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# Improving the Open Innovation R&D Process and Opportunities for Industry-University Collaboration

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## Preface

When we started the Industrial Management program in the autumn 2014, Marjatta and the staff repeatedly said that it is going to be a very demanding but possible to graduate already in the spring. Little did I know how accurate that came out to be during the spring. The delightful lectures and discussions we had during the program have helped to make new friends and learn useful skills for the future. This has been an enjoyable journey.

Special thanks belong to my instructors, Thomas Rohweder and Marjatta Huhta who provided valuable support and tips to get me back to focus when I felt lost with the thesis project. Also, deepest thanks to Zinaida Grabovskaya for making sure this thesis is readable. Without your support I doubt many would be able to read this thesis through. Also a big thanks to everybody at work who have supported my study, my manager, thesis sponsors and all the participants who gave me such a valuable insight to the process.

Finally, thank you for my wife Monica for making this possible and pushing me on with your questions and comments, not to mention the countless times you took care of the kids and the house so I could concentrate on school. And thank you my children who have kept me going with their joyful nature. Now it's time for you to get more attention from daddy again.

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<p>This study aims to propose improvements to the Open Innovation process for the case company R&amp;D. The case company is a European chemical producer involved in a range of different types of chemical products. Currently, to succeed in the ever more competitive environment, the case company needs to speed up its product and chemical process development activities. The case company is increasingly using Open innovation concepts to speed up its product and process development activities. To do this, the company is increasingly using the open innovation concepts, with this thesis assisting in these efforts by concentrating on external research cooperation.</p> <p>This study uses action research as the research approach as action research is an iterative and collaborative in nature. The data collected from reviewing internal documents and interviewing stakeholders of the process is analysed by using qualitative content analysis. The data collected was used firstly to map and analyse the current state of the External cooperation process, secondly, as input to build a proposal for improved External cooperation process, and finally, as feedback to the initial proposal to validate the improvement proposal.</p> <p>The outcome of this study is an improved External cooperation process, including a completely documented process map with improval recommendations, recommendations for improving personnel commitment to the process and recommendations for communicating the improved External cooperation process.</p> <p>Implementing the proposed changes to the existing process and implementing them by involving personnel in the change will improve the reception of the process and increase commitment of the personnel to follow the process. Increasing the focus on the early phases of the cooperation, the definition of the desired outcome will make it easier to search for a best potential partner and even help to improve the probability of successful cooperation.</p>	
Keywords	Open innovation, R&D cooperation, Industry-University collaboration

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## **Acronyms and Abbreviations**

AR            Action Research

BSRF        Business Service Request Form

ERT         External Review Table

IP            Innovation Project

Intellectual Property (in Existing Knowledge section)

IPR          Intellectual Property Rights

ITMM        Innotech Management Meeting

NDA         Non-Disclosure Agreement

NPV         Net Present Value

S&P         Strategy and Portfolio

SoS         Sign-of-Sheet

STiV        Strategic fit, Technology potential, its implementation complexity and Value potential

SVP         Senior Vice President

OI            Open innovation

R&D         Research and Development

## 1 Introduction

Innovation research has been growing in the past decade, especially after the introduction of Chesbrough's Open innovation paradigm in 2003. In addition to the approach pioneered by Chesbrough, there is another school of thought that focuses on internal innovation. The research by both these schools is notable and comes as significant for the topic of this study.

The key message through all research in innovation is that competitive advantage can be achieved through disruptive innovations, rather than competing against the incumbents. Moreover, the future way to compete successfully is ever more often related to customer-oriented thinking proposed in service-dominant logic and customer-dominant logic. Since co-creation with the customer cannot truly happen without an open dialog, access to the partners' processes and transparent communication, this approach brings also risks which need to be mitigated and well-thought of before launching an open innovation or customer-focused partnerships. Still business practice suggests that, if business models are properly adapted to both product and service innovation and customer oriented, opening up the innovation pipeline can yield significant benefits.

This study focuses on improving the current Open Innovation processes in the case company operating in the chemical industry. The market environment in this industry is becoming ever more competitive and, to gain competitive advantage, many companies have increased their research cooperation with external bodies, for example, research institutes. In this industry, this process is commonly referred to as open innovation.

### 1.1 Business Environment

The business environment where the case company operates presents a number of serious challenges. In the near future, the polyolefin industry in Europe is facing the fluctuating oil prices and instability in feedstock and product pricing, as well as instability of the European companies due to utilizing alternative feedstock as shale gas in the North America and non-existent transportation costs in the Middle East. Simultaneously, EU is leading the world in CO<sub>2</sub> reduction, which creates

even more hurdles to European companies in the global markets. The situation is further influenced by the tightening chemical regulation within EU that is especially hitting “domestic” producers. As a result, the European polyolefin producers are hindered in their growth compared to competition. To crown this all, in many industries, alternative raw materials are finding their way as replacements for polyolefin based raw materials. In high margin semiconductor industry, for example, the ceramic capacitors are winning the ground, and at the same time bioplastics are growingly replacing the polyolefin based plastic bags and wrappings.

All these challenges call for search for a winning competitive advantage which is more and more often associated with external research cooperation with research institutes in R&D processes, and *open innovation* in particular.

## 1.2 Key Concepts

*Open innovation* has various definitions. In the most general sense, *open innovation* refers to idea generation which leads, through the invention stage, to a marketable outcome, and carrying out this process in an open, traceable mode. Open innovation can involve processes directed from outside-in or inside-out which means either taking ideas from outside the company and developing them into innovations (outside-in), or taking the ideas developed inside the company and letting someone else utilize them (inside-out) (Chesbrough 2003). In this thesis, the term open innovation is used for the outside-in process of open innovation and mainly concentrates on external cooperation with universities and research institutes.

*Outside-in* type of open innovation is defined as a process of using external ideas and resources to advance the company’s own innovation. It is often used for utilizing external resources to alleviate resource constraint, acquiring expertise that the company lacks, or increasing the speed of innovation (Gassmann & Enkel 2004).

*Inside-out* type of open innovation means utilizing external paths to profit from internal ideas and inventions that the company does not want to fully utilize internally (Gassmann & Enkel 2004).

In a *coupled* type of open innovation, the information and ideas flow to both ways, into the company and out from the company. This way the company can release ideas to the outside execution and at the same time also benefit from outside ideas itself (Gassmann & Enkel 2004).

*Innovation funnel* is often described as a process of how innovations are transferred from ideas (wide end) to innovations (narrow end) as seen in Figure 1 below. It encompasses the screening of ideas in the ideation phase, inventing in the middle, and an innovation as the outcome from the funnel.

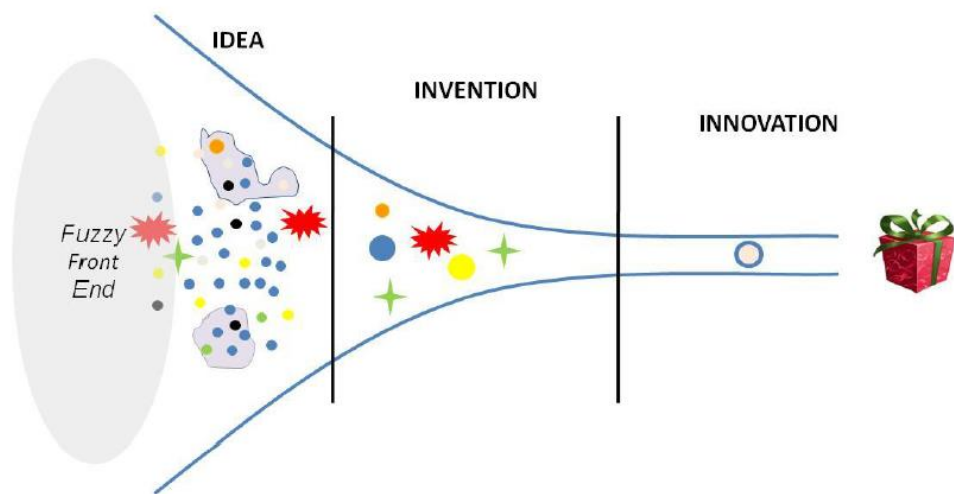


Figure 1. Innovation funnel in a general sense (Rintala 2011: 6).

As seen in Figure 1 above, the many ideas are screened in the wide front end of the innovation funnel through the narrowing stage, where ideas are refined to invention. Inventions are turned into innovations when they are commercialized.

*Open innovation funnel*, as seen in Figure 2 below, depicts how a firm can use either outside-in or inside-out processes to strengthen the internal competencies and accelerate the company innovation to a marketable output and create new sources of income (Vanhaverbeke 2013: 6).

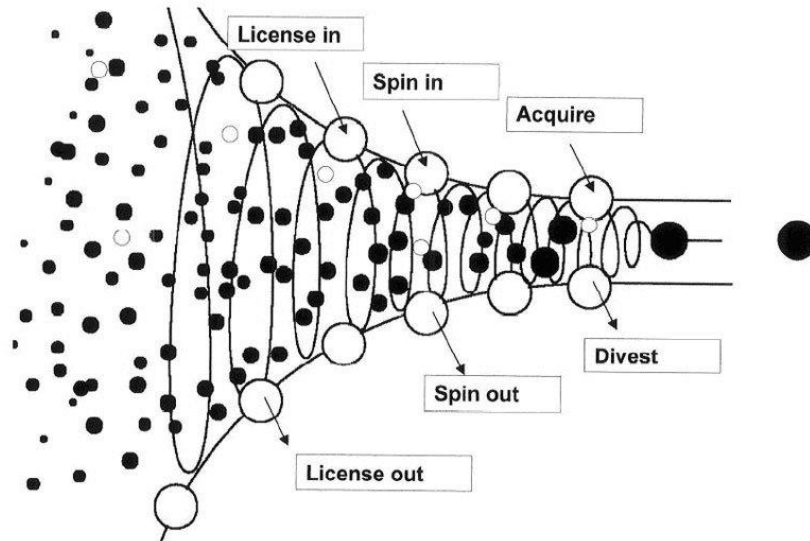


Figure 2. Open innovation funnel (Kirschbaum 2005).

### 1.3 Case Company and Business Challenge

The case company of this thesis is a European chemical producer. The company has three strategic business units in different chemical products sector and production sites and R&D facilities in several European countries

In recent years, seeing the need for an increased R&D throughput and step change in technology, the company management has increasingly embraced the open innovation ideology. Thus far it has been seen mainly as the outside-in type of process within the current fields of operation. This has included cooperation with competitors for catalyst and process sourcing, and cooperation with academia.

The reshaping of the company R&D funnel has started by adding more high-throughput experiment capacity within the company. In addition to that, the company has increased its co-operation with universities, including polymerization studies, fluid dynamics and systems modeling, and complex syntheses to name a few. The world-renowned experts are consulted on matters such as mixing or fluid dynamics simulations and mixing. Recently, some avenues for co-operation have also been found outside the traditional market segments. The promise of high margins has created interest inside the company to investigate these opportunities. These plans would most likely include outsourcing some manufacturing to the sites better suited for the production of customers' material.

Currently, to succeed in the ever more competitive environment, the case company needs to speed up its product and chemical process development activities. To do this, the company is increasingly using the open innovation concepts, with this thesis assisting in these efforts by concentrating on external research cooperation.

#### 1.4 Objective and Scope of This Study

The market success of the case company requires competitive product and technology innovations. A significant portion of innovation in the case company is realised through external cooperation networks, with research institutes in particular. For this end, the case company is already using open networked innovation. Nevertheless, its “Open Innovation” concept and process can be further updated for better performance.

At present, the company open innovation process is still under development. Several tests and trials with different concepts have been done, but the company still lacks a coherent, simplified process for its open innovation management. Therefore, the company wants to improve its open innovation management process with external cooperation partners.

The objective of this study is thus to propose improvements to the Open Innovation process for the case company R&D. This study on the Open Innovation process concentrates only on the perspective of external research cooperation with universities and research institutes (University-Industry collaboration). The outcome of this thesis is a proposal for the improved open innovation process for managing the external cooperation.

This study is written in 7 sections. Section 1 overviews the study. Section 2 describes the method and material involved in this study. Section 3 presents the results of the current state analysis of the company existing Open innovation process. Section 4 discusses the findings from business and academic literature related to open innovation process between business and research institutes. Section 5 contains the proposal for improving the external cooperation process. Section 6 concentrates on validating the improvement proposal built in section 5. Section 7 discusses the findings and proposal of this study.

## 2 Method and Material

This section describes the research approach and research design used in this study. It also includes description of where the data is collected and how it is analyzed.

### 2.1 Research Approach

In this study, the Action research (AR) approach was utilized, since it encompasses collaborative and iterative approach to solving practical problems. Action research is an approach that includes taking action and learning from that action (Coughlan & Coughlan 2002). Kaplan (1998) proposes a five stage cycle for Action research iterations. In contrast, Coughlan and Brannick (2006: 21-24) describe a four stage iterative cycles. Coughlan and Brannick also divide action research in two concurrent cyclical projects, the core part (the practical project) and the research part of action research. In their model, the practical project cycles evolve through several iterations of *constructing, planning action, taking action* and *evaluating* actions (Coughlan and Brannick 2006: 21-24). At the same, time in each stage, the researcher also goes through the research cycles of *taking action, experiencing, understanding* and *judging* (Coughlan and Brannick 2006: 37). The second logic shapes the research process in the action research approach and is equally valuable for learning from the experience.

### 2.2 Research Design

This study aims to produce an improvement proposal to the case company current open innovation process used in external research cooperation. Therefore, action research was seen as a suitable research approach as it produces a practical outcome (the improvement proposal) and the research outcome (this study), with the researcher involved as a company practitioner. The action research cycle for his study is depicted in Figure 3 below.

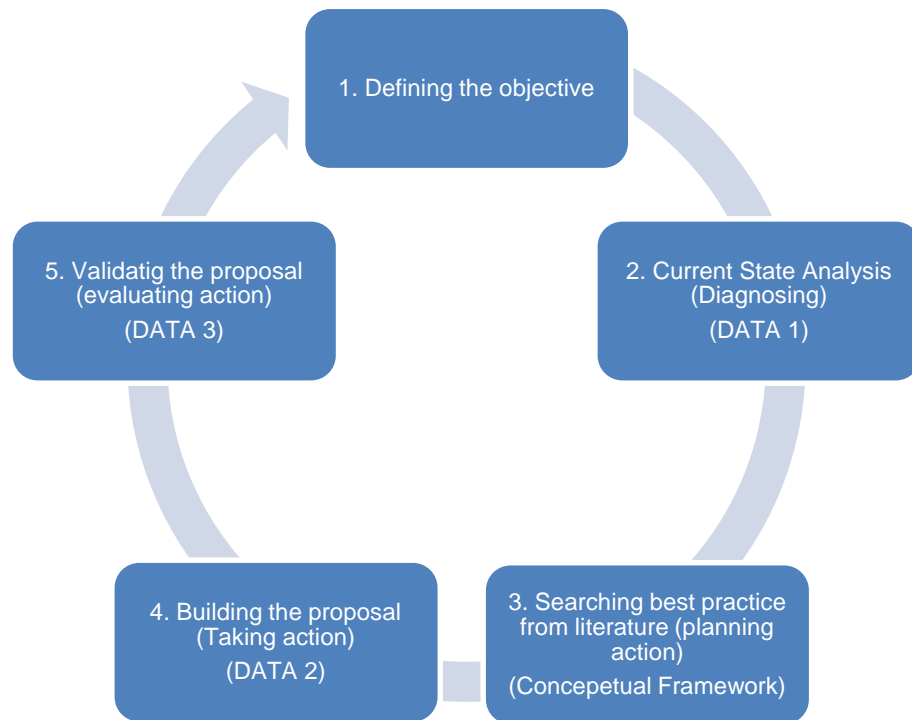


Figure 3. Action research cycle of this study.

A more detailed research design of this study which follows the steps of the action research cycle is depicted in Figure 4.

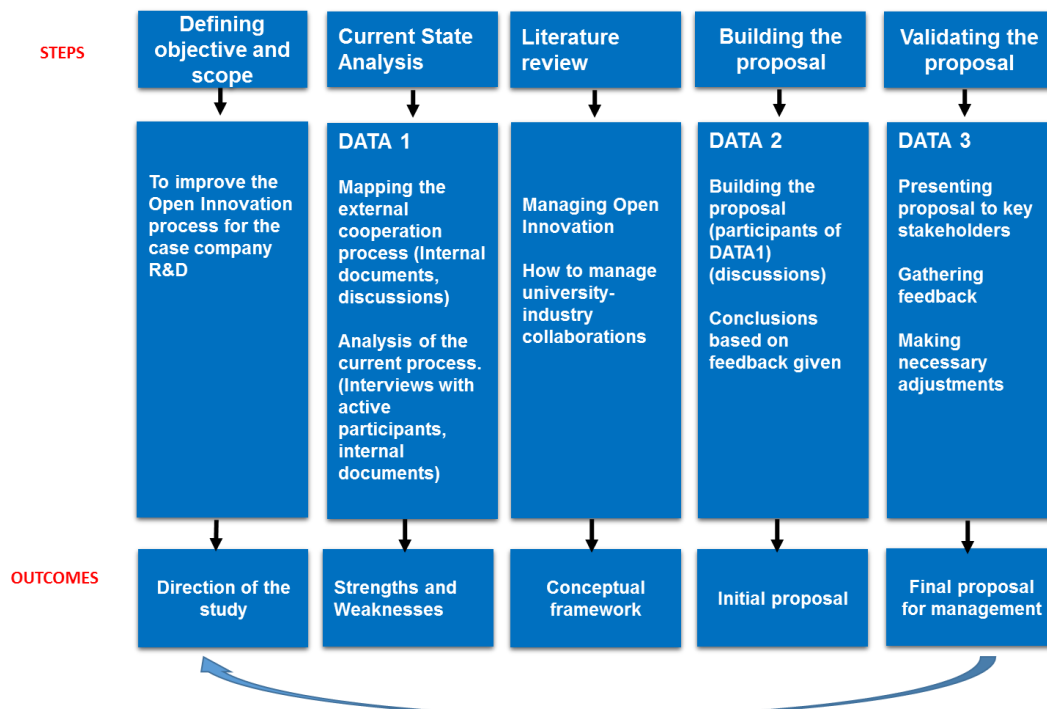


Figure 4. Research design of this study.

In Stage 1, the study defines its objective and sets the scope for further research. In Stage 2, the current state analysis is carried out which results in a summary of strengths and weaknesses for current process. In Stage 3, the study focuses on exploring the current concepts of managing Open innovation and university-industry cooperation projects. This stage results in the conceptual framework of this study which is developed for improving the company open innovation and University-Industry cooperation process. In Stage 4, an initial improvement proposal for external cooperation process is built. Finally, in Stage 5, the improvement proposal is validated through stakeholder acceptance and feedback.

### 2.3 Data Collection and Analysis

This study utilized three iterations of data collection for gathering and analysing the data on the current state, and building and validation the proposal for the case company.

#### 2.3.1 Data collection 1, for the Current State Analysis

The data for the current state analysis was collected by using company internal documents (training material, power point presentations) and internal and external interviews.

The internal documents were explored first and served for the purposes of preliminary mapping the current state of open innovation process in the case company. Table 1 below details the types of internal documents involved in this study.

*Table 1. Details of Data collection 1 (internal documents).*

Topic	Description	Date	Length	Documents
1. Current and past cooperation data	Current and cooperation information	Jan-Mar 2015	6 hours	ERT meeting minutes, cooperation proposals
2. Description of the current process	Open innovation in case company, innovation process, external cooperation process	Jan-Mar 2015	4hours	“External research” – presentation documents (ppt)
3. Internal training material	Internal Innovation Process: Training material, 2014	Apr 2014		

In addition to the scrutiny of internal documents related to the current and previous cases of cooperation with external research institutes, this study also used a series of interviews with internal stakeholders and external experts. The interviews were conducted as semi-structured interviews. The questions were developed based on the map of the current external research process. The interviews took place in the spring 2015 and involved people related to the company external research cooperation process in their work. The respondents were identified either as key stakeholders in the company research cooperation, or identified as the external partners. *The stakeholders* included project managers, a line manager and external research coordinators (responsible researchers in the case company). The current process was further specified (from mapping based on the company internal documents) by interviewing the current “process owner” of the company.

Details of the interviews for Data collection 1 (for the current state) are shown in Table 2 following page.

Table 2. Details of Data collection 1: interviews about the current and previous cooperation (for the current state analysis).

Data type	Participants / role	Topic, description	Date	Length	Documents
1. Telephone/lync meeting	External cooperation expert	The case company OI approach and external cooperation process	Jan 2015	2 hours	Field notes
2. Face to face Interview Respondent1	Researcher / cooperation coordinator	Experiences in coordinating 3 different cooperation projects (coop1-coop3, with University C)	Feb 2015	75min	Field notes and recording
3. Face to face Interview Respondent2	Researcher / Cooperation initiator	Interview about current process related to the respondent experiences as cooperation initiator	March 2015	45min	Field notes and recording
4. Telephone interview Respondent3	External research partner, University A	The external research cooperation from external point of view in project 1	March 2015	40min	Field notes and recording
5. Telephone interview Respondent4	Researcher / Cooperation initiator	The external research cooperation from point of view of project 2 / general experiences of company external cooperation process	March 2015	45min	Field notes and recording
6. Face to face Interview Respondent5	Project manager / project 1	The external research cooperation from point of view of project 1 / general experiences of company external cooperation process	March 2015	75min	Field notes and recording
7. Face to face Interview Respondent6	Line manager	Interview about current process related to the respondent experiences	April 2015	30min	Field notes and recording
8. Telephone interview Respondent7	Researcher / cooperation coordinator	The external research cooperation from point of view of project 3/ general experiences of company external cooperation process	April 2015	30min	Field notes and recording

As shown in Table 2, eight interviews were conducted and analyzed with both the internal stakeholders and external partners from the current and previous cooperation cases.

The outcome of Data collection 1 is, first, the map of the case company current process specified with the help of documentation and discussions with persons responsible or participating in the process. These discussions were themed around each step of the external cooperation process (see Appendix 1 and example of field notes Appendix 2). All data was verified by asking the informants to check the field notes. The interviews were mostly recorded and the field notes written down as soon as possible using the recording as the source. The interviews were analyzed by using content analysis to acquire an in-depth understanding of the current state of the current process.

### 2.3.2 Data Collection 2, for building the Proposal

The second set of data was gathered in the form of workshops and discussions focused on how to improve the current Open innovation process. The conceptual framework was used as the basis for discussion and improvement proposals. The identified positive issues from Data 1 were also incorporated into the Proposal in cooperation with the respondents. The details of Data collection 2 are summarized in Table 3 below.

*Table 3. Details of Data collection 2: interviews for building the Proposal.*

<b>Data type</b>	<b>Participants / role</b>	<b>Date</b>	<b>Length</b>	<b>Documents</b>
1. Face to face Interview (Respondent1)	Researcher / cooperation coordinator	April 2015	20 min	Field notes, proposal draft
2. Face to face Interview (Respondent2)	Researcher / Cooperation initiator	April 2015	15 min	Field notes, proposal draft
4. Face to face Interview (Respondent5)	Project Manager/ project 1	April 2015	10 min	Email exchange, proposal draft
3. Face to face Interview (Respondent6)	Line manager	April 2015	10 min	Field notes, proposal draft

As seen from Table 3, the data for Proposal building was collected through semi-structured interviews and email exchanges with key stakeholders (main project and cooperation (sub-project) personnel). Each respondent was interviewed for input into the proposal draft by presenting the draft and then checking key items in each stage for their

opinion and suggestions for each stage. The data analysis followed the logic from the previous stage.

### 2.3.3 Data collection 3, for validating the Proposal

Finally, the third round of data collection was conducted for validating the Proposal with the case company. Table 4 shows the stakeholders who participated in the group discussion for validating the proposal.

*Table 4. Details of Data collection 3: group discussion participants for validating the Proposal.*

<b>Participant</b>	<b>Role</b>	<b>Date</b>	<b>Length</b>	<b>Documents</b>
Respondent 8	Portfolio Management Team Manager	May 2015	60 min	Field notes, final proposal
Respondent 9	External cooperation expert	May 2015	60 min + 30 min for email	Field notes, email exchange, final proposal
Respondent 10	Innovation Process Specialist	May 2015	60 min	Field notes, final proposal

The group discussion consisted of the key stakeholders and sponsors of this study. This group is responsible of maintaining and communicating the Open innovation process and a host and facilitator for the external research cooperation. The data analysis followed the logic from the previous stage.

In all three data collection rounds, participant observation by the researcher was also utilized, the researcher being a member of the case company for 8 years.

## 2.4 Validity and Reliability Plan

Validity and reliability relate to the quality of research gained through observing its credibility and reproducibility. For any research to be valid and reliable, it needs to be credible, transferable, dependable and confirmable (Lincoln and Guba, in Watkins (1991:5). On the other hand, Näslund et. al (2010: 8) identify the same requirements for validity and reliability among others in their criteria.

To address the issues of *validity*, the research needs to be clearly structured, the methods used in the research and data collected need to be explicitly described, and data triangulated by using multiple sources of data (Näslund et al. 2010: 9). Having the data also checked by the interviewees also improves the validity of the study (Huhta 2014: 9). Validity also requires that the data is collected in an accurate and correct manner, so that the participants' perspective is understood. For validity of the theory and explanation building, not only the key and most relevant theories supporting the researcher's views are taken into account, but also the alternative explanations need to be investigated. The key test for validity is if the study can answer the initial research question (Huhta 2014: 7).

In this study the objective is used instead of the research question but the same test can be done comparing the objective and outcome of this study. Having the data also checked by the stakeholders (interviewees for field notes, process map by specialists) also plans to improve the validity of this study. This study also uses several sources of data, thus data triangulation is utilized (interviews, internal documents, own observations). The data for Building the Proposal is collected by presenting the proposal draft to the respondents of data collection 1 and asking their opinions and suggestions, simultaneously taking steps to preserve accuracy and to avoid bias. The interview questions are designed to dig deep into the details of the External cooperation process.

To address issues of *reliability*, the research needs to be trustworthy, authentic and the results need to be replicable. The key test for reliability is the consistency of results if the study is conducted in different time, by different researcher or by using another method (Huhta 2014: 10-13), (Golafshani 2003: 5-7). To be reliable, the research also needs to show a connection to existing theory (Näslund et al. 2010: 9). Trustworthiness of the study builds upon credibility (improved by data triangulation), transferability (richness of data), dependability and conformability (avoiding researcher bias).

To increase the reliability of this study, the following measures are planned to be taken. Firstly, this study uses multiple types of data (interviews, internal documents, own observations). Secondly, the topic areas of the key findings connect the search for best practice to the existing theory in literature search, thus connecting the basis of the proposal building to the existing theory.

### 3 Current State Analysis

This section describes the results of the current state of the Open innovation process in the case company and then concentrates deeper on the state of the external R&D cooperation process in the case company.

#### 3.1 Innovation Process in Case Company

Based on the results of the interviews and examination of internal documentation (Data collection 1), the current Innovation process in the case company starts from *idea generation* and goes through *idea*, *project* and *product management* as described in Figure 5 below.

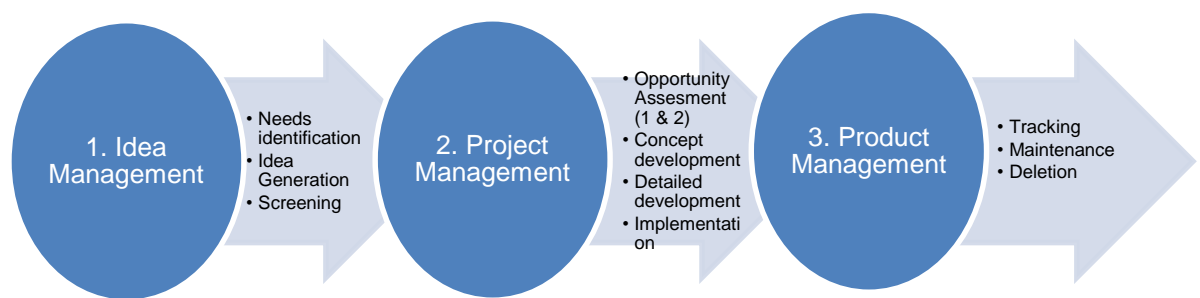


Figure 5. Current Innovation process and its steps (the initial map).

The goal of the *Idea Management* in the case company is to have a large pool of ideas and select the right candidates to become Innovation Projects and to ensure that there are always ideas in the front end of the pipeline to wait for actualization as projects. The ideas are collected from everywhere inside the company using an Idea management software. In addition, external ideas can also be put in as long as there is a company person involved in coordinating the activity.

The next stage is the *Project management* stage. The selected ideas enter the opportunity assessment phase where their potential and feasibility are further evaluated. The ideas that are approved after this assessment become innovation projects. The project portfolio is balanced in terms of timeframe of the projects, the expected value and the uncertainty and risk. Currently, the innovation projects are classified in four categories

according to their *risk, return and resource consumption*. Innovation projects follow the stage gate approach and typically they have five stage gates with *Go/No-go* decisions.

The last phase is the *Product management* phase, where the product or process developed in the earlier phases is marketed, sold and maintained or improved in normal business cycles. (Internal Innovation Process: Training material, 2014)

### 3.2 Open Innovation Process in Case Company

Currently, the case company is defining its Open innovation as a combination of outside-in activities and inside-out activities. This means looking for (a) the outside ideas and using outside resources to improve the company internal innovation efficiency and looking into (b) licensing of internally developed technologies that are deemed as outside the company's focus. (External research –presentation documents)

The company has defined points for *how, when and why* open innovation can take place. The How is described by involving open-minded partnerships and exchanges between domain experts in relevant fields of operation or research. The When for open innovation is defined as suitable cooperation when the competences are not existing in-house or when fast innovation is necessary. The Why element currently provides five reasons for the usefulness of open innovation. Open innovation, first, increases intellectual cooperation. Open innovation, second, can enable cost saving and, third, improve speed in time-to-market. It can also improve the involvement from people and reduce risks through shared responsibility. (External research –presentation documents)

The case company has been testing out different open innovation concepts and methods and, by now, has been developing its own system for a few years (from the interview by the company External Cooperation Expert). It has already identified the key areas and developed a concept for looking at each space. The spaces in Open innovation, as utilized by the case company, are depicted in Figure 6. Main dimensions that have been identified in the spaces are *outside-in* type (*outside-push* or *inside-pull*) or the “*known needs*” and “*unknown needs*”. Each quadrant is then given a descriptive name, with the general matrix shown in Figure 6 below.

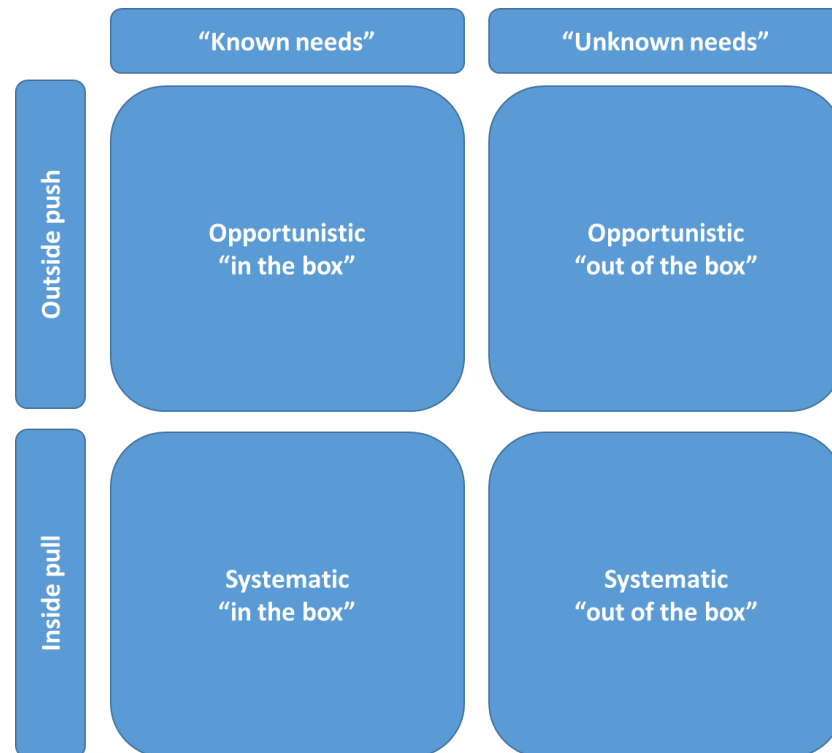


Figure 6. Company Open Innovation working spaces.

As shown in Figure 6, each of the boxes describes a different starting point: *outside push, up on top*, is used for situations where the company is approached from outside and offered an opportunity for cooperation. *Inside pull, down low*, is used when the company has itself initiated a search for external new technologies, business areas or partners, for existing projects or businesses. (External research –presentation documents)

The systematic *"in the box"* quadrant has been developed furthest within the organization. Opportunistic *"in the box"* means the opportunities within the existing business areas and where the company has already tested some structured approaches. Opportunistic *"out of the box"* quadrant has recently gained its evaluation concept and the company waits for the chance to evaluate any possible new business areas. Systematic *"out of the box"* is deemed as the most challenging area which involves strategic planning and scenario building. This is the least developed area at the moment in the company. (External research –presentation documents)

The company also recognizes that open innovation, by definition, covers a very broad range of areas and that it is in fact already being applied in most parts of the company. Key stakeholders also pointed in the interviews that this approach has been present from

the start of the company (with a different name). However, a structured and aligned approach was missing until 2011 when the company started implementing open innovation concept. Presently, the company realizes that the concept needs to be further developed within the next few years. The main challenges have been identified as “*not invented here syndrome*”, *time* needed for a change in mindset and the difficulties of properly *aligning* the whole broadness of working areas that are touched by open innovation. (Internal Open innovation presentation material)

Currently, the Innovation support team has a main task to manage the external R&D activities on a group level, increase the total yield from innovation by smartly leveraging the available resources and capabilities, secure the utilization of “best available technology”, be a platform for exchange of ideas, and finally also facilitate and coordinate the process to align open innovation activities within the company.

By now, the Open innovation concepts and tools have been explored through different cases, for example: technology scouting, push- and pull cases and tools (intermediaries, software), new business development and idea management process (internal crowdsourcing). (Internal Open innovation presentation material)

Based on the internal documentation and discussion with the external cooperation expert, the company sees that open innovation brings most value in the areas listed in Table 5 below:

*Table 5. Open innovation areas in the case company.*

	<i>Target</i>	<i>Description</i>
1	Active scouting in selected strategic areas	Input from strategy roadmaps
2	As part of the Innovation Projects	As an integral part of an IP project. Focus should be more on the early phases of the project.
3	Outside “push”	Contacts for co-operation interest from the company should be evaluated shortly and fast and a clear yes-interested/no answer should be given.

4	New Business Development	Open innovation should be utilized to screen and search new business possibilities.
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These findings relate to the Open innovation process in general. Next section discusses the findings from the correct state related to the cooperation with research institutes.

### 3.3 Current External Research Cooperation process in Case Company

Presently, the case company is already involved in extensive external research cooperation. The external research cooperation is coordinated through External Research Table (ERT), which is composed of seven permanent members and guests, as shown in Table 6 below.

*Table 6. Current External Research Table in the case company.*

Position	Department
<b>Director 1</b>	Innotech
<b>Director 2</b>	Innotech
<b>Director 3</b>	Innotech
<b>Portfolio Manager</b>	Strategy and Portfolio
<b>External Cooperation Expert</b>	Strategy and Portfolio
<b>Advisor 1</b>	Strategy and Portfolio
<b>Advisor 2</b>	Strategy and Portfolio
<b>Guests:</b> <ul style="list-style-type: none"> <li>• <b>Internal Experts from relative area</b></li> <li>• <b>Requestor if needed</b></li> <li>• <b>Cooperation owner if needed</b></li> </ul>	Appropriate department

The External Research Table shown in Table 6 handles the research cooperation proposals prepared by the requestor of the cooperation (initiator) with the help of line managers and appointed ERT member. When the proposal is presented in the ERT meeting, the ERT is using the Strategic fit, Technology potential, its implementation complexity and Value potential (STiV) criteria to assess and rate the proposed cooperation, as described in Figure 7.

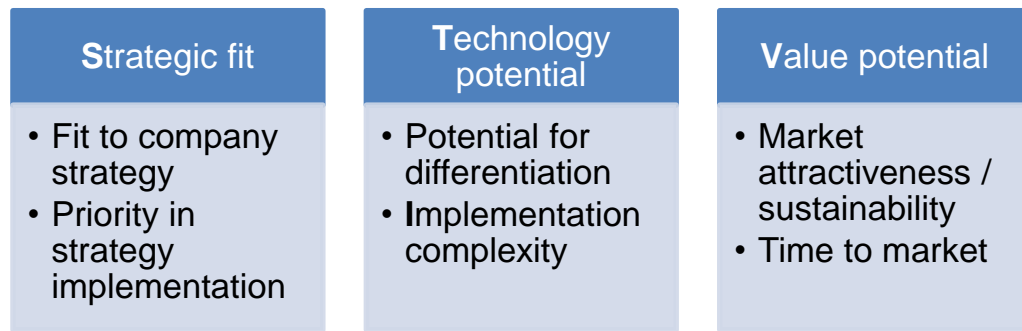


Figure 7. Criteria used for rating the cooperation proposals (STiV).

As seen from Figure 7 above, the STiV criteria include the Strategic fit (to company strategy and the priority in strategy implementation), Technology potential (and potential for differentiation and complexity of the implementation of the idea included in the proposal) and Value potential (market attractiveness and sustainability and the time to market for the potential product) features to evaluate the cooperation proposal.

The current external research cooperation process is depicted in Figure 8 (next page). The map was created based on the results of the interviews and from the examination of internal documents. The current external cooperation process includes eight main stages, described below one by one. However, it must be pointed out that the first two identified stages of the process are not part of the company documented process, but they are essential to any cooperation and therefore included in this current process map.

The current eight stages of the current external cooperation process (as the focus part of the Open innovation process) are described below.

### 3.3.1 Identification of Need for Cooperation

As the first stage of the current external cooperation process, *Identification of Need*, the requestor identifies the need for external cooperation: this need might be related to an ongoing project (speed, cost and expertise) or a strategic reason (competence build-up, technology development or screening, recruitment, visibility or commitments).

Step 1 is visible in the current external cooperation process shown in Figure 8 below.

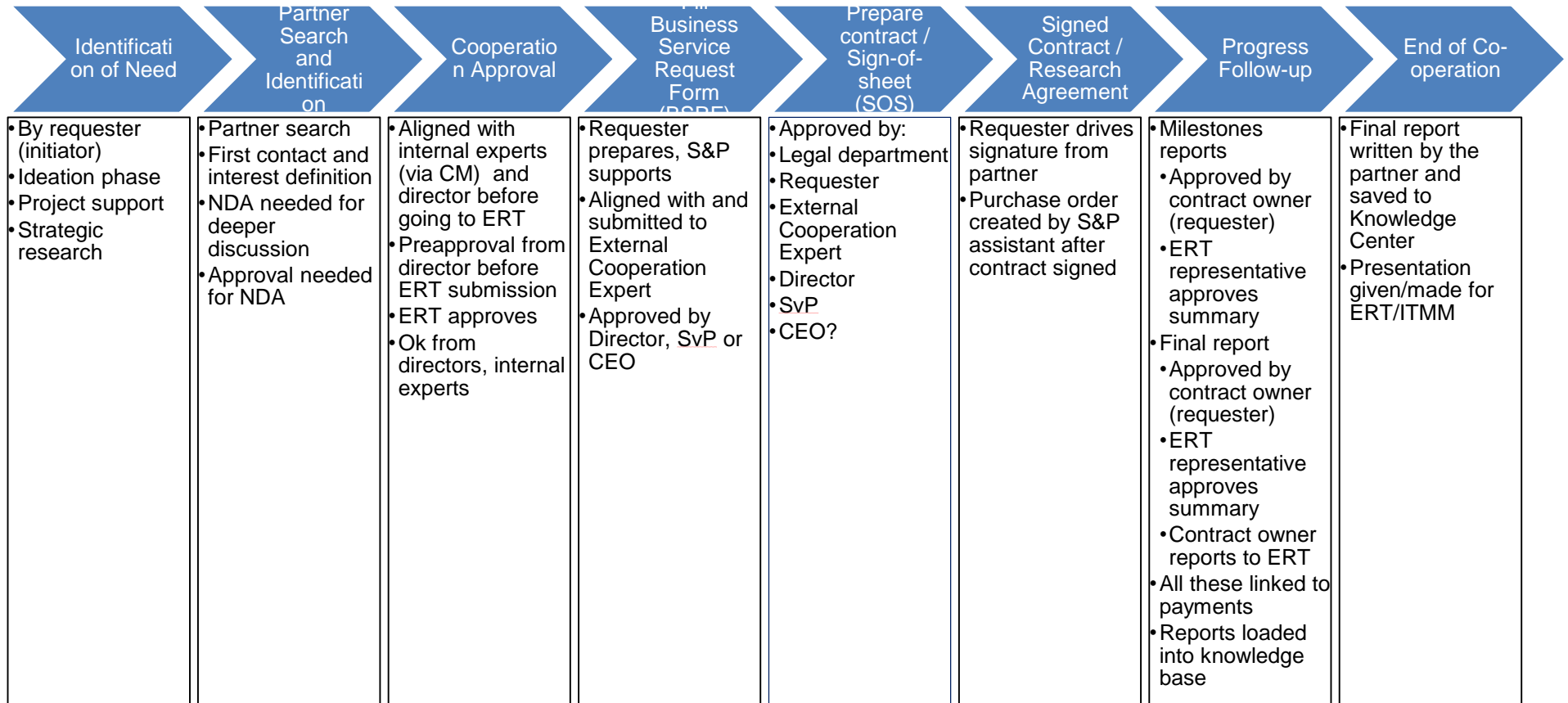


Figure 8. Current external cooperation process in the case company.

In the company, the *Identification of need* and reasoning for the research cooperation are not clearly communicated to the company's research community. This creates misunderstandings about the usefulness of some of the cooperation. As one Respondent mentioned in his interview:

*There seems to be a fundamental issue as the ability to identify the needs goes beyond academic value; the business focus or the sense of urgency isn't prominent.*

As this comment shows, along with more respondents sharing the same doubt, the case company should articulate the need for a certain need more clearly. It will help to gain support from the research community for some particular kind of basic research and will make the company able to benefit from this cooperation more. After the need has been identified and formulated, the requester needs to find a suitable research partner.

### 3.3.2 Partner Search and Identification

In the second step, *Partner Search and Identification*, the requestor identifies potential partners for cooperation, which includes partner search from the existing partnerships and searching from other possible sources for best possible partners. The requestor should also in this stage determine the potential partners interest and motivation to cooperation and summarize his findings. The case company OI strategy includes three research institute cooperation types (in strategic level), each targeted for about 1/3 of resource allocations and motivated in the following way. First, most cooperation cases are directed to the institutes near the company Innovation Centers: these are used for recruitment bases and competence development areas, also speeding up the innovation process, idea generation, increasing fundamental understanding and long term relations, could be among the motives for working with these institutes. The second type is the preferred customer/supplier locations (across Europe). The approach for these partners is networking and strategic co-operations with specific tasks. The third type is to utilize the world class research groups across the globe. These are looked for the best fit with the project specific problems/approaches. (Company External Research Process presentation). Following these motivations, the current cooperation projects can be further classified in six more detailed types, as shown in Table 7 below.

Table 7. Classification of the current cooperation in the case company.

Type of cooperation	Driving force	Owner
1. Competence build-up	Knowledge, learn to support existing development and enable/accelerate future development	Related research group
2. IP-project task	Critical for project success, speed-up of time-to-market, expected NPV	Innovation Project
3. Firefighting (outside-in)	Loss of business, loss of credibility (customer complaint etc...)	Innovation Management Team level
4. Business unit project task	BU project success, speed-up of time-to-market, expected NPV	Business Unit project
5. Strategic (technology) development	Technology roadmaps, new business opportunities, screening of new technologies	Open innovation, New Business Development
6. Other external activities	Visibility, positioning, recruitment, Management Commitment	various

As seen from Table 7, there are currently six main types of cooperation utilized by the case company. The cooperation types can be classified as (1) Competence build-up to increase internal knowledge in the relevant research group, (2) IP-project task within an innovation project to increase the projects chances of success, (3) Firefighting in Innovation management team level to solve a problem that customer has raised up, (4) Business unit project task to increase the chance of success in business unit project, (5) Strategic development to serve for strategic new business opportunities and (6) Other external activities like company positioning within a community, recruitment or management commitment. These are the motive classifications for the cooperation. (External research –presentation documents)

The key challenge related to *Partner Search and Identification* relates to the fact that, currently, there appears to be not much support for partner identification. The initiators invest a significant time and effort to come up with the idea and to search and identify potential partners for cooperation around that idea, but these efforts for partner identification do not have any support from the company. At the moment, the company does

not have a database for identified potential partners or old cooperation partners in different research fields. Moreover, there are no existing guidelines for the initiators for how to search for suitable partners and identify the best ones.

All the criteria which are currently applied when looking for partners only exist as tacit knowledge. For example, the criteria suggested by Respondent 2 in his presentation on the subject included the potential partner's communication skills, availability, experience working with industry and their motivation for cooperation. One other respondent described the cooperation partners as having a long history of ongoing collaborations with the case company and thereby the partner being very flexible and used to the case company's way of working and IPR needs. Another one described the external partner as a personal friend with such level of trust that he himself would trust the partner to do their part also without formal contracts.

The same evidence for lack of support, database or guidelines when looking for alternative partners was found from the company internal documents on the previous cooperation cases. Cooperation cases with Universities A,C and D were identified as the ones where alternative partners had been looked for, but in both cases the chosen partners were identified as best fit for the current needs. On top of that, there is also the first approval step for NDA needed before being able to discuss the issue in more detail with the potential partner. When the requester has aligned with the potential partner and mutual interest for cooperation has been established, the requester needs to obtain approval for the cooperation.

### 3.3.3 Cooperation Approval

The next stage focuses on obtaining the *Cooperation Approval*. After identifying the partner, the requestor needs to fill in the Cooperation Approval Form and get a pre-approval from the Director level before sending the Cooperation Approval Form to ERT. This part is also aligned with internal experts through competence managers (line management). The form is submitted to the Director level and approved in ERT. The criteria used in evaluating external cooperation are the STiV criteria listed in Figure 7.

In this step, when a suitable partner has been identified and mutual interest for cooperation established, the initiator needs to fill in a Cooperation approval form and make a one page PowerPoint presentation for presenting the cooperation proposal in External Research Table (ERT). The needed templates are located in the external research

team's SharePoint site, which is not well-known in the company. As it was discovered in the interviews, the reason to have the External Research Table is not well known by most of the research community and the external research support team appears to lack visibility on the company level (confirmed also by the researcher's own observations in this study). In most cases, the initiators have resorted to asking for the templates from the personnel in Strategy and Portfolio team, who are responsible for External Research cooperation. The initiator needs to align the proposal with senior management and External Research Expert with the help of his line manager, in a way, getting a preapproval to present their cooperation proposal in the ERT. To expedite the handling of the proposal in ERT meeting, the ERT names a contact from its members to the initiator to discuss and improve the proposal. This "sparring" was seen as a positive thing by two of the responders, on the other hand, one Respondent felt that the initiator has "to sell" his idea to the ERT to get an approval. Another Respondent had a more positive outlook to the preparation of the proposal:

*The sparring has helped to improve the application and get it easier through in the ERT. It also makes the requester to look the project from many angles and to describe the what, how and why parts of the reasoning for the project.*

It is the time and efforts reason that make this issue painful for the team. As the interviewees noted, the preparation of the proposal and its iteration with the ERT contact can easily takes 40 hours' worth of work. Moreover, most responders did not know the criteria used to evaluate the cooperation proposals.

#### 3.3.4 Business Service Request, Contract and Sign-of-Sheet

The next stage is *the Business Service Request, Contract and Sign-of-Sheet*. After getting approval in ERT, the requestor fills a Business Service Request Form (BSRF) and includes an executive summary (PowerPoint 1-pager) with the support of Strategy and Portfolio group. The form is submitted to the External Cooperation Expert and then forwarded to approval by appropriate level (senior management, Senior Vice President, CEO) who might already have been involved in approving the cooperation.

After the approval of BSRF, the contract and Sign-of-Sheet (SoS) is prepared by the requestor with help of legal department and the IPR department. The contract has to be approved with signatures in the Sign-of-Sheet by the requestor, legal department, OI manager, director and senior vice president (depending on the value of the cooperation).

When the contract/research agreement has been signed, the purchase order will be created by the S&P team assistant. Finally, the research cooperation can be started.

Thus, these were identified as redundant steps by one of the responders. The cooperation approval form and its 1-page can be utilized to fill a lot of the required information in the BSRF and its executive summary; therefore, BSRF which asks for more detailed information about the planned milestones and deliverables in the planned cooperation could be used instead of Cooperation Approval Form.

The contract can take several iterations going between the company's legal department and the partners' legal department. The SoS also needs to get approval from several stakeholders in several different departments in the company (initiator, legal department, IPR department, several steps in management), and depending on the value of the cooperation, the final approval can go all the way to the CEO. If the initiator needs to expedite the process, he needs to follow up where the documents are at the moment and make sure that they go to the next person in time. This has proven to be fairly difficult as one Respondent described:

*Getting signatures is an effort that is not easily followable, it is hard to follow where the document is and to move the document to the next step, you have to make the effort to find out where the document is. That requires a lot of work to coordinate, getting all signatures to speed up the process. If you have no hurry, you can always let the document flow with normal speed from desk to desk.*

So it falls fully into the initiator's responsibility to push this process of signing ahead if there is a need to shorten the time it takes. Respondent 2 described the role of the initiator as over-burdened with busy-work.

### 3.3.5 Progress Follow-up

During the cooperation, the fulfillment of the agreed milestones is followed through milestone reports written by the partner and approved by the Contract owner (often the requestor). The contract owner reports to the ERT and payments are linked to the approval of the milestones. (External research –presentation documents)

The milestone reports from partners is, in most cases, of good quality and delivered timely. Some examples were given, however, where the established procedure was not followed, as one Respondent said:

*Discipline would be needed for approving milestones that really are not met. We should be able to identify if our partner really cannot deliver what is expected of them. Currently, some cooperations continue though objectives are not being met.*

In another example, the partner was said to need a close follow-up so he would not get side-tracked from the agreed research agenda. The same partner was said to be one of the best that the Respondent had worked with and the first one to get more freedom to pursue the targets, if the Respondent was tasked to choose one partner for such freedom. Yet another issue identified as affecting the follow up quality was the lack of experience for working with industry in the university research team. That inexperience led to severe delays in delivering the desired outcomes. Fortunately, the cooperation was a several year's project and the final delivery was in time after getting the partner aligned with the case company needs. At least a couple of instances in different sample cases were mentioned, where the partner had been ill-prepared for a milestone or had needed a reminder to deliver the milestone report.

Thus this points to the challenge of managing the cooperation. The follow-up of the agreed progress should be rigorously handled (as in rigorous project management) and any deviations from the agreed deliverables dealt with swiftly. The partners should be informed and given a chance to correct their performance to the expected level. Also it should be identified if the partner cannot deliver what was agreed upon and the cooperation terminated if needed.

### 3.3.6 End of Cooperation

After the research is finalized, a final report is written by the partner and approved the same way as the milestone reports. The contract owner reports to the ERT and after approval, the final payments can be made and the cooperation can be ended. After the end of cooperation, the results will be reported at ERT and Innotech Management Meeting (ITMM). The payments are linked to achievement of milestones and confirmation of requirement fulfillment. The final reports are saved into internal database.

There is also a challenge that relates to the End of Cooperation stage. In some cases, the final payment has not been paid in time since the partner did not deliver the final report or it was not accepted by the coordinator or the ERT sponsor (source: ERT meeting minutes). One Respondent also expressed their concern about the quality of the reports uploaded and accepted into the knowledge management system: *“We need to improve the quality of our reports, time should be “budgeted” in the project for writing high quality reports.”*

Additionally, some of the outcomes of cooperation were criticized for being just an academic paper without any quantifiable business value. Another interviewee expressed a wish to have the same kind of closing meeting for the cooperation as with the innovation projects. As this Respondent pointed out, this meeting would be useful for evaluation of the external research process and the external cooperation and the partner.

### 3.3.7 Challenges Related to the Whole Process

Most of the interviewees shared the sentiment that speeding up the internal process to start the cooperation requires a very significant effort and time from the initiator of the cooperation (usually the researcher with an idea). At the fastest, the time needed for the whole process has been about 2,5 months and that pace had elicited the following comment from a IPR department representative: *“This is the fastest when we have come to a conclusion on an agreement with a University, ever.”*

In the normal circumstances, the duration of this internal process, coupled with the contract negotiations with the legal departments of the case company and the partner University, can easily take from four months to a year. One responder described the whole process as:

*The initiator needs to sell the idea and the partner choice, then he needs to drive the whole process step by step: get alignment from ERT members, take care that the signatures are received for all the required documents (which are numerous: NDA, cooperation approval form, BSRF, contract, SOS and he often needs to be involved also in creating the purchase order. There is too much involvement needed from the initiator/requester in all the paperwork phases.*

The above description of the whole External cooperation process points to the challenge of having the initiator know what to expect when they initiate the approval process. Also it is obvious that scientifically/technically oriented researchers need to use a lot of their highly paid and highly skilled time to manage bureaucratic paper work.

Summing up, the current external cooperation process in the case company follows seven main stages: (1) Identification of need, (2) Partner Search and Identification, (3) Cooperation approval (4) BSRF, (5) Contract, (6) Progress Follow-up, and (7) End of Cooperation. The stages from Cooperation approval onward have responsible persons and the documentation related to each stage, but the first two stages lack any official documentation and assigned responsibilities. The current external cooperation process makes part of the company Open innovation process and is specific in the sense that it has research institutes as its primary partners. Although the case company has such a process in place, the results from the interviews and documentation analysis shows that the current external cooperation process needs improvements.

### 3.4 Summary of the Current State Analysis

Based on the current state analysis above, the case company has several improvement areas in its external research cooperation process. The case company is improving the process and the Strategy and portfolio team members are more actively helping to expedite the process. Additionally, the management wants some changes to make the process more nimble as per the company values (based on the researcher's own observation). The challenges found in the current state analysis can be summarized under five general categories. This summary of the findings categorized into five groups is shown in Table 8 below.

*Table 8. Categorized key findings from the results of the current state analysis.*

Theme	Which stage	Why
Time allocation	Identification of Need	Time investment for developing the idea and looking for a partner not understood or valued in the company
	Partner Search and Identification	

	Cooperation approval	Time investment to fill the documents, sell the idea and improve the proposal (easily 40 hours of work)
	Progress follow-up	Partner takes a lot of time to get aligned with our needs
	End of Cooperation	Time to write the reports and prepare presentations
Target setting / outcome	Identification of need	Clear business or project need missing or target vaguely defined
	Progress Follow-up	Cooperation continue even though objectives are not met
	End Cooperation	Usable “business outcome” missing
Partner choice	Partner search and identification	Partners previous experience and ability to collaborate
	End cooperation	Partners inability to deliver results
Cooperation process	Throughout	Lack of standardized and well communicated (complete) process
Communication	Partner Search and Identification	No list of existing partners, cooperation given to the coordinator top-down (proper support missing)
	Cooperation approval	Not clear how to find documents needed Approval criteria not transparent ERT and its purpose not clear
	BSRF and Contract	Hard to track where the documents are and where they need to go next
	Cooperation Follow-up	No communication from partner in timely manner Partner needs a close follow-up not to get sidetracked

From the findings categorized and shown in Table 8 above, the three key themes were chosen to concentrate when searching for suggestions form best practice. These three

areas are: (a) target setting, (b) partner choice and (c) cooperation process, marked in color in Table 8. These themes were chosen as the most important for improvement in the current external research cooperating process and also manageable by the researcher from his current role. As the communication challenges appeared to be included in all these themes, this theme was not identified separately. A summary of the findings, placed into the process map is included in appendix 3.

The next section discusses the findings from the business and research literature as well as best practice identified for the selected theses.

## 4 Existing Knowledge in Open Innovation and Managing External R&D

This section discusses the Open Innovation paradigm, the motivation for businesses to utilize open innovation and best practice in managing external R&D collaborations.

### 4.1 Concept and Process of Open Innovation

According to Chesbrough (2004), open innovation paradigm implicates that companies can and should use ideas from within and outside the company as well as internal and external paths to market. The use of Open innovation has been proliferating from high tech industry and pioneering high performance companies to low tech industry and mainstream companies (Gassmann et al, 2010:215; Chesbrough & Crowther 2006).

The key motivations for practicing open innovation include utilizing external ideas for innovation, bringing innovations faster to market and with less money (Chesbrough, 2007:1). Furthermore, according to Enkel (2012:6) companies mostly orient either on efficiency or innovation when conducting open innovation. Overall, the driver for companies to do open innovation has been to enhance the company's innovation capabilities to utilize company's unused innovations by outbound innovation (Mortara & Minshall, 2011:586; Chesbrough & Crowther, 2006: 229-230).

One main benefit seems to be a significantly higher NPV of open innovation projects (Enkel, 2012). On the other hand Gassmann et al. (2010:219) claim that internationalizing R&D is a strategic decision that large and successful companies make to be closer to markets and to get access to world's best talents in their field. Similarly, Vanhaverbeke suggests that instead of concentrating mostly on new product development, to get the most out of open innovation, the company needs to integrate open innovation into its strategy (Vanhaverbeke 2013:10) He lists strategic reasons alongside the traditional new product development for utilizing open innovation in companies. These reasons include exploration and exploitation as growth strategies and building capability and acquiring dynamic capabilities as central topics. These motives indicate a much larger and strategic focus in open innovation than just maximizing NPV of new products or services.

Chesbrough & Crowther (2006: 233) report that companies outside high-tech industry have begun implementing open innovation in their strategies with top-down direction of activities and aligning the desire to look outside with business growth objectives. They identified that most companies are slowly aiming either from business as usual or think tank mentality to creating growth options from emerging technology. The business as usual –companies are most likely starting to utilize open innovation first by incremental change aimed at optimizing execution before going for growth.

Mortara & Minshall (2011) in their study on large multinational companies' implementation of open innovation identified that most companies implementing inbound open innovation follow a centralized model. They also found that most companies that had started to implement open innovation bottom-up wish to increase the coordination of their open innovation efforts by moving to top-down and centralized approach to implementing open innovation (Mortara & Minshall 2011:593). In addition, De Jong et al. (2008:17) distinguish five behaviors of enterprises practicing open innovation. These five behaviors are: (1) Networking, (2) Collaboration, (3) Corporate entrepreneurship, (4) IP management, and (5) R&D.

Implementing the open innovation management has been studied by Chiaroni et al. (2011). They identified networks, organizational structures, evaluation processes and knowledge management systems as levers for managing open innovation. To move from closed to open innovation each of these levers has been changed to better fit to open innovation paradigm. Chiaroni et al. studied the change of these levers through Lewin's three stages of managing change, namely un-freezing, moving and institutionalizing (Chiaroni et al. 2011: 36). Additionally, Chesbrough identifies new and different metrics for managing innovation in open system (Chesbrough 2004: 25-26). These metrics are summarized in Table 9 below.

Table 9. Metrics for managing open innovation and their management focus (Chesbrough 2004).

Metric	Focus for management attention
1. What % of sales last year came from externally licensed technologies? Is this % increasing or decreasing?	Outputs of open innovation process.
2. What % of net income last year came from technology licensed out to other companies? Is this % increasing or decreasing?	Outputs of open innovation process.
3. How long does it take to put patented ideas from inside the company into products and services? Has this interval changed and to what direction in the last five years?	Internal time-to-market for new products and/or services.
4. What percent of your internal ideas are offered for external license? How much time elapsed between the patenting of ideas and their external licensing?	External time-to-market for new products and/or services.
5. How many projects were terminated last year? How many are reviewed at a later date? How many subsequently were offered to external parties for further development?	Managing false negatives.
6. Of the projects tracked in No.5, are any developing faster technically and/or growing faster in the market than expected? Are any projects able to raise external capital for further development? Have they signed any major customers?	Any further progress of those false negatives identified in No.5.

As seen from Table 9 above, these metrics focus management attention on the outputs of the open innovation, the time-to-market for new products and services, and managing false negatives. From managing open innovation in general, this study dives deeper into finding best practice in managing the External research cooperation with universities.

#### 4.2 University-Industry Cooperation as Part of Open Innovation

The university-industry cooperation has been studied for much longer than the Open innovation paradigm. Some of these studies aim to develop the tools for R&D project management (Coombs et al. 1998) or collaborative R&D management (Barnes et al. 2002 & 2006). As R&D cooperation with university is one form of Open innovation project, the best practice from project management and innovation management can be applied and utilized to the university-industry cooperation as well. Some efforts focused specifically on assisting the managers and focusing on global innovation management (Wilson & Doz, 2012) and building collaborative teams (Gratton & Erickson, 2007). These key sources and their themes for best practice are summarized in Table 10 below.

Table 10. Relevant R&amp;D cooperation management topics identified from literature.

Cooperation management themes	Barnes et al. 2002 & 2006	Wilson & Doz 2012	Gratton & Erickson 2007	Salter et al. 2014	
		10 Rules for Managing Global Innovation	Eight Ways to Build Collaborative Teams	Coping with Open Innovation: Responding to the Challenges of External Engagement in R&D Coping strategies OI Practices	
Partner choice	Choice of partner  (Partner related issues)	Start Small	Investing in signature relationship practices	Coping Strategy I	“Going local”
	Project Management (Partner related issues)	Provide a Stable Organizational Context	Modeling collaborative behavior	Regular immersion in potential partner organizations	Better reward for successful open innovation
Time Allocation	Environmental factors (Corporate stability)  (Project Set-up & Execution)	Assign Oversight And Support Responsibility to a Senior Manager	Creating a “gift” culture	Coping Strategy II	Transaction-light explorative partnerships
	Ensuring Equality (Project Set-up & Execution)	Use Rigorous Project Management and Seasoned Project Leaders	Ensuring the requisite skills	Coping Strategy III	IP training focusing on confidentiality and disclosure
Project setup	“Cultural Gap”	Appoint a Lead Site	Supporting a strong sense of community	Knowing what you can and cannot disclose	Modular IP systems
	Universal Success Factors	Invest Time Defining The Innovation	Assigning team leaders that are both task- and relationship-oriented	Coping Strategy IV	Create dedicated assimilator role
	(Outcomes)	Allocate Resources on the Basis of Capability, not Availability	Building on heritage relationship	Translation-in activities Translation-out activities	Selective revealing
Communication		Build Enough Knowledge Overlap for Collaboration	Understanding role clarity and task ambiguity		
		Limit the Number of Subcontractors and Partners			

Target setting and outcome		Don't Rely Solely on Technology for Communication			
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The color coding used defining the themes in best practice is the same as was used in the summarizing current state analysis: orange for Target setting and outcome, light blue for Partner choice, blue for cooperation process, tan for communication and light green for Time allocation. Key themes from the literature described in table 10 above are, firstly, the need to define the expected outcome explicitly and in as much detail as possible as early as possible. Secondly, the importance of choosing the right partner to cooperate with. The partner needs to be chosen by their capabilities and not by their availability. Thirdly, defining clear roles and responsibilities for each party, also having a communication plan is important. Fourthly, making sure the project is run properly and the oversight is put in place.

The identified best practice is grouped next by chronological order for a cooperation. The groups used in this study follow closely to the lines presented by Barnes et al. (2006:398). The used groups are: (1) Target setting, (2) Partner Choice, (3) Cooperation Setup and Execution, and (4) Outcomes and their evaluation.

#### 4.2.1 Target Setting

First, as for the challenges of the target setting in the external R&D cooperation between business and university, best practice stresses the importance of setting the clear target for the research needs and innovation element in the cooperation. Wilson & Doz (2012) point to the need to invest time to define the innovation in managing global innovation. If not well defined, the outcome of the project might not be what was originally anticipated. When the project is split across multiple locations, the definition of the desired outcome becomes even more crucial. Everything in innovation research projects needs to be defined upfront as well as possible. The same logic applies to the external R&D cooperation. The scope and the aim of the collaborative research needs to be well defined in advance. Similarly, Barnes et al. (2002) identify the clearly defined objectives and realistic aims as project management issues and tangible outcomes and proprietary benefit as outcomes related issues. However, Christensen et al. warn about the misapplication of *Net Present Value* and *Discounted Cash Flow* as tools to evaluate the value of the initiative (Christensen et al. 2008: 100).

#### 4.2.2 Partner Choice

The choice of right university partner for R&D cooperation is identified as another key success factor in external cooperation process. Wilson & Doz (2012) define the issue as allocating the resources on the basis of capability, not availability. They inform that effective staffing of global project requires a great deal of attention to choose and integrate the best possible knowledge and capabilities. On the other hand, they also claim that firms most often use global projects to balance the workloads, not to use the best fitting teams to the problems. Similarly, they identify the need to limit the number of subcontractors and partners as managing relationships with external parties takes time and energy. This can be alleviated somewhat by choosing partners located close to one of company's own sites (Wilson & Doz 2012: 89-90).

Similarly, Barnes et al. (2006:399) recognize the partner choice as one key success factor to cooperation management. They list at least the role and experience of the lead investigator as key traits for university partner. In addition his experience working with industry and effective organization of university researchers are recognized as important areas, including of course a proven academic track record. Moreover, Gratton & Erickson (200:104) identify building on heritage relationships, meaning that at least some parts of the collaborative team know each other from past, as a successful factor for building collaborative teams. For testing the new partnerships, transaction-light explorative partnerships might be in order to limit the need for IP disclosure and could focus on interesting, but non-essential development areas (Salter et al. 2014:85). This is supported by Wilson & Doz's rule no.1: start small, which they mean as starting with a non-essential project first to build an efficient and coherent project team (Wilson & Doz 2012: 86).

#### 4.2.3 Project Setup and Execution

In the project setup phase, the cooperation partners need to discuss and come together on terms of deliverables, timelines and other contractual issues. This phase also involves getting approval for the cooperation from both parties' management. Barnes et al. (2006: 398-400) identify a list of key issues to be taken into account, they inform about the need to clearly define the objectives, clarify roles and responsibilities, develop a work plan and an effective communication plan. This phase also relates to the university-specific issues, the "cultural gap", which is evident in the confidentiality and IPR issues, the rights to publish and differing the priorities need to be taken into account in the setup stage.

Most of these issues can be addressed as the project management issues or contractual issues.

Similarly, Wilson & Doz (2012:87-88) give success rules like appointing a lead site, assigning oversight and support responsibility to a senior manager and use of rigorous project management and seasoned project leaders as necessary for ensuring success in managing global innovation. In addition they convey the need to build enough knowledge overlap for collaboration as important issue to be able to transfer the results to the other partner's team. These key points are further supported by Gratton & Erickson's understanding role clarity and task ambiguity and assigning team leaders that are both task and relationship oriented (Gratton & Erickson 2007: 104-109). On the other hand, Christensen et al. warn about the overuse of the widely accepted (and milestone heavy) stage-gate approach to project management and advocate the use of discovery-driven planning as an alternative that has potential to greatly improve the success rate of innovation (Christensen et al. 2008: 105).

#### 4.2.4 Outcomes and Their Evaluation

Both Wilson & Doz (2012) and Barnes et al. (2006) advocate defining the desired outcomes as early on as possible. The progress of the R&D cooperation can be followed through milestones, communication between partners as planned during the setup and as needed (Barnes et al. 2006), or through the assumptions checklist proposed in discovery-driven planning (Christensen et al. 2008). When ending the cooperation, the outcomes should also be evaluated and assessed against the early phase expectations and whether further collaboration can be considered with the partner (Barnes et al. 2006: 400).

#### 4.2.5 Universal Success Factors

Investing time in different stages of the process is seen as paramount to success. This includes the definition of target (Wilson & Doz 2012), evaluating the potential partner (Barnes et al. 2006) and also having face to face meetings with the partner (Wilson & Doz 2012; Barnes et al. 2006; Salter et al. 2014; Gratton & Erickson 2007). Even with present days advanced communication equipment, the need for face to face meetings and contacts and the need to reserve travel budget for that was mentioned by both Wilson & Doz and Barnes et al.

#### 4.3 Conceptual Framework for Managing External cooperation projects

The conceptual framework of the study is built around the key issues identified to determine the success of the university-industry R&D cooperation. These themes are: (1) Target Setting, (2) Partner choice, (3) Project setup and execution, (4) Outcomes and evaluation, and (5) Universal Success Factors. The outline of the approach which builds these stages into an Open innovation process, as constructed from the findings from the business and academic literature and best practice, is shown in Figure 9 below.

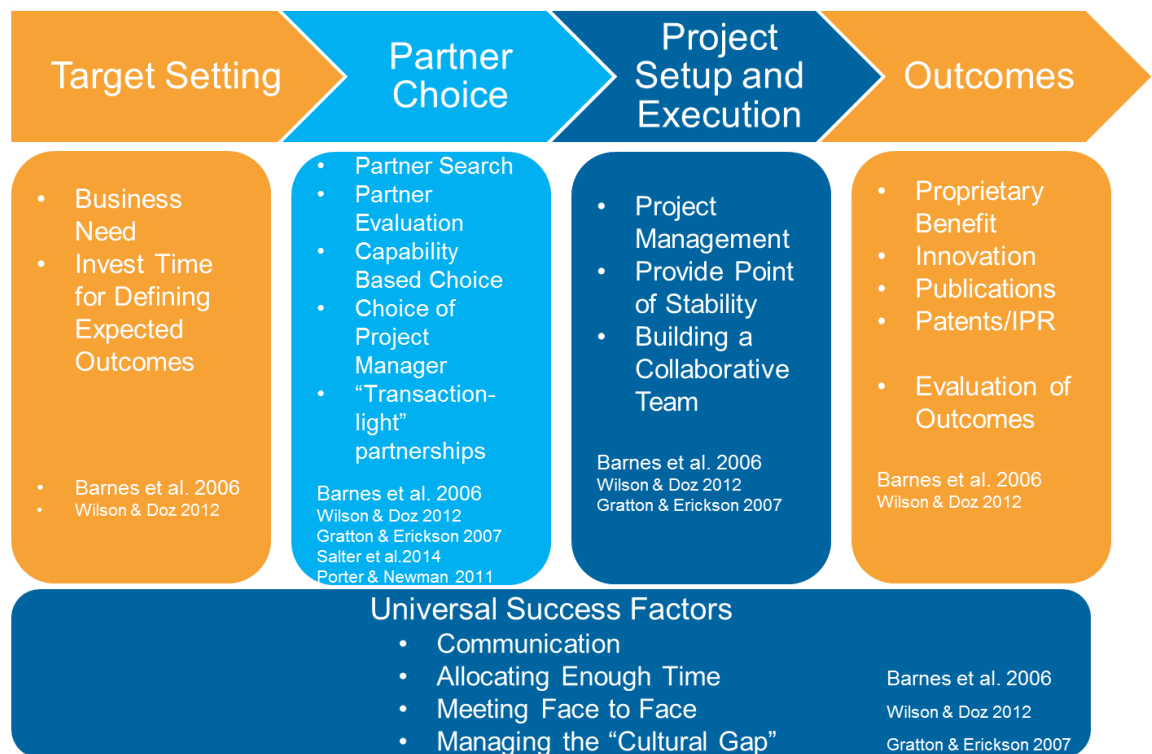


Figure 9. Conceptual Framework.

The conceptual framework of this study points to the following key stages in the external research cooperation process. First, it is the Target Setting. This phase includes such areas of special attention as defining the business need and using enough time to define the expected outcomes. Second, it is the Partner Choice. This phase includes such areas of special attention as partner search, partner evaluation and choice of project manager. Third, it is the Project Setup and Execution. This phase includes such areas of special attention as use of rigorous project management, providing point of stability for the partner and building a collaborative team. The fourth phase is the Outcomes. This phase includes such areas of special attention as the benefit from the cooperation and

evaluation of outcomes. The universal success factors include such areas of special attention as communication, time allocation, meeting face to face and managing the “cultural gap”.

This section looked for the existing knowledge e for managing external cooperation projects and summarized the main ideas for the conceptual framework. The next section will then build a proposal for the case company.

## 5 Building Proposal for the Case Company

This section builds the proposal for improving the External research cooperation process in the case company. The section builds on the interview findings from the current state analysis, as well as the findings from the company internal documents, and researcher's own observations, supported by suggestions from best practice and literature. These findings, enriched with and discussed in the second round of data collection lead to building the Initial proposal of the improved process for the case company.

### 5.1 Findings of Data Collection 1

As the current state analysis revealed, there are five major areas of challenges in the case company's current External cooperation process. The areas of challenges are: (1) time allocation, (2) Target setting and outcomes, (3) Cooperation process, (4) Communication, and (5) Partner choice. All these areas of challenge have significant effect to the outcome of the cooperation. The identified areas of challenges and their placement in the External cooperation process stages are shown in table 11, below.

*Table 11. Areas of challenge in the External cooperation process.*

Identifi- cation of Need	Partner Search and Iden- tification	Coopera- tion Ap- proval Form and Ap- proval	Business Service Request Form	Contract & SOS	Progress Follow- up	End Co- operation
Time Allocation						
Target Setting and Out- comes						Target Setting and Out- comes
		Cooperation Process				
		Communication				
	Partner Choice					Partner Choice

The identified areas of challenge were the starting point in search for best practice from the literature. The researcher initially decided to concentrate on Cooperation process and Communication as key areas to improve, but soon, based on the literature it became evident that communication was involved in all the stages and needed to be part of the solution building in any case. The cooperation process was kept as one key area, as simplifying the External cooperation process and documenting it properly was seen as a

major benefit for the case company. Based on the findings from current state analysis, the External cooperation process was not thoroughly documented and it was also seen by some respondents as so heavy, that it discouraged the initiation of new cooperation projects. It was also noted during the search for best practice, that the choice of the right partner was crucial for cooperation success, as well as defining the desired outcome of the cooperation. Thus, these two areas: partner choice and target setting were taken as key improvement areas for this study alongside the cooperation process.

The best practice from the literature included practical tools and key rules to manage the External research cooperation and to manage the innovation projects. These rules and tools addressed exactly the same issues that were identified as key areas in the current state analysis.

As the initial input for the process improvement discussions in the case company, the following construct was used (merged from the identified challenges and the suggestions from best practice). The proposal draft includes elements picked up from literature and enhanced with proposals from the respondents and case company guidelines and values described in Figure 10 below. This initial suggestion concentrated on the themes chosen from current state analysis and recognizes that other key areas are still in need of improvements.

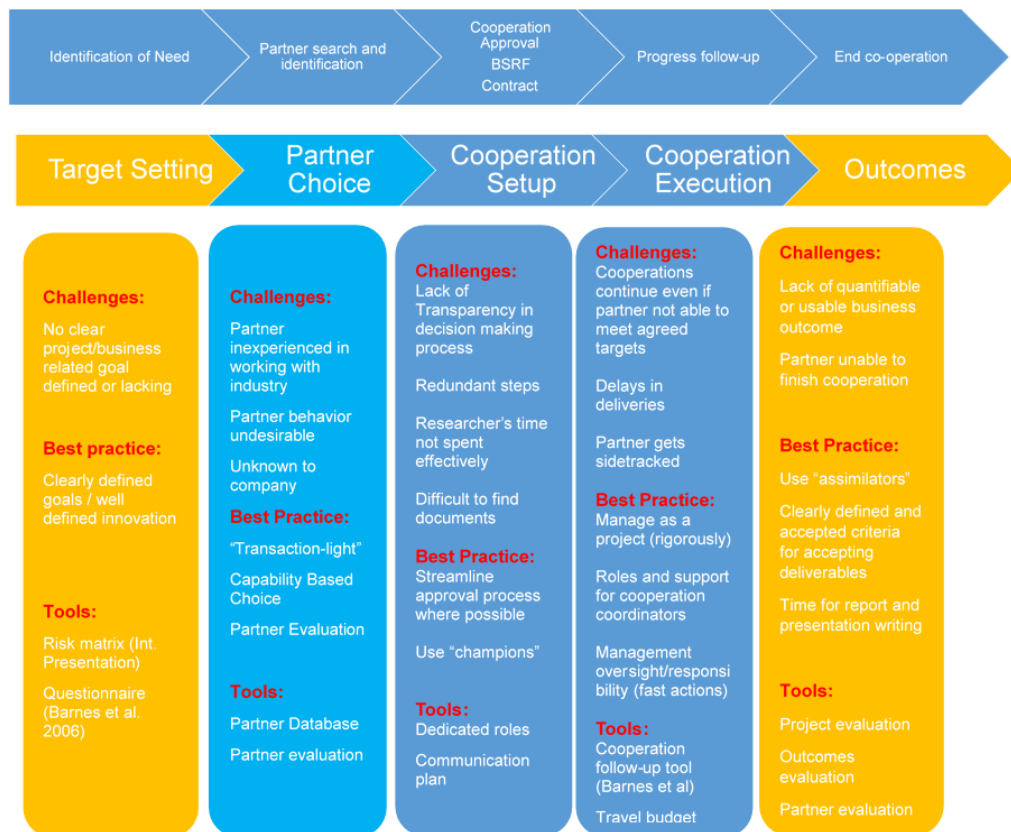


Figure 10. Initial input for improvement discussions in the case company.

In this stage, the study connected the present naming of the process stages and proposes more generic ones for use in internal communication. In the next stage, Proposal building, this initial input was presented for discussions and inputs from the stakeholders in the process.

## 5.2 Building the Initial Proposal

The results of the Proposal building stage, which came from the company discussions merged with the initial input, are described below, phase by phase.

### 5.2.1 Identification of Need – Target Setting

In the first phase, *Identification of the Need for Cooperation* (also discussed as Target setting in the literature), the best practice support some critique that came up in the current state analysis. The need for the collaboration motivation and targets is stressed as well-defined and justified (Wilson & Doz 2012; Barnes et al. 2006). The question Why

needs to have a clear answer for the collaboration to have good chances of success. The following mind map in Figure 11, below, was formed from company internal presentation to help assessing the need for starting a collaboration.



Figure 11. Question for defining the need for the cooperation.

Based on both the criticism of the current process and suggestions from best practice, it is advisable to invest time to define the expected outcome, the business need for the collaboration already as soon as possible. That way the target setting and motivation clarification can be used as help to find the best fitting partner and to identify if common interest for addressing the need exists.

When presented for discussion to the stakeholders, the following suggestions were made for the Identification of Need stage. First, in a project driven organization, the need should come from the project either on long-term or short-term basis. There should always be a clear project or business need: either to gain competences that the company does not have or to do it outside faster or more efficiently. Second, the target definition really needs to be unambiguous. Otherwise we risk producing questionable outcomes. As Respondent 6 commented: *“The importance of unambiguous target definition cannot be overemphasized. It needs to be in shape”*

### 5.2.2 Partner Search and Identification – Partner Choice

For the second phase, *Partner Search and Identification* (named Partner Choice in literature), the best practice highlights the need to select the partner by their capability and not availability (Wilson & Doz 2012), also, the best practice emphasizes the need to evaluate the potential partner for their suitability for cooperation. A way to test new and unfamiliar partners, the “transaction-light” partnership is proposed by the best practice also. This study did not find any evidence of partner database existence in the case company. This issue was also raised by the respondents. The proposal thus includes to build a partner database to help speed up the search by first looking into if the partner database includes someone with previous cooperation history and needed capabilities. The relevance is highlighted by the literature findings, that cooperation is easier with partners that have a history of successful cooperation, this also includes personal connections (Barnes et al. 2006), (Gratton & Erickson 2007).

One commonly used method for identifying potential partners is a literature search. Partner search can also be helped by proper mining of external R&D, part of which is literature search (Porter & Newman, 2011). Their R&D mining process has five stages as depicted in Table 12 below.

*Table 12. Stages for mining external R&D.*

1. Literature Review
2. Research Profiling
3. Tech Mining
4. Structured Knowledge Discovery
5. Literature-based Discovery

If possible, new partners, that the company is hesitant about should be tested with by first building trust and collaborative dialogue by “starting small” and using the “transaction-light” approach, not revealing too much detail and company IPR to the likely partner (Wilson & Doz 2012), (Salter et al. 2014). Barnes et al. (2006) have also developed a tool to evaluate potential partners, this actualizes in the form of a questionnaire and response map. This tool should be modified to the case company needs.

When presented for discussion to the stakeholders, the following suggestions were made for the Partner Search and Identification stage. First, establish a partner database. The

database can be used as the first source when looking for potential partners for a cooperation. This would give the requester a starting point from already tested and evaluated partners to start from. The partner database would include the partner's field of expertise, the evaluation of past cooperation and also potential new partners identified by company experts from conferences and other events. As Respondent 1 put it:

*"I think there is a need to create a kind of database, which would be regularly updated with the potential contributors. Mainly they would be detected from conferences, events and other consortia."*

The company experts should also be active in looking for the possible partners when networking outside the company. Second, the partner evaluation tool should be provided to help the requester determine the potential partner's suitability and identify their risk areas. The evaluation should also include how active the partners are, what their latest achievements are and established cooperation cases.

### 5.2.3 Cooperation Approval - Cooperation Setup

In the third phase, *Cooperation Approval* (named Cooperation Setup in literature), the best practice from literature informs about the importance of clearly defined roles and responsibilities for cooperation. Establishing effective communication channels and also if possible face to face meetings are also seen as crucial for cooperation success. Building the collaborative team with the partner also by informal communication is seen essential.

For filling the necessary forms and acquiring approvals and signatures, this study suggests using internal "champions". That means specific roles to help build up the proposal in the best identified way and also to drive the process further when the initiators are not needed (acquiring signature after approval, following up the documents and running them through the organization). These champions would be external cooperation coordinators or open innovation coordinators.

Finding the necessary documents needs to be made easier, there the communication plan for the whole process will help. The communication package will include information about where to find all necessary documents and help on filling them. The cooperation coordinators are also there to help. The decisions from the ERT is recommended to be

made more transparent: the decision (approved, postponed, declined etc.) to be posted in ERT SharePoint site with the grounding for the decision to help the initiators to understand the reasoning and to be able to build better proposals.

Where possible, the approval process is to be streamlined so that approval/signature for the next documents are not required or separately collected from managers that have already given their approval. It is also recommended to include travel budget for the approved cooperation already in the setup phase latest to meet the partner face to face and discuss the develop the cooperation / research plan in more detail for the approval documents and contract (deliverables, responsibilities etc.)

When presented for discussion to the participants, the following suggestions were made for the Cooperation Approval stage. First, to start a cooperation a good contract needs to be drafted, meaning the company will pay only when the partner delivers the agreed deliverables. Second, choose a coordinator that is capable of handling the cooperation. As one respondent described: *“Project manager should be someone who has at least a very good knowledge of the field and be able to steer the cooperation.”* Thirdly, it is advisable to appoint a steering committee, or management responsibility to make sure that the cooperation is in the right direction and fast decisions can be made with sufficient authority as needed.

#### 5.2.4 Progress Follow-up – Cooperation Execution

For the fourth phase, *Progress Follow-up* (Cooperation Execution in literature), the best practice supports the findings from current state analysis. To avoid accepting unsatisfactory deliverables from the partner, a rigorous project management approach and discipline in accepting the milestones need to be utilized. Also, for following up the cooperation, a travel budget is recommended for face to face meetings (frequency requirements to be determined together). This part also helps to build a collaborative team. A communication plan need to be included in the contract, including informing about difficulties, changes or progress reporting.

All of the follow-up or execution phase should follow project management practices and the research plan that was worked out together in the setup phase. Tools and training should be made available to help with the follow-up and project management principles.

When presented for discussion to the stakeholders, the following suggestions were made for the Progress Follow-up stage. First, have a knowledgeable project manager, who needs to also understand different needs of potential partners for communication. The project manager should be supported in his task by the organization. Second, have a steering committee to follow up on the cooperation. Third, utilize best available technology (i.e. videoconferencing, skype) when not able to meet face to face. As one Respondent expressed it: *“There is plenty of research on the effect of different forms of communication and spoken communication without visual confirmation is not very high on that list.”*

#### 5.2.5 End Cooperation - Cooperation Outcomes

In the last stage, *End Cooperation* (also discussed as Outcomes in literature), the critique from the current state analysis is supported by the best practice. The best practice indicates clearly the need to evaluate the outcome of the cooperation, as suggested by one of the Respondents. Other recommendations for ERT and cooperation coordinators is to have transparent discipline when accepting the milestones / deliverables. Clear communication is needed if the milestones are not completely met as stated in the contract.

After completing the cooperation, the whole cooperation should be evaluated for the key areas described in Table 13 below:

*Table 13. Cooperation evaluation areas.*

1. Outcomes of the cooperation (as expected or not)
2. The cooperation partner
3. Internal cooperation management (together with the partner)
4. The external cooperation process

In the end of cooperation these areas should be discussed and evaluated in a closing meeting with the partner (as with IP projects that have a closing meeting/evaluation). And finally, the organization should allocate time for report writing and preparation of presentation of the cooperation.

When presented for discussion to the stakeholders, the following suggestions were made for the End of Cooperation stage. First, a possibility to demonstrate the real impact of the cooperation would be beneficial. This would serve the purpose as final test for the cooperation benefit for the company and also serve as an opportunity for the coordinator

and the partner to market the benefit of the cooperation. Second, the criteria for accepting the contract need to be included already in the contract, otherwise it is too late. This will increase the transparency and clarity of the process. Thirdly, the importance of unambiguous target definition was again emphasized. This because the success of the cooperation starts from well-defined target for the cooperation. As one Respondent explained: *“The criteria for accepting the milestones should be defined in the contract, otherwise it is too late to do something about them and we have examples of that!”*

### 5.3 Initial Proposal

This initial Proposal includes the elements picked up from literature and enhanced with the case company guidelines and values, and further fertilized with the proposals coming from the process stakeholders in the case company. The proposal concentrates on the themes chosen from the current state analysis and recognizes that other key areas are still in need of improvements. The initial proposal, before validation with the key stakeholders and the management, is shown in Figure 12 below.

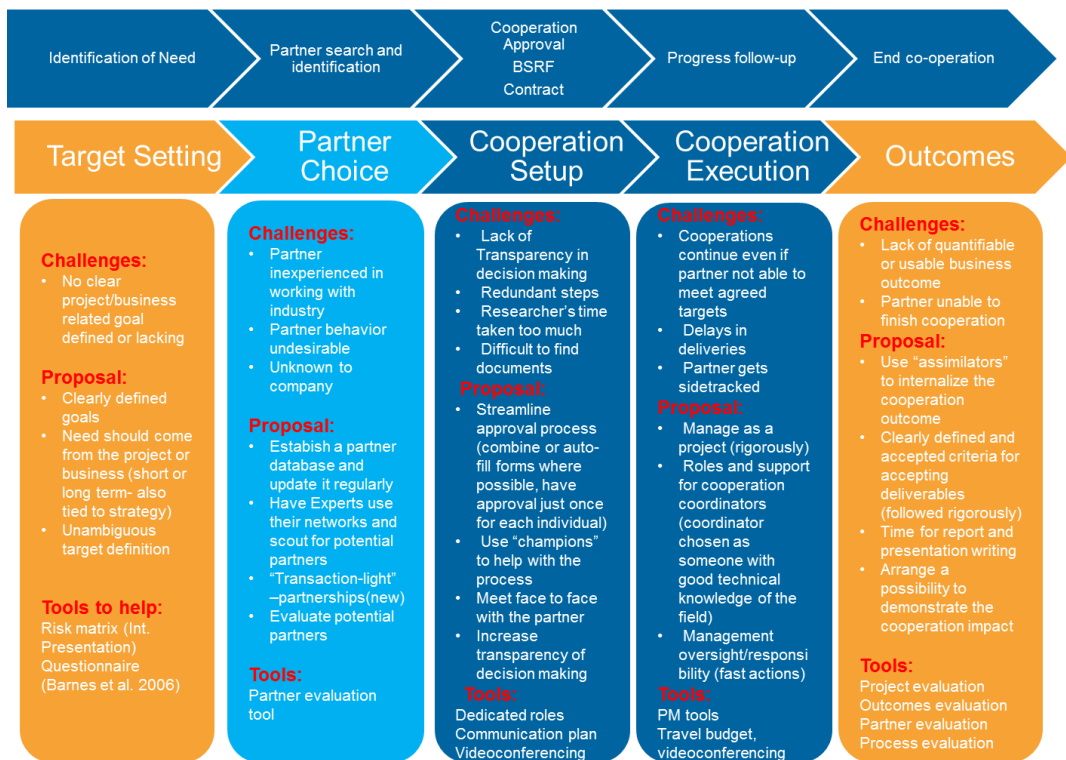


Figure 12. Initial Improvement proposal for case company.

As pointed above, this study connected the present naming of the process stages and proposes more generic ones for use in internal communication. The suggestions for improvements are categorized under each stage and include: for Stage (1) Identification of need: clearly defined goals for cooperation, need for cooperation should come from a project or business (either short- or long-term need) and the target for the cooperation needs to be unambiguously defined. The proposed tools to help in defining the need include: a risk matrix to describe risks of the company not acting and a target/need definition questionnaire as proposed by Barnes et al. (2006).

For Stage (2) Partner search and Identification: establish a partner database and update it regularly, have company Experts use their networks and expertise to scout for potential external partners and update them to partner database, test new partners with “transaction-light” –type cooperation if uncertain of their capabilities and motivation, evaluate potential partners. Tools to help in the Partner search include the partner database, a structured approach to mining external R&D and a partner evaluation tool developed from the one introduced by Barnes et al. (2006).

For Stage (3) Cooperation Approval: streamline the approval process where possible (combine the forms or have the first one auto-fill the second where possible, accept and approval from authority once and do not require another or third round of approvals from the same authorities), use “champions” locally to help the requestors with the process, increase the transparency of decision making by publishing the decisions and their argumentation when possible in ERT SharePoint site and finally, include travel budget to enable face-to-face meeting with the chosen partner when preparing for the cooperation. Tools for this stage include the dedicated roles for champions to help with the process, a communication plan to inform the decisions and the whole process to make it more well-known and finally videoconferencing tools to enable the second best choice for meeting the partners after face-to-face meetings.

For stage (4) Cooperation Follow-up: use the basic project management approach in the company to manage the cooperation, define the roles for cooperation coordinators and support them with project management and collaboration and communication training as needed, choose the coordinator (project manager) so that they have at least very good knowledge of the field and are able to steer the cooperation, lastly, assign oversight responsibility to senior management or steering committee that can make fast decisions about the fate of the cooperation if needed. Tools for this stage include company project

management tools or approach as minimum, videoconferencing equipment and travel budget to meet the partner.

For stage (6) End Cooperation: use “assimilators” to internalize the cooperation results and outcome to company needs, make sure the criteria for accepting the deliverables are clearly defined and well communicated and transparently followed in all every cooperation, arrange an opportunity to demonstrate the real impact of the cooperation, reserve enough time for report writing and preparing a presentation for communication purposes and arrange a cooperation project closure meeting to evaluate the cooperation. Tools for this stage include evaluation questionnaires for the cooperation project, the external partner, the outcome of the cooperation and the external cooperation process.

For implementation of the initial proposal this study suggests a communication package of the whole process to be prepared and presented at each relevant location and to each relevant department. The package should include the process description, a complete process map and stage by stage steps. In addition to this, the relevant links to the Innovation support team SharePoint site need to be added as well as contact details for people that can and will help requestors with the process. To help implement the changes, this study proposes to establish workshops for each of the stages of the process to determine the key issues in each stage and to develop and customize the tools for each stage so that the tools fit to the company approach.

This section presented the proposal build together with the respondents to address the challenges discovered in the current state analysis. The outcome of this section, the initial proposal presented above, was next presented to the stakeholders for proposal validation.

## 6 Validation of the Proposal

This section discusses the validation of the improvement proposal. First, it discusses the feedback from the stakeholders to the initial proposal. The stakeholders in question are the key members of the Innovation support team, which is the External cooperation process owner. Second, the section describes the final proposal with the stakeholders' feedback implemented. Last, it iterates the recommendations for implementing the changes and communicating it throughout the organization.

### 6.1 Findings of data collection 3

The initial proposal developed in the previous section was presented to the stakeholders of the External cooperation process in a teleconference held in May 5<sup>th</sup> 2015. The initial proposal was first sent to the stakeholders by email and then the proposal was discussed in a teleconference and written feedback gathered by email. The feedback from the stakeholders is described phase by phase below.

#### 6.1.1 Identification of Need – Target Setting

The stakeholders expressed their support for the proposed actions. It was highlighted that the Innovation support team can support by providing some tools and guidelines to help identify the need, but those tools are not to be made mandatory to use. The cooperation target needs to be better aligned either with project needs or strategic needs. This phase has been addressed also recently, as one Respondent commented:

*The target setting has been an area where we have struggled a bit. Fortunately, this area is something we have made huge improvement last year and not approved any cooperation proposals without proper target setting.*

#### 6.1.2 Partner Search and Identification – Partner Choice

The second phase, Partner Search and Identification, was seen by the stakeholders as something that can be supported by the proposed partner database. The database proposal was discussed and especially the part of the proposal to link the database to the company's Knowledge Management was seen as a good idea.

### 6.1.3 Cooperation Approval - Cooperation Setup

The next phase, Cooperation Approval, was acknowledged as a phase where the stakeholders have been getting feedback that the process is too complicated. The proposal to streamline the approval process by combining the Cooperation Approval Form and the BSRF was supported with reservations. The Cooperation Approval Form was seen as giving a valuable, deeper insight into the cooperation and BSRF was considered something that the stakeholders have no power to change. The stakeholders agreed that the streamlining and combining of the documents needs to be discussed further, as well as accepting the approvals from the required stakeholders for the documents. It was concluded that there is a clear room for improvement in this area. For increasing the transparency, the stakeholders agreed, as one Respondent described: *“Actually this was discussed in the last ERT meeting and we need to improve on this.”*

The stakeholders also highlighted that sometimes the decisions are also done after the ERT phase and still everyone agreed that the changes in status or the reasoning for the decisions should and could be communicated better, for example in the relevant SharePoint site. About the suggested use of facilitators, the stakeholders agreed that Respondent 10 was responsible for supporting the proposal preparation and tries his best to help the requesters. But all the stakeholders agreed, that the purpose is not going to be to take away the paperwork from the requester. The Innovation support team will support and facilitate, but the requestors need to accept that they have to be the main drivers for acquiring the approval for their proposal.

### 6.1.4 Progress Follow-up – Cooperation Execution

In the fourth phase, Progress Follow-up, the stakeholders agreed that the proposal is sound. The stakeholders emphasized that some tools could be implemented especially for larger cooperation projects involving significant investments to the partner's facilities or equipment. As one Respondent described:

*The use of tools really depends of the complexity of the external cooperation. Some cooperation projects are much larger than others. In some cooperations that involve large investments some tools might be in place. But never complicate it too much.*

The project management approach should be investigated for the larger cooperation projects. The stakeholders also agreed with the need for travel budget. Their suggestion was to take the findings of this study to management forums and support those findings with the feedback that ERT had received to highlight the need to face-to-face meetings with the partners. As reserving travel budget is a line responsibility, the line organization needs to be made clearly informed about the need for travelling. A gentlemen's agreement to accept these travel costs by the line organization should be pushed for to make sure that every department has the same approach to it.

#### 6.1.5 End Cooperation - Cooperation Outcomes

The last phase, End Cooperation, was considered mainly as addressed by the first four phases. The cooperation is most likely to success when all the elements from previous phases are properly implemented.

#### 6.1.6 Feedback for the Suggested Tools

For the suggested tools, the stakeholders felt that the company should try to avoid adding more tools that are required to use in the process. As one Respondent put it:

*Now we have a process in place, that every once and while I get comments that the process is complicated. We have to be careful how much we put new tools in place. We could look at the project management principles but not overdo it.*

Although it was agreed that the process can suggest tools to help with each of the phases, but the tools should not be made mandatory to use. Another Respondent expressed his opinion on tools strongly as: *"Never add an additional tool, we replace one or adjust one, but never increase the number of tools and the complexity of the process."*

The overall conclusion was to offer a choice of tools, but not force their use. Another accepted approach was to use workshops to define and modify the tools for each phase from company existing tool base and the best identified tools. Videoconferencing and economy travel was considered good alternatives to enhance the communication with the partners.

### 6.1.7 Overall comments for the current state analysis and the proposal

One Respondent described: *“Overall the work is seen very useful. We are most of the time reactive in communicating the process, not proactive. And that is why the first parts are missing.”* The need to improve the communication about the External cooperation process and the ERT was accepted and the proposed communication plan was seen as a good starting point to build upon. There is still a desire to better connect the process to innovation projects, so it was suggested that the work would be expanded to include more of the innovation project managers to get their views on how to connect the external cooperation projects better to the larger project entities. Respondent 9 suggested that:

“Continue to expand with interviews with the project managers. Get their view how we could connect the cooperations more to the IP projects. Use different locations as the basis of choice of the project managers and maybe take one embedded project.”

Based on all feedback received from the stakeholders, the final proposal was built. The next section describes the final proposal.

## 6.2 Final Proposal

The final proposal for improving the External research cooperation process in the case company was built from the initial proposal, incorporating the best practice found from literature and feedback from respondents participating in building the initial proposal, and the feedback from the stakeholders, consisting of the current process owner and coordinator in the Strategy and Portfolio team and the S&P department manager.

The figure 13, next page, describes the final proposal and highlights the suggested improvements and changes to the current process phases. The figure 13 thus forms the updated process map for the External cooperation process.

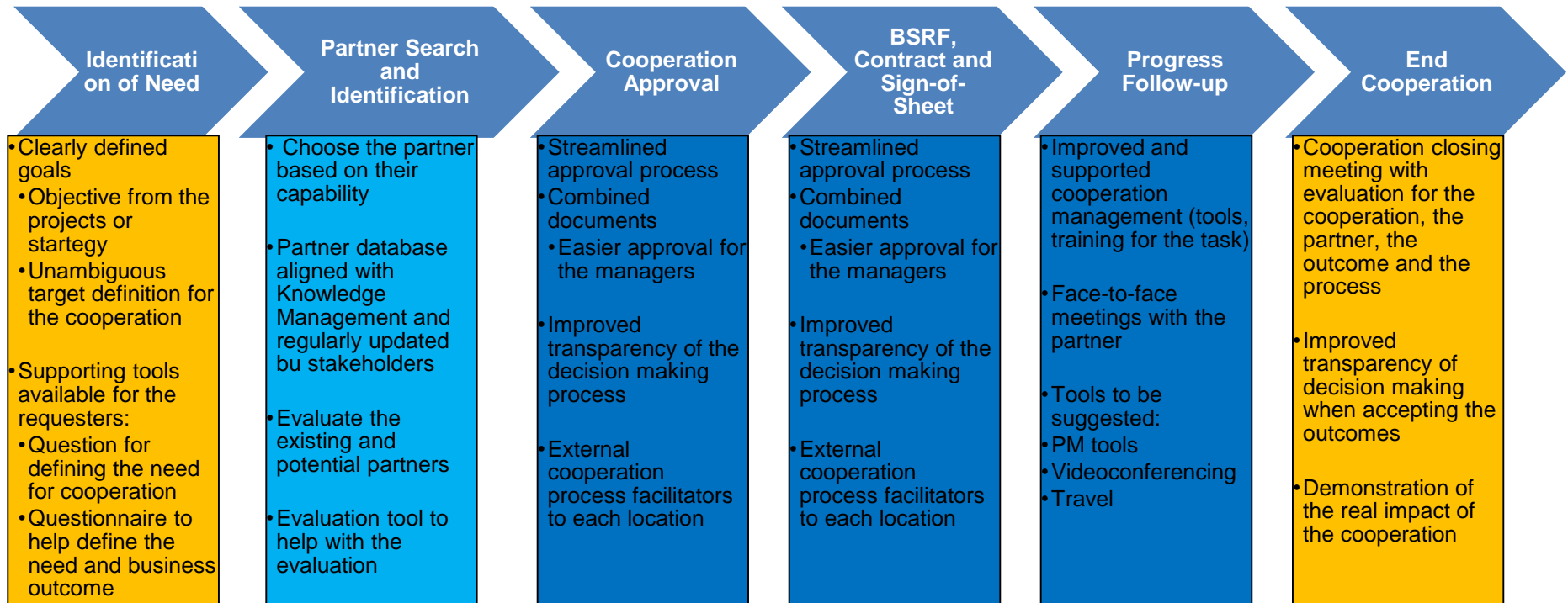


Figure 13. Improved External cooperation process in the case company.

### 6.3 Recommendations for Implementation

The initial proposal included a suggestion for establishing cross functional workshops to define the key steps and tools for each phase of the improved cooperation process. These workshops help to involve people in the organization to change the current process and thus the involvement creates a stronger commitment to the changes and the changed process. This was also accepted by the stakeholders with a reservation of not adding more tools on top of the existing ones. The existing tools can be adjusted to fit the process needs and if needed, new ones can be presented as help, but their use is not to be forced

It was also concluded, that there is a need to improve the organization's knowledge about the External cooperation process. This will be implemented through communication and training about the process. For that, the proposal to build a communication package to be distributed and presented throughout the relevant departments was seen as valuable. The communication package will include the improved External cooperation process map, including the currently missing phases and key items to keep in mind in each phase and supportive tools offered. The package is proposed to be presented in all departments dealing with external R&D cooperation projects during the implementation of the improved process. Figure 14, below, sums up the recommendations to management for each stage of the improved External cooperation process.

The stakeholders also wish to tie the improved process more closely to the innovation projects by gathering feedback from the innovation project managers on how to utilize the external cooperation opportunities better in innovation projects. This will be realized as an extension to this study.

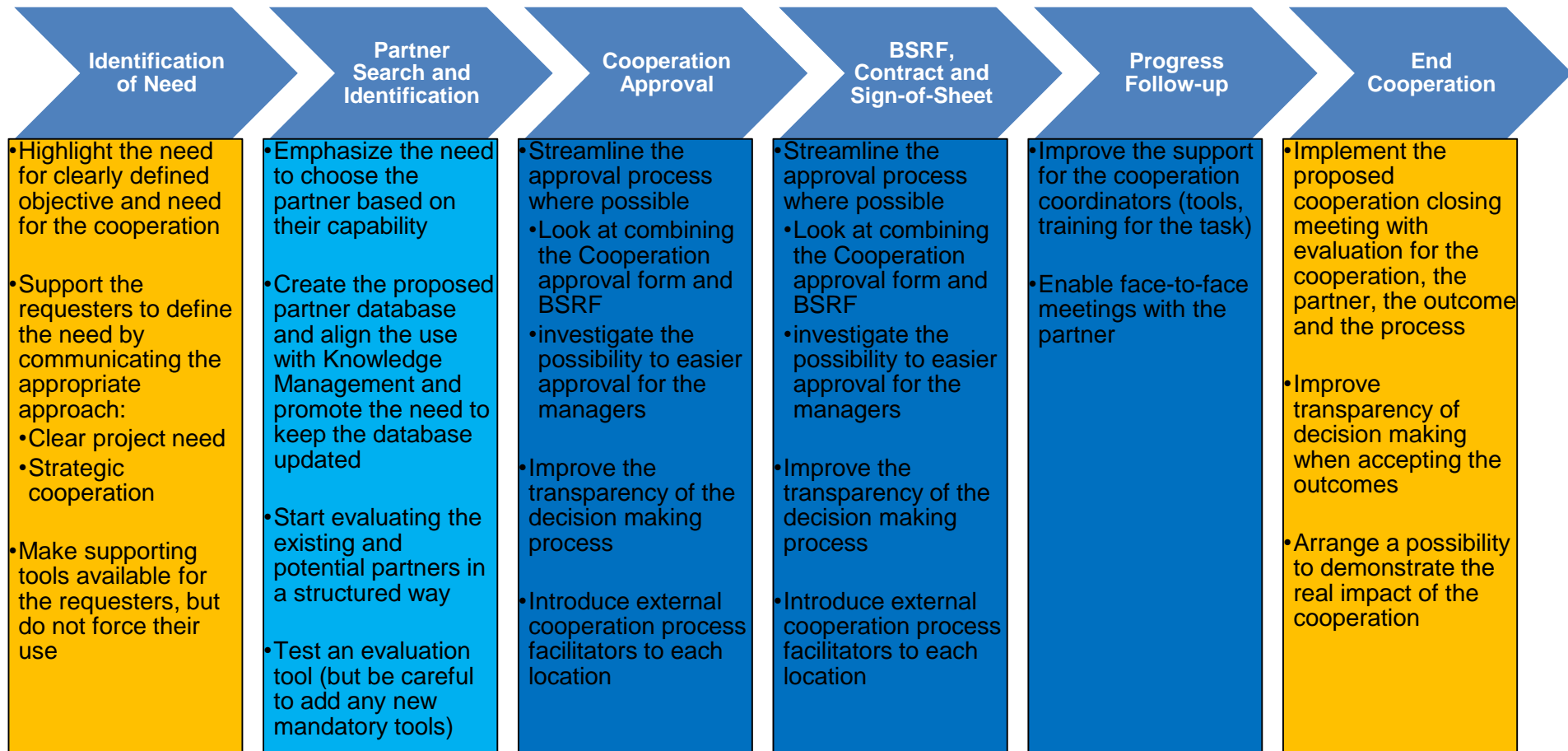


Figure 14. Guidelines for management of the external cooperation process.

## 7 Discussion and Conclusions

This section discusses the results of this study. First, it summarizes the proposal for the case company. Second, it discusses managerial implications of this study. Finally, it discusses validity and reliability of the study and the outcome of the study.

### 7.1 Summary

This study focused on improving the External research cooperation process of the case company. The objective of this study was to propose improvements to the case company's current process in order to get the most out of the cooperation projects. The improvement proposal targeted the identified weakness areas of the current process. The proposed improvements should lead to a higher level of knowledge about the External research cooperation process and increased acceptance of it in the case company R&D organization.

The action research approach was applied in this study. The primary sources for data in current state analysis were the internal documents and in-depth interviews with stakeholders of the External cooperation process. Key strengths and weaknesses were analyzed in the current state analysis and the main areas for improvement identified as: (1) *Target setting and Outcome*, (2) *Partner Choice*, and (3) *Cooperation process*. These all have a major impact to the outcome and success of the cooperation. Also *Time allocation* and *Communication* were identified as key challenge areas affecting the whole scope of the process.

A literature review was conducted to explore the best practice identified on the challenge areas. It was found that the communication and time allocation could be mostly incorporated in the other challenge areas, so the main focus was to search for best practice in managing the External research cooperation projects. Based on the input from best practice and the feedback received from the participant discussions, the initial improvement proposal was built and presented to the key stakeholders and current process owners.

The results of the current state analysis and the initial improvement proposal were discussed with the stakeholders. The stakeholders gave further suggestions for the initial improvement proposal and a refined proposal was finalized along with an overview plan

for implementation of the improved External cooperation process. The proposed solution thus includes: (1) Updated process map, including the previously missing two phases, (2) Guideline for managing and communicating the process, (3) Action plan for implementing the improved External research cooperation process.

The proposed improvements to the external research cooperation process were well received by the stakeholders. The Strategy and Portfolio department responsible for the process plans on using the outcomes of this study to improve the current process. However, it was already asked from the researcher if he would expand this study to get more views from the innovation project managers to tie the whole External research cooperation process more closely to the innovation projects.

## 7.2 Managerial Implications

This section presents the managerial implications (MI) identified to make sure the External research cooperation process in the case company is going to be well received and well known in the organization.

**MI-1, Make sure the target is well defined:** From using external resources to enhance the delivery of internal innovation projects to strategic cooperation initiatives, the business need and outcome for the cooperation needs to be well defined. Otherwise the company will rely on luck to get the desired outcome out of the cooperation.

**MI-2, Document the whole process:** The whole External cooperation process needs to be documented and communicated in the company. The best practice clearly shows that all the phases of the process need their essential steps be well defined. The findings of this study also support that the lack of structured approach from the beginning to the end reduce the effectiveness of the cooperation and might lead to waste of resources (deliverables not met).

**MI-3, Manage the change:** Establish workshops to define the steps and required focus areas for each phase, including the supporting tools. When the stakeholders of the process are included in defining the changes in the process, they become better involved and the change will be easier to implement. This approach is the classic way to reduce change resistance.

**MI-4, Communicate the process:** Communicate the improved process across the departments that are involved in External R&D cooperation projects. The increased transparency and improved knowledge of the External cooperation process makes it easier for the stakeholders to find the relevant documents and contacts. Even the best process is worthless if nobody knows about it.

**MI-5, Allocate Time to Manage the Process:** The allocation of time for managing the whole process is vital. From defining the business objective of the cooperation to writing a final report of the cooperation, the requestor or coordinator needs to have enough time allocated to take care of the cooperation steps. The successful cooperation cannot be defined and managed “left handed”.

**MI-6, Enable face-to-face meetings:** It was clearly indicated by the best practice, that nothing beats face-to-face meetings when establishing the collaborative team (in this case with external partner). The effective management of external cooperation cannot be done completely by means of technology.

### 7.3 Evaluation of the Thesis

This section concentrates on evaluating the research project. First it compares the outcome of the study to the objective defined in the beginning. Second, it evaluates the validity and reliability of the study and compares them to the plan defined in section 2.4.

#### 7.3.1 Outcome vs Objective

The objective of the study was to propose improvements to the current Open innovation process of the company. The scope was limited to the external research cooperation with universities. This process is called the External cooperation process inside the case company, so that name has been used in this study.

The current state analysis identified that part of the External cooperation process was completely undocumented. It also identified several challenges in the current process which were linked either to the undocumented part of the process or to the existing parts.

Since the first two, undocumented phases of the process were identified as very important by the best practice found from literature, it was decided by the researcher to improve the documentation of the process and propose improvements to each phase. Concrete improvement proposals were collected from the participants of the study and input from the literature review.

The final proposal for improving the case company current external cooperation process was built in cooperation with the internal stakeholders of the process (involved research personnel, project management and process owners) with the help of input of best practice from relevant literature. In addition, this study suggests a set of managerial implications to be considered when implementing external cooperation projects. Feedback from the participants and feedback for the final proposal from the key stakeholders (see appendix 4 for an example) support that the outcome fully meets the objective of this study.

### 7.3.2 Reliability and Validity

As described in section 2.4, the validity and reliability in this study were secured by several steps. Among different measures taken to the reliability and validity of the study, the authenticity of the gathered data was secured by checking the interview notes by the respondents, also making sure that different perspectives were considered by including more respondents.

To secure the validity of the study, the following measures were taken. Firstly, the primary data was gathered from multiple sources for triangulation of data. These sources included different internal documents related to the External cooperation process, participant observation and, mainly, interviews of participants in differing roles in the process, including an external partner. Secondly, the gathered data was also checked by the respondents to make sure the observations are accurate and correct. Additionally, when appropriate, full quotations from the interviews were used to report the data. Finally, the outcome was evaluated against the research objective and considered to meet the objective of the study.

To secure the reliability of the study, the following measures were taken. Firstly, multiple sources of data were used to ensure the credibility and transferability of the data. These sources included internal documents, interviews and participant observations. Secondly, the findings of the current state analysis guided the search for best practice from existing

theory, thus creating a link from the current state analysis through the existing theory to the building of the improvement proposal for the case company. Finally, the proposal building was tested in two stages: first during the building of the proposal by presenting the proposal draft to the participants of the proposal building stage and secondly during the validation by presenting the initial proposal to the stakeholders and involving them in building the final proposal. The inclusion of the participants and key stakeholders in addition to the researcher as participant also helps to avoid researcher bias.

There were some challenges identified to the validity of the study. Firstly, the amount of participant interviews was relatively low to make generalization possible and also risks to raise the concerns of small minority to a much higher relevance than they are in reality. Secondly, the data was collected mainly just from the case company perspective, just one external partner was interviewed to get the outsider's view on the performance of the case company process. However this can be alleviated when implementing and testing the proposed improved External cooperation process by asking the external partners to evaluate the case company as a partner.

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## **Appendix 1: External R&D Collaboration Questions**

### **Identifying need and potential partner**

What was the reasoning for this collaboration?  
Was it business/project driven or “strategic”?  
Who initiated this collaboration?  
How did partner identification go?  
Were several options considered? Why?  
How was partner search conducted?  
How long did the process take from initial contact to signed contact?  
Was partner selection supported?

### **Approval forms and acquiring approval**

Tell how did the approval process go, what good, what bad?  
How was the speed?  
How long did it take from form filling to getting approval?  
How much influencing was involved?  
What levels of management were involved?  
Do you know if any criteria or rating was used for determining approval and if yes, what?  
How many steps did the approval phase have?  
How many touch points the same levels have for this phase?

### **BSRF and Contract**

Tell about the BSRF phase. Was it supported, did you get help for that, was it easy?  
How did the contract preparation go?  
How long did getting BSRF filled and signed take?  
Did it need another round of approval from the same people that were already involved in the Collaboration approval phase?  
How about getting the necessary signatures and approvals for contract?  
How quickly did the research work start after paperwork was done?  
How were the milestones agreed upon?  
Were the payments connected directly to milestone achievements?  
Have the reports been published/submitted in time and before payment?  
Has that been done by partners own initiative or has it needed “help”?

### **Progress follow-up**

How good has the quality of reporting been? Milestones, final report?  
Have the reports been on time?  
Have the wanted results been achieved?  
How do you see overall support?  
How would you classify the cooperation? (IP-task, competence build-up, firefighting, BU-task, strategic, other?)  
How do you feel about the speed/time spent on the collaboration and its preparations?

## Appendix 2: Interview field note sample

Interview 5:  
Face to face  
Project 1 with University A  
Project manager / Initiator of cooperation  
Date 13.3.2015  
Duration 75min

First agreed to concentrate on the latest cooperations (~2 years)

### Reason and background for cooperation:

History of cooperations with this partner for about ten years of consecutive cooperation projects. Reason has been mainly to increase the basic understanding and knowledge of the catalyst technology. Supporting basic research that supports our development efforts. Has increased our understanding of what are the effects of made modifications and what we are actually modifying by changing the chemistry. Also screening for potential working chemical structures. Respondent sees the cooperation as concurrent to our development efforts as getting more insight and understanding about the catalyst system precursors. Easy to modify one of the old contracts. Well-known group in the field.

### Optional partners

There were some alternative partners that were looked at (internal lead researcher has more info on those options). One potential partner would have been a company, which would have escalated the costs of cooperation. It is known that many research groups have expressed interest in studying the case company's catalyst. Another interesting group had concurrently cooperation with a competitor -> seen as potential risk and problem. Trustworthiness is still seen as a criteria for choice even if the highest priority.

On partner search, one criteria in choosing a partner is IPR negotiations. The partners' flexibility and view on IPR plays a major role.

### Time

Getting aligned with ERT members and senior management took more time than thought. The amount of time needed not realised. At least a month went for getting alignment before presenting in ERT. The cooperation started about 2,5 months after getting approval. It takes easily 40 hours work to fill the forms and discuss with management and other stakeholders.

Time needed for administrative chores after the cooperation approval is astonishingly huge amount. Following up the documents and filling forms, getting signatures to the forms to make sure the process is kept ongoing. Also the requirement to upload the documents takes a lot of time.

The amount of time needed to managing the cooperation can grow to quite big and expand to several people. Case example discussion of University C cooperation (refer to interview 1), where many people were involved in solving partner's problems and issues to help get them back on track. Important also to make sure that we are not unnecessarily delaying the partner's participation in seminars or publications before approving their material

**Approval process**

Not seen as just a walkthrough. ERT is once through, but sparring ERT member for 3 times before going to ERT -> many iterations on *cooperation approval from*. The sparring has helped to improve the application and get it easier through in the ERT. It also makes the requester to look the project from many angles and to describe the what, how and why parts of the reasoning for the project.

No real need for persuasion, the reason seen by the chief scientist and manager also just wanted to make sure that our vision is clear for the cooperation requirements and needs.

The amount of work needed after approval is astonishing. (BSRF, contract, SOS, milestone reports, end reports, maintaining the cooperation).

The contact in ERT was named for the prealignment part (sparring for ERT). Chief scientist and senior manager involved in this case (in addition to project manager and researcher leading the development task). The STiV criteria unknown -> not clarified to cooperation proposers. Should the decision and its criteria also be communicated to everybody involved?

**Contract**

Has been easy to use old contracts as base for the new one. Agreement on IPR has been flexible -> external partners have been agreed on getting included as co-inventors in potential patents.

Research plan as attachment to the contract is a standard procedure. The way it is formulated defines quite well how rigid the cooperation is. If flexibility is desired by both parties (for example when studying something really new), it needs to be written into the contract and research plan. Standard agreement also includes provision how to agree on changes to the plan. It must be kept in mind that the agreement binds both parties.

**Communication**

Needed documents received by email from External cooperation expert. Chief scientist explained how the process goes. Present situation unclear since chief scientist positions are unfilled at the moment (retired and changed company). Lack of visibility for the Innovation support team -> communication of the team purpose and team website for parties doing proposals needs improvement. A description / checklist for the process suggested. Several discussions needed for getting alignment from management / ERT members.

Communication with the external partner works very well, they already know how our process works and can accommodate to that. They discuss also their resource constraints/needs and explain how their side of things go if/when cooperation starts. This partner is a good communicator and there is trust that they would communicate immediately if something significant would happen that would affect the cooperation.

**Overall feeling from the cooperation**

A flexible partner who understands our needs and way of working. A long tradition of cooperating with them helps with this. They understand our needs for withholding some information from publications and agree to post-poning if needed or leaving off information essential to the case company IPR. Partners also communicate very well if they have potential resource constraints or recruitment needs.

Worry about the fact of life that the worlds experts and well known professors also grow old and retire at some point. Who is there to replace them? –This partner has already thought this side and they have the next generation growing in their ranks.

Refers to ask from the leading researcher if any of the identified chemical candidates have been used in inside development. At least the current candidate had basis from this cooperation.

**Current process**

Final project closing meeting goes through the cooperation. The same kind of review meeting should be used for the whole External research cooperation process. Respondent doesn't remember if older cooperations have had this kind of review and if they've been reported somewhere somehow.

“External Research team is known inside mainly for closing the funding for the moment.”

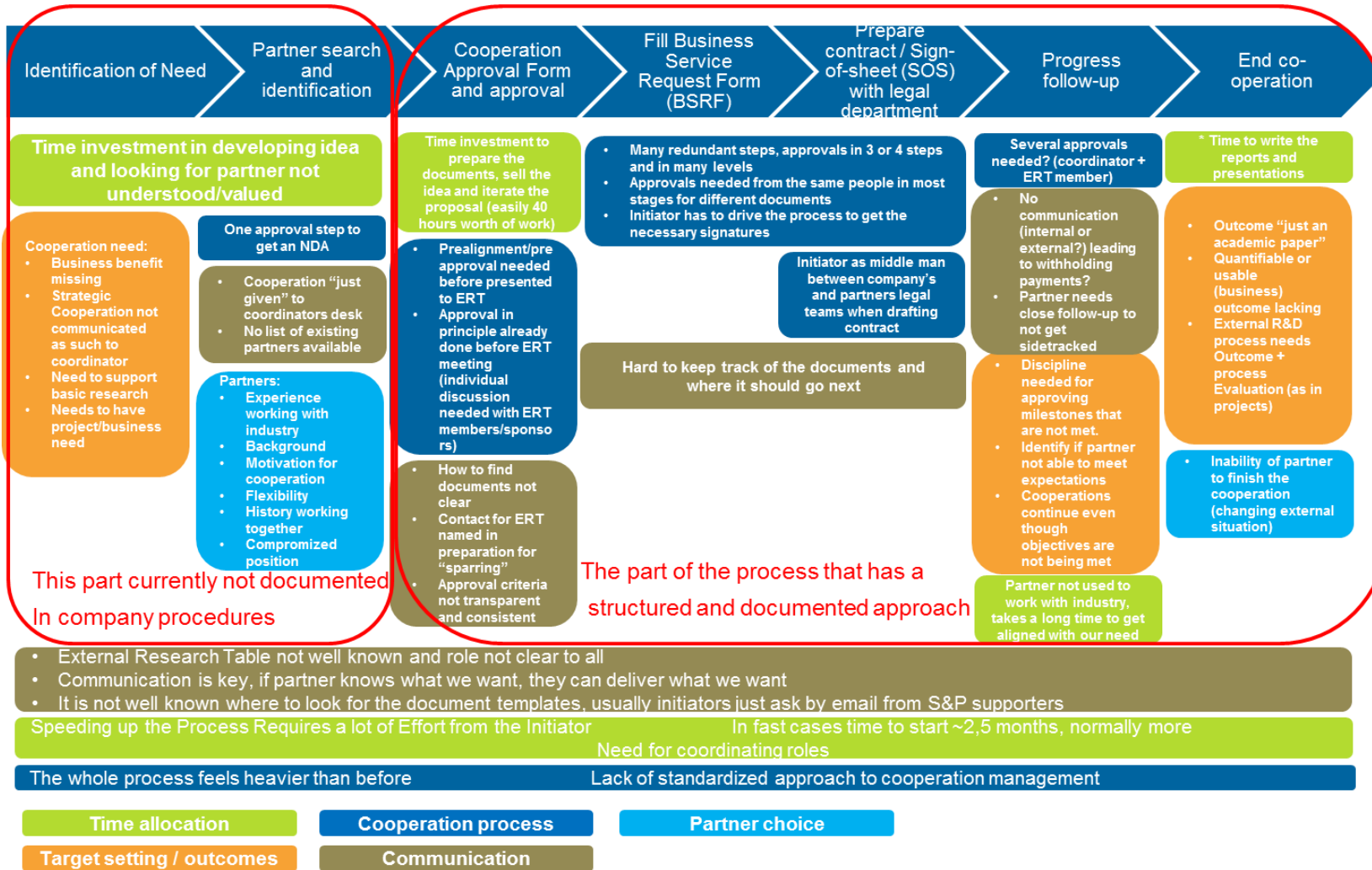
“It is difficult to describe how supporting basic research benefits us. The requirement for the results being applicable seems to be too big sometimes in the company. Basic research should be supported in some level. The case company should support building up university competences also.”

If no need to hurry the start of the cooperation, S&P department has supported very well the collection of signatures. -> communication of where the process is at the moment could be improved. SOS signatures needed to be reminded about to get the cooperation started.

A feeling that things were easier in earlier times, when it was common to have several big cooperations ongoing within the same project and even having them linked to each other. Nowadays the process feels heavier or then maybe it is just more open.

The interviewee wouldn't put the milestone reports into the knowledge base. The final reports definitely should be collected and saved. A checklist for cooperation closing could be useful (required documents etc.). Clear documentation and instructions to the external research process would be nice to have available.

**Appendix 3: Current External cooperation process and findings from current state analysis**



## Appendix 4: Feedback received for the Initial Proposal

Email exchange from Respondent 10:

Please find below my comments on your initial proposal. Please take a look and let me know if this is what you're looking for. Comments to improve the proposal I gave already, so hopefully it's enough.

*Through the research work of this master thesis it came clear that there are several possibilities to improve external research cooperation management and coordination with universities and research institutes internally in the case company. Especially interesting findings are apparently underestimated effort for "pre-work" in the cooperation (e.g. to find a correct external cooperation partner) and extensive need for communication and transparency. As it is stated in master thesis, personally I see also the biggest areas for improvement in streamlining external cooperation process where it is possible, sufficient communication and transparency in decisions in order to ensure a good motivation to start new external collaborations with universities and research institutes. In the case of business need for cooperation the members of External Research Table have always required a clear business need for external cooperation. However, it might be that this has not been communicated openly in the case company and to my mind this is definitely part of transparent decision making.*

*As stated above the communication and training of external cooperation requestors is crucial. In the proposal described the "champion" concept should be considered as research community (who are main external cooperation requestors) is relatively difficult to handle by small Open Innovation team. One possibility is that one person from each location or research group would work as a "champion". This concept has been used in the case of normal innovation project management tools (e.g. Clarity) and it has been found as a good way to share information efficiently.*