failure of the whole improvement process than problematic activities performed by the teams themselves. A major reason for this might be that a higher proportion of the activities that had to be performed by people outside of the team were critical to the whole improvement process. People outside of the team had to frequently authorise or implement solutions. If these activities failed, the whole process failed. Another reason for the relatively large number of problems in the whole improvement process might be that the team members were not motivated to correct problematic activities performed by people outside of the team. It has been shown that many problematic improvement activities did not result in problems in the overall improvement process, because many problematic activities were corrected later in the process. For example, if a solution could not be implemented by a team, they would search for another solution and implement this one; than the whole improvement process did not fail because of the problems with the implementation of the first solution. However, when people outside of the team had problems in performing an activity, the team was less motivated to correct these problems. They regarded the problems as the responsibility
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of someone else, especially if this person was higher in the organisational hierarchy. Because the team members were not motivated to correct the problematic activity, no other improvement activities were performed and the whole process failed.

Problematic improvement activities performed by people outside of the team are likely to result in problems with the overall improvement process if the team members are not motivated to correct such activities.

The research has shown that the improvement teams heavily influence the improvement activities carried out by people outside of the team. The motivation of the team members to communicate with outsiders, and their motivation to correct problematic improvement activities, influences the problems that arise with the activities performed by people outside of the team. Especially the interaction or communication between the team and the people outside of the team seems to be very influential on the success or otherwise of the activities performed by the people outside of the team. It could be suggested that functional conflicts are relevant in explaining the problems with the interaction between the teams and the people outside of the team. The team members do not have to ask people senior in the hierarchy to do something for them in their operational work, and they do not have to correct the problematic activities of these people. However, during their improvement work, the team members have to ask others to do such things or correct their activities, and then problems arise. Thus, the difference between the operational and the improvement tasks might be relevant in explaining these problems. It is important to recall that, in this research, the focus was on the activities performed by the team members. The activities performed by the people outside of the team were not examined in depth, and additional research is needed to examine the influence of the team members on the problems that arose with these activities, and the importance of functional conflicts in these activities. Based on this research, only tentative hypotheses can be formulated.

7.1.6. Conclusions on the reasons for problems

The discussion on the different reasons for problems has shown that, alongside the functional conflicts and general reasons for problems, the structural and cultural characteristics of the organisation are very important in explaining the problems that arise. In the culture of the organisations researched, people tended to give priority to operational tasks; communication was not regarded as very important. The research suggested that if in the culture communication gets little attention, a proper communication structure is very important for the success of improvement activities and processes. The research showed the importance of a good structure for communication between the teams and their supervisors, and between the teams and the people outside of the teams who have to perform improvement activities. The discussion also highlighted the importance of another structural characteristic: people must have time to work on improvement activities, for example during team meetings. If teams do not get adequate time, it is suggested that operational tasks will get higher priority, and problems will arise with improvement tasks, especially with the tasks that cannot easily be performed alongside the operational tasks.
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7.2. Discussion on the reasons for problems not occurring in differing tasks

In this section, attention is given to the varying reasons why problems did not arise with improvement tasks that differed from the operational tasks. These reasons are very relevant for organisations in practice, because they can offer solutions to prevent problems with those improvement tasks that differ from operational tasks and that correspond with problematic operational tasks.

Table 7-2 gives an overview of the different reasons why problems did not appear with improvement tasks that differed from the operational tasks. The table gives, for each reason, the relative importance; it shows how often each reason was relevant for each task in percentage terms. The most frequently performed improvement tasks are mentioned in the first rows of the table. The table gives a good indication of the importance of each reason in preventing problems for each task. The table shows that slack was very important in preventing problems in some tasks that frequently performed. In addition, the table highlights that the help of the coach was very important with almost all tasks. The table also shows the relatively low importance of improvement tools.

<table>
<thead>
<tr>
<th></th>
<th>Appearances of slack in the operational configuration</th>
<th>Use of improvement tools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experience in the operational configuration</td>
<td>High commitment of team</td>
</tr>
<tr>
<td>Identify an improvement opportunity</td>
<td>96</td>
<td>74</td>
</tr>
<tr>
<td>Develop a solution for an unfamiliar problem</td>
<td>69</td>
<td>25</td>
</tr>
<tr>
<td>Communicate with people outside of the team</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Write a report</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>Initiate tasks</td>
<td>22</td>
<td>100</td>
</tr>
<tr>
<td>Analyse unfamiliar information</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Decide to focus on one problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicate within the team</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Position new tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate a changed situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remind the supervisor to do things</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approve a solution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7-2: Differences between the operational and the improvement tasks and the reasons that problems were prevented (in percentages).
The process model that was discussed in the second chapter gave some insights into the reasons why problems might not arise with improvement tasks that differed from operational tasks. The model suggested that problems in improvement activities that differed from operational activities might not occur because of: (1) the use of different tools or arrangements (help of the coach) in the improvement configuration; (2) slack in the operational configuration that can be used to perform improvement activities; (3) lowering the requested improvement function. The first two of these reasons were extensively discussed in the preceding chapter, and they also appear in the table. The third reason has not receive much attention as yet because it could not be measured with the research method used. This third reason, however, might also be very important in preventing problems. Therefore, it is discussed below.

### 7.2.1. Adjusting the improvement function by the teams

In the companies researched, the improvement teams chose which problems they wanted to solve. Thus the teams could select the improvement processes, and they determined the desired improvement function. In this section, the importance of the selection of the improvement functions and processes made by the teams is discussed. The importance of the selection of improvement processes is illustrated by a discussion on the number of times that teams performed improvement activities. This discussion shows that it is likely that the improvement processes selected by the teams was very influential on the number of times that activities were performed. Based on this observation, the consequences of the selection of improvement processes by the teams on the problems that appeared in improvement tasks will be discussed throughout this section.

Chapter 5 analysed how often each improvement activity was performed; a summary of these data is given in Table 7-3. The table shows, for each improvement activity, in how many processes the activity was performed and how often. The table highlights two groups of activities: activities that were often performed and in many processes (printed in bold and italics), and activities that were not often performed and in not many processes (printed in italics).

Chapter 5 indicated that there were specific reasons when the less frequently performed activities were performed. The analysis of the problem was only performed if a solution was not easily found and if the problem was rather complicated. In many cases, solutions were

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number of times that the activity was performed in a process</th>
<th>Total number of times performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the problem</td>
<td>0  57  16</td>
<td>154</td>
</tr>
<tr>
<td>Analyse the problem</td>
<td>56  13  4</td>
<td>27</td>
</tr>
<tr>
<td>Develop a solution</td>
<td>2   31  40</td>
<td>252</td>
</tr>
<tr>
<td>Test the solution</td>
<td>65  7  1</td>
<td>10</td>
</tr>
<tr>
<td>Authorise the solution</td>
<td>51  21  1</td>
<td>21</td>
</tr>
<tr>
<td>Implement the solution</td>
<td>12  48  13</td>
<td>60</td>
</tr>
<tr>
<td>Standardise the solution</td>
<td>64  5  4</td>
<td>47</td>
</tr>
<tr>
<td>Evaluate the solution</td>
<td>61  12  0</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 7-3: Number of times that an activity was performed in an improvement process by the team members (N=586).
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readily available, or easy to develop, and then the problem was not analysed. *Testing a solution* was generally performed only if the team wanted to convince someone who had to authorise the solution, or if the team wanted to see if a solution would work. In many cases, solutions were not tested because the consequences of implementing a solution that was less successful than expected would be minor and the investment was small. The advantages of testing were not expected to outweigh the extra costs. *Authorisation of the solution* took place when the team needed some investment or wanted to change a working method, and someone else had to agree to this, or because the team wanted to inform someone else about the problems they were working on. *Standardisation of the solution* took place when people had to change the way they worked. In many cases, standardisation was not relevant because it occurred automatically after the team had implemented a solution. *Evaluation of the solution* only took place explicitly if the solution did not work well, or if someone other than then the user of the solution (often the coach) wanted to evaluate it. In many cases, no explicit evaluation of the solution took place, because the team members noted during their normal work that the problem had been solved.

This shows that not all the improvement activities were needed to realise an improvement; in many cases only a few activities were performed. Three activities were performed in almost every improvement process; the remainder was only performed to compensate for specific characteristics of the improvement process, for example a complicated problem, or the existence of someone outside the team who had to agree to a solution. An important question is *why* so many improvement activities were performed infrequently. This can be explained by considering the context of the improvement teams in the companies. In both companies, it was an objective that the improvement teams should perform improvement activities as far as possible without additional help. This policy was made to avoid the teams only complaining to others, and not really solving problems themselves. Before the coaches started working with a team, the people were told that they were supposed to focus on problems where they could perform most of the improvement activities themselves. The coaches emphasised this in the first team meeting. Further, the teams had the authority to select the problems they wanted to solve; in other words the teams determined which improvement functions they desired. In the selection of improvements to work on, the coaches greatly assisted the teams. They told the teams to select problems that (1) were important, (2) could be solved quickly, and (3) could be solved (mostly) by the team. Consequently, the teams tended to focus on problems that could be easily solved by themselves; they selected problems that were not very complicated for them to solve. Alongside choosing the improvement function, the teams could also decide *which* activities to perform during the improvement process. Further, they could design parts of the improvement organisation around the processes they performed; they could decide for example, to some extent, which people performed which activities, and which tools were used. Thus, the team also *designed* the improvement processes. This had several consequences for the types of problems that were chosen and the activities that were performed by the team:

- Often problems were chosen where a *solution was immediately at hand*, or where they supposed a solution would be easy to develop. In most cases, it was easy to understand
these problems, and therefore not much analysis of the problem was needed. Because a solution could be developed easily, it was usually not a very complicated solution; testing the solution therefore did not seem necessary. It was possible to judge beforehand if a solution would be appropriate or not.

- In addition problems were chosen which the team members already knew much about; they were local problems in the department of the team members. Solutions to such problems were often also local; they only influenced the operational processes in the department of the team members. Solutions did not influence other parts of the company and their consequences were limited. The risks of implementing a wrong solution were also limited and testing the solution did not seem to be necessary. Because the solutions influenced the operational processes of the team members, they discovered during their daily work if the solution worked or not. No additional explicit evaluation of the solution was needed, and this can explain the limited of evaluation activity.

- Since a solution was rather simple and it often had only local influences, authorisation of the solution was straightforward. Often it was only necessary to discuss the solution with one person outside the team, such as the supervisor or the head of the quality department. Consequently, only a few activities to authorise a solution were performed.

The number of times that activities were performed in the improvement processes gives an indication of the characteristics of many improvement processes. An overview of this is given in Table 7-4.
Discussion of the major findings

<table>
<thead>
<tr>
<th>Improvement activity:</th>
<th>Was performed:</th>
<th>Characteristics of many improvement processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analyse the problem</strong></td>
<td>If the problem was rather complicated and no solution was found</td>
<td>Solutions were obvious, no search for a solution was needed.</td>
</tr>
<tr>
<td><strong>Test the solution</strong></td>
<td>If the team wanted to convince someone who had to authorise the solution. If the team was not sure that a solution would work and the consequences of implementing a wrong solution were large.</td>
<td>No people outside of the team had to be convinced to implement the solution. Consequences of implementation were small and not much investment was needed.</td>
</tr>
<tr>
<td><strong>Authorise the solution</strong></td>
<td>If the team wanted some investment or to change the situation, and someone else had to agree with it. If the team wanted to inform someone about the solution they wanted to implement.</td>
<td>Nobody had to agree with the changed situation. Nobody needed to be informed about the changed situation: change without global impact.</td>
</tr>
<tr>
<td><strong>Standardise the solution</strong></td>
<td>When the team changed the way they worked.</td>
<td>Working methods were not changed, solution was used automatically.</td>
</tr>
<tr>
<td><strong>Evaluate the solution</strong></td>
<td>If the solution did not work well. If the coach wanted to know if a solution worked.</td>
<td>Team members observed during their daily work that solutions worked well Coaches did not want to know if solution worked.</td>
</tr>
</tbody>
</table>

Table 7-4: Relationship between activities that were performed, and characteristics of the improvement processes.

Teams were supposed to solve problems without much additional help. Therefore they focussed on improvement processes where they could perform most of the improvement activities without such help. Such processes were often about rather simple local problems where not many activities were needed to analyse the problem, or to test, authorise, and evaluate the solution. This indicates that the goals which the teams are given (for example: ‘teams must solve problems without additional help’) influence the improvement processes that the teams select and it influences the improvement functions required. This, in turn, influences the improvement activities that are performed.

: The goals which improvement teams are given influence the improvement functions the teams select, and the improvement activities performed by the teams.

: Improvement activities to analyse a problem, test a solution, authorise the solution, and evaluate the solution will not be performed that often if improvement teams are supposed to select problems that can be solved without much additional help.

The discussion in this section has shown that the selection of improvement processes by the teams heavily influences the activities that are performed by the teams. It is probable that this selection influenced more things in the improvement processes than only the activities that were performed. It could also have influenced, for example, the problems that appeared in the different improvement processes. This will be discussed in the following sections.
7.2.2. Slack in the operational configuration

In this section, the exploitation of slack in the operational configuration is discussed in more depth.

Effectiveness of teams in exploiting slack knowledge

The research showed that the existence of slack in the operational configuration facilitated several improvement tasks, for example the identification of problems. Team members have much slack knowledge on operational problems and it can be wondered whether this slack knowledge was exploited before teams were introduced. Experience during the research indicates that, before the teams existed, the slack knowledge of the team members was often not used well since the team members were able to identify some serious operational problems that had not received much attention before. For example, teams began to complain about the problems that arose in their work due to bad inputs. Because of problems with inputs, it took longer to set up machines, more waste was produced, and processes were interrupted. One team started to communicate problems with paper to its supplier. After a while, the paper factory reacted to the complaints. They gave the company financial compensation for the problems with the paper. After some time, the complaints about the paper continued and then the paper factory realised that the problems with their production processes were not occasional incidents; they became conscious that structural problems existed. To solve these problems, they also introduced improvement teams. In several other cases, problems with inputs from other departments within a company were also communicated in a structured way and then the other departments also noticed some structural problems in their processes, and they started to work in a more organised way to solve problems in their departments. By communicating problems in a structured way, the teams started a whole chain of improvements. Often, these problems had existed for a long time, but they were never seriously tackled before. People that were not so close to the operational processes, such as managers and staff specialists, never noticed these operational problems. The teams were very effective in capturing the slack knowledge of the operators about such operational problems. This exploitation of slack knowledge on operational problems was far less effective before the teams existed, and it could be one of the most important contributions of the improvement teams.

Other ways to capture the slack knowledge on operational problems and possible solutions also exist. For example, suggestion boxes also have this as a goal. In the companies researched, suggestion boxes existed, but they were rarely used to communicate operational problems since the improvement teams were a much more effective option. A reason for the effectiveness of the teams in identifying problems might be that the team members were asked personally about problems in the team meetings. Another reason might be that in the team setup the people were given time to explicitly identify and discuss problems, which is not the case with the suggestion box approach.

: Improvement teams are effective in exploiting the slack knowledge of the team members on problems in the operational processes.
To realise improvement processes successfully, the team members’ (slack) knowledge on problems and solutions was often not sufficiently. Other improvement tasks had to be performed, and additional capabilities were needed, for example to communicate both within the team and with people outside of the team. In addition, cognitive capabilities were needed, for example to analyse unfamiliar information, and to structure information and write a report. Slack facilitated these tasks sometimes, because some team members had extra capabilities that could be used by the team to perform these kinds of tasks. However, the research showed that slack facilitated these social and cognitive tasks only to a limited extent. Additional measures were needed to complete these tasks successfully. For example the help of the coach was frequently important in preventing problems.

Slack in the operational configuration is unlikely to prevent problems in all improvement tasks that differ from operational tasks.

The importance of the team members’ slack knowledge on the operational processes suggests that the capabilities of the team members to perform improvement tasks might be limited to problems that are related to their own work environment. Team members might not be able to solve problems that are further from the own operational processes, since then they do not have the slack knowledge about other processes.

It is likely that problem solving in other operational processes than those of the team members will not be facilitated by the slack capabilities of the team members.

The research findings suggest that not all improvement tasks can be facilitated by the slack capabilities of the team members. For example, problems in other operational processes than those of the team members might not be facilitated by it. In addition, the previous chapter showed that problems that require social skills are also difficult for improvement teams; apparently, the existing slack capabilities were not sufficient. To solve these problems, improvement teams might be non-effective, and additional ways of organising incremental improvements are needed. However, the research has shown that teams are very effective in identifying problems; often they identify problems that are not noticed by others. Problems may arise if teams identify problems that they cannot solve themselves, if it is necessary for other parts of the organisation to be aware of these problems. In these cases, the teams must communicate the problems. However, in the organisations researched, the communications between the team and the rest of the organisation were not well structured, because the teams were expected to perform most of the improvement activities themselves. In such cases, the team might fail to communicate the problems they have identified to those who can solve them, and the problems might thus not be solved. To increase the effectiveness of improvement teams, it is important to organise a good communication about problems that the teams have identified but cannot solve.

Organisation-wide problem solving is likely to be facilitated if the team is able to communicate about the problems they have identified but which they cannot solve.

Exploiting slack versus learning and behavioural changes

Several improvement tasks that differed from operational tasks were not problematic, because the team members had gained experience and capabilities during earlier improvement
processes. For example, problems with communicating with people outside of the team were avoided because of experiences gained in earlier improvement processes. However, some elements of communication, such as explaining ideas to others, or convincing others, were not mastered, even after the team had gained some experience from improvement processes. Coaches of several teams noticed this, and several attempts were made to solve the communication problems. One coach gave the team a short course about on how to convince others’. Communication then improved slightly, but problems still appeared. This shows that taking the initiative to communicate is comparatively easy to learn, but learning how to communicate is much harder. The research indicated that team members did not develop these communication skills as they gained more experience from improvement process. In terms of several other improvement tasks, such as analysing unfamiliar information, initiating tasks, and writing reports, it also did not became clear during the research that the team members had developed more capabilities. These activities were not facilitated by experiences from earlier improvement processes (see Table 7-2). One reason for this might be that the team members were more focussed on solving problems, and not on learning problem solving capabilities. The findings indicated that team members did not like doing the tasks they were not good at, and they wanted team members who were better at it, or their coach, to perform them. With this attitude, they did not learn to perform the tasks themselves, and they did not develop their problem solving capabilities. This indicates that improvement teams are a good concept to use existing capabilities of the different team members. Extra capabilities of team members, that are not used in the operational processes, could be effectively used in the team. However, the team concept was not a good one to develop the capabilities of the team members; the learning that took place by the team members was very limited. The research did not show that teams learned sufficient improvement capabilities to perform all the improvement processes; with all the teams, the help of the coaches remained very important. It is important to recall that the research did not examine the changed capabilities of the team members, or their learning in depth. During the research, only indications about this learning were obtained. Additional research is needed to explore the learning in teams in more depth.

: Improvement teams are effective in exploiting the existing capabilities of the team members.
: Improvement teams are not effective in developing improvement capabilities in individuals.

Although the people did not develop many new problem solving capabilities, their behaviour often changed after they had become a member of an improvement team. One significant change was that team members paid more attention to the problems in their daily work. When people started to work in a team, they realised that problems were not a normal thing and that action could be taken. In one team, people started to check products more frequently, and they paid more attention to in-process quality. This change was even noticed by supervisors of other departments. With another team, one of the members made a list of about thirty problems he observed in his daily work. Thus, working in an improvement team started to make workers more conscious of problems during their daily work. Further, they were more conscious that action was needed if a problem existed. This behavioural change took place within a few weeks of the introduction of teams, and several people in the organisations mentioned these changes.
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It is striking that a behavioural change such as this, which is often considered to be very hard to achieve, was not deliberately proposed when the teams were introduced. It was a ‘side effect’ of the introduction of the improvement teams.

: Improvement teams are effective in changing the team members’ behaviour towards problems in the operational processes.

Slack and selection of improvement functions

The research shows that the use of the slack in the operational configuration was important in preventing problems with improvement tasks that differed from operational tasks. A reason for the importance of slack might be that teams were supposed to select improvement processes that they could perform without much help from people outside of the team. The teams were supposed to select problems that they could solve with their existing capabilities; they were supposed to adjust the desired improvement function to their own slack capabilities. The research showed that slack capabilities were important in preventing problems with improvement tasks; it indicated that the teams did indeed adjust the improvement processes to their own slack capabilities. The slack in the teams was especially important in the selection of problems and the development of solutions to problems; teams seemed to select problems where they had the slack knowledge needed to develop a solution to the problem. Thus, the selection of the desired improvement function by the teams might explain why slack the capabilities of the team members were so relevant in preventing problems.

: If improvement teams are supposed to perform most improvement activities without additional help, they are likely to select improvement processes that fit to their own slack capabilities.

The learning by the teams might also be influenced by their selection of improvement processes. If teams can focus on simple improvement processes, they might not be challenged to focus on somewhat less easy processes and learn new improvement capabilities. Considering their aversion to communicating with others, teams might for example focus on processes where they do not have to communicate much. In addition, the fact that the teams were supposed to perform most improvement tasks without additional help might have enforced the selection of simple improvement processes. The teams might have hesitated to select the more complicated problems because they might have been afraid that they would not have been able to solve such problems alone. Thus, the selection of the improvement functions by the team might have resulted in the selection of improvement processes where the existing slack capabilities of the team members could be used well, and where the team members did not have to learn many new improvement capabilities. This could explain why teams did exploit their existing capabilities well, but did not develop many new improvement capabilities.

: If improvement teams are expected to perform most improvement activities without additional help, they are likely to select simple problems where they do not have to learn new improvement capabilities.

During the visits to the team meetings, the teams gave the impression that they did not only consider their slack capabilities to develop a solution when selecting problems. The team members’ knowledge of the importance of problems in the operational processes was also used in the selection of problems. In several cases teams selected a problem because it was very
important in their operational processes. In some of these cases they were not aware of a proper solution for the problem, and the problem did not seem to fit very well with their slack capabilities. This shows that, in the selection of problems, the existing capabilities of the team members was not the only relevant factor; the importance of the problem to the operational process was also highly influential. The way slack was used in these improvement processes was in the identification of the problem; because of their knowledge of the operational processes, the team members were able to identify a problem.

If teams can select the desired improvement function, they are likely to use their own knowledge about operational problems to select those problems that hinder themselves the most.

Knowledge on problems in the operational processes did not only facilitate improvement processes; it also interrupted some improvement processes. During the team meetings the teams would decide to focus on certain problems, and solve these problems before others would be discussed. However, the team members often wanted to discuss the problems that appeared in their daily work shortly before a team meeting, although they had already selected another problem to focus on. They were so committed to their operational tasks, that they wanted to solve these problems immediately. In this way the problems that the team members were confronted with in their daily work interrupted other improvement processes. This shows that the team members’ slack knowledge on operational problems is not sufficient to realise improvements; the slack knowledge must be channelled to be effective. Slack knowledge alone cannot only facilitate, it can also interrupt and hinder improvement processes. Slack knowledge on operational problems might particularly interrupt existing improvement processes if team members can select the desired improvement functions, and if they are very committed to their operational processes, as was the case in the organisations researched.

Slack knowledge on new operational problems is likely to interrupt existing improvement processes if team members are very committed to solving operational problems immediately when they appear.

Team members have much knowledge of the needs in their local operational processes; they might know these needs better than anybody else in the organisation. Because the team can select the desired improvement function, they can focus on the most important problems in their local operational processes. However, a disadvantage of this is that they might know less about the problems of the organisation as a whole. They might for example not know about the major problems in the market, and the problems in the whole operations function of the organisation. Consequently, they might focus on things that are not essential for the organisation as a whole. In literature on continuous improvement, attention is paid to this subject. Imai (1986) discusses, for example, the importance of policy deployment. Through policy deployment, the general goals of the whole organisation are translated, by the management, to goals for all the different parts of the organisation and for all levels of the hierarchy. In this way, every person in the organisation gets clear goals that contribute to the realisation of the goals of the whole organisation. Imai (1986) argues that policy deployment is important if organisations want to work on continuous improvements. The results of this research seem to support the importance of policy deployment in improvement teams. If the goals of the organisation are not communicated to the teams, it is less likely that teams will select improvement processes that contribute to these goals; teams might otherwise only focus
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on the needs of their local operational processes. If improvement teams can select the desired improvement functions, and they are supposed to contribute to organisation wide goals, then the teams must at least know these goals. Then, the teams might be able to exploit their knowledge about their local operational processes and at the same time contribute to the goals of the organisation as a whole.

Improvement teams are more likely to select improvement processes that contribute to organisation wide goals if these goals are communicated to them.

Relationship between capabilities, motivation, and realised improvements

The research suggests that a relationship exists between the improvement capabilities of the team members, the realised improvements, and their motivation. In the research, the motivation of the team members was not explicitly measured over time. This makes it hard to describe and examine the motivation of the team. However, during the research, the team members and the coaches gave some indications of their motivation. They said, for example, that the motivation was very high or that the team was no longer motivated to work on improvements. Therefore, some hypotheses on the teams’ motivation could be formulated. However, the statements are very tentative and more research is needed to be able to formulate well grounded statements. Figure 7-1 gives an indication of the relationships that were suggested by the research.

- The research suggested that the improvement capabilities of the team members partly depended upon their motivation to work on improvements. Strong commitment of the team members was important, for example, in the identification of improvement opportunities, and with the initiation of tasks. The strong motivation of the team members helped them to free slack capabilities; when team members were very motivated they were very willing to use all their capabilities in performing improvement tasks. When teams were motivated, improvement tasks were performed without problems, and a whole improvement process could be successfully concluded very quickly. In some cases where a team was motivated to solve a problem, and when a solution was to hand, teams did not even wait for the next meeting to discuss the problems again; they solved the problem before the next team meeting. Conversely, several activities were problematic because team members were not motivated to perform them. This indicates a relationship between the motivation of the team members, and the use of their capabilities.

  The stronger the team members’ motivation, the greater the extent to which they use their improvement capabilities.

- Further, the motivation of the team members depended upon their capabilities. It depended, for example, upon their capabilities to communicate with others, and on their knowledge of operational problems. Often, team members tended to communicate indirectly, rather than face-to-face. In one case, a team wanted to put a notice on the machines to inform their
Discussion of the major findings

colleagues about an improvement. Their coach had to tell them that this was not adequate to explain the improvement to their colleagues. In another instance, the team wanted to remind their supervisor about some tasks he had promised he would do for them by sending him a copy of the report of the team meeting where the subject was discussed. They did not understand that more direct communication was needed to explain things to people, or to convince people to do something for them. It seemed as if team members had a very simple, or naïve, organisational model inside their heads. They thought that if a short note was sent to someone, that person would react immediately. To the team members, this was a natural way for people to do their work. If things did not work that way, they could become very angry or disillusioned, especially if people higher in the hierarchy, such as supervisors, managing directors, and staff specialists did not react to a request. They then thought that the others were lazy, were not doing their work well, or were not motivated to improve things. Then they would complain: “why should we work so hard on improvements if other people are not doing anything?” Their own motivation to do things would dramatically decrease. This was a serious problem with most of the teams, and it was very hard to explain to the team members that organisations do not work in that way, and that better communication was needed in order to convince others. Thus poor communication due to lack of communicational skills, led to perceived non-commitment by non-team members. The capabilities of the team members could also influence their motivation in a positive way. The team members had much knowledge about problems in the operational processes and they were proud that they could use this knowledge in the team; therefore they could be very motivated to work on improvements.

- The better the team members’ improvement capabilities, the stronger their motivation to work on improvements.

Further, the (slack) capabilities influenced the tasks that were performed, which then influenced the improvements that were realised. If many (slack) capabilities were used, then many improvement tasks could be successfully fulfilled and many improvements could be realised. Contrarily, if not many capabilities were used, fewer tasks could be performed and fewer improvements were realised.

- The better the team members’ improvement capabilities, the more improvement tasks will be performed successfully.

Conversely, the motivation of the team members depended upon the realised improvements. Team members were strongly result-oriented rather than process-oriented; the results of the improvement processes were much more important to them than performing improvement activities. They wanted to implement solutions quickly, and if they felt that it took too long to implement a solution, their motivation often decreased rapidly. On several occasions, team members complained that the progress of the improvement teams was too slow. Some of them even wanted to leave the teams because they thought that the results from the invested time were too small; they would prefer to spend the time on operational activities!

- The more improvements that are realised, the stronger the team members’ motivation to work on improvements.
Discussion of the major findings

In several improvement teams, the motivation fluctuated widely over time. During some periods, teams were very motivated, while during other periods they did not want to work on improvements any more. This change in motivation can be explained by referring to Figure 7-1. When people are motivated they use many of their slack capabilities. Then, for example, problems with communicational tasks will not occur. People will convince others to do things for them, and improvements will quickly be realised. This further increases the motivation of the team. On the other hand, a negative spiral could start. This happens for example when improvement activities performed by people outside of the team are problematic. Then the team can become demotivated; they do not use their slack capabilities, other improvement tasks become problematic, improvements are harder to realise, and the team became even less motivated.

The relationship between the realised improvements and the motivation of the team members suggests that it is important to keep realising improvements over time. However, it can be questioned whether this is possible over a long period. As has been shown, improvement teams are useful in solving problems where much knowledge of local operational processes is needed; they might be less useful in solving interdepartmental problems, or problems with many social and cognitive tasks. Thus, the number of problems that can be solved by a team could be limited. It might be that, after some time, the simpler problems have been solved and only problems that are more complicated remain. Then improvements might be realised at a much slower pace and the motivation of the team members might decrease. This would suggest that, in order to keep teams motivated, it is preferable to work with improvement teams on only a temporary basis until most of the problems that can be solved by the team have been resolved. Further, a decrease in motivation might be avoided if enough improvements can be realised over time. This could happen if, for example, production methods or products change regularly. After such a radical change, many small improvement opportunities might arise for re-optimising the operational processes; this could facilitate incremental improvement processes by teams. In addition, teaching the teams to become less result oriented, and more process oriented, might prevent a decrease in the teams’ motivation. They could learn to appreciate the work on improvements, instead of only focussing on realising improvements. However, the research did not provide indications on how to change the attitude of the teams. Further, it might in general stimulate the motivation of the team members if they can select improvement processes themselves. They might focus on improvement processes that best fit to their own capabilities, and they might focus on problems that are important to them. This might increase their motivation to work on improvements strongly, and this might then increase again the number of improvements that are realised. However, additional research is needed to examine these suggestions in more depth.

Conclusion about the applicability of slack

The research has shown that the slack in the operational configuration was important to in preventing problems with improvement tasks that differed from operational tasks. In addition, the research showed that improvement teams were a good mechanism for using the existing
slack knowledge of operators about operational problems; in both organisations researched, this knowledge was better used since the introduction of teams. The importance of the slack capabilities of the team members could be explained by the fact that the teams were expected to perform most improvement activities without additional help. In this way, they were expected to adjust the improvement processes to their own capabilities. Consequently, few problems arose with improvement tasks that differed from the operational tasks, and the existing slack knowledge on operational problems could well be exploited by the teams. The research suggests that the teams were especially effective in using the existing problem solving capabilities of their members, while the number of new improvement capabilities that were developed by the team members were limited. Also here, the selection of improvement processes by the teams might have been important; teams might have selected improvement processes that fit with their existing capabilities, while neglecting processes where many new capabilities were needed. Further, the research showed that the teams were effective in changing the behaviour of the operators towards operational problems. Another finding was that the use of their existing capabilities, by the team members, seemed to be related to their motivation to work on improvements, and the improvements that were realised in practice. This suggests important limitations to the use of improvement teams. Improvement teams seem to be especially useful if there are many improvements that can be realised in the departments of the team members, or if the operators’ behaviour towards operational problems needs to be changed. However, if organisations have other mechanisms for using the existing problem solving capabilities of the team members well, and their attitude towards operational problems is satisfactory, the introduction of improvement teams might not give the organisation many advantages. Thus, the slack capabilities of the team members are not only important in preventing problems with improvement tasks that differ from operational tasks. Effectively exploiting the slack could be one of the major benefits of improvement teams; it could be one of the main reasons that teams are worth introducing. If this slack is well exploited already, the contribution made by the introduction of teams might be limited.

One of the major contributions of improvement teams is that they lead to the exploitation of the team members’ slack knowledge on operational problems.

The research again showed the importance of proper communication between the improvement teams and their environment. Teams are well able to identify many problems, but they need not be able to solve them all. Consequently, good communications on the problems that teams have identified but cannot solve is needed. Although improvement teams are expected to perform most improvement activities themselves, problem solving in teams isolated from the rest of the organisation is likely to result in missed improvement opportunities, because teams are unlikely to be able to solve all the problems they identify.

7.2.3. Help of the coach

Next, some of the major effects of the help of the coach are considered, and it is discussed how the organisations dealt with them.


**Discussion of the major findings**

**Importance of the help of the coach**

The research showed that in many cases, the team members performed some of the improvement tasks, while others, such as the coach, performed other tasks. For example, the team members would identify a problem, the coach would suggest a solution, someone outside the team would authorise the solution, and the team members would implement the solution. Over time, then, the organisation of the two processes differs. Over time, the organisation alternates between one group of people performing both operational and improvement activities, and a differentiated design where two different groups perform the different activities. This is illustrated in Figure 7-2.

![Figure 7-2: Different ways to organise over time](image)

In the research, the differentiated design was only used during short periods of the improvement processes. Table 7-2 showed that the help of the coach was less important when slack in the operational configuration is important in preventing problems, which was the case especially with identifying an improvement opportunity, and with developing a solution to an unfamiliar problem. This indicates that the differentiated design, with the help of the coach, was not needed if the team members had sufficiently slack capabilities to perform improvement tasks. However, if the team members had insufficiently slack capabilities to perform improvement tasks, the help of the coach could be used to prevent problems. In the previous section on the slack in the operational configuration, it was suggested that the teams selected improvement processes that fitted their own slack capabilities; and in this way they could prevent many of the problems with improvement tasks that differed from their operational tasks. However, the teams also selected improvement processes because of the importance of the problem to the operational processes. Often such problems could not be fully solved by the existing slack capabilities of the team members. Further, in apparently simple improvement processes, unexpected tasks arose that did not always fit to the team members’ slack capabilities. In such cases, the help of the coach was very welcome in preventing problems with the improvement tasks. One consequence of the differentiated design was that the coach had a lot of work to do. Initially it was assumed that the main activity of the coach would be to chair the team meetings and assist the team from some distance. However, it quickly became clear that the coach had to do much more then this. Often, the coaches had to arrange things outside the team meetings and, in many cases, they actually had to perform several improvement activities themselves. Coaches were, for example, the main intermediate between the team and the rest of the organisation; they performed many communicational tasks for the team. Often they had to discuss with supervisors of other departments, or with the supervisor of the team. Further, they had to regularly ask team members, outside of the team meetings, about the progress made with an improvement process. In addition, the coaches also had to guide many communicational and cognitive tasks during the team meetings. Consequently, coaching a team required much more energy and time than expected when the
companies introduced the teams. A consequence of the differentiated design is that coaches have to perform many activities for the teams outside of the team meetings. When the companies first introduced improvement teams, they assumed that the teams could work fully independently after a start-up period of some months, and a short course on improvement tools, but this was naive. Even after more than a year, the teams still needed the coach to attend all their meetings. With some improvement processes, less help from the coach was needed, but the assistance of the coach remained essential. The research did not show that improvement teams made up of operators could perform both operational tasks and all the required improvement tasks successfully. Even after a long period, the differentiated design remained important in performing improvement processes alongside operational processes. This suggests that improvement teams made up of batch production process operators might never be able to perform the complete improvement process themselves. The slack capabilities that they posses might never become sufficient to perform a full improvement process. From time to time, they will still need the help of others, for example a coach.

> With a differentiated design, it is likely that the coach must perform, and assist the team with, improvement tasks.

**Coaches must have slack to perform improvement tasks**

Because most coaches worked in departments where their jobs were not clearly prescribed from minute to minute, most of them had enough time during their daily work to perform the necessary improvement tasks for the team. Thus, there was also slack in the operational processes of the coaches to facilitate the improvement tasks that they performed. If this slack were not to have existed, the coaches would have been less able to perform improvement activities outside of the team meetings, and the differentiated design would have faced more problems. This also occurred with one team, the coach did not have time to make reports of the team meetings during his operational work, and he had to do this at home in the evenings. After a while the coach refused to make the team reports any more and a discussion between the coach and the team arose about who should make the reports. Thus, a prerequisite for the success of the differentiated design is that the coaches must have enough slack in their operational processes to perform improvement tasks outside of the team meetings. This prerequisite is not only important for the coaches, it is also relevant for all the people outside of the team who have to perform improvement tasks in the processes of the teams. If they do not have enough slack in their operational processes, or if they do not get explicit time to perform these activities, problems can occur. In literature on quality circles, this is also recognised. Lawler (1985) states that people who have to implement ideas are often faced with a choice between continuing their normal activities, and picking-up on ideas that the quality circles have suggested. Unless these people are willing to put their regular duties aside, they will never implement the ideas.

The research indicated that time was not the only facility coaches needed to perform improvement tasks well. An important task of the coaches was to communicate with people outside of the team. However this task was not recognised or managed in advance. No mechanisms were designed for the communication between the coaches and people in the
organisation that was important for the teams. Consequently, coaches always had to initiate these communications themselves and the communication seemed to be incidental, instead of a consequence of the formal improvement organisation. Because the communication was not organised, it did not seem to be important. Coaches, therefore, had to depend on the willingness of others to communicate with them. This required specific communicational skills of the coaches. In the companies problems with this communication did not arise. One reason for this was that the coaches were highly educated and well able to perform communicational tasks. Another reason was that the coaches were often familiar with the people they had to communicate with, because they also met them during their operational work and this also facilitated communication. This shows that coaches do not only need time to perform improvement tasks for the team, but also other facilities such as proper communication structures are important.

A differentiated design is more likely to be effective if coaches have facilities to perform improvement tasks outside the team meetings.

**Coach must be motivated to perform tasks**

In the teams researched, coaches were not prepared for the large role they had to play. They expected that, after a while, the teams would be able to do more things themselves. When this did not happen, they saw this as a failure of the team members, or they assumed that the team members were not motivated to improve. In some cases, the coaches became disappointed by all the work they had to do, and the small number of tasks performed by the team members. However, in most teams, the team members did perform some important tasks from time to time, for example they developed a clever solution for an important problem and then the motivation of the coaches rapidly increased. If coaches have to perform activities for the team, they must not only have time for these tasks, they must also be motivated to perform the tasks for the team.

A differentiated design is more likely to be effective if coaches are motivated to perform improvement tasks.

**Organisations must have enough coaching capacity**

In all the organisations involved in the research, the importance of a good coach was recognised, and it was noticed that coaches must have many capabilities. Often, young academics who worked in the offices were regarded as good coaches. However, it was found that people with the necessary capabilities were scarce and alternatives within an organisation were few. Consequently, after a time most companies had problems in finding enough coaches for the intended number of improvement teams. Therefore, they had to limit the number of new teams, simply due to this lack of coaching capacity. Thus, a prerequisite for working with improvement teams, and a differentiated design, is that the organisation has enough coaching potential for the proposed number of teams.

When a differentiated design is used, the possible number of improvement teams in the organisation is determined by the extent of the coaching potential.
Conclusions on the help of the coach

The research has emphasised the large role of the coaches in preventing problems with improvement tasks that differed from operational tasks. Coaches had to assist the teams with many tasks. A consequence of this is that coaches must be available to perform the many tasks for the teams; they must be motivated, and have enough slack to perform these tasks. The research did not find teams that could function well without the help of the coach. Because of the major role of the coaches in the teams, the extent of coaching potential determines the number of teams that can be introduced. In literature on CI, it is stressed that improvement teams need to be coached, but it is underestimated what this role actually involves. Most attention is paid to the managerial tasks of the coach, and hardly any is paid to their important contribution made by actually performing improvement activities themselves. Because of the practical implications of the coach performing improvement tasks, more attention to this subject should be given.

7.2.4. The use of tools

In this section, the tools used to facilitate improvement tasks are discussed in more depth.

Additional improvement tools needed

The research showed that not only cognitive tasks (identifying an improvement opportunity, developing a solution, and analysing information) were important in improvement processes. Also communicational tasks, and doing things, such as initiating tasks and placing tools, were needed. Table 7-2 showed that team members did not have enough slack capabilities to perform communication tasks or to initiate tasks. Many problems with these tasks were avoided because the coach performed the activities. It could be suggested that, by using tools, problems with these tasks could also be prevented. So far, literature on continuous improvement has paid most attention to tools that facilitate cognitive tasks, such as analysing a problem or developing a solution. However, the set of tools that are useful in continuous improvement processes by teams could be enlarged with new tools; for example tools to ensure that people do the things they must do, and tools that facilitate communicational tasks. It might seem obvious that people have to do the required improvement tasks. However the research has shown that one of the problems in improvement processes is that people just did not do these things. Thus, apparently, tools may be needed to facilitate this. Facilitating such improvement tasks is not only relevant to incremental improvement processes, they are also important in more radical innovation processes. Therefore it is possible that literature on innovation processes can give useful suggestions on tools that can be used. More research is needed to explore which tools are suggested in this literature, and to evaluate if such tools can be used in incremental improvement processes by improvement teams.

- Improvement processes are more likely to be effective if tools are used that facilitate communication tasks.
- Improvement processes are more likely to be effective if tools are used that facilitate people to perform the required improvement tasks.
Discussion of the major findings

Tools requiring new capabilities
With the teams researched, the use of improvement tools required new capabilities of the team members. For example they had to discuss, in a group, causes and effects, and write down different aspects of a problem. They were not used to performing these tasks during their operational processes when problems needed to be solved. Team members often felt too proud to use formal methods to analyse a problem. They complained that they had to analyse problems every day without using tools, and they argued that they were well able to analyse things without using tools. In addition, in the operational configuration the people focussed on achieving physical results, and also in the improvement process the team members were very motivated to realise these. The use of improvement tools seemed to delay ‘the real work’ to the team members. Often the team members did not regard the analysis of problems and solutions as useful; they did not want to spend any time on it. They wanted to implement a solution as quickly as possible, and using analysis tools was regarded as delaying the important things. This shows that tools need not only facilitate improvement tasks; they can also cause problems in the improvement process because they require specific capabilities. The capabilities that are required to use improvement tools may differ from the operational capabilities, and conflicting requirements and problems can arise.

Problems with improvement tasks are more likely to arise if the use of improvement tools requires capabilities of the team members that differ from the capabilities needed for their operational tasks.

Limited use of tools
With the teams researched, the use of tools required new capabilities of the team members. However the team members were more motivated to solve problems than to learn new problem solving capabilities. In addition the team members tended to regard tools as useless paperwork. Thus, the team members were not motivated at all to use tools. Further the teams in the research could select the improvement function, and they could design the improvement process, and select the tasks they wanted to perform, to realise a desired function. In this way teams could avoid the use of tools. For example they could directly implement a solution and, in this way, test if the real problem was solved; they did not have to analyse a problem by using tools first. Because the teams did not like tools, they could avoid them and select improvement functions and processes where the use of tools was unnecessary. This could explain the low importance given to the use of tools by the teams researched.

If teams can select the improvement function, and team members are not motivated to use improvement tools, teams are likely to select improvement processes where the use of tools can be avoided.

Often, coaches were disappointed that tools were not used more often by team members. They saw that the team could solve problems without using tools, but they considered that this happened because the team members only selected simple problems and neglected the complicated ones. They considered the problem that the teams tackled as ‘somewhat less than real problems’. The coaches hoped that it would be just a matter of time until the teams recognised problems that were more complicated. When this did not occur, the coaches saw this as a failure of their team due to a lack of capabilities to recognise problems. This indicates
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that the coaches assumed that the team was supposed to solve problems that were rather complicated and where a formal problem solving method was needed. The co-ordinators in the organisation and the researcher also shared these assumptions. Their assumptions were mostly inspired by literature on continuous improvement. Literature heavily promotes the use of improvement tools to analyse problems (see for example Imai, 1986) and pays much attention to problems needing in-depth analysis.

Although the improvement tools were used only to a limited extent by the teams, the research shows that problems seldom arose because tools were not used. It can be suggested that the problems that arose because tools were not used were hard to measure, and that several problems could have been prevented if tools were used more often. The research showed, for example, that a major problem in the improvement processes was that it was very difficult to find a satisfying solution to some problems. Problems could not be prevented by the existence of slack capabilities and knowledge. It could be suggested that, in several of these cases, the use of tools to analyse the problem would have facilitated the improvement process. On the other hand, it can also be argued that the use of tools was not really necessary in the improvement processes researched. It can be argued that the team members were not totally wrong in their resistance to the use of tools. The research shows that the analysis of unfamiliar information was, on many occasions, not facilitated by the use of tools; many problems with the analysis of unfamiliar information were avoided because the coach performed this task, and therefore the team did not need to use tools. Concerning the decision of focus on a single problem, tools were not always needed because the choice could be made without the use of tools in several cases; the team members had enough slack capabilities to perform this task. In addition, in many cases, problems in the development of a solution, and the evaluation of a changed situation, were prevented because the team members had adequate slack capabilities to perform these tasks. In many of these cases, tools were not needed to make the improvement tasks easier for the team, and formal analysis would indeed have resulted in more paperwork. This shows that there are several reasons why tools might not really be needed in an improvement process. One reason is that the teams were able to avoid the use of tools by selecting specific improvement processes where the existing slack capabilities were sufficient to perform improvement activities; additional use of tools was not needed. Further, problems could be prevented because the coaches helped the teams, which also decreased the need for the team members to use tools. This suggests that the importance of using improvement tools is not universal, as is often suggested in literature. The importance of using tools depends for example on the kind of improvement processes that are selected, and the tasks that have to be performed; using tools will not always increase the effectiveness of an improvement process.

If teams can select the improvement function, and they select improvements that fit their existing slack capabilities, it is likely that the use of tools will be less important.

If coaches perform tasks that differ from the operational tasks for the teams, it is likely that the use of tools will be less important.

In the organisations researched, the expectations of the team members and the coaches on the improvement teams seemed to differ somewhat. Both wanted to solve problems in the operational processes. However the team members were very result oriented; they wanted to
implement solutions as quickly as possible. The coaches, on the other hand, did not only want to solve problems; they also wanted to develop the problem solving capabilities of the team members. This can explain why the opinions of the coaches and the team members on the usefulness of tools differed. The team members were happy that the coach performed, for example, the analysis activities. They were only concerned that problems were solved, and that improvement tasks were performed well; if this was done by the coach this was fine to them; they did not feel the need to use tools to perform these tasks themselves. Conversely, the coaches wanted the team members to do more things themselves, and therefore they wanted them to use tools. They became disappointed if this did not happen. This shows that the impression people have about the goals of the improvement teams influence the activities they want to perform. The research clearly illustrated the influence of the team members’ and the coaches’ expectations on the use of tools in the improvement processes.

Conclusions on the use of improvement tools

Literature on continuous improvement often emphasises the importance of using improvement tools. The use of tools can prevent problems with improvement tasks that differ from operational tasks because, by using tools, more knowledge is incorporated into the improvement process. However the findings of the research suggest that tools need not only facilitate, they can also hinder improvement processes. Especial where tools require new capabilities, and team members are not motivated to learn new capabilities, problems can arise. The research also shows that tools might not be needed where improvement processes are selected in which the existing slack capabilities of the team members can prevent problems, or where the coach assists the team with tasks. In such cases the importance of using tools decreases; the use of tools, as emphasised in literature, might be of less relevance to such improvement processes.

7.2.5. Interaction between the reasons for a lack of problems

In this research, three major reasons why problems did not appear in improvement tasks that differed from the operational tasks were found: (1) slack in the operational configuration, (2) help of the coach, and (3) the use of tools. The discussion on these reasons also showed that it is probable that many problems were prevented because the teams could select improvement processes, and chose the desired improvement function. By choosing the improvement functions, the teams could adjust the improvement processes to their own slack capabilities. In this way, problems with many improvement tasks could be avoided. However, teams could not always predict which activities would have to be performed. Further, teams sometimes selected problems that were very important to the operational processes, despite these problems not fitting to their slack capabilities. In such cases, the existing slack capabilities of the team members could not prevent problems; and the help of the coach often prevented problems. This shows that the help of the coach can be used to supplement the slack capabilities of the team members; if the slack is insufficient, the help of the coach can prevent problems. Literature on continuous improvement suggests that problems can be prevented by using improvement tools. However the research has shown that the use of tools was of limited importance to the teams
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researched. The major reason for this is that the use of tools required new capabilities, and the team members were not motivated to put much effort into learning these. The team members were satisfied when the help of the coach prevented problems; they did not feel the need to use improvement tools themselves. This indicates that the reasons that avoid problems are interchangeable. Problems with improvement tasks that differ from operational tasks can be prevented by the use of tools, or by the use of a differentiated design in which the coach performs tasks, or by using the slack in the operational configuration. Which of these ways will be used to prevent problems depends on the circumstances. Table 7-5 gives an overview as to when each approach to avoiding problems is likely to be appropriate.

<table>
<thead>
<tr>
<th>Reason for lack of problems</th>
<th>Facilitates tasks</th>
<th>Appears when …</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slack</td>
<td>Tasks that differ from the operational tasks</td>
<td>• People have capabilities and/or knowledge to perform the improvement task</td>
</tr>
</tbody>
</table>
| Use of tools                | Tasks where slack is not sufficient. | • Team has capabilities to use tools  
|                             |                                | • Team is motivated to use tools |
| Help of the coach           | Tasks where slack and the use of tools are not sufficient. | • Coach has slack in job to perform improvement task  
|                             |                                | • Coach is motivated to perform the improvement task  
|                             |                                | • Organisation has enough coaching capacity |

*Table 7-5: Applicability of measures to prevent problems with improvement tasks that differ from the operational tasks*

Table 7-5 indicates that the limitations with one reason for a problem not arising can be compensated for by another one. If improvement tasks differ from the operational tasks, slack in the operational configuration might prevent problems. If team members do not have enough slack to perform the task and the coach does not perform the improvement task, then the use of tools might facilitate the task. On the other hand, if the existing slack capabilities can facilitate an improvement task, or the coach can perform the improvement task for the team, the use of tools might not have any additional advantages.

*The use of improvement tools is likely to facilitate improvement activities where the team members do not have sufficient slack capabilities to perform the improvement activities and the coach does not perform the activities.*

Further, the table suggests that a differentiated design can prevent problems where tools are not used. The table suggests that it is effective to use a differentiated design, because it can compensate for the occasions when the team members do not have enough slack capabilities to perform improvement tasks, and the use of tools does not resolve this. However, it could also be effective to avoid the use of a differentiated design whenever possible, because the slack of the team members is not fully exploited if a differentiated design is used. This suggests that it is effective to use a differentiated design only from time to time, during certain stages of the improvement process. In this way, the slack knowledge of the team members can be well exploited, while a lack of slack can be easily compensated for by the help of a coach.
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A differentiated design is likely to facilitate improvement activities if the team members have insufficient slack capabilities to perform the improvement activities and where they do not use tools that facilitate improvement activities.

7.2.6. Design tasks as performed by improvement teams

In the preceding sections, it has been suggested that it is effective to use tools and a differentiated design only in specific circumstances, for example where there is insufficient slack. However, it need not be clear in advance which slack knowledge and capabilities team members actually have. In addition, capabilities differ for each person, and it could be difficult to predict in advance which people can perform which tasks. Further, the research has shown that it is not clear in advance which improvement tasks should be performed. Consequently, it might be difficult to predict in advance which improvement tasks the team members can perform successfully, and which they cannot. This has important consequences for the deliberate planning of the use of the alternative options to prevent problems:

• It is difficult to predict in advance whether the use of improvement tools will be needed to facilitate improvement tasks. This will only be found out during the improvement process, when the team tries to solve a problem. The research showed that team members have much resistance to what they consider as useless paperwork. If team members have to use tools in all the processes they perform, in many cases it will indeed result in useless paperwork, and the resistance to the tools might even increase. It might be more effective if the teams only use tools when they are needed to realise specific tasks. In such instances, the coach could teach the team the needed tools. Then the team members should experience the usefulness of tools, and they might become more motivated to use them. Conversely, it could be argued that it is easier to teach the tools during a less complicated improvement process. However, in the organisations researched, this immediately resulted in resistance by the team members to this ‘useless’ paperwork.

• It is also difficult to determine beforehand whether a differentiated design should be used or not. One solution to this is to organise improvement processes in such a way that a team can switch to a differentiated design if it is needed. To make this possible there must be someone who oversees the improvement processes of the team. This person must allow the team members to perform as many activities as possible, and help them where their capabilities are not sufficient. This is the solution that has been chosen by the companies; it is the solution of adding a coach to the teams, who assists them from time to time. Thus, adding a coach to a team, who can assist them with difficult activities, makes it possible to make the improvement organisation flexible to the requirements of each individual improvement process.

The research showed that with improvement processes by improvement teams, one very important factor was the improvement function that was chosen, which in turn influences the
improvement processes that must be performed. To make a good decision on the desired improvement function, knowledge is needed about the problems in the operational processes. The research showed that by choosing an appropriate improvement function, the existing slack in the operational configuration could be well exploited and problems might be avoided. Thus, knowledge on the slack in the operational configuration is also required to make a sound decision on the desired improvement function. Based on the findings in the research, it could be argued that it is rather effective to let the team chose the desired improvement function. An advantage of this is that the team members, with their coach, might best know their own slack capabilities and thus, they may be best able to adjust the improvement processes to their existing slack capabilities. In this way, their slack capabilities might be used to the maximum, and problems in performing improvement tasks that differ from operational tasks might be reduced as much as possible. In this way the team could minimise the misfit in the improvement configuration. Further, the research has indicated that the teams have much knowledge about problems in their operational processes and, thus, they might know well which improvements are desirable. They might try to realise as many improvements as possible and, thus, they can also maximise the desired improvement function and minimise the slack in the improvement configuration. The team is able to search for a good balance between: (1) exploiting the slack in the operational configuration, (2) minimising the slack in the improvement configuration, and (3) maximising the desired improvement function. The teams researched did not deliberately balance these three forces; however, they did search for a balance on a very intuitive level. They discussed, for example, if problems were important (thus they questioned the desired improvement function) and they discussed if they could solve a problem (thus they questioned their own slack capabilities).

It is likely that improvement teams will be able find a balance between exploiting the slack in the operational configuration, minimising the misfit in the improvement configuration, and maximising the desired improvement function.

Thus, based on the findings of the research, it can be suggested that it is effective for coaches, maybe together with the team members, to decide when to use tools, and when to use a differentiated design. In addition it seems to be effective to let teams decide the desired improvement function. Of course it is then important that the team has enough knowledge about organisational goals to adjust the improvements they perform to these goals. This indicates that it is effective if teams not only perform the improvement tasks but that they also perform tasks to design improvement processes and to choose the desired improvement function.

7.2.7. Problems that reoccur

In the preceding sections, several reasons were discussed why problems did not arise. It was shown that exploiting the existing slack capabilities of the team members and the help of the coach were important in preventing problems. Further, the use of tools also prevented, to a limited extent, problems with improvement tasks that differed from operational tasks. However the research showed that not all problems were prevented; some improvement tasks were still problematic. With several improvement tasks, the slack capabilities of the team members, the
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help of the coach, and the use of tools could not prevent problems. In the previous chapter, when the different reasons for problems were analysed, some indications were given as to why such problems still appeared. The previous chapter showed that functional conflicts were an important reason for problems. Functional conflicts appeared, for example, when the coach did not perform a needed task. In many such cases the coaches had tried to let the team members perform the improvement tasks themselves. However it appeared that these tasks were too difficult for them, and problems occurred. Further, coaches were sometimes not motivated to perform activities for the teams, for example in the case where the coach refused to make the reports of the team meetings; and then also problems appeared. The research also showed that problems arose with the development of a solution, because no solution could be found. Seemingly, such problems were difficult to solve, and neither slack capabilities, the help of the coach or the use of tools could change this. Thus, although many problems were prevented by slack in the operational configuration, help of the coach, and the use of tools, some problems still appeared. A contribution by this research is that reasons that prevent problems have been detected. However additional research is needed to explore why all problems cannot be prevented, and when problems still appear.

7.2.8. Conclusions on reasons for a lack of problems

The previous chapter showed that many improvement tasks differed from operational tasks but were not problematic. Several reasons were found that could explain this: the slack in the operational configuration, the help of the coach, and the use of tools. In this chapter, one additional reason was discussed: the teams could choose the desired improvement function themselves. In this chapter it has been suggested that this reason is rather influential on the findings of the research; it could be used to explain several of the findings; for example, the importance of the slack capabilities of the team members, and the limited use of improvement tools. However, based on this research, only tentative suggestions could be made on the importance of the team members choosing the improvement function. Additional research is needed to explore the importance of the improvement teams choosing the improvement function in more depth. For such additional research another theoretical model might be required. In the next sections it is discussed why another model might be needed.

7.3. Conclusion

In the previous chapter, the research findings that were relevant to the major research problem were analysed and discussed. This chapter reflected upon these findings, and some explanations for the findings were discussed. In the following sections, some concluding remarks are made about this research. First, the contribution of this research to the existing theory is considered. An important contribution of this research are the hypotheses formulated and, in the following section, the validity of the formulated hypotheses is discussed. Then, in the following, the theory that was used in the research is considered. Finally, directions for further research are summarised and discussed.
7.3.1. Contribution to the theory on continuous improvement in teams

The goal of this research was to develop theory that explains incremental improvements by improvement teams. To achieve this goal a research problem was formulated. The main research problem was: To what extent do differences and correspondences between operational and improvement processes explain the problems that arise with improvement processes by improvement teams? In the previous chapter several reasons for problems or otherwise were discussed, and relationships to the differences and correspondences with operational tasks were found. In this chapter, the findings of the previous chapter were discussed in relation to the context of the organisations in which the research was carried out. Based on the analysis of the research findings in the previous chapter, and the discussion in this chapter, hypotheses on the observed improvement processes were formulated. An overview of all the hypotheses is given in Appendix 2; they were formulated throughout the last two chapters and they are the major contribution of this research to the theory on continuous improvement in teams. The major insights, and some of the most important hypotheses are summarised below.

Many of the hypotheses refer to the relationship between the differences and correspondences between operational and improvement tasks, and the problems that can appear. An overview of these relationships is given in Figure 7-3 (see also Hypothesis 8, Hypothesis 9, Hypothesis 10, Hypothesis 11, Hypothesis 16, Hypothesis 17, Hypothesis 18, 0). Alongside these relationships, the research provided several other important insights into the functioning of improvement teams. The research showed the influence of the goals with which teams were introduced, and the fact that the teams were supposed to perform improvement tasks without help from others. It showed that the goals given to the teams influenced the improvement functions they selected, and the improvement processes they performed (see 0). The research also showed that problems in improvement tasks that differed from operational tasks could be avoided in several ways; because of the use of slack (Hypothesis 11), the help of the coach (Hypothesis 16), and the use of tools (Hypothesis 17). Further, the research suggested that the different ways of preventing problems might be interchangeable (0, 0). The research provided several additional insights into these subjects. It was shown that the coach had to perform many tasks for the team (0) and that this had many consequences. Further, the research suggested that further tools might be used in improvement processes above those that facilitate problem solving tasks (0, 0); however, the use of such tools might also cause problems because they require new capabilities (0). The research showed that teams were effective in exploiting the existing slack capabilities.
of their members (0) and that this might even be regarded as one of the major contributions of improvement teams.

7.3.2. Validity of the hypotheses
It is important to note that the hypotheses formulated in the research are likely to have a limited validity, namely for the context in which the research was performed. The fourth chapter described the major aspects of the context of the teams; this chapter gives an indication of the contexts in which the hypotheses are valid. Some aspects of this context are summarised below, because they indicate the major aspects of the context in which the hypotheses are supposedly valid. The hypotheses considered to be valid in situations with:

1) Improvement processes that are performed by improvement teams.

2) Improvement teams that exist to solve more than one problem; more or less permanent teams.

3) Improvement teams with people from the shop floor linked to a specific operational process:
   a) Operational processes that have as major tasks setting up and operating machines, using tools, and solving routine problems.
   b) Operational processes where not much unstructured communication is needed.
   c) Operational departments that have a supervisor to solve non-routine problems.
   d) Operational departments where communication with the supervisor about non-urgent problems is not very structured.

4) Improvement teams that are assisted by a coach from an office department who has more education and experience in communicational and problem solving tasks than the team members.

5) Improvement teams where the supervisor of the team members is not a member of the team.

6) Improvement teams that can decide for themselves which problems they want to solve; improvement teams that can chose the desired improvement function themselves.

7) Improvement teams that are expected to solve problems without additional help from people outside of the team.

7.3.3. Reflection on the theory used
In the second chapter, the major theoretical insights that were input to the research were discussed. In this chapter, the concept of ‘functional conflicts’ has received much attention. This research introduced the concept of functional conflicts to the context of improvement teams and it investigated whether the concept was important in practice. The discussion of the research findings (section 7.1.1) shows that the concept of functional conflicts says nothing more than that improvement tasks differed from operational tasks and were problematic.
However, although the information provided by the concept is limited, the research has shown the importance of the concept of functional conflicts. The research showed that functional conflicts seemed to occur rather often when tasks were problematic; the concept was important in explaining problems with improvement activities by improvement teams. In this regard, the concept does seem to be important in relationship to improvement teams, and additional research is needed to build on the insights given so far. The research also showed that functional conflicts were not the only important factor; many other things were important. The research findings showed that many improvement tasks that differed from the operational tasks were not problematic. Many of these successful tasks could be explained by the insights that were developed in the second chapter based on the process model (the existence of slack, the differentiated design, and the use of tools). This suggests that the more general insights that were developed, based on the process model, were, alongside the concept of functional conflict, important in explaining the research findings. However the process model also has its limitations which were relevant to this the research. One of the major limitations of the process model is discussed below.

In the discussion on the research findings in this chapter, it was suggested that it was important that the team members could choose the desired improvement function. However, this could not explicitly be assessed; based on this research only hypotheses can be formulated. The major reason that the influence of the chosen improvement function was not ‘measured’ was that this was simply not possible with the theory (the process model) that was used. In the theory used the desired function is the start of the analysis; the desired function itself cannot be analysed with this theory. The process model cannot be used to judge the appropriateness of a desired improvement function; it cannot tell if the proposed improvement function itself is good or bad. It can only be used to analyse situations where a desired function is already stated. This has some important consequences:

- **The function must be stated:** The research showed that whether improvement tasks are considered problematic or not depends on the function that was chosen. By changing the desired function, other improvement tasks will become problematic, and problems might appear or disappear. The theory that was used, the process model, does not give insights into which functions are appropriate. The process model does not identify which improvements are desired and which are not. This means that the process model can only be used if functions are clearly stated; if functions are not given, the theory cannot be used. For improvement processes by teams, this means that someone (team members, coaches, or management) must provide a function that can be used in the research to analyse whether improvement activities were problematic. In this research, the statements by the team on the proposed improvement were chosen as the desired improvement function. However, if another definition of the improvement function was chosen, alternative things might be regarded as problematic.

- **Different functions are hard to model:** Another important consequence of the theory used was that it was difficult to examine what happens when different improvement functions exist. In the process model it is assumed that an organisation is a purposeful whole with
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One goal or function to be realised. This assumption was applied to the improvement configuration; it was assumed that the improvement processes were performed to realise one improvement function, as stated by the team. However, it can be questioned if this reflects what is actually going on in organisations that have improvement teams. For example, a coach of a team might have as a goal helping the team members to develop new capabilities. That these teams realise concrete improvements in the operational processes might be of secondary importance to him. Contrarily, the team members might have as a goal to realise as many improvements as possible in the operational processes with their existing capabilities; they might not be interested at all in learning new capabilities. In situations like this, it is not possible to state one overall improvement function, or goal, for an improvement process. Different stakeholders exist with different goals. The goal that is chosen determines, however, if activities are defined as problematic or not. If people fail to solve a problem, but they learn some new capabilities, the coach might not regard the activities as problematic, but the team members will. In addition, a coach might regard time spent on learning new improvement tools as very useful, while the team members regard it as useless paperwork because it did not contribute to the fulfilment of their goal, realising concrete improvements. The theory used does not offer concepts to examine such dynamics; it did not provide concepts to describe and analyse the interaction between different people with different goals, it assumed that the organisation as a whole had a purpose. Consequently, the theory used seems not to be fully applicable to situations where different stakeholders have multiple goals.

7.3.4. Reflection on the research method used

An important limitation of this research is that only improvement activities that were explicitly mentioned in the team and research reports could be measured. It might be suggested that many more activities were performed in the improvement processes which were not observed during the research and that this could influence the findings of this research. It could be suggested that the more difficult activities got most attention during the team meetings, and consequently these difficult activities will be mentioned more often in the team and research reports. Thus, the research method might be less applicable in recording the simpler improvement activities. A consequence of this might be that the problematic activities were measured rather well, while unproblematic activities might have been missed. This could also have been the case with activities performed by people outside of the team, which might explain why so many of these activities were problematic. Thus, overall, it might be suggested that more simple activities existed in the improvement processes than were measured. It can be questioned whether these simple activities differed or corresponded with operational activities, but it is hard to make comments on this. It might however be suggested that where simple improvement tasks that differed from the operational tasks were not measured these tasks might have been facilitated relatively often by the slack of the team members. If the coach had helped the team, or if tools were used, this would probably have been discussed in the team meetings and thus such tasks would be recorded. Simple improvement tasks that were performed outside of the team meetings because of the slack of the team members were hard to measure. Thus, it can be
suggested that slack was even more important than has been indicated in this research. That disproportionate attention could have been paid to the more difficult and problematic activities, because these could be measured better, does not invalidate the findings of this research. The research still provides useful insights into the causes of several problems, the reasons why problems did not appear, and the conditions under which those reasons were likely to be relevant.

7.3.5. Directions for further research

The research has provided indications of several answers to questions about incremental improvement processes by improvement teams. However, in performing the research, also many questions have been raised. The most important questions are discussed below.

Testing hypotheses: In the research, was examined to what extent differences and correspondences between operational and improvement tasks explain the problems that arose, or did not arise, with improvement activities by improvement teams. This was done by examining improvement processes carried out by several improvement teams in practice and, based on these observations, hypotheses were formulated. However, based on this research, only propositions can be made about what happens with continuous improvement in teams. Additional research is needed to test the hypotheses that were formulated in this research.

Different operational processes: In this research, focus was on improvement teams that consisted of operators from the shop floor in repetitive batch production. However, people in other operational processes could also be involved in incremental improvement processes by teams. More research is needed to explore which problems might appear with such teams. It could be that the general explanation on the differences and correspondences of tasks can still be used. However, these people might have many more (or maybe fewer) slack capabilities. Consequently, with other operational processes, the importance of slack, the use of tools, and the assistance of a coach might be very different. It might for example be possible that in other types of operational processes, team members are well able to perform all the required improvement tasks, and a coach of a team is not needed. Then the differentiated design might be used less often. More research is needed to explore this.

Use of tools: This research showed that the possibility of using tools in incremental improvement processes should be examined in much more depth. Attention should be given to understanding the reasons why people do not want to use tools, rather than only promoting the use of existing improvement tools. It might be investigated if the motivation of team members to use tools (and perform tasks that differ from their operational tasks) can be increased. In addition research is needed to develop tools for other improvement tasks than cognitive tasks. Tools need to be developed that can facilitate communication between people in incremental improvement processes. In addition, tools are needed to facilitate people in taking the initiative to perform tasks. It should be explored whether examples of such tools exist in literature, possibly in literature on innovations. In addition, it should be explored if and how these tools could be applied to incremental improvement processes by teams.
Organisational context of teams: In general it is important to examine how teams are embedded in an organisation. This research showed several subjects where the organisational context of the teams was important and were further research is needed:

- **Relationships with supervisor:** The companies researched chose not to let the supervisors be team members or coaches, because they expected that the team members would then feel less free to suggest improvements. However, this also blocked the flow of ideas between the supervisor and the team, and maybe opportunities to improve and learn from each other were missed. More research is needed to examine if the relationship between the team and their supervisor can be organised in such a way that fewer problems arise.

- **Communication with people outside of the team:** The findings of the research suggest that many problematic improvement tasks that were performed by people outside of the team were due to poor communication between the people and the team. Additional research is needed to examine if and how such problems can be avoided.

- **Learning in the team:** The research showed that the learning by team members was rather limited. A reason for this was also suggested: that team members had to select improvements where they could perform most of the activities without additional help. It should be investigated whether improvement teams can also be used to stimulate learning by the team members, for example by increasing the importance of the selection of improvement processes where the team has to learn new capabilities.

- **Interaction with other ways to organise continuous improvement:** The research showed that improvement teams of shop floor operators are likely to be only able to perform specific improvement processes. Other people must perform certain improvement processes. However the research showed that these teams might well be able to identify problems and develop solutions. More research is needed to examine if the team members can still perform these tasks, while others perform the more difficult tasks. In such an improvement organisation, the team would only be involved in parts of the improvement process. More research is needed to indicate how such improvement processes might be organised.

- **Improvements by specialists and managers:** More research is needed to explore how incremental improvement processes outside of teams of operators can be organised. The first chapter showed the importance of managers and specialists working on incremental improvements. This research gave no explanations about the problems that arise in such processes, and how these might be solved. In addition, more research is needed to examine the interaction between improvements by teams, other improvement projects, and other ways to improve.

**Examining people’s capabilities, motivation, and behaviour:** In this research, the focus was on characterising the operational and improvement tasks that had to be performed by team members. Based on this, improvement activities were explained. In this research, less attention was paid to examining which (slack) capabilities team members possessed. It was not
examined if and how these slack capabilities could be measured. This knowledge might be very useful for organisations in practice. If organisations could measure which slack capabilities people have, they might be better able to decide which improvement processes people should perform. Therefore, further research is needed to explore the (slack) capabilities of people in more depth. This research gave indications that the behaviour of the team members towards mistakes has changed dramatically since the introduction of teams. The research has also suggested a relationship exists between the motivation of the team members, the use of slack capabilities, and the tasks performed and improvements realised. More research is needed to test these hypotheses.

What should be improved: In the reflection on the theory, it was stated that the theory used in this research could not indicate which improvements should be realised; the improvement functions stated could not be judged. With the theoretical model used it was not possible to analyse whether the proposed improvement was an appropriate one. In addition situations where only one improvement function existed could be examined. Situations where different people had different improvement goals couldn’t be studied. More research, maybe from a different theoretical point of view that pays more attention to different stakeholders opinions, is needed to examine these situations.

Applicability of theory to other contexts: The hypotheses that were formulated gave several very useful insights into improvement processes by teams. Several of these insights might also be applied to other situations than incremental improvement processes by an improvement team. However, further research is needed to explore this in more depth. The hypotheses on fit relationships between two different processes might also be applicable to the following situations:

- The model of the different fit requirements might not only be used to compare operational and improvement tasks; it might also be used to explain differences between improvement tasks within one improvement process. The research showed that, within improvement processes, many different tasks must be performed, for example identification of a problem, development of a solution, communication within and outside the team, and implementation of the solution. It might be suggested that to perform all these tasks well, different characteristics are required. Consequently, functional conflicts might not only arise between operational and improvement tasks, but also within improvement processes. The concepts of fit and functional conflicts that were used in this research might also be applied to fit relationships within one improvement process.

- The model of the different fit requirements might be used to explain other situations in which one group of people must perform two different processes. This happens with many different types of temporary project teams that contain people who also have to perform daily tasks. Further, the model might also explain activities by permanent groups of representatives in organisations, such as works councils. In such situations, one group of people also has to perform two different processes, and the same dynamics as were found
Discussion of the major findings

with improvement teams might also be relevant. Consequently, some of the hypotheses that were formulated might also be applied to such situations.

- The relationships that were suggested in this research might also be applied on a higher level of abstraction. Then, instead of people, the organisation as a whole has to perform different processes to realise different functions. The model might be applied to explain whether an organisation can fulfil two different functions by performing two different processes, for example processes of operation and innovation, or operational processes with different technologies. Such situations are described, in general terms, by Gresov and Drazin (1997). The relationships that are suggested in this research might explain many of the tensions and problems that arise on the organisational level in most organisations. It might show that problems with organisational processes arise because different and conflicting functions are requested. By systematically comparing the different functions an organisation must realise, and the different processes that must be performed to realise these functions, conflicting functional demands might be uncovered. In addition, systematic research might also show opportunities to deal with these conflicting demands, so that misfits can be prevented. Research might also show that also organisations as a whole have slack capabilities that can be utilised to perform specific tasks. In addition, organisations as a whole might be assisted by ‘coaches’ to perform specific difficult tasks; for example by letting subcontractors perform the tasks that result in conflicting demands. Further, organisations as a whole might also be able to adjust the desired function to the capabilities that they have, for example by focussing on specific market segments. The theory developed in this thesis might provide theoretical explanations for the misfits that can arise in organisations when they have to perform different tasks, and the measures that can be used to deal with misfits. In this way, some of the major problems that organisations have to deal with might be better understood. One of the most important contributions of this research might be that some of the general underlying mechanisms that are at work in situations with different functions, including in organisations as a whole, have been be detected and described from the examination of a rather simple situation. By studying an organisation as a whole, it might have been much harder to detect these mechanisms, because the situation would be less transparent. However, additional research is needed to explore if the mechanisms described in this research are indeed more generally applicable.

7.3.6. Conclusion

Improvement teams are an interesting subject for research, because they receive much attention in both practice and literature, while still much is unknown about them. This research investigated the improvement processes performed by teams, and it attempted to formulate some explanations for the problems that appeared in these processes. Based on the research some interesting insights into improvement teams have been developed. However, these insights need to be further tested and many new questions have been raised by the research that need further examination. This shows that building theory on continuous improvements might
be a never ending journey; theory on continuous improvement needs to be improved continuously. It’s up to researchers to perform this improvement process without too many problems.
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Literature


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Literature


Summary

Introduction

Organisational change and especially improvements receive a lot of attention in both literature and practice. Often in literature, a distinction is made between periods of revolution with major changes, and periods of evolution with minor or incremental changes. Although in periods of evolution change is less radical, incremental improvements are important. Especially where incremental improvements are realised continuously, they can have an important contribution to the competitive advantage of organisations. Because of this importance of continuous incremental improvements, this research focuses on them.

Literature on continuous improvement

Based on the increasing competition from Japanese organisations during the 1970s and 1980s, the Japanese way of organising and managing has received more and more attention. Important subjects in this regard were quality circles, Total Quality Management, and lean production. Alongside literature on these subjects, during the 1980s and 1990s literature emerged that gave specific attention to organising ongoing incremental improvements, or continuous improvements. The existing literature on continuous improvement can be categorised into three different types.

(1) Most publications are, what can be called, attention literature. These publications stress the importance of incremental improvements and they focus attention on the subject of continuous improvement. Often general prescriptive conditions for continuous improvement are presented, but it can be questioned if these prescriptions are based on scientific research.

(2) A second type of literature is descriptive literature. This literature describes the current practices in continuous improvement. Most of this literature describes or proposes CI tools, techniques, and practices. Further, this literature contains publications on kaizen or on comparisons between kaizen and Western-style CI. Others have examined the spread of continuous improvement and the practices used elsewhere, for example in Europe and Australia.

(3) A third, and currently still relatively rare, type of publication is theory building literature, which aims to contribute to the development of CI theory. This literature attempts to categorise and explain empirical observations, and considers the mechanisms and rules behind the observations. This literature analyses the ways to organise and manage CI, discussing and explaining, for example, the role of team working, which types of teams exist, and how they function.

Because of the characteristics of the existing CI literature, many companies have become aware of the importance of CI. However, many of them find it difficult to deploy it successfully. A reason for this is that much emphasis has been paid to the promotion of CI
and prescribing solutions and specific tools. However, less emphasis has been paid to describing what is happening in practice, and building theory that explains what is going on. Consequently, the scientific base of the solutions that are offered is not clear. Further, the existing theory is often not adjusted to contingencies. As a consequence, organisations have to find out about CI the hard way, with trial-and-error learning playing a key role. This often results in a lot of efforts and costs. A goal of this research is to solve the theoretical and practical problems of a lack of theory about continuous improvement, and to contribute to the development of theory on continuous improvement. Focus in this research is on incremental improvements realised through improvement teams.

**Theory to explain improvements in teams**

An improvement team is a group of people who work on solving problems that occur in their own work. Two different types of processes exist for people in an improvement team: (1) the operational processes, which are the daily work of the team members, and (2) the improvement processes. The figure that shows the operational and the improvement configurations have one common element: the people of the improvement team; other organisational elements may differ.

Based on contingency theory and the process model used in this research, an organisation is defined as a purposeful system of people who, either or not using resources (for example tools and equipment), perform processes aimed at realising a desired function. Organisational arrangements divide and co-ordinate the constituent activities of the processes. According to contingency theories of organisation, an effective organisation is characterised by a fit between the desired function and the characteristics of its processes, people, resources, and organisational arrangements. This is showed in Figure 0-2.
The members of an improvement team perform both operational and improvement processes. Applied to improvement teams, the fit requirements from contingency theory mean that, for both configurations to be effective, the characteristics of the process, people, resources, and organisational arrangements must fit in both the improvement configuration and the operational configuration. In other words, the people in the team need to fit both the operational and the improvement configuration (see Figure 0-3). If the characteristics of the operational and the improvement process differ, contingency theory suggests that it cannot be assumed that the organisation of the operational process is also the most effective one for the improvement process.

It can be questioned, if it is possible for improvement teams to perform both processes effectively and to realise the requested improvement function. Based on this argument, one can ask what the consequences are of the correspondences and differences between operational processes and improvement processes as performed by improvement teams. It can be asked if problems in improvement processes can be explained by the differences and correspondences between the operational and the improvement processes.

The main research problem is: To what extent do differences and correspondences between operational and improvement processes explain the problems that arise, or not arise, with improvement processes by improvement teams?

**Research method**

In the research, the focus was on improvement teams made up of shop floor people from batch production processes. The major reasons for this focus were the generalizability of the results, and the possibility of gaining access to companies to perform the research. The research method that was used was case study research in the form of action research. Because little still is known about the research problem, case study research is appropriate to perform this research. The reasons to use action research were that it fitted the goal of generating knowledge that can be used to guide future practical actions, because the dual role of researcher and consultant could be combined well, and because social complexities could also be experienced.
The units of analysis for the research were the improvement activities performed by teams, and not the teams itself. During a period of eight months, five improvement teams in two companies were studied. The researcher acted as a coach of one team, as an observer of four other teams, and as a consultant to the management of the teams. During the eight months, the teams carried out 15 large and 58 small improvement processes. These contained in total 735 improvement activities of which 586 were performed by the teams, and the rest by people outside of the teams. The activities in the improvement processes were categorised into six types, based on difference or correspondence with the operational process, the problems that appeared in performing the activity, and the people (team members, or people outside of the team) who performed the activity. All the improvement processes, with their activities, were entered into a database. The database made it possible to analyse such a large number of improvement processes and activities (73 processes and 735 activities) in a structured way.

Analysis of the research findings

The findings of the research (see Figure 0-4) show that many improvement activities differ from the operational activities of the team members (78%). Only 22% of the improvement activities had the same characteristics as the operational activities. The table also shows that from the group of activities that corresponded with the operational activities, most were not problematic (only 3% of the activities are of type 2, while 19% of the activities are of type 4). In addition, the table shows that many improvement activities that differ from the operational activities also were not problematic (68% of the activities were of type 3). Only 10% of the activities differed from the operational activities and were problematic.

The research indicated that some relationships exist between problems that arise, and the differences and correspondences with the operational tasks:

- The research findings show some general reasons for problems: they occur in both operational and improvement tasks. These reasons were relevant in 15 of the 63 problematic improvement tasks performed by the teams. One general reason for problems with improvement tasks was that the problem disappeared because it was solved by
activities outside of the improvement process. Another reason for problems is that team members were not motivated to perform the required tasks. A further reason for problems was that people forget to perform the required tasks. This illustrates that not all problems that appear in improvement processes by improvement teams are related to the correspondences and differences between the operational and the improvement tasks. Some types of problems appear with improvement tasks, irrespective of the difference or correspondence with operational tasks. The research also showed that these general reasons for problems occurred only in a very few improvement tasks.

• The research showed that several tasks that differ from the operational tasks are problematic. This group contained 58 tasks (10% of the improvement tasks performed by the team, see Figure 6-2). For most of these tasks (51 of the 58 tasks), there was no general reason for the problems that appeared; there were different reasons for the problems. The main reason for the problems was that functional conflicts existed. However, there were other reasons for the problems; although these appeared far less often than functional conflicts. One other reason for problems was that it was simply very difficult to develop a solution in several cases. Another reason for problems was that the operational tasks had higher priority and therefore improvement tasks that had to be performed outside the team meetings were delayed.

• Improvement tasks that corresponded with the operational tasks could also be problematic. This group contained 15 tasks (3% of the improvement tasks performed by the team, see Figure 6-2). In about half of these tasks (7 of the 15 tasks), no general reason for problems appeared to exist; another reason for the problems was applicable. One reason for such problems was identified: imported misfits. In the operational configuration, misfits already exist, and these misfits are imported into the improvement configuration. Consequently, improvement tasks that correspond with these operational tasks are also problematic. In this research, imported misfits arose only in communication between a team and its supervisor. The number of times that imported misfits arose were very limited.

• Many improvement tasks that differed from the operational tasks were not problematic. This group contained 339 tasks (68% of the improvement tasks performed by the team, see Figure 6-2). Several reasons for the lack of problems existed. One important reason was that there was slack in the operational configuration, that could be used to perform improvement tasks successfully. Another important reason that problems did not appear was the help of the coach with the improvement tasks, often coaches performed many activities themselves. Further, the use of improvement tools sometimes prevented problems.

• Most improvement tasks that corresponded with operational tasks were not problematic. This group contained 114 tasks (19% of the improvement tasks performed by the team, see Figure 6-2). The major reason that problems did not appear was that the improvement tasks corresponded with the operational tasks, and thus the team members were well able
to perform them. However, this was not the only reason that problems did not appear. With communication tasks, problems were prevented by the help of the coach and the fact that communication was deliberately organised or that it took place by coincidence. These reasons also avoided problems arising with tasks that were problematic in the operational configuration; they prevented imported misfits causing problems with the improvement tasks.

The research shows that the correspondence or difference between operational and improvement tasks is relevant in explaining improvement processes. However, it is not possible to argue that improvement tasks that differ from the operational tasks will be problematic, while corresponding tasks will not. The relationships between the difference or correspondence, and the problems that appear, are somewhat more complicated:

- The research shows that most improvement tasks that corresponded with operational tasks were not problematic; if they were problematic, then there was a clear reason for the problems: the corresponding operational tasks were also problematic, or a more general reason for the problems existed.

- The research also showed that problematic improvement tasks could be explained by their difference to operational tasks, or by their correspondence with problematic operational tasks, or by a more general reason for problems.

The research also failed to find evidence of suggested relationships:

- It was not found that non-problematic improvement tasks always correspond with operational tasks; the research showed that many improvement tasks that were not problematic differed from the operational tasks.

- It cannot be argued that improvement tasks that differ from the operational tasks are always problematic. In these tasks, problems were often avoided due to specific reasons, for example the help of a coach or the use of tools.

- In addition, it also cannot be argued that improvement tasks that correspond with problematic operational tasks will always be problematic. The research showed that some of these improvement tasks were not problematic, because specific reasons prevented problems, for example because of the help of the coach.
The major relationships supported by the research are shown in Figure 6-3. The research also highlighted three more general reasons for problems: people are not motivated to perform a task, they forget to perform a task, or the problems disappeared. These reasons for problems appeared in both corresponding and differing improvement tasks; they are not incorporated in the figure.

It is important to recall that the research also showed that many improvement activities that were problematic did not result in problems with the improvement process as a whole. In addition, the research also showed that it is not sufficient to examine only the differences and correspondences between the operational tasks and the improvement tasks, more things are relevant. Insights into fit that were developed in the second chapter, by using the process model, were highly useful in explaining what is going on with improvement processes by improvement teams. The research showed that the process model was very satisfactory in explaining why improvement tasks that differed from operational tasks were not problematic. Based on insights from the process model, it can be argued that slack, the help of the coach, and the use of tools were relevant in preventing problems.

**Discussion of the major findings**

**Reasons for problems**

The discussion of the different reasons for problems shows that, alongside functional conflicts and general reasons for problems, the structural and cultural characteristics of the organisation were very important in explaining the problems that arose. In the culture of the organisations, people tended to give priority to performing operational tasks; communication was not regarded as very important. The research suggested that, if in the culture, communication gets little attention, a proper communication structure is very important for the success of improvement activities and processes. The discussion also showed the importance of another structural characteristic: people must get time to work on improvement activities, for example during team meetings. If teams do not get this time, operational tasks will receive more priority and problems will arise with improvement tasks, especially with tasks that cannot be easily performed alongside with the operational tasks.

Figure 0-5: Relationships suggested by the research (excluding general reasons for problems).
Reasons for no problems

The research showed that it is likely that many problems were prevented because the teams could select improvement processes, and chose the desired improvement function. By choosing the desired improvement functions, teams could adjust the improvement processes to their own slack capabilities. In this way problems could be prevented with many improvement tasks. In the research three major reasons why problems did not appear with improvement tasks that differed from the operational tasks were found and these are discussed below.

The research shows that slack in the operational configuration was important in preventing problems with improvement tasks that differed from operational tasks. In addition, the research showed that improvement teams were a good mechanism for using the existing slack knowledge and capabilities of operators from operational problems. In both organisations studied, those knowledge and the capabilities were better used after the introduction of teams. The importance of the slack capabilities of the team members can be explained by the fact that the teams were supposed to perform most improvement activities without additional help. They were supposed to adjust the improvement processes to their own capabilities. Consequently few problems arose with improvement tasks that differed from operational tasks, and the existing slack knowledge about operational problems could be very well exploited by the teams. The research suggested that the teams were especially effective in using the existing problem solving capabilities of the team members, while new improvement capabilities that were developed by the team members were limited. Also here, the selection of the improvement processes by the teams might be important; teams might have selected improvement processes that fit their existing capabilities, while ignoring processes where many new capabilities had to be learned. Further, the research showed that the use of teams was effective in changing operator’s behaviour towards operational problems; for example, operators reacted more quickly to mistakes. Another finding was that the use of the existing capabilities of the team members seemed to be related to their motivation to work on improvements and whether improvements were indeed realised in practice. This suggests there are important limitations to the use of improvement teams. Improvement teams seem to be especially useful if there are many improvements to realise in the departments of the team members, or if the operators’ behaviour towards operational problems needs to be changed. However, if organisations have other mechanisms that use the existing problem solving capabilities of the team members well, and the behaviour towards operational problems is satisfactory, the introduction of improvement teams need not give the organisation any further advantages.

The research emphasised that the help of the coach was important in preventing problems with improvement tasks that differed from operational tasks. Coaches had to assist the teams with many tasks. A consequence of this is that coaches must be available to perform many tasks for the teams; they must be motivated and have enough slack to perform these tasks. The research did not show that teams could function well without the help of a coach. Because of
the essential role of the coaches to the teams, the extent of coaching potential determines the number of teams that can be introduced.

Literature on continuous improvement often emphasises the importance of using improvement tools. The use of tools can prevent problems with improvement tasks that differ from operational tasks, because by using tools more knowledge is incorporated into the improvement process. However, the findings of the research suggest that tools not only facilitate, they can also hinder improvement processes. Especially if the tools require new capabilities, and the team members are not motivated to learn these, problems can arise. The research also shows that tools might not be needed if improvement processes are selected where the existing slack capabilities of the team members can prevent problems, or if the coach assists the team with tasks. In such cases, the importance of using tools decreases; using tools, as emphasised in literature, might be of less relevance for such improvement processes.

Based on the analysis and discussion of the research findings, several hypotheses were formulated during the research; an overview of them is given in Appendix 2. These hypotheses are the major contribution of this research to the theory on continuous improvement in teams.
Samenvatting

Inleiding

Onderwerpen als organisatieverandering en in het bijzonder organisatieverbetering krijgen veel aandacht in zowel de literatuur als de praktijk. In de literatuur wordt vaak een onderscheid gemaakt tussen perioden van revolutie, met grote veranderingen, en perioden van evolutie, met kleine stapsgewijze oftewel incrementele veranderingen. Hoewel de veranderingen gedurende perioden van evolutie minder radicaal zijn, zijn incrementele veranderingen ook belangrijk. Vooral als incrementele veranderingen continu plaatsvinden, kunnen ze een belangrijke bijdrage leveren aan het concurrentievoordeel van organisaties. Vanwege het belang van continue incrementele veranderingen, is dit onderzoek specifiek gericht op dit soort veranderingen.

Literatuur over continu verbeteren

Gedurende de zeventiger en tachtiger jaren onstond er, vanwege de toegenomen concurrentie door Japanse organisaties, meer en meer aandacht voor de Japanse manier van organiseren en managen. Belangrijke onderwerpen waren onder meer kwaliteitskringen, integrale kwaliteitszorg (Total Quality Management) en lean production. Naast literatuur over deze onderwerpen verscheen er gedurende de tachtiger en negentiger jaren ook literatuur die specifiek aandacht besteedde aan het organiseren van voortdurende incrementele verbeteringen, oftewel continu verbeteren. De bestaande literatuur over continu verbeteren kan worden onderverdeeld in drie groepen:

1. Veel bestaande publicaties kunnen worden gekenschetst als attentie literatuur. Deze publicaties benadrukken het belang van incrementele verbeteringen en ze zorgen er voor dat continu verbeteren onder de aandacht komt. Verder worden vaak algemene voorschriften voor continu verbeteren gegeven, waarbij het kan worden betwijfeld of die voorschriften zijn gebaseerd op wetenschappelijk onderzoek.

2. Een tweede soort literatuur is beschrijvende literatuur. Deze literatuur beschrijft de bestaande praktijk van continu verbeteren. De meerderheid van deze literatuur beschrijft methoden en technieken voor, en toepassingen van, continu verbeteren. Verder bestaat deze literatuur vaak uit publicaties over kaizen, of vergelijkingen tussen kaizen en westere manieren van verbeteren. Anderen hebben de verspreiding van continu verbeteren onderzocht, bijvoorbeeld in Europa of de Verenigde Staten.

3. Een derde, momenteel nog vrij zeldzame, soort literatuur is theoriebouw literatuur, die poopt bij te dragen aan het ontwikkelen van theoretie over continu verbeteren. Deze literatuur probeert empirische observaties te categoriseren en te verklaren, en geeft aandacht aan de mechanismen en regels achter observaties. Theoriebouw literatuur analyseert de manieren die er zijn om continu verbeteren te organiseren en te managen, en
Summary/Samenvatting

bespreekt bijvoorbeeld de rol van werken in teams, welke soorten teams bestaan, en hoe teams functioneren.

Vanwege de kenmerken van de bestaande literatuur over continu verbeteren zijn veel bedrijven zich bewust geworden van het belang van continu verbeteren. Velen vinden het echter ook lastig om continu verbeteren succesvol toe te passen. Een reden hiervoor is dat in de literatuur veel aandacht is besteed aan het promoten van continu verbeteren, en het voorschrijven van oplossingen en specifieke technieken. Er is echter minder aandacht besteed aan het beschrijven van wat er nu precies in de praktijk gebeurt en het opbouwen van theorie die verklaart wat er gebeurt. Een gevolg daarvan is dat de wetenschappelijke basis van de bestaande voorschriften niet duidelijk is. Verder is veel van de bestaande theorie niet aangepast aan specifieke lokale omstandigheden. Dat heeft tot gevolg dat organisaties continu verbeteren op een moeilijke manier moeten ontdekken; ze moeten vaak al doende, met vallen en opstaan, leren hoe ze continu verbeteren kunnen gebruiken. Dat heeft de nodige inspanning en kosten tot gevolg. Een doel van dit onderzoek is om het theoretische en praktische probleem van het gebrek aan theorie over continu verbeteren op te lossen, en bij te dragen aan het ontwikkelen van theorie over continu verbeteren. De aandacht is daarbij gericht op incrementele verbeteringen die worden gerealiseerd door verbeterteams.

Theorie om verbeteringen in teams te verklaren

Een verbeterteam is een groep mensen die, vaak samen met een coach, werkt aan het oplossen van problemen in het eigen werk. Voor mensen uit een verbeterteam zijn er dus twee soorten processen: (1) het operationele proces, dat bestaat uit het dagelijks werk van de teamleden, en (2) het verbeterproces (zie Figuur 1). De figuur laat zien dat operationele en verbeterconfiguraties één gemeenschappelijk element hebben: de mensen uit het verbeterteam; andere elementen van de organisatie kunnen verschillen.

Gebaseerd op contingentie theorie en het procesmodel dat in dit onderzoek wordt gebruikt, wordt een organisatie gezien als een doelgericht geheel van mensen die, al dan niet gebruik makend van middelen, processen uitvoeren die gericht zijn op het realiseren van een gewenste functie. Organisatorische regelingen verdelen en coördineren de activiteiten waaruit de processen bestaan. Volgens de contingentie theorie van organisaties wordt een effectieve organisatie gekarakteriseerd door een fit tussen gewenste
functie en de karakteristieken van de processen, de mensen, de middelen, en de organisatorische regelingen. Figuur 2 illustreert dit.

De leden van een verbeterteam werken zowel in het verbeterproces als in het operationele proces. Als de fit vereisten van de contingentie theorie dus voor verbeterteams worden toegepast, dan betekent dat, als beide configuraties effectief moeten zijn, dat de karakteristieken van het proces, de mensen, de middelen, en de regelingen bij elkaar moeten passen in zowel de verbeterconfiguratie als de operationele configuratie. Met andere woorden, de teamleden moeten zowel passen bij de operationele als de verbeterconfiguratie (zie Figuur 3). Als de karakteristieken van het operationele proces verschillen van die van het verbeterproces, dan suggereert de contingentie theorie dat het niet vanzelfsprekend kan worden aangenomen dat de organisatie van het operationele proces ook de meest effectieve is voor het verbeterproces. Het kan bijvoorbeeld betwijfeld worden of het mogelijk is voor verbeterteams om beide processen effectief uit te voeren en beide gewenste functies te realiseren. Gebaseerd op deze redenering kan men zich afvragen wat de gevolgen zijn van overeenkomsten en verschillen tussen de operationele processen en de verbeterprocessen die worden uitgevoerd door verbeterteams. Men kan zich afvragen of verbeterprocessen kunnen worden verklaard door de verschillen en overeenkomsten tussen operationele processen en verbeterprocessen.

**Het belangrijkste onderzoeksprobleem is: In welke mate verklaren overeenkomsten en verschillen tussen de operationele processen en de verbeterprocessen de problemen die optreden, of niet optreden, in de verbeterprocessen van de verbeterteams?**

**Onderzoeksmethode**

In het onderzoek lag de nadruk op verbeterteams die bestonden uit mensen van de werkvloer van batch-gewijze productieprocessen. De belangrijkste redenen voor deze focus waren de generaliseerbaarheid van de resultaten en de mogelijkheid om toegang te krijgen tot bedrijven in de praktijk om onderzoek te doen. De gebruikte onderzoeksmethode was case studie onderzoek in de vorm van actieonderzoek. Omdat nog niet veel bekend was over het onderzoeksprobleem, was case studie onderzoek een geschikte onderzoeksmethode. De redenen om actieonderzoek uit te voeren waren dat deze methode goed paste bij het doel om kennis te genereren die gebruikt kan worden voor toekomstige acties in de praktijk, omdat de duale rol van onderzoeker en adviseur goed vervuld kon worden, en omdat sociale complexiteiten goed ervaren konden worden.
De analyse eenheden van het onderzoek waren de verbeteractiviteiten uitgevoerd door de teams, en niet de teams zelf. Gedurende een periode van acht maanden zijn vijf verbeterteams in twee bedrijven onderzocht. De onderzoeker vervulde de rol van coach van één van de teams en was observator bij de andere vier teams; daarnaast had de onderzoeker de rol van adviseur voor het management van de teams. Gedurende de acht maanden vervulden de teams 15 grote en 38 kleine verbeterprocessen die in totaal bestonden uit 735 verbeteractiviteiten, waarvan er 586 werden uitgevoerd door de teams zelf (de overige activiteiten werden uitgevoerd door mensen buiten de teams). De activiteiten van de verbeterteams werden onderverdeeld in zes typen, gebaseerd op de overeenkomst of het verschil met de operationele activiteiten, de problemen die wel of niet ontstonden bij het uitvoeren van de activiteit, en de mensen (teamlleden of mensen buiten het team) die de activiteit uitvoerden. Alle verbeterprocessen met hun activiteiten zijn beschreven in een database. Deze database maakte het mogelijk om een groot aantal verbeterprocessen en activiteiten op een gestructureerde manier te analyseren.

**Analyse van de bevindingen van het onderzoek**

De bevindingen van het onderzoek (zie Figuur 4) laten zien dat veel verbeteractiviteiten (78%) verschilden van de operationele activiteiten van de teamleden. Slechts 22% van de verbeteractiviteiten correspondeerde met de operationele activiteiten. De figuur laat ook zien dat van de corresponderende activiteiten de meeste niet problematisch waren (slechts 3% is problematisch, terwijl 19% niet problematisch is). Daarnaast laat de figuur zien dat ook veel verbeteractiviteiten die verschilden van de operationele activiteiten niet problematisch waren (68%); slechts 10% van de activiteiten verschilden van de operationele activiteiten en was problematisch.

Het onderzoek liet verschillende relaties zien tussen de problemen die ontstonden met verbetertaken, en de overeenkomsten en verschillen met de operationele taken:

- De bevindingen van het onderzoek laten enkele *algemene redenen* voor problemen zien; deze traden op bij zowel corresponderende als verschillende verbetertaken. Deze redenen waren relevant voor 15 van de 63 problematische verbetertaken die werden uitgevoerd.
door de teams. Sommige soorten problemen treden op bij alle soorten verbetertaken, onafhankelijk van het verschil of de overeenkomst met de operationele taken. Het onderzoek laat ook zien dat deze algemene redenen voor problemen slechts voorkomen bij een zeer klein aantal verbetertaken. Eén algemene reden dat verbetertaken problematisch waren, was dat het probleem verdween omdat het was opgelost door activiteiten buiten het betreffende verbeterproces. Een andere reden voor problemen was dat teamleden niet gemotiveerd waren om de vereiste taken uit te voeren. Verder was een reden voor problemen dat mensen vergaten om de vereiste taken uit te voeren. Dit alles laat zien dat niet alle problemen die optraden in verbeterprocessen van verbeterteams afhankelijk zijn van de overeenkomsten en verschillen tussen de operationele taken en de verbetertaken.

- Het onderzoek laat zien dat sommige verbetertaken die verschillen van de operationele taken problematisch zijn. Deze groep bestond uit 58 taken (10% van alle verbetertaken uitgevoerd door de teams). Bij de meeste van deze taken (51 van de 58) was geen algemene oorzaak voor de problemen aan te wijzen; er was blijkbaar een andere reden voor de problemen. De belangrijkste reden voor de problemen was dat er functionele conflicten bestonden die resulteerden in problemen. Er waren echter ook andere redenen voor problemen van belang. Eén zo’n andere reden was dat het in sommige gevallen gewoonweg heel moeilijk was om een geschikte oplossing voor het probleem te ontwikkelen. Verder was een reden voor problemen dat de operationele taken meer prioriteit kregen dan de verbetertaken; daardoor werden de verbetertaken die moesten worden uitgevoerd buiten de teambijeenkomsten vertraagd.

- Verbetertaken die corresponderen met de operationele taken kunnen ook problematisch zijn. Deze groep bestond uit 15 taken (3% van alle verbetertaken uitgevoerd door de teams). Bij ongeveer de helft van deze taken (7 van de 15) was er geen algemene reden voor problemen aanwezig, maar was een andere oorzaak relevant. Een reden voor problemen die werd geïdentificeerd in het onderzoek was een geïmporteerde misfit. In zo’n geval bestonden in de operationele configuratie dan al misfits, en deze misfits werden geïmporteerd naar de verbeterconfiguratie. Het gevolg hiervan was dat verbetertaken die correspondeerden met (problematische) operationele taken ook problematisch waren. In dit onderzoek ontstonden geïmporteerde misfits alleen bij de communicatie tussen het team en hun chefs. Het aantal malen dat geïmporteerde misfits optraden was beperkt.

- Veel verbetertaken verschillen van de operationele taken, maar waren niet problematisch. Deze groep bestond uit 339 taken (68% van de verbetertaken uitgevoerd door de teams). Er waren verschillende redenen dat er geen problemen optraden. Een belangrijke reden was dat er speling was in de operationele configuratie die gebruikt kon worden om verbetertaken succesvol uit te voeren. Een andere belangrijke reden voor het niet optreden van problemen was de hulp van de coach met het uitvoeren van verbetertaken, vaak voerden coaches ook zelf verbetertaken uit. Verder traden in sommige gevallen geen problemen op omdat verbeterhulpmiddelen werden gebruikt.
• Veel verbetertaken die **corresponderen** met de operationele taken waren **niet problematisch**. Deze groep bestond uit 114 taken (19% van de verbetertaken uitgevoerd door de teams). De belangrijkste reden dat er geen problemen optraden was dat de verbetertaken **correspondeerden** met de operationele taken; de teamleden waren daarom goed in staat om de verbetertaken uit te voeren. Dit was echter niet de enige reden dat er geen problemen optraden. Bij sommige communicatietaken werden problemen voorkomen door de **hulp van de coach** en het feit dat communicatie **welbewust werd georganiseerd** of bij toeval plaats vond. Deze laatste redenen dat er geen problemen optraden kwamen voor bij taken die in het operationele proces ook problematisch waren; de redenen voorkwamen dat geïmporteerde misfits problemen veroorzaakten met verbetertaken.

Het onderzoek liet zien dat de overeenkomsten en verschillen tussen operationele taken en verbetertaken van belang is om verbeterprocessen te verklaren. Het is echter niet mogelijk om te stellen dat verbetertaken die verschillen van de operationele taken problematisch zullen zijn, terwijl corresponderende taken niet problematisch zullen zijn. De relaties tussen overeenkomsten en verschillen, en de problemen die optraden zijn wat gecompliceerder:

- Het onderzoek laat zien dat de meeste verbetertaken die **corresponderen** met de operationele taken **niet problematisch** waren. Als ze wel problematisch waren, dan was er een duidelijke reden voor de problemen, namelijk dat de corresponderende operationele taken ook problematisch waren (of dat er een algemene oorzaak voor de problemen was).

- Het onderzoek laat ook zien dat **problematische verbetertaken** konden worden verklaard door het **verschil** met de operationele taken, of met de **overeenkomst met problematische operationele taken** (of vanwege het bestaan van algemene oorzaken voor problemen).

Het onderzoek liet ook zien dat sommige relaties niet werden gevonden:

- Er werd **niet** gevonden dat **niet-problematische verbetertaken** altijd **corresponderen** met de operationele taken; het onderzoek liet zien dat veel verbetertaken die niet problematisch waren juist verschillen van de operationele taken.

- Verder werd er **niet** gevonden dat verbetertaken die **verschillen** van de operationele taken altijd **problematisch** zullen zijn. Bij veel van deze taken traden juist geen problemen op vanwege specifieke redenen, bijvoorbeeld vanwege de hulp van de coach.

- Er werd ook **niet** gevonden dat verbetertaken die **corresponderen met problematische operationele taken** altijd **problematisch** zullen zijn. Het onderzoek liet zien dat sommige van zulke verbetertaken niet problematisch zijn vanwege specifieke redenen, bijvoorbeeld vanwege de hulp van de coach.
De belangrijkste relaties die worden gesuggereerd door het onderzoek worden weergegeven in Figuur 5. Het onderzoek liet ook zien dat er drie algemene redenen voor problemen waren: mensen waren niet gemotiveerd om een taak uit te voeren, ze vergaten een taak uit te voeren, of problemen verdwenen. Deze redenen traden op bij zowel de corresponderende als de verschillende verbetertaken; ze zijn niet meegenomen in de figuur. Het is belangrijk om te bedenken dat het onderzoek ook liet zien dat veel verbeteractiviteiten die problematisch waren niet resulteerden in problemen in het verbeterproces als geheel.

Verder liet het onderzoek zien dat het niet voldoende is om alleen naar de overeenkomsten en verschillen tussen operationele taken en verbetertaken te kijken; er zijn meer dingen relevant. De inzichten over fit die werden ontwikkeld op basis van het procesmodel konden goed worden gebruikt om te verklaren wat er zich afspeelt in verbeterprocessen van verbeterteams. Het procesmodel kon goed gebruikt kon worden om te verklaren waarom verbetertaken die verschillen van de operationele taken niet problematisch waren. Gebaseerd op de inzichten die het procesmodel gaf, werd duidelijk dat speling, de hulp van de coach, en het gebruik van verbeterhulpmiddelen belangrijk was in het voorkomen van problemen.

Figuur 5: Relaties die werden gesuggereerd door het onderzoek (algemene redenen voor problemen zijn niet meegenomen).

Discussie van de belangrijkste bevindingen

Redenen voor problemen

De discussie van de verschillende redenen voor problemen laat zien dat, naast functionele conflicten en algemene redenen voor problemen ook de structurele en culturele karakteristieken van de organisatie van belang waren voor het verklaren van de problemen die optraden. De cultuur van de onderzochte organisaties was zo dat mensen er naar neigden prioriteit te geven aan het uitvoeren van operationele taken; communicatie werd niet gezien als zeer belangrijk. Het onderzoek suggereerde dat als communicatie niet veel aandacht krijgt in de organisatiecultuur, een goede structuur voor de communicatie van groot belang is voor het succes van verbeteractiviteiten en –processen. De discussie liet ook het belang van een ander structureel kenmerk zien: mensen moeten de tijd krijgen om aan verbeteringen te werken, bijvoorbeeld gedurende teambijeenkomsten. Als teams deze tijd niet krijgen dan zullen operationele taken de prioriteit krijgen boven verbetertaken en zullen er problemen ontstaan met verbetertaken, in het bijzonder met verbetertaken die niet eenvoudig samen met de operationele taken kunnen worden uitgevoerd.
Redenen voor geen problemen


Het onderzoek liet zien dat *speling* in de operationele configuratie belangrijk was in het voorkomen van problemen met verbetertaken die verschillen van de operationele taken. Verder liet het onderzoek zien dat verbeterteams een goed mechanisme waren om de bestaande speling in de kennis en vaardigheden van de mensen op de werkvloer te benutten. In beide organisaties van het onderzoek werden deze kennis en vaardigheden beter gebruikt sinds de introductie van de teams. Het belang van de speling in capaciteiten van de teamleden kan verklaard worden door het feit dat de teams verondersteld werden om de meeste verbeteractiviteiten zonder hulp van derden uit te voeren. Op deze manier werden zij verondersteld om het verbeterproces aan te passen op hun eigen capaciteiten. Een gevolg daarvan was weer dat minder problemen optraden met verbetertaken, en dat de bestaande speling in kennis over operationele problemen goed geëxploiteerd kon worden door de teams. Het onderzoek suggereerde dat de teams zeer effectief waren in het benutten van de bestaande probleem-oplossende capaciteiten van de teamleden, terwijl de nieuwe probleem-oplossende vaardigheden die werden ontwikkeld slechts beperkt waren. Ook hierbij is het waarschijnlijk dat de selectie van verbeterprocessen door de teams van belang was; het is mogelijk dat teams verbeterprocessen selecteerden die pasten bij hun eigen capaciteiten, terwijl ze processen waar ze veel nieuwe capaciteiten voor moesten leren negeerden. Verder liet het onderzoek zien dat de teams effectief waren in het veranderen van het gedrag van de mensen van de werkvloer bij het optreden van operationele problemen; mensen gingen bijvoorbeeld sneller acties ondernemen wanneer fouten optraden. Een andere bevinding van het onderzoek was dat het gebruik van de bestaande capaciteiten van de teamleden leek samen te hangen met hun motivatie om aan verbeteringen te werken en feit of er daadwerkelijk verbeteringen in de praktijk werden gerealiseerd. Dit suggereert belangrijke beperkingen aan het gebruik van verbeterteams. Teams lijken in het bijzonder bruikbaar te zijn als er veel verbeteringen zijn te realiseren op de afdelingen van de teamleden, of als het gedrag van de mensen bij operationele problemen moet veranderen. Als de organisatie echter andere mechanismen heeft om de bestaande capaciteiten van de teamleden voor wat betreft het oplossen van problemen te benutten, en het gedrag bij operationele problemen is naar tevredenheid, dan kan het zijn dat de introductie van verbeterteams de organisatie niet veel extra voordelen oplevert.

Het onderzoek liet zien dat *de hulp van de coaches* belangrijk was in het voorkomen van problemen met verbetertaken die verschillen van de operationele taken. De coaches moesten de teams bij vele taken assisteren. Een gevolg hiervan was dat de coaches beschikbaar
moesten zijn om taken voor het team uit te voeren; ze moesten gemotiveerd zijn om dit te doen, en er genoeg speling voor hebben. Het onderzoek liet geen teams zien die goed konden functioneren zonder de hulp van de coach. Vanwege de grote rol van coaches voor de teams, bepaalt de hoeveelheid aanwezige coaching binnen een organisatie het aantal teams dat kan worden geïntroduceerd.

Literatuur over continu verbeteren geeft vaak veel aandacht aan het belang van het gebruik van verbeterhulpmiddelen. Het gebruik van verbeterhulpmiddelen kan problemen voorkomen met verbetertaken die verschillen van de operationele taken, omdat door het gebruik van verbeterhulpmiddelen meer kennis wordt ingevoerd in het verbeterproces. De bevindingen van het onderzoek suggereren echter dat verbeterhulpmiddelen verbeterprocessen niet alleen kunnen faciliteren, maar ook kunnen hinderen. In het bijzonder wanneer verbeterhulpmiddelen nieuwe capaciteiten vereisen, maar de teamleden niet gemotiveerd zijn om nieuwe vaardigheden te leren kunnen problemen optreden. Het onderzoek liet ook zien dat het gebruik van verbeterhulpmiddelen niet nodig is als er verbeterprocessen worden geselecteerd waarbij de bestaande spelingscapaciteiten van de teamleden al problemen voorkomen, of als de coach het team assisteert met taken. In zulke gevallen verminderd het belang van het gebruik van verbeterhulpmiddelen; het gebruik van tools zoals dat wordt benadrukt in de literatuur kan dan ook van minder groot belang zijn in zulke verbeterprocessen.

Gebaseerd op de analyse en discussie van de onderzoeksbevindingen is een groot aantal hypotheses geformuleerd gedurende het onderzoek; een overzicht hiervan wordt gegeven in Appendix 2. Deze hypotheses vormen de belangrijkste bijdrage van dit onderzoek aan de theorie over continu verbeteren in teams.
Appendix 1: Activities in improvement processes

This section works towards a categorisation of the different activities in an improvement process. To make this categorisation, several different models are used that describe activities in innovation or improvement processes. First, several different models are briefly discussed. Then, it is considered which parts of each model can be used to describe improvement processes by an improvement team. Based on this discussion, a framework is developed that can be used to describe the relevant activities in improvement processes. Finally, the categorisation of activities is compared with the models found in literature.

The process model

Boer and Krabbendam

In the process model, different types of processes are distinguished. The transformation processes that transform inputs into outputs and which are useful for the environment of the organisation, and by which the organisation achieves its goals, are called the primary processes of the organisation (Boer, 1991). Alongside these primary processes, organisations employ support (or maintenance) and management (or regulatory) processes. Maintenance processes are focused on supporting the other processes by providing sufficient people, resources, and inputs to perform the transformations (Boer, 1993). Management processes have as a goal letting the other processes perform in the desired way (Boer, 1993). In this research, the focus is on the primary processes of the improvement organisation. These processes are called improvement processes.

During

During (1984) puts forward a model to categorise activities in an innovation process. In his model, he distinguishes three different types of processes: problem solving, internal diffusion, and organisational change (Boer, 1991):

1. **Problem solving.** The core of During’s innovation process model is a quasi-cyclical process of problem solving, which consists of four stages:
   - **Creative stage,** during which the innovation problem is defined or redefined and ideas for possible solutions are generated. Further, during this stage information is collected, analysed, and evaluated.
   - **Selection stage,** during which ideas are selected which appear sufficiently promising to be elaborated upon. Possible solutions are specified, and priorities are set against which possible solutions will be evaluated. Alternative solutions are evaluated and selected.
   - **Design stage,** during which concrete possibilities are elaborated. Principle solutions are designed and operational specifications determined.
• Application stage, during which the innovation is tested in practice and eventually implemented.

2. Internal diffusion. Internal diffusion consists of knowledge awareness, during which information about an idea or problem is transferred, and attitude formation, during which an opinion about the idea is formed.

3. Organisational change. To let the innovation be successful, organisational adaptations are needed.

Models of innovation and improvement processes

Imai

Imai (1986:61) says that the PDCA cycle is a series of activities, pursued for improvement. It consists of four stages:

1. Plan: Improvement begins with a study of the current situation, during which data are gathered to be used in formulating a plan for improvement.

2. Do: Once this plan has been finalized, it is implemented.

3. Check: After this, the implementation is checked so to see whether it has brought about the anticipated improvement.

4. Action: When the experiment has been successful, a final action is taken to ensure that the new methods introduced will be continued for sustained improvement.

Alongside the operational improvement activities, Imai also pays attention to activities that support the improvement process. Imai stresses the importance of collecting and using data to solve problems. One way to use data is by the use of improvement tools, such as diagrams and charts. These tools are supposed to support the improvement process.

Robinson

Robinson (1991) describes the road to improvement as several different steps. The improvement process can be broken down into two stages: problem identification, and problem solving. Both have several steps:

1. Problem identification

   - Identification. All improvements start with the perception of a problem, a slight deviation from the ideal or standard, detected by a sharply honed instinct for spotting problems. Thus, a problem can not become apparent unless the ideal state is known.

   - Research. Careful analysis of an occurrence will usually show there is more than one cause of a problem. Further, to solve a problem, it must be understood. This requires gathering all the relevant facts. The data that are collected must be organised to be easily understood.
Appendix: Activities in improvement processes

- **Idea formulation.** Problems dealing with workplace improvement often have many possible solutions and the goal is to select the best answer from these possibilities.

- **Organisation or idea modification.** There are many possible answers to problems, and the criteria used to judge a solution might come from the benefits produced by the various answers. Often, ideas must be modified through numerous experiences of trial and error.

2 Problem solving

- **Improvement implementation.** After an idea has been developed, it must be implemented.

- **Improvement follow-up.** After an idea has been implemented, it is important to check if the improvement is achieving the desired objectives. If the results are not satisfactory, it might be necessary to go back to the beginning and again with the improvement.

Alongside the operational improvement activities, Robinson also considers activities that support the improvement process. Robinson pays a lot of attention to the different tools that can be used in the improvement process to analyse data, like charts and diagrams; checklists; asking fixed questions, such as asking ‘why’ five times. Further, he says that for creative suggestion making, it is important to develop the ability to write.

**Van de Ven**

In the Minnesota studies, Van de Ven, (1989) developed an emerging innovation process model that is based on observations and data from seven innovations that have been intensively studied over time. The main points in his model are:

- At time zero in the model, a *shock* occurs that propels an idea or innovation in a new direction B, while the organisation is proceeding in the general direction A. The shock provides a discontinuity in the old organisation.

- As the innovation begins to be implemented in the organisation, a proliferation of new ideas occurs, and a *divergent multiple progression process* begins to emerge. The original idea develops into several ideas. The innovation still moves in direction B, but it now has multiple divergent and parallel paths of progression.

- As work proceeds on the ideas over time, *setbacks and surprises* are encountered. Although some setbacks are treated as aborted dead ends to certain paths in the innovation process, more often they are terminated as incomplete or not immediately useful ideas, or components for progressing with the innovation at that point in time. These terminated ideas or components are often stored in memory or placed on the ‘shelf’ for possible subsequent use. For an ongoing organisation that undertakes multiple innovations over time, these terminated ideas and components become a rich store of knowledge and materials for use in unforeseen ways in subsequent innovations.
Appendix: Activities in improvement processes

• As the innovation develops further, *convergent linkages* are established by integrating different component paths of the innovation, as well as by overlapping the old and the new. Converging links emerge between the operational organisation moving towards point A, and the innovation moving towards point B. This process of multiple convergent progression appears to take three forms: (1) the old organisation can be moved towards point B, as the entire organisation fundamentally changes direction as a result of the innovation, or (2) the innovation can be moved towards point A and blended into the old organisation, or (3) the old and the new can coexist in parallel progression with linkages between the old and the new.

• Also, the organisation is constantly being *restructured* as it moves towards point B. The initial shock may require restructuring, proliferation requires restructuring, setbacks and surprises may require restructuring, and linkages require restructuring.

• Finally, *hands-on top management* takes place all along the route towards point B. Top management controls proliferation, deals with setbacks, helps to link the old and the new, and restructures the organisation as needed, in addition to providing general goals and resources to support the innovation.

The model of Van de Ven indicates that the messy and complex progression of ideas as observed in the innovation cases is not accurately represented by a simple, sequential progression model of stages or phases.

**Decision models**

**Mintzberg**

Mintzberg (1976) used empirical research to suggest a basic framework that can be used to describe unstructured, strategic decision processes. Although the model of Mintzberg is about decision processes rather than renewal processes such as innovation or improvement, it is very useful to this research. The model of Mintzberg gives some clear insights into the activities that are performed when decision-makers try to find a solution to a problem. Also in improvement processes, a solution must be found to a problem, and thus many correspondences between the activities could be expected. Hence, the model of Mintzberg is useful when studying improvement processes.

In his model, Mintzberg distinguishes three phases, which are described in terms of seven routines. Three sets of supporting routines are further distinguished, which support the central phases. The three phases with seven routines are:

1 Identification phase:
   - *Decision recognition*, in which opportunities, problems, and crises are recognised and evoke decisional activity.
   - *Diagnosis*, in which management seeks to comprehend the evoking stimuli and determine cause-effect relationships in the decision situation.
Appendix: Activities in improvement processes

2 Development phase: in which the activities lead to the development of one or more solutions.
   - *Search routine*, focussed on finding ready-made solutions.
   - *Design routine*, focussed on developing custom-made solutions or modifying ready-made ones.

3 Selection phase:
   - *Screen routine*, which is used to reduce a large number of ready-made alternatives to a few feasible ones.
   - *Evaluation-choice routine*, which is used to investigate the feasible alternatives, and to select a course of action.
   - *Authorisation*, which is used to ratify the chosen course of action at a higher level in the organisation hierarchy.

Further, Mintzberg distinguishes three sets of supporting routines:

(a) *Decision control*, which concerns decision making about the decision process itself.

(b) *Communication*, which provides the input and output information necessary to maintain decision making. Three types of communication are distinguished: (1) The exploration routine; the general scanning for information and the passive review of what comes unsolicited. (2) The investigation routine; the focused search and research for special-purpose information. (3) The dissemination; disseminating information about the decision process.

(c) *Political routine*, which help the decision maker to work to a solution in an environment of influencing and sometimes hostile forces. Political activities reflect the influence of individuals who seek to satisfy their personal and institutional needs by the decisions made in an organisation.

Alongside these routines, Mintzberg distinguishes several dynamic factors that are important in strategic decision processes: interrupts, scheduling delays, timing delays and speedups, feedback delays, comprehension cycles, and failure recycles.

**Discussion and integration of the different models**

The categorisation of processes by Boer and Krabbendam is very general and much attention is paid to the activities that are performed alongside the primary activities. However, this research focuses on the primary improvement activities and therefore a more detailed categorisation of the primary improvement activities is needed. Several other models can be used for this.

The model of During focuses in more depth on operational activities in an innovation process. During distinguishes problem solving, internal diffusion, and organisational change.
However, his model of an innovation process is not fully applicable to improvement processes. Therefore it has been adapted as follows:

- In an innovation process, organisational change is needed to adapt the organisation to the innovation that is to be implemented. Innovation is often about abrupt, volatile changes and large steps, while improvement is about gradual changes and small steps (Imai, 1986). Consequently, organisational change seems to be less relevant to improvements. Improvements are focused on optimising the existing organisation by small adaptations and not on radically changing it. Therefore, it is unlikely that the existing organisation will have to be changed to realise improvements. Therefore, organisational change is not distinguished in describing improvement processes.

- Because innovation is often about abrupt, volatile changes and large steps, while improvement is about gradual changes and small steps (Imai, 1986), it is less likely that people will have to get used to new ideas in improvement processes. The activities of knowledge awareness and attitude formation therefore seem to be less relevant to small improvements and therefore these activities are not distinguished in describing improvement processes.

- Innovation processes have a scrap and rebuild mode and they are focused on technological breakthroughs and new inventions. Further, the effects of an innovation are often dramatic (Imai, 1986). Therefore, it is very important to prepare for the implementation of innovations carefully. Often several different solutions are developed in order to find the best solution for the problem at hand. Contrarily, improvement processes are less complicated. Improvements are more focussed on maintaining the existing solution and more focused on conventional know how (Imai, 1986). Often, a solution is less complicated and less planning is needed before the solution can be implemented. Therefore, in improvement processes it is less relevant to distinguish between the creative stage, the selection stage, and the design stage in the operational improvement process. In this research, these stages are combined in the activity ‘develop a solution’.

The Plan-Do-Check-Action model of Deming that Imai uses also pays specific attention to operational improvement activities. Imai shows that an improvement process consists of four main activities: preparing, and then implementing a solution, testing the solution, and standardising it. Especially testing and standardising receives much attention by Imai. These activities are very important in improvement processes, because the changes that are a result of an improvement process are often small and not dramatic. There is a significant risk that not enough attention is paid to testing the usefulness of the solution and in the standardisation of the solution. Imai shows that it is important to recognise these activities in improvement processes. Imai, and also Robinson, give a lot of attention to certain activities that support the improvement process. They discuss the importance of gathering and analysing data; they discuss many different improvement tools that can be used to support the improvement process. Imai proposes that the sequence Plan-Do-Check-Action is important. This research
takes a different view as is explained in more detail later in this section, when the model of Van de Ven is discussed.

The model of Mintzberg especially focuses on the planning phase of Imai’s model. Mintzberg shows that several different activities can be distinguished in this phase, and his model can be used to specify the planning phase of Imai in more depth. Mintzberg shows that Imai’s planning consists two phases: (1) identification of the problem, and (2) developing a solution. Further, Mintzberg pays explicit attention to authorising the solution. With improvement teams authorisation is an important activity because often a team identifies a problem and works towards a solution on its own, but does not have the formal power to implement the solution. Before the solution can be implemented people outside of the team, such as a supervisor or manager, must authorise the solution. Thus, in improvement processes by an improvement team, authorisation is an important activity. Because of the differences in improvement processes, some adaptations must be made to the model of Mintzberg:

- As was shown earlier, the problems and solutions in an improvement process are often not very complicated. Problems can be easily recognised and solutions are based on existing know-how. Consequently identification of the problem, and development of a solution, are often not very complicated in an improvement process. Therefore, all the routines that Mintzberg uses in the identification and development phase are not distinguished in this research. It is enough to distinguish the two phases and the research routine.

- Because improvement processes often only concern incremental changes, not much disagreement about the solution is expected. Therefore, the political routine seems to be less important for incremental improvement processes and this routine is not distinguished explicitly in this research.

The model of Mintzberg pays no attention to what happens after a decision has been made, no implementation activities are distinguished. The model of Imai can be used to describe this part of the improvement process. Thus, the models of Mintzberg and Imai are complementary: together they can be used to describe operational improvement activities.

The model of Robinson lies somewhere between the models of Imai and Mintzberg. It pays somewhat more attention to identifying a problem and finding a solution than Imai does, and it also pays more attention to the implementation and its follow up than Mintzberg does. However, the model of Robinson adds little new insights to the combination of the models of Mintzberg and Imai; it distinguishes virtually the same activities as the combination of the two other models. In a sense it reaffirms the activities that are distinguished in the other two models.

The model of Van de Ven emphasises the messy and complex progression of ideas in an innovation process. It shows that an innovation does not follow sequential phases; that an innovation often consists of shocks, surprises, and setbacks. Improvement processes are about less radical changes than innovations, and thus less surprises should be expected; an improvement process could have a more structured character than an innovation process. However, improvement processes are about the development of new ideas and, therefore, in
improvement processes uncertainty also plays an important role. For example, it is often not clear which activities must be performed to achieve the desired output. Some of the messy and complex characteristics of the innovation processes that Van de Ven (and also Mintzberg) describes might also be found in improvement processes. The framework that is used to describe improvement processes must therefore be able to incorporate this complexity. In this research, this complexity is incorporated by describing all activities which might be possible. A sequence of activities is not suggested in the model, and not all the possible activities have to exist in each process. In this way, a model that can describe the different activities of an improvement process is used while the complexities that arise will not be ignored.

Based on the work of these authors, an overview can be made of the activities that are important in analysing improvement processes. The model of Boer and Krabbendam can be used as a general model to distinguish operational, management, and support processes. The models of Imai, Robinson, and Mintzberg can be used to describe the operational improvement process in more detail. The main activities in the operational improvement process are identifying a problem, analysing a problem, developing a solution, testing the solution, authorising the solution, implementing the solution, standardising the solution and evaluating the solution. The table on the next page gives an overview of these activities. The first column lists the activities that are distinguished in this research. The next columns compare this to the activities that are distinguished by the various authors.
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<th>Activities</th>
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<td></td>
<td></td>
<td></td>
<td>Communication</td>
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</table>
Appendix 2: Hypotheses formulated in the research

Hypothesis 1: Functional conflicts in developing a solution to an unfamiliar problem are likely to arise if a solution is required for a social problem, or for a problem that involves other departments.

Hypothesis 2: Functional conflicts in analysing unfamiliar information are unlikely to arise if the team is assisted with the task.

Hypothesis 3: Functional conflicts with structuring and writing down information are unlikely to arise if the team is assisted with the task.

Hypothesis 4: Functional conflicts in communication tasks are less likely to arise if the team is assisted with the task.

Hypothesis 5: Functional conflicts in taking the initiative to perform tasks are likely to arise if the team members are not motivated to perform the required task.

Hypothesis 6: Taking an initiative to perform improvement tasks is likely to be problematic if the tasks have to be performed outside the team meetings and operational processes have higher priority.

Hypothesis 7: Communication between a team and its supervisor is likely to be problematic if the task is also problematic in the operational configuration.

Hypothesis 8: Improvement tasks that correspond with problematic operational tasks are more likely to be problematic than improvement tasks that correspond with non-problematic operational tasks.

Hypothesis 9: Improvement tasks are likely to be problematic if a team forgets the required tasks.

Hypothesis 10: Improvement tasks are likely to be problematic if the team is not motivated to perform the required tasks.

Hypothesis 11: Improvement tasks that differ from operational tasks are less likely to be problematic if the team has slack in the operational configuration that can be used to perform the tasks.

Hypothesis 12: While performing operational tasks, team members gain slack knowledge that can be used to perform improvement tasks that differ from operational tasks.

Hypothesis 13: If team members are very committed, they are more willing to use their slack capabilities to perform improvement tasks that differ from operational tasks.

Hypothesis 14: By problem solving as a group, the different slack capabilities of the individual team members are combined and the team has more capabilities to perform improvement tasks that differ from the operational tasks than the individual team members have.
Appendix: Hypotheses formulated in the research

Hypothesis 15: While performing improvement tasks, team members gain slack knowledge that can be used to perform improvement tasks in later improvement processes that differ from operational tasks.

Hypothesis 16: Improvement tasks that differ from operational tasks are less likely to be problematic if the coach helps the team with the tasks.

Hypothesis 17: Improvement tasks that differ from operational tasks are less likely to be problematic if tools are used to facilitate the tasks.

Hypothesis 18: Improvement tasks that correspond with operational tasks are not likely to be problematic if the corresponding operational task is not problematic and none of the general reasons for problems exists.

Hypothesis 19: Communication between a team and its supervisor is less likely to be problematic due to imported misfits if the coach performs the task.

Hypothesis 20: Communication between the team and the supervisor is less likely to be problematic if communication channels are deliberately or coincidentally created.

Hypothesis 21: Improvement tasks that correspond with problematic operational tasks are less likely to be problematic if the existing misfits are deliberately or coincidentally corrected.

Hypothesis 22: Improvement tasks that have to be performed outside the team meeting and correspond with operational tasks will be less frequently problematic than improvement tasks that have to be performed outside the team meeting and differ from operational tasks.

Hypothesis 23: Team meetings are likely to facilitate people in making time to perform improvement tasks that differ from operational tasks.

Hypothesis 24: Improvement tasks that differ from operational tasks, and have to be performed outside of the team meetings will be more often problematic than improvement tasks that differ from operational tasks but that can be performed during a team meeting.

Hypothesis 25: If team members give more priority to performing their operational tasks, than to communicating about less urgent subjects with their supervisor, and there is no good structure for communication, then communication is likely to be problematic in the improvement processes.

Hypothesis 26: People outside of the team perform more difficult activities than the team members.

Hypothesis 27: Improvement activities performed by people outside of the team are likely to be problematic if the team does not remind them about the activities they have to perform.

Hypothesis 28: It is likely that a team will not remind people outside of the team about the activities they have to perform if a good structure for communication with people outside of the team does not exist.
Appendix: Hypotheses formulated in the research

Hypothesis 29: It is likely that a team will not remind people outside of the team about the activities they have to perform if the team gives more priority to performing operational tasks than to communicating with people outside of the team.

Hypothesis 30: It is likely that the team will not remind people outside of the team about the activities they have to perform if the team feels that it is not their task to remind people higher in the organisational hierarchy about activities they have to perform.

Hypothesis 31: Problematic improvement activities performed by people outside of the team are likely to result in problems with the overall improvement process if the team members are not motivated to correct such activities.

Hypothesis 32: The goals which improvement teams are given influence the improvement functions the teams select, and the improvement activities performed by the teams.

Hypothesis 33: Improvement activities to analyse a problem, test a solution, authorise the solution, and evaluate the solution will not be performed that often if improvement teams are supposed to select problems that can be solved without much additional help.

Hypothesis 34: Improvement teams are effective in exploiting the slack knowledge of the team members on problems in the operational processes.

Hypothesis 35: Slack in the operational configuration is unlikely to prevent problems in all improvement tasks that differ from operational tasks.

Hypothesis 36: It is likely that problem solving in other operational processes than those of the team members will not be facilitated by the slack capabilities of the team members.

Hypothesis 37: Organisation-wide problem solving is likely to be facilitated if the team is able to communicate about the problems they identified but which they cannot solve.

Hypothesis 38: Improvement teams are effective in exploiting the existing capabilities of the team members.

Hypothesis 39: Improvement teams are not effective in developing improvement capabilities in individuals.

Hypothesis 40: Improvement teams are effective in changing the team members’ behaviour towards problems in the operational processes.

Hypothesis 41: If improvement teams are supposed to perform most improvement activities without additional help, they are likely to select improvement processes that fit to their own slack capabilities.

Hypothesis 42: If improvement teams are expected to perform most improvement activities without additional help, they are likely to select simple problems where they do not have to learn new improvement capabilities.

Hypothesis 43: If teams can select the desired improvement function, they are likely to use their own knowledge about operational problems to select those problems that hinder themselves the most.
Appendix: Hypotheses formulated in the research

Hypothesis 44: Slack knowledge on new operational problems is likely to interrupt existing improvement processes if team members are very committed to solving operational problems immediately when they appear.

Hypothesis 45: Improvement teams are more likely to select improvement processes that contribute to organisation wide goals if these goals are communicated to them.

Hypothesis 46: The stronger the team members’ motivation, the greater the extent to which they use their improvement capabilities.

Hypothesis 47: The better the team members’ improvement capabilities, the stronger their motivation to work on improvements.

Hypothesis 48: The better the team members’ improvement capabilities, the more improvement tasks will be performed successfully.

Hypothesis 49: The more improvements that are realised, the stronger the team members’ motivation to work on improvements.

Hypothesis 50: With a differentiated design, it is likely that the coach must perform, and assist the team with, improvement tasks.

Hypothesis 51: A differentiated design is more likely to be effective if coaches have facilities to perform improvement tasks outside the team meetings.

Hypothesis 52: A differentiated design is more likely to be effective if coaches are motivated to perform improvement tasks.

Hypothesis 53: When a differentiated design is used, the possible number of improvement teams in the organisation is determined by the extent of the coaching potential.

Hypothesis 54: Improvement processes are more likely to be effective if tools are used that facilitate communication tasks.

Hypothesis 55: Improvement processes are more likely to be effective if tools are used that facilitate people to perform the required improvement tasks.

Hypothesis 56: Problems with improvement tasks are more likely to arise if the use of improvement tools requires capabilities of the team members that differ from the capabilities needed for their operational tasks.

Hypothesis 57: If teams can select the improvement function, and team members are not motivated to use improvement tools, teams are likely to select improvement processes where the use of tools can be avoided.

Hypothesis 58: If teams can select the improvement function, and they select improvements that fit their existing slack capabilities, it is likely that the use of tools will be less important.

Hypothesis 59: If coaches perform tasks that differ from the operational tasks for the teams, it is likely that the use of tools will be less important.
Appendix: Hypotheses formulated in the research

Hypothesis 60: The use of improvement tools is likely to facilitate improvement activities where the team members do not have sufficient slack capabilities to perform the improvement activities and the coach does not perform the activities.

Hypothesis 61: A differentiated design is likely to facilitate improvement activities if the team members have insufficient slack capabilities to perform the improvement activities and where they do not use tools that facilitate improvement activities.

Hypothesis 62: It is likely that it is more effective to decide during an improvement process whether to use tools for certain activities, than to use tools in every improvement process.

Hypothesis 63: It is likely that it is effective to decide during an improvement process for which activities the differentiated design will be used.

Hypothesis 64: It is likely that improvement teams will be able find a balance between exploiting the slack in the operational configuration, minimising the misfit in the improvement configuration, and maximising the desired improvement function.

Hypothesis 65: It is unlikely that slack in the operational configuration, help of the coach, or the use of tools can prevent all problems with improvement processes by improvement teams.
Appendix 3: Instruction for using the database

**Start the database:** To use the database, Microsoft Access must be started. Then the file containing the database must be opened.

**Structure of the database:** The database consists of four parts that are relevant for this research:

1. **Tables.** This part contains several tables where the basic information about the cases is stored. To read these data, the form-part of the database can be used.

2. **Queries.** Queries can be used to combine data from several tables, to sum totals, or to select data (for example all the activities that concerned the ‘identification of a problem’ of that were performed by the team ‘air’ and that were problematic). Some examples of queries are included in the database to show the major findings of the research.

3. **Forms.** Forms can be used to add new data to the database, and to display the existing tabulated data in a structured way.

4. **Reports.** Reports can be used to export or print data from the database in an appropriate format.

**Reading the case descriptions:** The 73 case studies of the research are all described in the ‘forms’ of the database. If the part with the forms is opened, three forms are displayed. The first two of these are the most important ones, they are relevant for reading the case data:

- One form contains a description of the 73 improvement processes with their activities. The first part of this form contains the description of the improvement process. The second part contains a short description of all the activities that were performed. At the end of the form, several extra fields are added that give some additional insights that were not especially relevant to this research.

- The second form is used to analyse the activities. The first part of this form contains a copy of the description of the improvement activity information on the process-form. The second part contains an analysis of the activity. This part is split into two sub-parts, one sub-part for the analysis of activities that were problematic, and one subpart to analyse the activities that were not problematic.

On both forms, a button is added to allow one to switch quickly to the other form. Some fields on the forms contain long descriptions, which are only partly shown on the form. These fields can be read by clicking on the field and scrolling using the arrows to the right of the field.
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