IMPLEMENTING COLLABORATIVE IMPROVEMENT
TOP-DOWN, BOTTOM-UP, OR BOTH?

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ABSTRACT
The research presented in this paper was aimed at increasing the current understanding of the process of developing collaborative improvement in Extended Manufacturing Enterprises (EME). Based on action research and action learning of three EMEs involving a total of thirteen companies from five European countries, the present study identifies three different approaches to collaborative improvement (CoI), that is, inter-organisational continuous improvement. One approach to CoI focuses on learning at a practical level, developing this knowledge into strategic and theoretical knowledge. We call this the bottom-up learning-by-doing approach. Another approach focuses on goal alignment and assessment to provide a foundation for improvement before actually improving. We call this the top-down directive approach. Yet another approach focuses on shared goals/vision and meeting on equal terms, and joint work in a non-directive matter. This is the laissez-faire approach. The different approaches influence the collaborative improvement results achieved, and how and why they do so is the question addressed this article.

INTRODUCTION
Theory about networks of firms developed since the early '80 from the idea that the firm needs to look outside its boundaries to find all the resources and competencies needed to produce its products/services. While some generic definitions of *network* are simply based on the presence of relations between persons, groups or bodies (e.g. Aldrich and Dubini, 1989), more specific ones distinguish networks as the place of *long term relations* between actors (e.g. Thorelli, 1986), and specifically an intermediate organisational form between market and hierarchy (Thorelli, 1986; Grandori, 1989; Miles and Snow, 1992). In effect, the battlefield of competition is increasingly moving from the level of individual firms to that of Extended

Manufacturing Enterprises (EMEs) (Busby & Fan 1993, Stock *et al.*, 2000).The basic mechanisms that characterises network relations or EME relations is *collaboration*, which is the willingness to share goals, information and technologies.

Due to functional and, especially, geographical and time separations between partners involved, EMEs can hardly rely on traditional organisational and managerial mechanisms supporting continuous improvement, while the Information and Communication Technology (ICT) needed to bridge these barriers is in its infancy. And then, even with suitable ICT-support, learning to improve collaboratively is a non-trivial, protracted process. Active collaboration between the firms involved is required in order to create and maximise synergy between the capabilities of the firms involved, while allowing each individual partner to realise its own strategic goals. This requires a well-developed capacity to learn, not only at the levels of individuals or companies, but also at the inter-organisational level. Until now there are few clear theories and tools to support inter-organisational learning in EMEs.

The EU-funded CO-IMPROVE project addresses this need. Focusing on the learning required to enhance collaborative improvement (hereafter CoI) of EME performance, the objective of the project is to develop:

- A business model, supported by:
- A software system, to facilitate collaboration between, and joint learning by, dispersed partners, as well as:
- Implementation guidelines building on a action learning approach and supporting the situational design, implementation and ongoing development of collaborative improvement, using the Business Model and the Software System.

The business model essentially describes what a CoI environment might look like, what may be enablers and barriers to achieving such an environment, what possibilities there are to create the enablers and to overcome the barriers. Furthermore, the model proposes and describes tools that are available for the partners to manage and monitor key aspects of the development process. Collaborative improvement can be defined as: "*a purposeful inter-company interactive process that focuses on continuous incremental innovation aimed at improving the performance the companies within a supply network*". The portal-based software system aims to enable and enhance the capturing, storage, retrieval, transfer and dissemination of knowledge generated as part of ongoing collaborative efforts to improve the performance of EMEs.

RESEARCH QUESTION

There are to the best knowledge and understanding of the authors no contributions addressing the implementation of CoI. Even, there are extremely few contributions to literature addressing the implementation of CI. This article focuses on the empirical evidence from three EMEs different approaches to initiate CoI: top-down directed, bottom-up learning-by-doing, and laissez faire. The research question addressed is:

Do the different approaches yield different results and, if so, why?

For reasons of space we will not to spend much text to presenting and discussing the theoretical background and methodological considerations. So, after a few words on method

and empirical setting, the main findings are presented, organised according to the different approaches towards CoI in each case. Next, the findings are discussed. The article is concluded with a summary and lines for further research.

METHODOLOGY

The central methodology in the project is action research (by university teams working closely together with three EMEs) of action learning processes (by the EMEs). The interventions by action researchers are based on the business model and aimed at facilitate the learning process.

THEORETICAL SETTINGS – ACTION LEARNING APPROACH

As mentioned in the methodology an action learning approach was applied to implement CoI. Action learning is an approach to the development of people in organisations, which takes the task as the vehicle for learning. It reverses the traditional learning process where one learns something first and then applies it. In action learning the starting point *is* the action. It is based on two principles:

- "There can be no learning without action and no (sober and deliberate) action without learning" (Revans, 1998)
- "Those unable to change themselves cannot change what goes on around them" (Revans, 1998)

Action learning is formulated around Revans' learning formula, L=P+Q (Revans, 1998). L stands for learning, P for programmed learning (i.e. current knowledge in use, already known, what is in books etc.) and Q for questioning insight.

Revans (1982) describes three processes central to action learning:

- A process of inquiry into the issue under consideration - its history, manifestation, what has prevented it from being resolved, what has previously been attempted. Revans calls this process System Alpha.
- Action learning is science in progress through rigorous exploration of the resolution of the issue through action and reflection. He calls this System Beta.
- Action learning is characterised by a quality of group interaction, which enables individual critical reflection, and ultimately the learning. This is the essence of action learning and Revans call it System Gamma. Revans (1998:75) refers to managers as "disciples of the Aristotelian ethic" by "doing what they set out to do and by setting out to do what they believe".

While the practice of action learning is demonstrated through many different approaches, two core elements are consistently in evidence:

- participants work on real organizational problems that do not appear to have clear solutions
- participants meet on equal terms to report to one another and to discuss their problem and progress (Marsick and O'Neil, 1999)

The implementation of action learning has four elements - the person, the group, the problem and action on the problem in the organisation and learning from it (Pedler, 1996). Action learning is essentially built around a structure whereby participants meet in a group, discuss and reflect on the progress of the particular project(s) on which they are working and then follow up on the learning from that meeting in the day-to-day enactment of attempted solutions to the problem.

Marquardt's (1999) six components of action learning provide a useful characterisation of the structure of action learning.

- A problem – whereby complex organisational issues which touch on different parts of the organisation and which are not amenable to expert solutions are selected and worked on.
- The group – comprises a typical number of six to eight members who care about the problem, know something about it and have the power to implement solutions.
- The questioning and reflective process.
- The commitment to taking action.
- The commitment to learning.
- The facilitator.

EMPIRICAL FIELD

The empirical field consists of three EMEs each comprising one system integrator and three or four suppliers. A system integrator (SI) is defined as a company that integrates components provided by a number of suppliers. The three SIs are located in Denmark, Italy and The Netherlands and their suppliers in Austria, Denmark, Germany, Italy and The Netherlands. In addition two software vendors (Sweden, Greece) and four universities (Denmark, Italy, Ireland and The Netherlands) are involved. The EMEs are active in the following businesses:

	SI	supplier 1	supplier 2	supplier 3	supplier 4
Denmark	mobile hydraulics	metal parts	metal parts	foundry products	
Italy	aircraft	composite parts	metal parts	metal parts	metal parts
Netherlands	electro hydraulics	plastic moulding	fine-mechanical parts	cylinder tubes	

In Figure 1 the accumulated number of improvement projects started in each EME is presented, further information about the projects is presented in Middel *et al.* (2003).
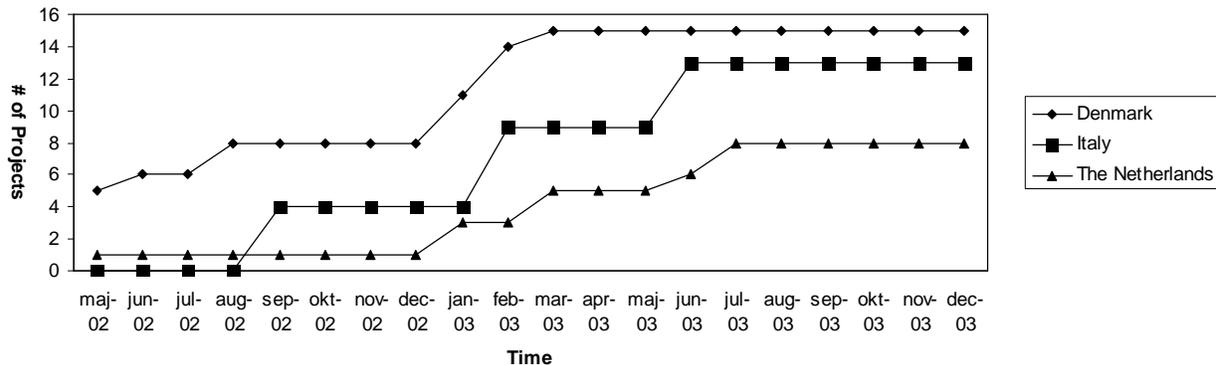
Figure 1: Accumulative number of improvement projects started in each EME.

THE DANISH EME

The philosophy behind the bottom-up and learning-by-doing approach implemented in the Danish EME was:

- Bottom-up: initial focus on the practical/operational level, gradually moving towards joint strategic aspects and from practice to the concept of collaborative improvement (theory).
- Learning-by-doing: initial focus on improvement projects within areas that where familiar to the participants (quality and delivery), slowly but steady advancing to greater impact, involve more resources and longer time perspective.

The philosophy behind this approach was that the practitioners need practical experience with CoI to create joint strategies and understand the concept in a, for them, new and partly unexplored area. Due to both practitioners' and researchers' inexperience with CoI (and the need for data access for the researchers) the Danish chose to incorporate high facilitation by researchers in the beginning of the CoI process. To create and keep momentum quick wins were sought in the first improvement cycles.

Structure

The two main aspects of the Danish implementation approach were a cycle of workshops and the work between the workshops. During the first eight months, these workshops had the following characteristics:

- Frequency: monthly workshops.
- Focus: planning, working with and presenting (in plenum) improvement projects.
- Team members: five supplier and four SI representatives, a consultant, two senior researchers and two PhD students, attendance close to 100%.
- Facilitation: researchers facilitated the workshops and decided the theme.

Between the workshops the PhD students facilitated the improvement projects initiated at the meetings. They attempted to keep the momentum by following up on deadlines and engaging in face-to-face interaction both jointly between the SI and the suppliers, but also at individual meetings. Operationalising the improvement projects demanded in some cases involvement of experts from the partner companies, e.g. quality engineering or IT experts. The interaction via phone and mail was frequent (almost daily) and the meetings were bi-weekly.

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Eight CoI projects were initiated during the first eight months, see Figure 1. The objective of these projects was to achieve improvements in areas such as quality, delivery and information sharing. One project was aimed at rolling out the SI's version of TPM into the supply chain.

Change of approach

After four months no new projects were initiated (see Figure 1), and the effort put into projects started during the first period, diminished too. This was mainly due to:

- Lack of project management and continuous improvement skills.
- Lack of joint dyadic vision needed to move beyond the results already achieved, no increasing impact, no spread further into the partner companies' organisations.

In order for the companies to foster the development of CoI the identified lack of skills and joint vision needed attention. Eight months into the process a decision was made to change the workshops to:

- Frequency: bi-monthly workshops.
- Focus: strategy, building up competencies, learning, reflection. Improvement projects: planning new, and learning from completed and ongoing, projects at the workshops.
- Team members: the same but the team became a steering committee, attendance close to 100%.
- Facilitation: researcher facilitated the workshops, theme decided by all members.

The aim of these changes was to achieve more frequent communication between the partners, to launch and conduct improvement projects with larger impact, and to get a longer, more strategic perspective in the projects. However, even though a large number of new improvement projects were initiated (see Figure 1), the focus and impact of these projects did change very slowly. Facilitation from researchers was still high after the change of approach. This change of approach is illustrated in Figure 2.
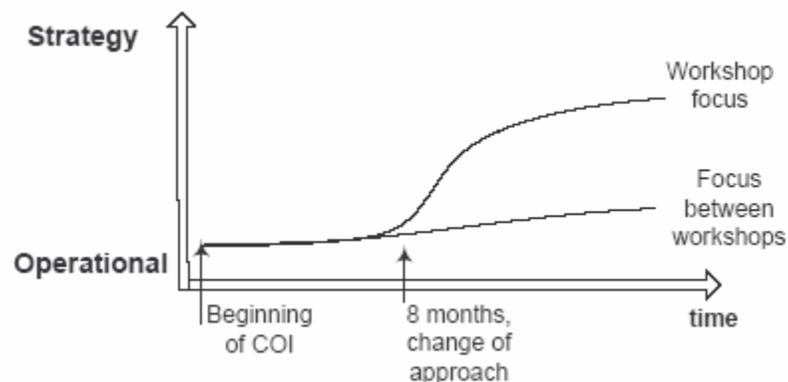
Figure 2: The development of the focus at workshops and between the workshops; Danish EME.

THE ITALIAN EME

Philosophy

The Italian EME chose a top-down and directive approach:

- Top-down: initial focus on assessment and goal alignment, which drove the selection of improvement projects
- Directive: due to the lack of previous experience and to the novelty of the approach, the process was guided by facilitators in terms of methodology and sequence of steps

The philosophy behind this approach was to provide structure and direction to the process by university and the SI and thereby to guide activities by providing methods and tools. The SI had no desire of imposing any decisions upon the suppliers. The reason the SI adopted this approach was that the company and the suppliers involved, lacked knowledge about and experience with CoI. They therefore thought it best to first provide direction (strategy), structure, methods and tools, so as to create a context within which, subsequently, CoI activities could be started.

Structure

Just like in the Danish EME, the CoI implementation process evolved around regular workshops. The workshops during the first five months had following characteristics:
- Frequency: monthly workshops.
- Focus: assessment, learning and planning, improvement projects.
- Team members: four senior researchers, one PhD student, two master students, and six supplier and six SI representatives, attendance close to 100%.
- Facilitation: researchers facilitated the workshops, which were prepared together with the SI representatives.

Between the workshops the master students tried to teach the representatives of the EME partners some basic collaboration theory and to train them in the use of assessment tools. However this seemed quite difficult for the participants to digest and as Figure 1 shows, actually not one single improvement project was initiated during the first five months, in spite of the facilitators' efforts not only at the workshops but also between the workshops.

Change of approach

In order to get out of this impasse, the EME decided to change focus, from creating a suitable context to actually doing things. To facilitate the new approach, the workshops were changed as follows:
- Frequency: two workshops every three months on average.
- Focus: planning, executing, evaluating, reflecting on and presenting (in plenum) improvement projects.
- Team members: six SI representatives were added to the team; attendance high but varying since some members were only involved temporarily for specific improvement projects.
- Facilitation: researchers facilitated the workshops, but participants were more proactive.

Between workshops company people further tried to work with improvement projects. This proved difficult for them. The improvement projects eventually commenced and the master students would attempt to keep the momentum by following up on deadlines, providing training for software tools and observing the interaction. In some cases experts from within the organisations, e.g. engineering or IT experts were involved. Between the workshops, contact between the practitioners was sporadic and defined by the needs of each project. The effects of the new approach are illustrated in Figure 3.
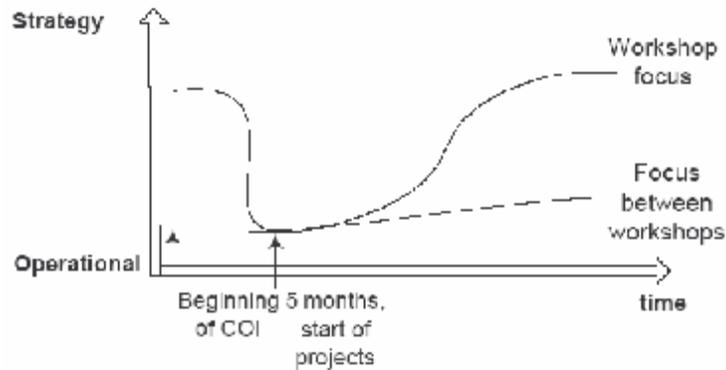
Figure 3: The development of the focus at workshops and in between in the Italian EME.

THE DUTCH EME

Philosophy
The Dutch initially chose a so-called laissez-faire approach, a non-directed approach, focused equally on the concept, assessment and non-facilitated improvement projects. The philosophy was that successful collaboration and improvement in a network of companies requires shared goals and vision, trust and commitment. CoI initiatives should be initiated and selected by the whole group based on immediate practical problems or improvement opportunities. The Dutch EME thought a laissez-faire approach would be the best way for the partners to discover and become aware of the concept and the possible benefits of CoI.

Structure
Eight months before the start of the process a workshop was held aimed at explaining the concept and benefits of CoI and assessing the current status with regard to CoI. In addition, the Dutch discussed the experiences, wishes and requirements related to CoI initiatives of each of the companies involved. During the first six months of the CoI implementation process, several workshops were held; only one improvement project was started. During that period, the workshops had the following characteristics:
- Frequency: bi-monthly workshops.
- Focus: assessment tools; initiating, selecting and planning improvement projects.
- Team members: one senior researcher, one PhD student, and three supplier and three SI representatives.
- Facilitation: researchers facilitated the workshops and decided the theme.
The only activity started during the first months concerned a quality improvement project.

Change of approach
The low number of improvement projects was mainly due to:
- Low frequency of workshops (bi-monthly) and, thus, no momentum.
- No sense of urgency.
- No direction from SI, which the suppliers actually were used to and therefore expected.
To create momentum and speed up or, rather, really start up the CoI process, attention was needed to the above bullets and the SI needed to become more directive. Consequently, after

six months, the EME changed strategy. As part of that the workshops were changed in various different respects:

- Frequency: monthly workshops.
- Focus: strong focus on choosing, working with and reflecting upon improvement projects and eventually diffusing learning between and into the companies.
- Team members: one representative of the SI less, but more active participation of others in improvement projects between the workshops.
- Facilitation: by the researcher, with a more active and directive role for the SI.

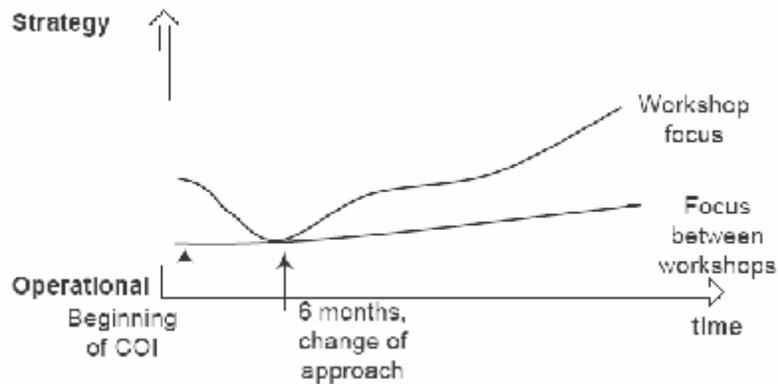The effects of the change of approach are shown in Figure 4.

Figure 4: The development of the focus at workshops and in between in the Dutch EME.

DISCUSSION

The discussion is divided into three main areas: the initial approach, workshops and activities taking place between the workshops.

Initial approach

The empirical evidence indicates that before commencing the implementation of CoI, one needs to consider how to approach that process. The main advantage of the bottom-up learning-by-doing approach selected in the Danish case was its focus on practical improvement projects and results. This created enthusiasm and engagement among the participants from the beginning of the process. The disadvantage became obvious eight months into the process when the EME experienced a stagnation of projects and motivation dropped. The main cause identified was lack of skills and joint vision, so they changed the approach accordingly. The strengths of the Italian approach, top-down and directive are skill and knowledge development, assessment of CoI maturity level, and identification of improvement areas. Five months into the process, however, the difficulty of translating these strengths into practical improvement projects became apparent. The Dutch identified lack of direction as a major disadvantage and when the SI started to take action in a more directive matter the results started to show.

Marsick and O'Neil (1999) and Revans 1982) claims that action learning or Q (questioning insight) cannot occur without action, inquiry and reflection amongst the participants. In Denmark the focus was primarily on action and the questioning insight accordingly to the

action occurring. With little focus on P such as initial collaboration level and assessment of existing knowledge the Danish case experienced stagnation on the improvement level and in number of initiated improvement projects. When focus was adjusted accordingly, the process received new energy and new improvement projects where initiated. The Italian and Dutch approach was focused at the P (programmed learning), existing knowledge and level of collaboration, but had little or no action to reflect upon and learn from. When focus was directed towards action and improvement projects, action along with Q and L started to occur. The learning took place without the difficulties experienced in the first phase of the Danish case and the reason was the foundation of P that was created before starting the actual action.

Evidence further suggests that, around half a year into the process, all three EMEs actively considered the pros and cons of each of the approaches outlined in this paper. With hindsight, however, a combination of the three approaches should probably have been considered. Anyway, in effect, all three EMEs changed strategy after some time, which rejuvenated the CoI implementation process in all cases. This seems to suggest that it is useful to evaluate, and consider a change or adjustment of, the selected approach at a suitable stage of the process. Using the theoretical terms, all cases simply experienced a imbalance in Revans (1998) formula and the change of approach was needed to adjust P and Q to create L.

Workshops

The structure of CoI in an action learning perspective must be developed based on a group based structure (Revans, 1998: 75). Marquardt (1999) and Pedler (1996) furthermore identify facilitation as an important factor to keep the actors focused on learning. Empirical evidence confirms the strong need for facilitation to kick-start the process and high frequency of interaction to keep the momentum. The initial philosophy in the laissez-fairer approach correspond very well to the recommendation from Marsick and O'Neil (1999), which is a set up at which the group meets on equal terms. The two other cases developed the workshop into this atmosphere but started out with directiveness from researchers and/or the SI. Creating this atmosphere caused difficulties initially because the suppliers regarded the relationship with the SI as a power relation (Nielsen et al, 2004). To experience proper learning Revans (1998) and Marquaerdt (1999) place emphasis on the commitment to learning, taking action and having willingness to change themselves to change what goes on around them. The empirical evidence shows difficulties with especially the latter, but once performed and once acknowledged by the partners the process matured faster.

According to the experience from the three cases and to theory we recommend the workshops to revolve around:

- Building up knowledge of CoI and improvement and project management skills to get CoI going.
- Assessing the CoI maturity level and potential areas for performance improvement.
- Creating a learning environment in which participants can and do share knowledge.
- Facilitating the translation of all this into concrete improvement projects.

The primary focus should be to commence improvement cycles and create results, while at the same time the development of skills and knowledge should not be neglected. After half a year or so, participants are likely to have developed some basic CoI skills and implemented them in

the daily work life. The focus of the workshops can gradually change away from actual improvement projects to the development of skills and a learning environment.

Between meetings
Another important interaction is between the workshops

The facilitation of improvement activities appeared very important as CoI was a new area to the participants. In the Danish case intense researcher facilitation from the beginning of the process ensured immediate results (see Figure 1), whereas the Italians and Dutch had difficulties, which were, at least partly, due to the much lower facilitation provided to those EMEs. The facilitators need not be experienced experts but merely individuals who will take action (as in the cases: PhD and master students), keep participants to deadlines and make sure that momentum is achieved and maintained. Furthermore theory and empirical evidence tells us that facilitation is very important to create a learning environment in which questioning and reflection occurs. In the course of time, external facilitation becomes less important, that is, provided that the industrial partners develop the experience and capacity needed to continue together, without assistance from outsiders.

CONCLUSION
The objective of this paper was to describe different approaches towards collaborative improvement, identify if the different approaches yield different results and, if so, explain why. Three system integrators with three to four suppliers each provided the empirical setting. Three approaches were identified through the three cases:
- Bottom-up learning-by-doing: move from practical level to concept and strategy, learning from experience.
- Top-down directed: focus on assessment and goal alignment to develop the foundation for improvement projects.
- Laissez-faire: a non-directed approach, with equal focus on concept building and experience from practice.

The strength of the bottom-up approach is that it creates immediate improvement results. Its potential weakness is that it may run out of steam after a while, due to lack of project management and continuous improvement skills and lack of joint vision. The strengths of the top-down approach are that it provides the fundament of theoretical knowledge, goal alignment and assessment improvement areas. Its potential weakness concerns the difficulty to translate knowledge and vision into action. The potential strength of the laissez-faire approach is that it may create a shared vision and goals, genuine collaboration and learning. However, if there is not enough commitment (will, time, resources) and/or trust, this approach does not even start to work.

The analysis presented in this paper also suggests that a combination of the three may actually be the best way to implement CoI, if not from the beginning then soon into the process. A successful implementation process requires understanding and direction (provided by the top-down approach), activity and learning (supported by the bottom up approach) and a genuine willingness to collaborate based on trust and commitment (key values underpinning the laissez faire approach).

We see four major lines for further research:

1) Are companies using other approaches not identified in our study? If so, what are the strengths and weaknesses of those approaches?

2) Is our proposition correct that a combination of the three approaches produces the most effective implementation of CoI? And would it be sensible to try and apply such a combination from the beginning? Or do companies need to go through a learning process anyway so that it may not actually make a difference how they start as long as they end up combining activity and learning and, from that, understanding, direction and a genuine willingness based on trust and commitment?

3) The study was performed in three EMEs, with SIs from three and suppliers from five West-European countries, all active in specific segments of the assembly industry (cars, aircraft, and agriculture). A main question is whether the results presented here hold for SIs and, especially, suppliers in other economic areas (e.g. Eastern-Europe and Asia), in other assembly industries (e.g. electronics, white-good), and also for example (semi-)process (e.g. food, pharmaceutical, chemical) industries.

4) The study has focused on dyads, not networks, and the first year and a half of attempts to get CoI off the ground. Further research is needed to identify successful approaches to get from the level of dyads to that of networks, and to find out if the approaches described and analysed in the present paper hold for later phases of collaborative improvement, i.e. with more mature partners.

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