Post-Project Reviews as a tool for stimulating commercialisation of knowledge creation projects at TNO Industrial Technology

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Post-Project Reviews are mainly used as a tool to improve organisational learning (Busby, 1999; von Zedtwitz, 2002). However, post-project reviews can also be used as a tool to identify new market potential and to hand over technical knowledge from technical to marketing personnel (von Zedtwitz, 2002). This paper presents the findings of a research project on the improvement of commercialisation at TNO Industrial Technology. After the problem analysis, post-project reviews are introduced as one of the potential solutions to improve the commercialisation of knowledge creation projects.

1. Introduction

This paper handles about the introduction of post-project reviews to stimulate commercialisation. It will start with a brief description of the case-company, TNO Industrial Technology. After this, the motives of the research will be clear and the research methodology will be explained in chapter 2.

1.1. TNO Industrial Technology

TNO Industrial Technology Institute is a public-funded Dutch research organisation for applied-scientific research. The mission of TNO is to generate knowledge based on scientific research and develop applications with the aim of strengthening the innovative power of the industry and the public sector. The main areas where such knowledge is developed are the fields of innovative product development, production processes, and materials application.

The government finances the research done by TNO Industrial Technology either wholly or partly and public funding makes about 30% of the institute's budget. The fundamental knowledge-creating projects with governmental funding have the duration of one year, during which the financing of the project is guaranteed. After that, a follow-up project can be started for further development of the created

knowledge and additional funding is possible[1]. If projects get more application-oriented, they must be increasingly financed by the industry (figure 1).
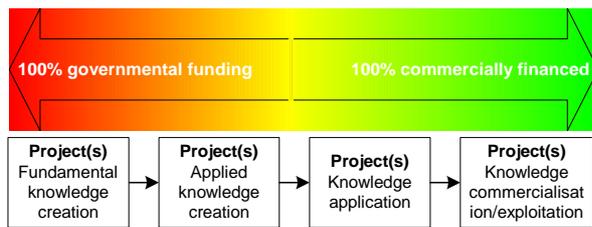

Figure 1: Innovation process and financing

TNO Industrial Technology is organised in 7 functional departments headed by a department manager. Project managers report to the department managers. Each functional department is staffed with among others one sales manager and one technology manager. Next to the functional departments, TNO has three staff departments; one of them is the staff department Technology, which is responsible for the knowledge creating programs and allocates the governmental funding.

1.2 Problem definition

Past experience indicates that a considerable part of the knowledge created in the more fundamental, governmental funded projects remains unused by both government and industries. The consequence is that this knowledge cannot be used for creating value and gain commercial funding that would strengthen the innovative power of industry and government. The purpose of this study is to investigate ways to increase the number of knowledge creation projects that are commercialised, becoming the basis for innovation or further research by the industry.

This research was carried out in close cooperation with the staff department Knowledge Management and the functional department Production Development.

2. Research Design and Methodology

The research is divided in two parts: In the first part, the study was focused on analysing the problem and defining its dimensions. This was done by studying several TNO documents referring to past projects including the preceded decision-making, results and further application of the results in combination with open and semi-structured interviews with about 20 TNO employees and, finally relating these insights to relevant theoretic foundations.

After defining the parameters of the problem, several alternative solutions were considered; one of these solutions was the introduction of post-project reviews. These solutions are further investigated in the second part of the research; therefore, three research questions are formulated:
1. What is the right structure of the post-project review session?
2. What is the effect of the structure on the preparation and follow-up of the post-project review session?
3. How should the post-project reviews be introduced in the organization?

TNO documentation and relevant theories in combination with the knowledge obtained by means of interviews were the main sources of information necessary for answering these research questions. Subsequently, ten pilot-sessions were held; the sessions were analysed and a survey was held among the participants of each session. The results of the analysis and the resulting knowledge became the basis for the final design of a methodology for the post-project review process. The drafted methodology was presented to the management of the TNO Industrial Technology who decided to implement it in all publicly funded knowledge creating projects.

3. Problem analysis

The first part of the research focused on analyzing and structuring of the motive of the research study: the lack of commercialization of governmental funded projects.

3.1 Value creation

The process of value creation consists according to Anderson and Narus (1999) of three phases: Understanding value, Creating value and Delivering value. Applying this model to a research institute implies that knowledge is the value created. This knowledge is generated in knowledge creating projects identified in the first stage of the process (understanding value). Delivering value implies the created knowledge-value finds its way to the market by means of commercialisation.

The reasons for failure to commercialise all knowledge created by the institute can be traced in each of the three phases of the value creation process (Anderson and Narus, 1999). Problems arising in the "understanding value" phase can result in selecting projects of questionable technological interest and market potential. If problems arise in the "creating value" phase, the projects can suffer from poor execution, and if problems arise in the "delivering value" phase the resulting innovations are not successfully brought to market.

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[1] At TNO Industrial Technology, projects last for the time they are granted financing, in generally, one year. After that year, a new project can be started to continue the subject. In this way, a set of successive projects can develop from idea to application. The commercialisation occurs in projects as well.

3.2 Causes of limited commercialization success

After analysing a number of projects in combination with employee interviews, TNO Industrial Technology appears to be focused on the creating value phase while not enough attention is paid to understanding and delivering value phases. This conclusion is based on the fact that many projects either lack a clear market focus (understanding value phase) and/or limited attention is paid to reach the customers interested in utilizing the knowledge (delivering value phase). In other words, technological aspects are receiving much more attention in relation to market aspects. This can be attributed to a variety of reasons; important ones are the internal technology-centred culture ignoring market needs and the lack of a consistent approach towards the value creation process from idea generation to market introduction (Kotler, 2003).

3.3 Increasing market focus and awareness

Increasing the number of successfully commercialised knowledge-creating projects, requires that the organization changes its attitude as to the way it deals with the market and the customer needs as well as increasing peoples' awareness in the knowledge creation process. A way to stimulate such an attitude change is to encourage researchers to discuss not only the technical but also the commercial aspects of the application and pay special attention to the market potential of the project or set of projects. This requires thorough market orientation in the initial stages, resulting in a roadmap and thorough analysis of the results of each project, in order to map the next and future steps (figure 2). With regard to the results analysis, a post-project review seems to be the proper way to achieve this. Currently, TNO Industrial Technology doesn't apply post-project reviews. There are however reviews in between and the project managers are required to fill in a review form afterwards. The accent on these reviews is at the execution of the project (time, budget, risks).

4. Design Post-Project Review

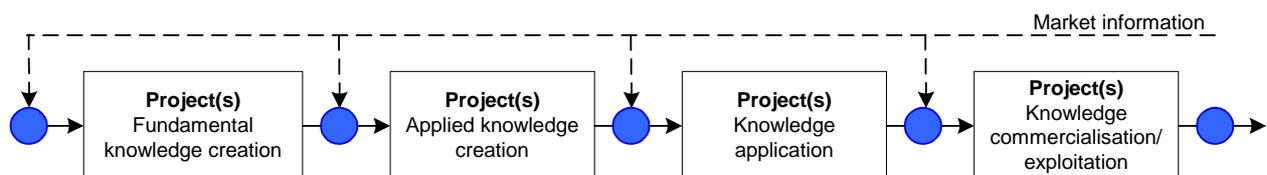The design of the post-project review process consists

of a post-project review session and the preparation and follow-up of this session. Choices need to be made regarding the participants, the facilitator and the way to structure the session itself.

4.1 Post-Project Reviews in Literature

In literature post-projects are mainly suggested as tools to facilitate and initiate organisational learning (Von Zedtwitz, 2002). Busby (1999) concludes that post-project reviews are important learning tools, whose value is often underestimated. The post-project review is one of the most important, most structured and most broad applicable ways to transfer knowledge (Von Zedtwitz, 2002).

Most organisations seem to lack a structural approach towards learning from past experience of projects. Even projects stopped prematurely aren't always reviewed. A survey (von Zedtwitz, 2002) shows that 80% of the projects aren't reviewed afterwards, 20% is reviewed but without clear guidelines. Interim reviews are not uncommon, while many post-project reviews are only focused on technical aspects or skipped due to time and management restrictions (von Zedtwitz, 2002). The importance of post-project reviews and the fact that few organisations regularly carry them out is often underlined in the literature.

According to von Zedtwitz (2002), post-project reviews should focus on obtaining process information for future projects. The main goal is to initiate and facilitate the continuous learning on all levels within the organisation (focus on double-loop learning), which is crucial in R&D organisations. However, learning from reviews doesn't have to be restricted to the lifecycle of the project. Von Zedtwitz (2002) gives an example of a post-project review in which new market potential is identified while at the same time technical knowledge is transferred to marketing employees. This is similar to the role the post-project review should be able to play for TNO Industrial Technology.

Regarding the structure of the post-project review session, the approach chosen depends heavily on the existing company culture and underlying motive for conducting post-project reviews: different objectives and needs, different markets and industries, different cultural contexts, and different degrees of innovation all influence the way post-project reviews need to be conducted (von Zedtwitz, 2003).

Figure 2: Innovation process with reflection moment

4.2 Multiple objectives

The main underlying motive to conduct post-project reviews at TNO Industrial Technology is the commercialisation of the projects' outputs, however, TNO Industrial Technology doesn't have an explicit strategy on the way projects must be reviewed in order to contribute to the organisational learning. Therefore, the post-project review might have multiple objectives:

Formal closing of the project by reviewing the course of the project for organisational learning.

Discussing the application and commercialisation issues of the project as well as formulating the necessary course of action.

Of course, discussing the application and commercialisation of projects' results is something that can be done also before and during the project. However, doing this in a structural way at the end of a project ensures that this step will not be omitted when the deliverables of the project are fixed. Besides, the probability that action decided and agreed during the session will be carried out increases when the project is over, since project activities will disrupt the agreements made.

The added value of this session based on the above premises, compared to the current situation, can be summarised in the following elements:

The approach is compulsory and uniform for the entire institute

Learning by reflection

Identification of possibilities for application and commercialisation of the projects' results. These can be the input to the follow-up project.

Finally, TNO wants to introduce assessments for all projects. The post-project review seems a good occasion for this assessment. However, this can cause problems because the assessment can cause people feel bounded and are not honest and open about e.g. problems that appeared or about the potential of the projects' results.

4.3 People involved

In order to reach the objectives of the sessions, the appropriate people need to be involved. In the case of learning by reflection, von Zedtwitz (2002) makes the distinction between three levels of learning: individual, team/group, and organisational. A post-project review focuses on the learning between individual and team/group or/and the learning between team/group and the rest of the organisation. For the learning between individual and team/group, the entire project team needs to be present. For learning between team/group and the organisation, the acquired knowledge within the team needs to be transferred outside a team. This can be done in several ways. An effective way appears to be the presence of an outsider at a post-project review (Busby, 1999; Von Zedtwitz, 2002). The outsider can be a project manager of similar

project or someone of the department Knowledge Management. Knowledge Management can be an intermediate between the post-project reviews and (top) management.

The second goal, the commercialisation, requires some other participants, e.g. customer manager, marketing manager, or group manager. In the case of TNO Industrial Technology, the technology manager and sales manager should be involved. The technology manager has the overview over the (portfolio of) knowledge-creating projects (technology push); the sales manager is responsible for retaining the current customers and acquiring new ones (market pull). Together they can deliver a positive contribution to business development (figure 3).

Conclusively, the following people should be participants of a post-project review session:

Project team (including project manager)

Technology manager of functional department

Sales manager of functional department

Representative of staff department Knowledge Management

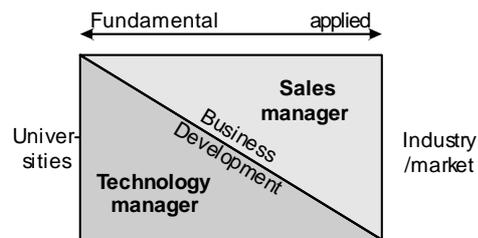Others, e.g. project managers of similar projects or the department manager

Figure 3: Role of sales manager and technology manager

This group of people is quit large and therefore needs to be reduced. As commercialisation is the most important goal, it's not required to involve the entire project team, only the key players are sufficient. Consequently, an additional meeting is required to facilitate the learning between individual and team/group.

4.4 The facilitator

The course of the session depends largely on the facilitator. The facilitator can be the project manager or e.g. an outsider. Provided that they have the necessary experience and training, external facilitators have the advantage that they attend the meeting with an objective perspective. The external facilitator can be someone from the Quality department (von Zedtwitz, 2002). In the case of TNO Industrial Technology this means someone from the department Knowledge Management that is also responsible for quality assurance. However, the Knowledge Management is also responsible for the granting of governmental funding and thus, the internal customer of knowledge-

creating projects. Furthermore, the success of the session is also dependent on the motivation and support of all involved. This support is likely to be higher if the session will be seen as a procedure required by their own department, rather than a staff department.

From the own department, the project manager can be the facilitator of the meeting but the disadvantage is that he is not objective at all. Most suitable of all is the technology manager. He has certain objectivity and he's from the own department. Furthermore, as there is only one technology manager for every department and only seven functional departments, there are only seven technology managers. This means that they can be trained to facilitate future post-project reviews within their department.

4.5 Items on the agenda of the session

As the session has multiple independent goals, the sessions are split up according to these goals. It's easiest to start with the goal of organisational learning as this is looking back to the whole execution of the project. For this first part a number of questions (figure 4) are formulated which are derived from the current project review form.

The second part of the session, the discussion about application and commercialisation of the projects' deliverables starts with the reached deliverables of the project. This is already made clear during the first part of the session. The questions of figure 5 are formulated for this part of the session.

Finally, the session itself will be reviewed for continuously improving the session itself.

The assessment of the projects will be done after the session. This will cause as little as possible disturbance to the free discussion.

4.4 Preparation and follow-up of the post-project session

In order to achieve the session objectives, it is important that the persons involves will prepare the session beforehand and that actions agreed will be followed up afterwards. The preparation requirements for all people involved are different. The project manager must have all the necessary information (process information, project report) available and distributed to the other participants. Next to that, the manager is the one initiating the session. The technology manager must make sure everything happens in time.

The follow-up is market oriented and therefore it is the responsibility of the sales manager. During the session an action list with the steps that must be taken will be drafted: the sales manager is responsible for these steps.

	What went good or wrong?	Why?	How could we have done it differently?	What can we learn from this for future projects?
Did we reach are goals/deliverables? Are our (internal) customers satisfied?				
How did the process go? (planning/actions/allocation of tasks/communication)				
How did deal with risks?				
Did we stay within the budget?				

Figure 4: Questions review

What are our exact deliverables? What are the unique selling points (USP's) of these deliverables?	Preparation for discussion
What is the relationship with other similar projects and with the strategy of the institute and department?	
What is written down in the (preceded) project plan about application and commercialisation of the deliverables?	
In what degree have activities for application and commercialisation of the deliverables already started?	
How can we apply the created knowledge and then commercialise it? Are there other possibilities? (Feasibility study: market, size, competitors, prices, product)	Discussion
How can we do this? Which activities must be developed? (Marketing strategy)	
Who will do this? To do list with names and completion dates)	

Figure 5: Questions discussion knowledge application

5. Pilot sessions

Before permanent implementation of the pilot-sessions, ten pilot-sessions were organised. The pilot-sessions should give more insight and understanding of the process and based on the results, adjustments could be made. It was also a opportunity to confront the employees with the concept before becoming a standard organisational process. Furthermore, based on the results of the pilot-sessions the management team can decide whether to continue or not.

5.1 Execution

To make possible to carry out the pilot sessions in short term, some changes were to the previously described design. Most importantly is that Knowledge

Management initiated and facilitated the sessions, because the technology managers are not trained yet in chairing the sessions. Knowledge Management cooperated in developing the sessions and had full knowledge of details and reasoning.

The projects that were selected for the pilot sessions were from the different functional departments. Nine out of ten projects were fully funded by the government grants, one project was funded for 25% by a commercial organisation. All projects were completed; it was known that some projects would be followed-up by a subsequent project.

For all projects a meeting was organised with the participation of the project manager, the technology manager, the sales manager and a representative of Knowledge Management. The project manager was encouraged to invite key players of the project team as well. In one department, the department manager carries out the role of sales manager and technology manager. Therefore, only three people were present at those sessions.

To evaluate the pilot-sessions, these were observed and the participants were asked for their opinion. The focus of both the observations and the questionnaire was on the extent the objectives of the session were met and if not what were the possible reasons for that.

After two sessions was already clear that a single session for both the project review and he knowledge application discussion is ineffective. The main reason for this was a defensive attitude of the project manager after the first part of the session, reflection for organisational learning. The defensive attitude seems to stem from the project assessment part and the facilitation by the board member responsible for technology (representative of the department Knowledge Management). The fact that it was the first confrontation with the post-project review might have had some influence as well.

As defensive attitude it is not desirable, from the third pilot-session on; the sessions are strongly focus on discussing the knowledge application and less focused on a project review. The project review was reduced to one question at the end of the meeting: Hence, the session is called 'Knowledge application discussion'.

5.2 Results

As mentioned, the results were determined by observation and feedback from the participants.

Observation indicated a lot of variation between different sessions. Various aspects caused the differences. One of these aspects was the nature of the project; some projects are more fundamental, others more applied (figure 6). This resulted in different discussions during the sessions. Discussions during sessions of more fundamental projects were focussed on possibilities of application of the results. These projects in general already had a follow-up project and although funding for the follow-up project was granted, the application and commercialisation of the projects'

outcomes wasn't considered. This resulted during the sessions in a discussion for direction of the follow-up project. The session added value to the process because the question about the application and commercialisation of the results were brought up and the researchers were forced to think about it. An example of a concrete deliverable of the sessions was an appointment for further development of the roadmap.

Discussions during sessions of more applied projects involved the commercialisation of the created knowledge, the application of the knowledge was already known. The added value of the session was originating form the new insights of the 'outsiders' and by the stimulation to explore all commercial possibilities. Concrete deliverables of these sessions was e.g. a to-do-list with actions like the approach of specified organisations by the sales manager.

The atmosphere was another aspect that made a difference between the sessions. A good atmosphere proved vital to reach the goals of the sessions, during two sessions, participants felt not very motivated. Both sessions had no designated deliverables, all others had.

	Application and commercialisation not clear	Application and commercialisation fairly clear
Succession	Project with 100% governmental funding	Sometimes partly governmental funding
Discussion about	Application of result of both project (current and next), roadmap	Next steps (to do's) for commercialisation; alternative options
Added value of the session	Stimulation to think about it	Moment for reflection of all possibilities, participation of different people
Concrete to do points (e.g.)	Clarify roadmap for next project in a next meeting	Approaching specified organisation by sales managers

Figure 6: Results observations pilot-sessions: distinction caused by the nature of a project

The results from the questionnaire were positive. 94% said that the sessions were useful and 71% said that they thought that the sessions in general would improve the number of projects that will be commercialised (figure 7).

Question / Thesis	Agree	Disagree
Do you think the session was useful?	94%	6%
'Discussions about knowledge application will contribute to a conscious evaluation of the innovation process'	93%	7%
'Discussions about knowledge application will improve the number of project results that are commercialised afterwards'	71%	29%
'Project reviews will improve organisational learning'	80%	20%

Figure 7: Summary results questionnaire pilot-sessions

5.3 Final design Post-Project Review (knowledge application discussion)

After the pilot-sessions, the management of TNO Industrial Technology was advised to continue the sessions (knowledge application discussion) and they agreed to this for all projects with 100% governmental funding. The sessions would be held in the same form as the pilot-sessions with some minor improvements. Furthermore, the sessions would eventually be facilitated by the technology managers of the departments and be initiated by the project manager. The introduction of the session as a standard procedure would be done gradually. Important point of attention is the motivation of the participants of the sessions. All technology managers should be convinced of the usefulness and this must be communicated thoroughly to all other participants.

6. Conclusions & Discussion

In this case study, the post-project review is used as a tool to stimulate the commercialisation of new technologies. The essence of the review is to bring multi-functional and multilevel participants together at the end of a knowledge-creating project to discuss the application and commercialisation of the project results. For projects followed up by a new (wholly or partly governmental funded) project, the knowledge application discussion resulted in a framework for the direction of the next project; hence, a post-project review session - before the follow-up project begins - can become a stimulant of the innovation process. In this sense the session can be seen as a moment of reflection on the direction taken with regard to future market opportunities. During the innovation process, the discussion will develop from a discussion about the application itself to the commercialisation of it.

By involving the technology managers and Knowledge Management, the sessions are becoming also tools to relate projects or innovation processes (groups of projects) to each other and widen their scope: the knowledge-creating projects are this way not limited to a single discipline in the chain from fundamental to applied knowledge, but can expand across disciplines and research areas.

Next to the post-project review it is also necessary to reflect on the value of the innovation at the beginning of the innovation process; a suitable moment for reflection is the submission of request for government funding; the request must be also be based on future market opportunities. In the case of TNO Industrial Technology this means changing the current attitude towards the granting procedures and criteria so that the organization is able follow the line of increasing the chances to focus on commercially interesting projects. This will require, among other things, a more extensive market exploration.

For further research the next questions will be interesting:

How common are post-project review sessions in organisations and how are they carried out with regard to objectives, participants, facilitation, and items on the agenda?

During the pilot sessions, the combination of reviewing and discussing the application didn't seem to work; should this be two, separated discussion items?

Furthermore, what other tools are used to tackle the lack of commercialisation of governmental funded projects?

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