

How Software Product  
Management becomes Software  
Platform Management in Software  
Ecosystems

Master's Thesis

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# How Software Product Management becomes Software Platform Management in Software Ecosystems



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Year	2012
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Everest BV	



## Acknowledgements

This master's thesis could not be accomplished without the support of many people. First of all, I would like to thank Everest BV and my internal supervisor Mark Mastop in special, for giving me the opportunity to conduct this study at Everest BV. They have facilitated me with a perfect and pleasant environment for finishing my master study. Second, I would like to thank Slinger Jansen for his guidance, support and advice throughout my master's thesis. With his extensive knowledge on the studied research domains and years of experience as a researcher, he always asked the right questions to bring this master's thesis to a higher level. Plus, his enthusiasm gave me the inspiration and confidence in myself and my study which I missed from time to time. Third, I would like to thank Sjaak Brinkkemper for his supervision during the final phase of my master's thesis. Fourth, I would like to thank my girlfriend Floortje. By saying the right words and doing the right things at the right moment, she boosted the morale during the hard times and unburdened me during the busy times. Fifth, I would like to thank everybody I did not named but have been supporting me in anyway during my master's thesis. But most of all, I would like to thank my parents, Frank and Irma. During and before my student time they have been supporting me in various ways; it enabled me to flourish in the best possible way.



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## **Abstract**

The object under study is the state of the art of Software Product Management (SPM); a competence model and maturity matrix that aids software product organizations in improving their SPM practices. The objective was to investigate if and how the model and matrix had to be changed for keystone product software organizations (i.e. platform developers) with a directed Software Ecosystem (SECO) approach. It was not clear if it consisted of all practices relevant for this approach. First, by conducting a literature study on the topics of SPM, SECOs and related research domains, candidate changes are elicited that could be necessary. Second, eleven structured interviews are conducted with product managers working in the Dutch product software industry. They were asked to evaluate and change the competence model and maturity matrix for keystones with a directed SECO approach. For all changes made to the model and matrix applied, if a majority of the interviewees altered the same thing it is processed into the model and matrix. Changes that were not performed by a majority, but were suggested by two or more product managers, are presented to and evaluated by the eleven product managers via a questionnaire in a second round of data collection. Third, during the interviews the product managers were asked to determine if and how the candidate changes needed to become part of the model as well. During this study is concluded that SPM of a keystone with a directed SECO approach needs to be called Software Platform Management (SPfM). The result of this study is a SPfM Competence Model and SPfM Maturity Matrix. It differs from the current competence model and maturity matrix in the following way: sixteen new capabilities, nineteen changed capabilities, ten focus areas with changed maturity levels and nine focus areas with changed descriptions. Implementing the capabilities of the new SPfM Model and Maturity Matrix will increase the chances of creating a successful platform. If a keystone implements these capabilities, it can manage stakeholders, know and align their interest, and thereby enabling new value creation by itself and ecosystem members.

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# 1. Introduction

Software Product Management plays a key role in product software organizations in creating successful products. Organizing it well will increase the quality of the developed products. Researchers have instantiated many initiatives to improve the activities with regard to Software Product Management. The results of these studies have led to new and changed approaches to organize the management of requirements, releases, products and portfolio of products. One of the initiatives has led to the creation of a complete framework with all practices relevant to Software Product Management (van de Weerd, Brinkkemper, Nieuwenhuis, Versendaal, & Bijlsma, 2006b).

However times are changing, software companies (and companies in general) are incrementally becoming aware that they are not and cannot function as single entities without any relationships with and dependencies on other companies (van den Berk, Jansen, & Luinburg, 2010). This awareness is very valuable. Those who are able to manage its software product, relationships and surrounding environment in a successful manner will create a sustainable and profitable business for themselves and their stakeholders. The above mentioned framework already contains some practices to conduct product management while taking into account their relationships. However, it is never studied whether it is valid for a situation with more emphasis on the external entities; i.e. a Software Ecosystem approach. This study investigates the adequacy of it, and if it is not, what needs to be changed.

## 1.1 Research trigger

When standard off-the-shelf software products (i.e. product software) grow larger, external parties may wish to extend products to create solutions for niche markets. The product software grows to a platform on which external parties build extensions, components and applications. As described by Iansiti and Levien (2004b), a platform is a set of standard services, tools, and/or technologies that function as resources for other members. In this case, the software company and its platform provide core technology that function as a basis Software Ecosystem (SECO). Jansen, Finkelstein and Brinkkemper (2009a) have defined a SECO as: *“a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts”* (p. 2). Bosch (2009) presents several reasons for software companies to take a directed SECO approach. One of the reasons is that (potential) customers come from a plethora of niche markets. Due to time constraints and limited R&D investment budget, satisfying different types of customers with software that fit their needs cannot be solely done by the product software company. Expanding the standard product to a platform on which externally created components or applications can be built is an instrument for creating the required niche functionality.

Taking a SECO approach affects how companies look at their Software Product Management (SPM). The instruments of the state of the art for the management of product software are the Software Product Management Competence (SPMC) Model (Bekkers, van de

Weerd, Spruit, & Brinkkemper, 2010; van de Weerd et al. 2006b) and the Software Product Management Maturity (SPMM) Matrix (Bekkers & van de Weerd, 2010). As mentioned in the introduction, it already consists of practices with regard to the management of partner. However, it is not yet studied if it is adequate for SPM in a situation where the software company tries to manage its product in a SECO.

Clues suggesting that the model and matrix are not adequate are found at the beginning of the master's thesis project. First, partner requirements in SECOs may be of a higher priority than customer requirements. While a customer only represents the value of one customer, partners usually have multiple customers and thus representing a larger possible value for the software organization. It makes requirements of partners more important. It may lead to a change in which partner involvement is more important than in the current model and matrix is the case. Second, it may affect release planning because the configurations of features in new releases have consequences for the externally created components. To avoid problems with partners, the creation of widely accepted release definitions may be essential. Third, beside a roadmap for the platform of the software company each partner may have a roadmap for its solution(s). If all of these roadmaps in the SECO are not aligned correctly, it can lead to major problems. For example, the vision of the platform might not be reconcilable with solutions created by partners. However the platform company does not want to get in a sort of a 'release stasis' as well, in which it does not dare to innovate its platform. Fourth, the externally built solutions may compete with other products built by the organization. During portfolio management decisions need to be made if the organization still wants to support the creation of these externally created niche solutions by providing them the platform.

These four problems and many more may arise when taking a SECO approach, which are explored. It establishes the formal problem statement of the master's thesis:

*It is yet unclear if the instruments of the state of the art of Software Product Management are adequate for platforms produced within a Software Ecosystem.*

## **1.2 Research objective**

The objectives of this master's thesis are in line with the components of the Information Science Research Framework (Hevner, March, Park, & Ram, 2004), see Figure 1. It consists of three parts: the Environment, the Knowledge Base and the IS Research. First, the Environment part consists of peoples, organizations and technologies; i.e. the problem space in which the study is performed. Important persons for the study are product managers and persons who are or have been responsible for areas within SPM. They work in companies that produce product software. Factors concerning company culture may influence the problem space, because it reduces the generalizability of the result. Technology is left empty, because how (e.g.) the current infrastructure and architecture look like is not relevant for the study. Second, the Knowledge Base part consists of foundations and methods; i.e. the resources from and through which information system research is performed (Hevner et al., 2004). The research is based on literature on the topics of the SPMC Model, the SPMM Matrix, SPM, SECOs, and activities related to these research domains. Design research, systematic

literature review and qualitative data analysis (see section 1.6) are used as the main methods for completing it. Third, IS Research consists of the artifacts that are created and how it is validated. The artifacts are changed versions of the SPMC Model and SPMM Matrix for a directed SECO approach. In short, a directed SECO approach (Bosch, 2009) means a keystone identifies specialized market segments (i.e. niche markets) to offer solutions for. However, the organization is incapable or reluctant to develop the required functionality itself. Therefore, it selects partners who are willing and are able to develop this functionality. More information on this approach and its counterpart see section 3.4. Made changes are evaluated by conducting interviews and questionnaires.

The identified problems (section 1.1) shape the research objectives of the master's thesis:

- 1) Study the characteristics and practices of Software Product Management in theory.
- 2) Study the characteristics and practices of Software Ecosystems in theory.
- 3) Create a model and matrix that covers all practices relevant for Software Product Management in Software Ecosystems.

The first and second objective is targeted at the Knowledge Base part. By reading literature on the topic of SPM a good understanding is created on the state of the art of research in the SPM domain. Plus, by reading literature on the topic of SECOs a clear overview is created on what characteristics and practices are considered as relevant and important for SPM in SECOs (i.e. candidate changes). The third objective is targeted at the Environment and the IS Research part. The new model and matrix are developed by using the support of practitioners (i.e. product managers). They give their view from a SECO perspective on the current model, matrix and candidate changes. In this way, they are able to determine if and how the model and matrix need to change for SPM with a directed SECO approach. If a majority makes a change it is processed in the model and matrix. Changes that are not performed by a majority but are considered as relevant to add are presented to the practitioners by means of a questionnaire. The practitioners are asked to give their view on these potential relevant changes. In this way consensus is reached on the important practices of the SPMC Model and SPMM Matrix for a directed SECO approach. More information on the research approach can be found in section 1.6.

Fulfilling the objectives of this master's thesis will result in a changed version of the SPMC Model (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010; van de Weerd et al., 2006b), see Figure 5 on page 28, and a changed version of the SPMM Matrix (Bekkers & van de Weerd, 2010), see Figure 6 on page 33. The matrix presents all SPM capabilities (i.e. relevant SPM practices described in the SPMC Model) in a best practice order for implementation by which organizations can improve their SPM practices. Further explanation on the model and matrix can be found in section 2.2 and 2.3. The result of this study, a changed model and matrix, is intended for product managers and product software companies which are (planning to go) collaborating with partners by taking a directed SECO approach. They will learn what the relevant SPM practices are for a more complex SECO environment.

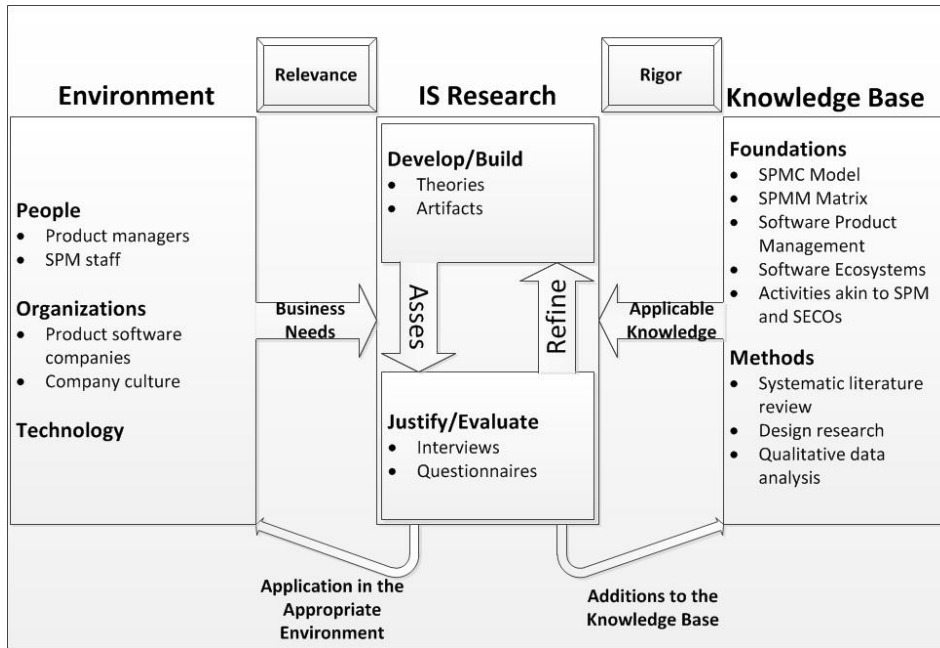


Figure 1 the Information System Research Framework.

### 1.3 Research questions

The main research question of the master's thesis is:

- 1) How should a keystone with a directed Software Ecosystem approach organize its Software Product Management?

To answer the main research question three sub-questions are formulated:

- a) What characteristics of or practices in Software Ecosystems affect Software Product Management in product software companies?

Answering the first sub research question creates an understanding of the characteristics of and practices in SECOs that affect the activities performed within the scope of SPM. It is a fundamental question since it results in a clear scope for changes in the SPMC Model and the SPMM Matrix. It corresponds to the first and second research objective, because SPM and SECOs in theory has to be studied to answer it. The answer is used in the next sub-question.

- b) What candidate changes can be derived?

Answering the second sub research question results in candidate changes for capabilities and focus areas in the model and matrix. The candidate changes are derived from the answer of the previous question. That is to say, candidate changes are derived from the found characteristics and practices. It corresponds to the third research objective, because it is the first step in determining what may have to change in the model and matrix. The candidate changes are used in the next sub-question.

- c) What is (not) important for Software Product Management with a directed Software Ecosystems approach?

Answering the third sub research question results in definitive changes that need to be incorporated in the model and matrix. The answer is derived by letting product managers review the model, matrix and candidate changes. It corresponds to the third research objective, because necessary changes for the model and matrix are determined for a directed SECO approach. Sub-question c is answered by conducting interviews and a questionnaire. The gathered data made also clear on which (focus area specific) maturity level (new) capabilities should be positioned in the model and matrix for a SECO approach. Maturity levels are necessary to give a complete answer on the main research question. Thus, answering the research questions result in a SPMC Model and SPMM Matrix for keystone organizations with a directed SECO approach.

#### 1.4 Scientific relevance

The past few years several studies have been performed on the topics of SECOs and SPM. Scholars argue managing (elements of) SPM effective is part of the solution in managing product software in SECOs. First, Jansen, Finkelstein, and Brinkkemper (2009b) say research is necessary on how to cope with the requirements, release heartbeat, release timing and portfolio planning in SECOs. The optimal moment for all stakeholders in releasing a new version, in the configuration of new functionality and the where and when needs to be found. Second, Bosch (2009) says the adoption of a SECO approach will lead to processes, optimized for intra-organizational purposes, not functioning (effective) anymore. Due to: “...*the number of parties involved and the complexity of the relationship between these parties...*” (p. 8). He argues it will lead to problems in requirement management, the management of platform releases (i.e. product releases) and roadmap planning. Third, in another paper of Bosch (2006) is stated to keep up with the many innovations that arise exists a necessity that partnering and orchestration in innovation is successful. It will affect the practices relevant to SPM as well. Fourth, van den Berk et al. (2010) state the processes portfolio management, roadmap definition, requirements management and release planning are executed in a different way in SECOs. However, it is yet unclear what is different and a good approach does not exist. Plus, they argue that in a SECO, decisions need to be made on how much of the R&D is done together with the partners. When partners state the ecosystem orchestrator is not innovative enough, they might jump to another ecosystem instead. A SECO which can provide them with the innovative features they need for creating new products.

Scholars have some ideas about how to solve these problems as well. First, Kittlaus and Clough (2009) say platform planning is the software ecosystem equivalent of product planning. The main elements are: roadmap definition, release planning and requirements management and it need to be performed with the partners in mind. Companies that conduct successful platform planning will realize several benefits (Robertson and Ulrich, 1998). They describe the following benefits: a greater ability to create niche products for niche markets or customers, lowering the costs to reach these niche markets or customers, and creating niche products that more closely meet the needs of them. Second, Bosch (2006) argues that a long term platform roadmap needs to be publicly released. It should give a clear view of what the intentions of the keystone company are and it should allow external developers to steer the niche solution into another direction. Third, Jansen, Brinkkemper, and Finkelstein (2008) say



that when firms decide to become part of a Software Supply Network (i.e. they decide to cooperate in a SECO) they need to decide how intimate their relationships are. In the most intimate relationship, they can for instance: “...lay out their release schedules and plan their releases cooperatively.” (p. 4). Fourth, Bosch (2009) argues that possible solutions are found in decentralized bottom-up, team driven roadmaps and requirement specification. Every component team (internally and externally) defines its own roadmap and requirements it will release. Problems may arise between component teams, thus it requires teams to communicate and discuss about the problems to think of solutions.

To sum up, this master’s thesis is relevant for two reasons:

- 1) SPM in SECOs is seen as an important activity in managing the platform and it need to be managed well;
- 2) only some ideas exist on how to manage these functions; however a complete developed and validated solution does not exist.

## 1.5 Social relevance

The lack of a SPMC Model and SPMM Matrix for software organizations with a directed SECO approach will lead to the following social problems. Members of a SECO need to have access to software platforms they can use to build their niche solutions. For developing platforms a software company needs to take the wishes of the partners into account. It requires SPM practices that can manage a platform in a SECO. The current SPMC Model and SPMM Matrix are not adequate or validated for this purpose. Therefore, the current model and matrix may lead to fewer or maybe to no possibilities for building new solutions. By revising the current model and matrix for a directed SECO approach, companies are assured of offering a platform with the highest quality which can be used by targeted partners for creating new solutions. The social relevance in this explanation is the following; SPM practices adequate and validated for a directed SECO approach will lead to a situation in which end-users (i.e. companies, organizations and peoples) will have more choice between solutions to solve their problems. It gives them the possibility to use software solutions that will more closely meet their needs, which enables them to work more efficiently and effectively.

## 1.6 Research method

The chosen research approach is design research. The decision to perform design science research is based on the identified problems. Design research aims at creating a new artifact, in this case an information systems research artifact. Hevner et al. (2004) determined seven principles to which information system research needs to apply:

- 1) *Design as an Artifact* – it must produce a viable artifact: a new SPMC Model and a SPMM Matrix for SECOs is developed.
- 2) *Problem Relevance* – the objective must be the creation of technology-based solutions for important and relevant business problems: as described above, during the study is tried to solve scientifically and socially relevant business problems.

- 3) *Design Evaluation* – utility, quality and efficacy must be demonstrated via evaluation methods: it applies to this principle by evaluating the artifact by making use of practitioners to develop and validate it.
- 4) *Research Contributions* – it must provide clear and verifiable contributions to the research/business domain: it applies to this principle as stated in section 1.4 and 1.5.
- 5) *Research Rigor* – rigorous methods must be used for the construction and the evaluation of the artifact: the research approach in the following sections describes which methods are used.
- 6) *Design as a Search Process* – it must utilize available means to reach desired ends while satisfying laws in the problem environment: it applies to this principle by following the Design Research Cycle (Takeda, Veerkamp, Tomiyama, & Yoshikawa, 1990).
- 7) *Communication of Research* – it must be presented effectively both to technology-oriented as well as management-oriented audiences: the master’s thesis and scientific paper will cover both audiences.

A successive cycle of the Design Science Research Cycle as described by Takeda et al. (1990) is conducted (see Figure 2) to answer the research question. The research cycle is an approach for performing design research. In it five steps are defined which represent the complete design research process. The five steps are: 1) awareness of the problem, 2) suggestion, 3) development, 4) evaluation and 5) conclusion. In the following sub-section is described how each step of the Design Science Research Cycle looks like for this study.

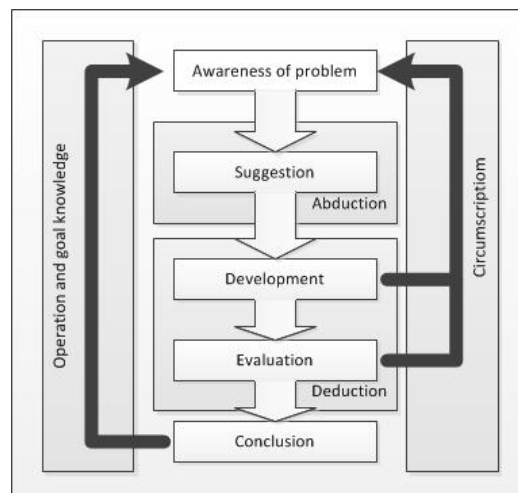


Figure 2 the Design Research Cycle.

### 1.6.1 Awareness

In the first step a relevant problem to conduct a study on is found. Based on relevant literature, opinions and other material a short proposal is written. After the approval of the short proposal by the graduate coordinator, the long proposal is written. The long proposal is a further elaboration of the short proposal and serves as a work plan for the master’s thesis.

After the long proposal is approved, it is presented at the MBI colloquium. Here, other master students and scholars have the possibility to give suggestions to improve the research.

### 1.6.2 Suggestion

The second step is suggestion; suggested is what solutions could be necessary to solve the stated problems. To find solutions a literature study and eleven interviews are conducted.

#### Literature study

The first activity of the suggestion step is a literature study on the topics of the SPMC Model, the SPMM Matrix, SPM, SECOS, and activities related to these research domains. Literature is gathered from journals, papers, conferences, books and other relevant sources. For the literature study the approach of Levy and Ellis (2006) is chosen. In this way, it is ensured the literature study can be replicated. The results are twofold. First, it leads to insights or solutions for how to solve the stated problems. It is therefore used as the knowledge base on which the interviews are structured. Second, the literature review in this master's thesis is written by using the throughput of the literature study.

The literature study has three main stages:

- 1) Inputs; gather and screen relevant literature.
- 2) Processing; process the literature in a correct way.
- 3) Outputs; write literature review.

First, in the Inputs stage all relevant literature is collected. Following the approach of Levy and Ellis (2006), the literature vendor databases need to be determined (e.g. Elsevier ScienceDirect, IEEE Computer Society or ACM Digital Library). The authors suggest picking multiple databases to be sure as many top ranked journals are studied as possible. However, the approach is not followed precisely. Google Scholar is chosen as the main search engine. In the approach of Levy and Ellis (2006) it is not considered as a high quality search engine. Nevertheless, it has become one of the leading search engines the past six years since it was written; i.e. it searches in almost all literature vendor databases. Therefore, it is a valid choice to use Google Scholar. Before starting with searching for articles, literature needs to be read that is already in possession on the topics of SPM and SECOS. It creates a basic knowledge on the topics under study by scholars in the field of the master's thesis. Based on it is determined what first keywords are used during the keyword search on Google Scholar. For the complete list of keywords and how many papers are found see Appendix A. During the screening of the found literature is decided whether a literature object is interesting for the master's thesis. If it is, it will be (partly) read. If it is not, it will be discarded. Plus, if the literature object is very interesting a decision is made to perform even a backward and/or forward search to find more highly relevant literature.

Second, the next stage of the approach of Levy and Ellis (2006) is the Processing stage. It starts with processing the literature by understanding what authors mean (i.e. knowing). Subsequently, it is comprehended to manageable chunks. Third, the literature is applied, analyzed, synthesized and evaluated to be able to determine the SECO characteristics and practices that affect SPM and to write the literature review in the third and last Output stage.

## Interviews

Next is the second activity of the suggestion step of the Design Science Research Cycle (Takeda et al., 1990). Structured interviews are conducted to gain more knowledge from practitioners in or related to the field of SPM (and SECOs). The interviews follow the guidelines of Baarda, de Goede and van der Meer-Middelburg (2007): audio record the interview, make notes by using keywords, have eye contact with the interviewee, give a summary of complex answers of the interviewee, take the time, silences are not bad, keep asking questions on incomplete answers, confront the interviewee with inconsistencies in their answers, give an introduction at the begin of the interview first and as first step the interviewees are selected. A total of eleven interviews (numbered as I1 to I11) are arranged. The interviewees are practitioners; i.e. product managers or persons with related functions. They work at a product software company that has partners which make use of their products to create their own solutions. By interviewing them, a profound insight is created on what relevant practices for SPM with a directed SECO approach are. The exact structure of the interviews is defined in an interview protocol; see Appendix B (written in Dutch). In brief, it is structured in the following way:

- 1) Introduction on the studied topics.
- 2) Explain the purpose of the study.
- 3) Present the first focus area and let the interviewee evaluate and if necessary change it for a directed SECO approach.
- 4) Present the corresponding candidate changes and ask the interviewee to determine whether the changes need to become part of the model and matrix.
- 5) Repeat steps 3 and 4 till all focus areas and candidate changes are evaluated.

First, the interview is started with an introduction into what the SPMM Model, SPMM Matrix and SECOs are and what the main SECO characteristics are that affect SPM. Second, is explained that the new model and matrix is intended for keystone organizations (see section 3.1.1) that use the directed SECO approach. See section 3.4 for more information on the directed approach. Third, the current focus areas are presented and reviewed by asking the interviewee questions about it. In each interview the same questions are asked. It enables the interviewee to evaluate and if necessary change the model and matrix (see section 1.6.4). Fourth, the interviewer presents the interviewees candidate changes as well. As explained earlier, candidate changes are elicited from or based on the output of the literature study. For example, if a scholar says in an article there should be a large emphasis on the involvement of partners in the prioritization of requirements. The resulting candidate change will be that partner involvement in the prioritization of requirements should be positioned on a low maturity level. This means it is more necessary to implement the partner involvement capability than the current model and matrix suggests. By presenting the interviewees candidate changes, they have the chance to process relevant SECO characteristics and practices into SPM. Following this approach, the current model, the current matrix and candidate changes based on the literature are validated in one interview.

Each interview is audio recorded and extensive notes are made on the printed interview protocols. The resulting data is further processed which results in qualitative data and an in

depth perspective per interviewee on the studied topic. Together with the results of the literature review the qualitative data is used for developing the SPMC Model and SPMM Matrix for a directed SECO approach. How, is described in the next section.

### 1.6.3 Development

The third step is the development step. Qualitative data of the literature study and interviews are processed to create the changed versions of the SPMC Model and SPMM Matrix. The development has three main stages:

- 1) Process interview data into statements.
- 2) Process statements into interviewee specific models and matrices.
- 3) Analyze the interviewee specific models and matrices and process changes based on majorities.
- 4) Conduct a questionnaire on the relevant changes not performed by a majority.

First, it starts with processing the made notes and audio recordings of each interview to clear statements per component of the model and matrix (i.e. capabilities, focus areas and business functions). Second, statements are processed into changed capabilities, focus areas and business functions. Per interviewee a model and matrix is made of how each individual interviewee thinks it should look like. Third, the interviewee specific models and matrices along with the statements made are compared with each other to see whether similarities and differences exist. As mentioned earlier, if a majority performs a change it will be processed in the model. In some cases, changes are processed without a majority. However, only in the case of minor and relevant changes (e.g. expanding the examples in the description of a SPM activity). It will be elaborately explained why it is legitimate to process into the model without a majority. Fourth, if the change analysis does not lead to a final conclusion the interviewees are asked to give their view for the second time. This is only the case with changes that are not minor and are not suggested by a majority, but are considered as relevant to add. The interviewees have to fill in a questionnaire in which the remaining changes are presented. Based on the questionnaire a final decision can be made. At the end of this step a changed SPMC Model and SPMM Matrix for a directed SECO approach is a fact.

The analysis approach of the data follows three of the four basic techniques described by Kaplan and Maxwell (2005). The three used techniques are: coding, analytical memos and displays. First, the coding of categories (i.e. the capabilities, focus areas and business functions) is established based on the current model and matrix. Second, by using analytical memos every analysis is described and every conclusion is backward traceable (e.g. see section 5.2). Third, by using displays (e.g.) every statement of an interviewee is processed into an individual model and matrix. It comprehends interview data into interviewee specific chunks which are comparable with other interviewees. The fourth basic technique, contextual and narrative analysis, is not needed since it is an alternative to the coding technique.

### 1.6.4 Evaluation

The fourth step is the evaluation step. It runs parallel to the previous two steps. During the interviews practitioners have to revise the current model and matrix. They are asked to argue

whether the current model and matrix is adequate; i.e. they validate the current model from a directed SPM-SECO perspective. By asking them the following questions:

- Which capabilities have to be changed for a directed SECO approach?
- Which capabilities are not relevant for a directed SECO approach?

If a majority of the practitioners does not change a capability or does not remove it from the model and matrix, it is valid for a directed SECO approach. If a majority of the practitioners performs the same change or removes the same capability, that change or removal is valid for a directed SECO approach. In addition, they are asked to argue whether candidate changes are necessary to add to the model and matrix. Thus, they validate the candidate changes for a directed SECO approach as well. By asking them the following questions:

- Which candidate changes have to be performed for a directed SECO approach?
- Which candidate changes have to be performed in a different form for a directed SECO approach?

If a majority of the practitioners does not perform a candidate change in the same form, it is not valid for a directed SECO approach. If a majority of the practitioners performs a candidate change in the same form, it is valid for a directed SECO approach. The practitioners are also asked if they are missing any capabilities with regard to a directed SECO approach, by asking them the following question:

- Are there any capabilities missing for a directed SECO approach?

If a majority of the practitioners indicates they miss the same capability, it is valid for a directed SECO approach. If not, it is not valid for a directed SECO approach.

In the case of new or changed capabilities added or performed by a minority, is determined if it could be relevant to add. Its relevance is determined by arguing during the interview analysis whether it could be relevant for the model and matrix with a directed SECO approach. If a change or capability is considered as relevant, the practitioners are asked to give their view by means of a questionnaire. The practitioners can indicate if the capabilities or changes are valid for a directed SECO approach. In this way, the new and changed capabilities added by a minority can be rejected or justified as well.

During the interviews and questionnaire is also analyzed where new, changed or current capabilities need to be positioned maturity-wise for a directed SECO approach. The focus area specific maturity levels (see section 1.8) are determined, by asking them the following question:

- Where should (new) capabilities be positioned for a directed SECO approach?

The final maturity levels are calculated by using the median and mean of the answers of the interviewees (further explained in the second last sub section of section 5.2.1).

To sum up, all performed changes and added new capabilities are justified or rejected by making use of the knowledge and experience of practitioners. By basing the decision for a change on what the majority thinks, a valid model and matrix for a directed SECO approach are developed. To create a generic and complete model and matrix decisions are made that

reflect the most generic view; i.e. outliers are recognized and processed in a correct way. Why this approach results in valid artifacts is described in section 1.6.6.

### **1.6.5 Conclusion**

The last step in the design research cycle is to conclude the study. All performed activities result in input for parts of it. The master's thesis is finalized by developing the final thesis document, scientific paper and a final presentation in which the master's thesis is defended.

### **1.6.6 Validity**

This section explains the validity of the changed SPMC Model and SPMM Matrix for a directed SECO approach. To create a valid artifact is chosen to follow a research method that leads to an intrinsic valid model and matrix. Therefore, it includes the following tactics.

#### **Content validity**

Content validity refers to the extent to which the measurement of a study (i.e. the interviews and questionnaire) represents all facets of the objects under study. During the study the state of the art of SPM is studied; a model and matrix which comprises all practices important for SPM. Plus, by performing a literature study on the topics of SPM, SECOs, and activities related to these research domains a clear view is created on alternative SPM practices (for SECOs). Thus, supporting and related literature clearly indicates what is and what is not part of SPM and therefore relevant for this study.

#### **Construct validity**

Construct validity refers to the extent to which the measurement of a study (i.e. the interviews and questionnaire) measures what is thought is measured. During the study the interviewer presents the instruments of state of the art of SPM and candidate changes for SECOs to the interviewees (i.e. the product managers). It will be presented in the form of a questionnaire and each interviewee indicates what exactly needs to be changed (e.g. with regard to the content of capabilities, its maturity levels and candidate changes). Actually, the interviewer only supports the interviewee in changing the model and matrix. No room is left over for own interpretations in the answers of the interviewees. Each interview results in an accurate interviewee specific model and matrix. To make sure the interviewees know what they are talking about, the interviews are precluded by an introduction. An explanation is given on what SECOs are, why it is or can be important for software companies to take into account and where the resulting artifacts are intended for. Plus, the model and matrix and their structure are described. In this way, each interviewee can give their professional view on how they think the model and matrix should look like for keystone organizations with a directed SECO approach. The individual models and matrices are then combined to a new model and matrix. By basing the choice for definitive changes on what the majority thinks (for the most part), the study leads to valid artifacts. (Almost) every part of the new model and matrix reflects how most of the product managers think SPM with a directed SECO approach looks like; i.e. outliers will be recognized and if necessary rejected. Only minor but relevant changes are processed based on arguments.

Thus, the interviewees know what they are talking about by the provided introduction, what they say (i.e. word for word) will exactly be processed in an individual model and matrix, the changed model and matrix is based on what a majority of the interviewees indicates, and only some minor changes are processed based on arguments.

### **External validity**

External validity refers to the extent to which the data source of a study (i.e. the practitioners) reflects the intended population for the artifacts (i.e. product managers working in SECOs). All eleven interviewees are product managers or persons with similar functions covering (parts of) the activities important to SPM. They work at a product software company and some have even worked at multiple product software companies in a similar function. In total they have worked in similar functions at fifteen different companies. All interviewees are (made) familiar with the concept of SECOs (by means of the introduction given at the start of the interview) and all are experienced in executing SPM practices in a company which closely works with partners.

### **Reliability**

Reliability refers to the extent to which a replication of a study would lead to the same result. Every study activity follows a predefined and structured approach. For example, every search term, (type of) data source and way of analysis is documented. Thus, a replication of an activity leads to the same conclusion. Plus, every data object will be coded; making everything backward traceable.

#### **1.6.7 The research method modeled**

To make the research method more clearly the complete approach is modeled using the Process-Deliverable Diagram (PDD) technique (van de Weerd & Brinkkemper, 2009), see Figure 3.



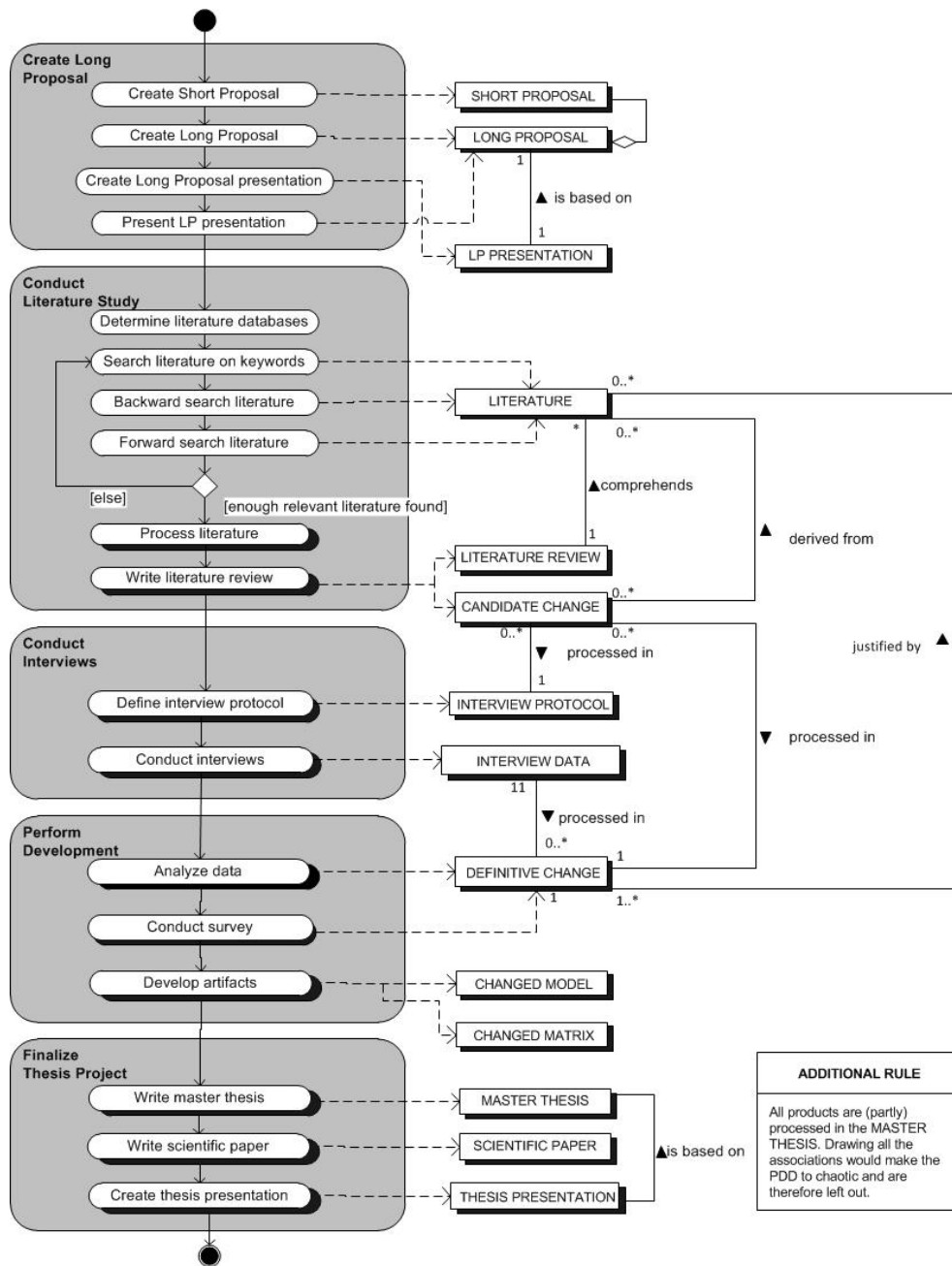


Figure 3 process-deliverable diagram of master's thesis.

## 1.7 Traceability

To create visibility in the how, when and what of this master's thesis is chosen to create a traceability matrix (see Table 1). In it all design research cycle steps, activities, objectives, questions, challenges, methods and deliverables are presented. The (roman) numbers and letters correspond to the numbers and letters given in the previous sections.

Table 1 master’s thesis traceability matrix.

Design Research Cycle (Takeda et al., 1990)	activity	research objective	research question	challenge	methods	deliverable
Awareness	Create Long Proposal					Short Proposal, Long Proposal & Presentation
Suggestion	Conduct Literature Study	(1) & (2)	a & b		(Levy & Ellis, 2006)	Literature Review & Literature Candidate Changes
	Evaluation Conduct Interviews	(3)	c	(I)	(Baarda et al., 2007)	Interview Protocol, Audio Recordings & Transcriptions
Development	Perform Development	(3)	c & 1	(II)	(Kaplan & Maxwell, 2005)	Individual Models & Matrices, Questionnaire, Definitive Changes, Changed SPMC Model & Changed SPMM Matrix
Conclusion	Finalize Thesis Project					Final Thesis, Scientific Paper & Thesis Presentation

## 1.8 Definitions

Several terms are used in this master’s thesis. In this section each term is described in the context of this study:

**Bespoke software** – software usually created on a project basis for a specific customer.

**Business Functions** – the four main SPM processes performed on a regular base. Each business function consists of multiple focus areas (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010) .

**Candidate change** – a potential change for capabilities or focus areas to create a model and matrix for SPM in SECOs.

**Capabilities** – all of the important practices for SPM (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010). Bekkers and Spruit (2010) add, it is: “*a predefined goal that needs to be achieved to reach the maturity level with which it is associated*” (p. 9).

**Focus area specific maturity levels** – letters which indicate the maturity levels of the capabilities with regard to the organization of SPM. The letters only indicate the relative maturity levels within a focus area.

**Focus areas** – all areas in the field of SPM that are considered as important. Each focus area represents a tightly related group of capabilities. (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010)

**Keystone (organization)** – Kitlaus and Clough (2009) state it is: “*...a benevolent hub in the network that provides benefits to the ecosystem and its members.*” (p. 25). They add to this, it typically gives other members (i.e. niche players) the necessary space to grow and prosper. It develops a product platform in or on which other components, extensions, applications, etcetera are processed or built by niche players.

**Market requirement** – within this study the definition is used as defined by van de Weerd & Brinkkemper (2010b): “...a customer wish related to current or future markets, defined using the terminology and context of the customer.” (p. 11).

**Matrix specific maturity levels** – numbers which indicate the maturity levels of the capabilities with regard to the organization of SPM. The numbers indicate the relative maturity levels of all capabilities presented in the SPMM Matrix.

**Niche Market** – a small subset of a market on which specialized products focus. (Potential) customers in this small market segment have specific requirements which are not met with a standard product. These requirements differ from the standard product at factors such as the price range, production quality and demographics. (Niche Market, 2008; Niche market, 2012)

**Niche players** – members of a SECO which cover specific areas of it; i.e. the niche markets. They contribute to functioning of the SECO by delivering value that differentiates from other members (Iansiti & Levien, 2004b). It leverages complementary resources of other members (i.e. niche players and keystone) and puts all its effort in improving its narrow domain of expertise (J. Brown, Durchslag, & Hagel III, 2002; Hacki & Lighton, 2001; Iansiti & Levien, 2004a)

**Niche solution** – a standard software solution specialized for a niche market by adding new or removing existing functionality.

**Partner**– an organization which has a formal relationship with the product software company in which all kinds of value is exchanged.

**Platform** – a set of standard services, tools, and/or technologies that function as resources for other members (Iansiti & Levien, 2004b).

**Portfolio management** – within this study the definition is used as defined by van de Weerd and Brinkkemper (2010a), it is the process which: “...concerns the strategic information gathering and decision making across the entire product portfolio.” (p. 2).

**Practitioners** – software product managers or persons within a product software organization with related functions.

**(Software) Product Managers** – within this study the definition is used as defined by (Ebert, 2007): “The product manager is a “mini CEO” representing the enterprise or business unit in strategy definition and operational execution.” (p. 850). It is responsible for the execution of (a part of) the SPM within a product software organization.

**Product Planning** – within this study the definition is used as defined by van de Weerd and Brinkkemper (2010a), it is the process which: “...is concentrated around the gathering of information for, and creation of a roadmap for a product or product line, and its core assets.” (p. 2).

**Product requirement** – within this study the definition is used as defined by van de Weerd and Brinkkemper (2010b): “...a requirement to be covered by future product releases described in the company’s own terminology and context.” (p. 12).

**Product Software** – within this study the definition is used as defined by Xu and Brinkkemper (2007): “...a packaged configuration of software components or a software-based

*service, with auxiliary materials, which is released for and traded in a specific market*” (p. 534). It differs from other types of software in the following ways (Brinkkemper, van Soest, & Jansen, 2009, p. 2): “*One copy is sold multiple times whereas tailor-made software is sold only once*” and “*The product sold is the software itself in contrast with embedded software where the software comes on a device that is sold as one product*”.

**Release Planning** – within this study the definition is used as defined by van de Weerd and Brinkkemper (2010a): “*...the process that deals with the set of requirements of each release in order to plan, manage, and launch the release*” (p. 2).

**Requirements management** – within this study the definition is used as defined by van de Weerd and Brinkkemper (2010a), it: “*...is the continuing process of dealing with the content and administrative data of individual requirements.*” (p. 2).

**Software Ecosystem (SECO)** – within this study the definition is used as defined by Jansen et al. (2009a): “*a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.*” (p. 2). In their definition they unify three concepts into actors, namely actors, organizations and businesses.

**Software Ecosystem Orchestrator(s)** – (typically) one or more keystone organizations. It manages (i.e. orchestrates) the ecosystem by (Jansen et al., 2009b): “*...developing strategies to keep a SECO vibrant and profitable for other organizations in the SECO.*” (p. 187). The orchestrator will try to change the overall value creation of the ecosystem.

**Software Product Management (SPM)** – within this study the definition is used as defined by van de Weerd and Brinkkemper (2010a): “*...the discipline that governs a software product over its whole life cycle, from its inception to customer delivery, in order to generate the biggest possible value to the business*” (p. 7).

**Software Product Management Competence (SPMC) Model** – a model based on the deliverable structure and corresponding business functions of a product software company (van de Weerd & Brinkkemper, 2010a). It consists of four business functions, namely: Requirements management, Release planning, Product planning, and Portfolio management. Each business function consists of multiple focus areas, each of which a tightly related group of capabilities represents (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010). The capabilities, focus areas, business functions and its structure (i.e. the model) are defined to aid product managers in executing software product management.

**Software Product Management Maturity (SPMM) Matrix** – a maturity matrix based on the Software Product Management Competence Model; it has the same structure (i.e. portfolio management, product planning, release planning and requirements management) and the same components (i.e. the focus areas and capabilities). However in the maturity matrix the capabilities, on which the focus areas are based, are spread in a best practice order over several maturity levels. In this way, product managers and software organizations can determine how mature their SPM organization is (i.e. the level corresponding to their capabilities) and what the areas of improvement are (i.e. the missing capabilities corresponding to the desired level).

## 2. Software Product Management

Software development is shifting from developing mainly bespoke software to making mainly software as a standard product (van de Weerd, Brinkkemper, Nieuwenhuis, Versendaal, & Bijlsma, 2006a; Xu & Brinkkemper, 2007). Software as a standard product is better known as product software, it is (Xu & Brinkkemper, 2007): “...a packaged configuration of software components or a software-based service, with auxiliary materials, which is released for and traded in a specific market” (p. 534). It differs from other types of software in the following ways (Brinkkemper et al., 2009, p. 2): “One copy is sold multiple times whereas tailor-made software is sold only once” and “The product sold is the software itself in contrast with embedded software where the software comes on a device that is sold as one product”. Xu and Brinkkemper (2007) state the development of product software differs from bespoke software from the development life cycle perspective. It means that at a certain point in time a bespoke software package is completed, the only development activities which will be performed are targeted at the maintenance of it. However, product software will be developed continuously; in other words release after release. Therefore SPM needs a different approach (van de Weerd et al., 2006a); this approach is called Software Product Management (SPM).

The capacity of a software product to satisfy the needs and expectations of stakeholders determines its quality (Berander, 2007). Therefore Berander (2007) states, a software company needs to gather, select and plan the right set of features for a product to find the highest value for all stakeholders. To reach its goal, SPM is an important and even a critical discipline for software companies. However, SPM covers more responsibilities, it (van de Weerd & Brinkkemper, 2010a): “...governs a software product over its whole life cycle, from its inception to customer delivery [till phasing it out], in order to generate the biggest possible value to the business.” (p. 7). It covers all phases of the life-cycle of product software (see Figure 4); defining a strategy for, distributing, launching, giving support to and phasing out a product (Ebert, 2007). The last phase (i.e. phasing out) is not processed in Figure 4. Why Ebert (2007) left out this part in the figure is not clear. The same author says about SPM, it assures winning products by: implementing business cases, agreeing on and implementing marketing, creating functional and technical roadmaps, managing product life-cycles, and aligning and optimizing the organization’ product portfolio. Plus, SPM has to grow market share, conquer markets and deliver value to customers as well. These tasks need to be executed by the product manager, so the success of a product depends on the competences of the product manager (Ebert, 2007).

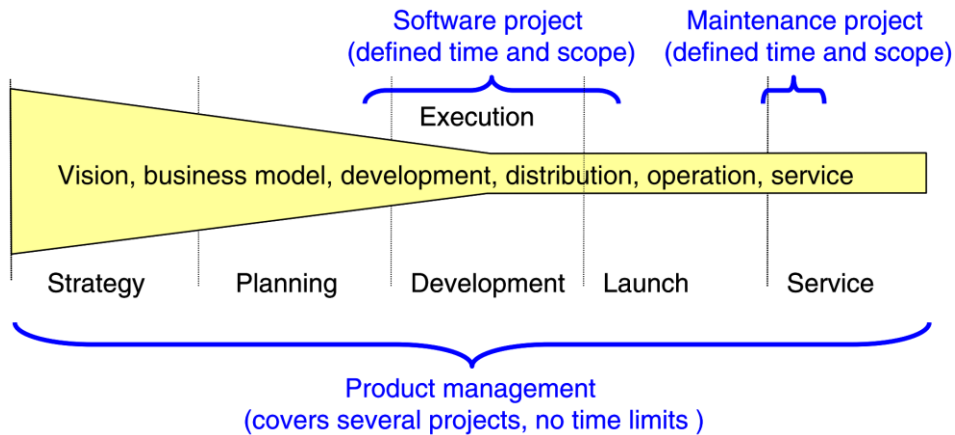


Figure 4 product management and the life cycle (Ebert, 2007).

SPM as a complete domain is a relatively young profession, the past few years it gets more and more attention in the scientific and business community. Scholars and software companies are beginning to recognize the relevance of it. SPM is a derivative of product management, which is executed in technical industries since the 19<sup>th</sup> century industrial revolution (Kilpi, 1997). Particularly in manufacturing sectors (e.g. consumer electronics and car industry) is the product management role common (van de Weerd & Brinkkemper, 2010a). However, SPM differs quite a lot from product management, due to some defining properties of software (van de Weerd et al., 2006b). Producing multiple copies of product software does not cost extra money. In contrary to ‘traditional’ products, for which every ‘copy’ needs extra actions and materials that increase the costs. The ease of changing a product and solving bugs is much larger for software as well.

Inherent to its advantageous properties exist some obstacles. The management of needs and wishes for, and keeping track of adjustments in the product is very difficult. Due to the before mentioned properties, but also because of the release frequency; i.e. the number of releases is much higher for product software. To tackle these problems SPM covers many complex responsibilities (van de Weerd et al., 2006a). Such as, requirements management, defining release definitions, determining product release lifecycles and setting up product launches (Ebert, 2007). What makes it even more complex is that the product manager has no or little authority over the development team (van de Weerd & Brinkkemper, 2010a). Thus, it has to be performed by taken many internal and external stakeholders into account (Berander, 2007). It makes SPM a daunting task.

## 2.1 The software product manager

The software product manager (also referred to as product manager) is the person who is responsible for an efficient and effective arrangement of SPM. He governs (a) product(s); it starts at the conception phase and ends at the point in time after it is phased out, in order to create the maximum value for the business (Gorchels, 2006). Ebert (2007): “*The product manager is a ‘mini CEO’ representing the enterprise or business unit in strategy definition and operational execution.*” (p. 850). He is located at the center of the company; from its position he needs to keep contact with every relevant stakeholder to collaboratively reach

goals derived from (business) strategy (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010). It demands a wide range of capabilities; from managing requirements and releases to analyzing markets and making life-cycle decisions on products. To conduct it as efficient and effective possible, he (van de Weerd & Brinkkemper, 2010b, p. 2): *“needs to have extensive domain knowledge of the (industrial) application of the product.”*

But the product manager is not responsible for every task related to the product. A demarcation of tasks is made by Ebert (2007) in his study on the impacts of good SPM on the success of product software. He explicitly states there is a difference between product managers, project managers and marketing managers. Roles which are often confused with each other, because they are closely related and they collaborate extensively. Ebert (2007) says it may lead to conflicts, such as, people addressing questions or tasks which are not the responsibility of that specific person. In contrary to the product manager, the marketing manager defines how a product or service is sold (Kotler & Keller, 2011) and the project manager defines how a project or contract is fulfilled in the best possible way (Royce, 1998).

The product manager decides when, what, where and for what price a product or product release is launched (Ebert, 2007). Ebert (2007) also says the product manager needs to find a balance between the needs and wishes of external entities (i.e. customer, markets and stakeholders) and guide them into the right direction. The product manager is committed to the product and therefore accountable for any failures.

## 2.2 The Software Product Management Competence Model

The Software Product Management Competence Model, see Figure 5, (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010; van de Weerd et al., 2006b) gives an overview of all key areas of SPM. The objective of it is threefold: it can be used as an aid in organizing and enhancing the product management of software companies, it structures education and research on SPM. It consists of four business functions: Portfolio management, Product planning, Release planning and Requirements management. The creators state they chose this structure because an organization possess a portfolio of products, which consists of one or more products, which has multiple release, and a release represent a selected set of requirements.

Each business function consist of a highly cohesive group of focus areas (the white boxes), which in turn represent a group of highly cohesive capabilities. If a product manager is responsible for a business function he is accountable for its deliverables. At both sides the stakeholders are positioned. At the left side the external stakeholders are placed (i.e. market, customers, and partners) and at the right side the internal stakeholders (i.e. company board, sales, marketing, research & innovation, development, support, and services). With the arrows in the model the creators tried to give an indication of the interaction between business functions, stakeholders and focus areas. The arrows within the business functions between the focus areas give an indication of how the main flow of the function runs. Focus areas not linked to each other interact as well. The creators have not added any development activities to the model, they state development is not part of SPM.

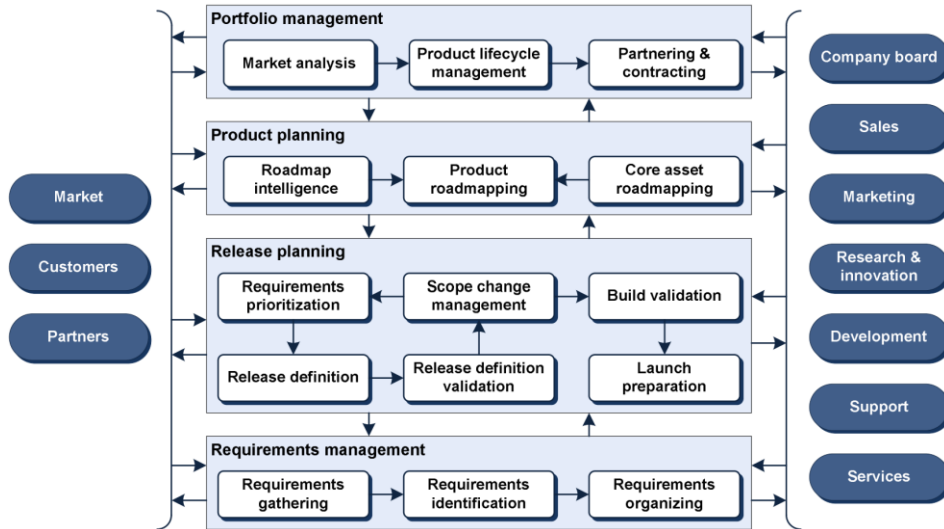


Figure 5 the Software Product Management Competence Model.

### 2.2.1 Requirements management

The business function Requirements management consists of three focus areas: Requirements gathering, Requirements identification and Requirements organizing. It comprises the complex tasks of collecting, identifying and structuring the needs and wishes of the internal and external stakeholders (van de Weerd et al., 2006b) by taking into account dependencies, core assets, product lines and themes (van de Weerd & Brinkkemper, 2010a). It is a key discipline in software organizations (Carlshamre & Regnell, 2000). The objective of it is (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010, p. 4): “...the continuous management of requirements outside of releases.” A requirement is (S. Robertson & Robertson, 2006): “...a statement on an action that the product is requested to do, or a quality that the product is requested to have.” (p. 9). Requirements management is a time consuming process, due to the usually large quantity of requirements entering the company (van de Weerd et al., 2006b). Requirements management for product software differs from bespoke software in the following way (van de Weerd & Brinkkemper, 2010b). Bespoke software is usually created for one customer, it is platform-specific, the development is phased and the costs need to be as low as possible. While, product software: is created for multiple customers, it is (typically) platform-independent, the product is constantly in development (i.e. release after release) and there exists a big time-to-market pressure. Thus, for bespoke software the necessary time and resources are determined based on the requirements, while for product software only the requirements which fit in the available time and resources are met.

In the first focus area Requirements gathering, all needs and wishes (i.e. Market requirements) for the product from all relevant internal and external stakeholders are collected by using several techniques. A Market requirement is (van de Weerd & Brinkkemper, 2010b, p. 11): “...a customer wish related to current or future markets, defined using the terminology and context of the customer.” In the second focus area Requirements identification, is started with separating errors from Market requirements; errors are solved at another location. The remaining Market requirements are redrafted to Product requirements



and requirements which overlap in functionality are linked to each other. A Product requirement is (van de Weerd & Brinkkemper, 2010b, p. 12): “...a requirement to be covered by future product releases described in the company’s own terminology and context.” In the third and last focus area Requirements organizing, Product requirements in every possible life-cycle phase are continuously organized on shared aspects (e.g. per product (line), release or theme) and dependencies are determined. Tracking dependencies is required because the implementation of a specific requirement may be necessary for another requirement. Which capabilities each focus area exactly comprises is described in Appendix C.

### 2.2.2 Release planning

The business function Release planning consists of six focus areas: Requirements prioritization, Release definition, Release definition validation, Scope change management, Build validation and Launch preparation. The objective of it is to (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010, p. 4): “... successfully create and launch a release.” It has to deal with the Product requirements elicited in the previous business function. Through this process software releases are defined for, distributed to and acquired by its end-users (van der Hoek, Hall, Heimbigner, & Wolf, 1997). Release planning is initiated by either a release initiation document (i.e. a document usually written by the board that initiates a project) or it follows a regular corporate release heartbeat (van de Weerd & Brinkkemper, 2010c).

In the first focus area Requirements prioritization, Product requirements are prioritized to be able to determine which requirements should be incorporated in the following release(s). The product manager determines the priorities together with internal and external stakeholders. The goal is to make a selection of requirements which satisfy the company its objectives as much as possible (van de Weerd & Brinkkemper, 2010c). In the second focus area Release definition, a selection of Product requirements for the upcoming release is made on the basis of the priorities given in the previous focus area. The selected requirements are processed in a document called Release definition. It normally contains short descriptions and references to Product requirements, the dependencies among requirements and the names of the persons responsible for the envisioned work (van de Weerd & Brinkkemper, 2010c). In the third focus area Release definition validation, specific internal stakeholders (e.g. the company board) validate the release definition before it is developed. In this way the fit with the roadmap is consolidated and investments in resources are accounted for (van de Weerd & Brinkkemper, 2010a). In the fourth focus area Scope change management, required changes in the scope of the current release (which come up during the development) are handled. Van de Weerd and Brinkkemper (2010c) say it is the formal process, that makes decisions and monitors change requests. The same authors state that if it is executed in the right way it will lead to shorter delays, less postponement, less waste of time, less waste of results and less frustration. In the fifth focus area Build validation, the build of a release is validated by internal and/or external parties prior to the launch. In the sixth and last focus area Launch preparation, everything relevant to a launch is prepared. It means all relevant stakeholders are communicated about the launch, documents and training for the release are developed, and the actual implementation is prepared. Which capabilities each focus area exactly comprises is described in Appendix C.

### 2.2.3 Product planning

The business function Product planning consists of three focus areas: Roadmap intelligence, Product roadmapping and Core asset roadmapping. Its objective is (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010, p. 5): “...*gathering of information for, and creation of a roadmap for a product or product line and its core assets.*” It is the business function which deals with the planning of multiple releases of a product. It is usually seen as a complex process, by creating a planning the organization is being forced to commit to an uncertain future (van de Weerd & Brinkkemper, 2010d). The same authors say it typically goes wrong when not all stakeholders are involved, roadmaps (i.e. plans) are not communicated or shared and roadmaps are not revised (on a regular base).

In the first focus area Roadmap intelligence, intelligence (i.e. information on markets, competitors and technologies) is collected which is essential for developing a pro-active product roadmap. Market and Product requirements are not part of this intelligence (van de Weerd & Brinkkemper, 2010a). In the second focus area Product roadmapping, the roadmap is created based on the collected intelligence. Vähäniitty, Lassenius, and Rautiainen (2002) say roadmapping (i.e. creating a roadmap) is a: “...*popular metaphor for planning and portraying the use of scientific and technological resources, elements and their structural relationships over a period of time.*” (p. 2). In a product roadmap the product manager defines how a product (line) is going to evolve the coming years; he makes plans for the future. It enables internal and external stakeholders to plan accordingly (van de Weerd & Brinkkemper, 2010d). The same authors state that creating and having a roadmap has the following benefits. Internally, it improves communication, understanding and decision-making, it can be used to gain consensus on the direction and commitment of key stakeholders, it promotes long-term planning, and it can be used as a measurement tool to determine whether a product is on track. Externally, it involves external stakeholders (e.g. customers) in thinking on long-term innovations, it improves customer relationships because information is shared, and the roadmap can be used as a negotiation instrument. Regnell and Brinkkemper (2005) define a roadmap as: “...*a document that provides a layout of the product releases to come over a time frame of three to five years.*” (p. 301). However in (van de Weerd & Brinkkemper, 2010a) Brinkkemper (and van de Weerd) revised this view and say roadmaps can be short-term (up to one year), or long-term (one to five years). Furthermore, they say the product manager needs to make different types of roadmaps for different audiences. For example, a software company does not want to reveal confidential information which is only intended for internal eyes. In the third and last focus area Core asset roadmapping, plans are made for the evolution of core assets. A core asset is a mutual component of several products, e.g. requirements, codes, services and documentation (van de Weerd & Brinkkemper, 2010b). To enable roadmapping for core assets, core assets need to be identified and stored in a central location (van de Weerd & Brinkkemper, 2010a). Which capabilities each focus area exactly comprises is described in Appendix C.

#### 2.2.4 Portfolio management

The business function Portfolio management consists of three focus areas: Market analysis, Product lifecycle management and Partnering & contracting. Its objective is (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010): “...the strategic information gathering and decision making across the entire product portfolio.” (p. 5). It involves making choices about the complete portfolio of products, coming up with new products by analyzing the market and looking at the product development strategy, making (tough) choices about the lifecycle of the products, and setting up new partnerships and contracts (van de Weerd et al., 2006b). Typical questions a product manager should ask himself are (van de Weerd & Brinkkemper, 2010e): “Which products are beneficial to our strategy?”, “In which new ideas should we invest?” and “Should this product be terminated?” (p. 2) by keeping in mind what product composition will create the most profit. The product manager is only concerned with the product portfolio; other types of portfolio (e.g. of projects and resources) do not fall under the responsibility of SPM.

In the first focus area Market analysis, intelligence is collected on several market variables; to gain insight in the relative position of the products and to find motivations of (potential) customers (van de Weerd & Brinkkemper, 2010f). It enables the product manager to make decisions about the product portfolio. In the second focus area Product lifecycle management, intelligence is gathered and decisions are made on product lives and major product revisions in the organizations its product portfolio. Van de Weerd and Brinkkemper (2010e) say: “It involves decisions on releases of products, alterations and enhancements of the product(s), diversifications into market segments, and end-of-life decisions on products.” (p. 8). By analyzing, if the portfolio fits strategic business objectives, whether overlaps and/or gaps between products exist, and how the competitive position can be improved (van de Weerd & Brinkkemper, 2010a). Having gaps in the product portfolio may have serious consequences. Needs and wishes of (potential) customers are not met which in turn may lead to the loss of potential revenue. In the third and last focus area Partnering & contracting, new partnerships are established, pricing models are determined, and distribution issues are solved. Product line management is also part of the business function Portfolio management (van de Weerd et al., 2006a). It is part of the second focus area Product lifecycle management in the form of a capability. Clements and Northrop (2001) defined software product lines as: “...a set of software-intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission, and are developed from a common set of core assets, in a prescribed way.” The creators have added it to the model, because using software product lines increases the performance of a developing organization (van de Weerd et al., 2006a). Which capabilities each focus area exactly comprises is described in Appendix C.

#### 2.2.5 Stakeholders

The product managers are faced with requirements coming from various stakeholders. Based on the work of Gorchels (2006) van de Weerd et al. (2006b) distinguished as internal stakeholders:

- company board: they have the responsibility to define and communicate the strategy;
- research & innovation: they need to explore new features to enhance the product and determine how features can be incorporated;
- services: the consultants of it need to implement the product;
- development: they have to execute the release plan;
- support: they help finding answer for questions of customers and help resolving minor faults of the product at the customer side;
- sales & marketing: they have the initial contact with customers, in so doing new needs and wishes can be gathered.

Based on the work of Lehtola, Kauppinen, and Kujala (2005) van de Weerd et al. (2006b) distinguished as external stakeholders:

- market: it is an intangible entity representing potential customers, competitors and analysts (e.g. The Boston Consulting Group);
- partners: e.g. partners which implement, partners to develop with and partners which distribute the product;
- customers: they have needs and wishes for the products which are communicated to the product manager and indirectly via the internal stakeholders.

The stakeholders are presented at the left and right side of the model (see Figure 5). Business function and focus areas interact with them in various ways.

## 2.3 The Software Product Management Maturity Matrix

The Software Product Management Maturity (SPMM) Matrix (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010) is based on the Software Product Management Competence Model; it has the same structure (i.e. portfolio management, product planning, release planning and requirements management) and the same components (i.e. the focus areas and capabilities). However in the maturity matrix the capabilities, on which the focus areas are based, are spread in a best practice order over several maturity levels. In this way, product managers and software organizations can determine how mature their SPM organization is (i.e. the level corresponding to their capabilities) and what the areas of improvement are (i.e. the missing capabilities corresponding to the desired level). The SPMM Matrix is intended for software companies of all sizes as a guide for incremental process improvement (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010). The creators say the reason to choose an incremental approach was twofold: it reduces risks in complex change projects; and in their view and from their experience they find it the natural way for method evolution.

The matrix is a Focus Area Maturity Model (van Steenberghe, Bos, Brinkkemper, van de Weerd, & Bekkers, 2010). It is structured around focus areas and each area has its own maturity levels. The authors chose this type of maturity model due to the shortcomings of other types (Bekkers, van de Weerd, Brinkkemper, & Mahieu, 2008b). Plus, it makes local assessment and incremental process improvement possible. Bekkers, van de Weerd, Spruit and Brinkkemper (2010) say maturity models structured on focus areas are already successfully used in other domains, such as in the testing domain (Koomen & Baarda, 2005) and the architecture domain (Krzanik & Simila, 1997).

The focus areas are positioned in the leftmost part of the matrix, see Figure 5. The complete matrix distinguishes eleven ascending levels, starting at level 0 and ending at level 10. As mentioned above, the model distinguishes focus areas specific maturity levels as well; represented by the letters ‘A’ to ‘F’. The distribution over the 10 general maturity levels points to a best practice order, whereby the general levels are implemented from left to right (Bekkers, van de Weerd, Spruit, & Brinkkemper, 2010). For example, if a company has no capabilities it has a maturity level of 0. If it wants to reach level 1 it needs to learn, acquire, implement, etcetera capability ‘A’ of Requirements gathering and ‘A’ of Launch preparation; i.e. these capabilities are the ‘areas of improvement’. To reach an even higher maturity level it needs to learn, acquire, implement, etcetera the capabilities corresponding to that level and capabilities positioned at lower levels. Bekkers, Spruit, van de Weerd, Van Vliet, and Mahieu (2010) indicate there are two criteria to determine whether a capability is present. First, capabilities must be performed iteratively. Second, the process concerning each capability must be completely documented. It should be noted that not always all capabilities are relevant for a software company. It depends on the situational factors, which will be further explained in section 2.3.2.

	0	1	2	3	4	5	6	7	8	9	10
<i>Requirements management</i>											
Requirements gathering		A		B	C		D	E	F		
Requirements identification			A			B		C			D
Requirements organizing				A		B		C			
<i>Release planning</i>											
Requirements prioritization			A		B	C	D			E	
Release definition			A	B	C				D		E
Release definition validation				A				B		C	
Scope change management				A		B		C		D	
Build validation					A			B		C	
Launch preparation		A		B		C	D		E		F
<i>Product planning</i>											
Roadmap intelligence				A		B	C		D	E	
Core asset roadmapping					A		B		C		D
Product roadmapping			A	B			C	D		E	
<i>Portfolio management</i>											
Market analysis					A		B	C	D		E
Partnering & contracting						A	B		C	D	E
Product lifecycle management					A	B			C	D	E

Figure 6 the Software Product Management Maturity Matrix.

### 2.3.1 Focus areas

This section explains a single focus area Requirements gathering, see Table 2. The remaining focus areas can be found in Appendix C. Each focus area is described by a title (dark blue box) and a description (light blue box). The capabilities are described by a title (red boxes), a required action (pink boxes), a goal (green boxes) and any prerequisite capabilities (purple boxes); i.e. capabilities which need to be present to enable an effective functioning. In the technical report of Bekkers and van de Weerd (2010) descriptions and definitions are given of the business functions, focus areas and capabilities in the order of the focus area specific maturity levels ‘A’ to ‘F’ (orange boxes).

Table 2 the focus area Requirements gathering.

Requirements gathering	Requirements gathering concerns the acquisition of requirements from both internal and external stakeholders	
a.	Basic Registration	Action: Requirements are being gathered and registered.
		Goal: Create a basis for product development.
b.	Centralized registration	Action: All incoming requirements are stored in a central database, which is accessible to all relevant stakeholders.
		Goal: Structuring of requirements registration.
		Prerequisite: Requirements gathering A
c.	Automation	Action: All incoming requirements are automatically stored in a central database (e.g. by means of an online helpdesk).
		Goal: Reduced workload / improved speed of requirements gathering process, reduced error percentage.
		Prerequisite: Requirements gathering A
d.	Internal stakeholder involvement	Action: Requirements are gathered from all relevant internal stakeholders: support, services, development, sales & marketing, research & development (parties not present in your organization can be ignored).
		Goal: Improved product quality & increased involvement of internal stakeholders in the product management process.
e.	Customer involvement	Action: Customer and prospect requirements are being gathered and registered, and the customer or prospect is informed of the developments concerning their requirements.
		Goal: Incorporation of customer needs and wishes in the product.
f.	Partner involvement	Action: Requirements are systematically gathered from partner companies.
		Goal: Improved product quality & increased involvement of external stakeholders in the product management process.

### 2.3.2 The Situational Factors

Bekkers, Spruit, van de Weerd, Van Vliet and Mahieu (2010) say Situational Factors (SFs): “...describe the situational context in which, in this case, the product manager has to operate and to which the SPM processes thus have to fine-tuned.” (p. 25). It consists of information about the process, the organization and its context (Bekkers, van de Weerd, Brinkkemper, & Mahieu, 2008a). It can be used to tune the generic SPMM Matrix and SPMC Model into an organization-specific matrix and model. The twenty-six SFs in the situational assessment method for SPM (see section 2.3.3) are divided into five groups: Business unit characteristics, Customer characteristics, Market characteristics, Product characteristics and Stakeholder involvement. Take for example the SF ‘Customer loyalty’, by which the product manager has to indicate how loyal customers to their business are. For each value (customer loyalty can be low, medium or high) some capabilities may or may not be relevant for the SPM organization; i.e. the Situational Factors Effect (SFEs). In this way, the product manager is able to determine what the true maturity level and areas of improvement are. Thus, by using SFs to determine how the process, organization and context looks like the product manager knows what needs to be done under specific conditions (Bekkers, Spruit, van de Weerd, Van Vliet, & Mahieu, 2010). However, what precisely the existing SFs in product software companies are is still an important research topic under study.

### 2.3.3 The Situational Assessment Method for SPM

The SPMM Matrix is part of the Situational Assessment Method (SAM) for SPM (Bekkers, Spruit, van de Weerd, Van Vliet, & Mahieu, 2010). It is a general assessment method for the organization of SPM practices and its goal is to identify areas of improvement. SAM-SPM consists of four components: a knowledge base, a questionnaire, a calculation component and a feedback component. First, the knowledge base consists of the SPMM Matrix, the Situational Factors (SFs) and the Situational Factors Effect (SFEs). It is the knowledge on which the assessment is based. Second, the questionnaire consists of two parts: an implemented capabilities questionnaire to determine which capabilities are implemented, and a situational context questionnaire to determine the SF values. Third, the calculation component calculates the current (Current Capability Profile (CCP)) and optimal maturity level (Optimal Capability Profile (OCP)). The difference between these two levels are the areas that need to be improved, i.e. the Areas of Improvement Matrix (AIM). Fourth, the feedback component is where the SAM-SPM based on assessments, new scientific literature, case studies, or expert interviews is updated. Summarized, the SAM-SPM is an evolutionary method for the assessment of the SPM organization. Evolutionary in this sense is twofold. First, it enables the software organization to improve their SPM organization in an evolutionary way. Second, the method itself evolves over time through the feedback component.

### 3. Software Ecosystems

Software companies are becoming aware of the fact that they are not isolated entities without any success determining relationships with or dependencies on external entities. They are ‘living’ in a Software Ecosystem (SECO) in which they collaboratively create and sell a plethora of products. In essence, there is a platform on which numerous internal and external developers build products and/or extend the releases of the platform (Bosch & Bosch-Sijtsema, 2010). The name Software Ecosystem and its underlying theory are based on biological ecosystems. The biological ecosystem is the result of the interactions between its members and the physical environment (Dhungana, Groher, Schludermann, & Biffel, 2010). SECOs involves the organization of its members (i.e. software vendors, third-party developers, suppliers and users) and its platform (Bosch, 2009; Dhungana et al., 2010; Liu, Lee, & Iyer, 2006). The concept is suggested for the first time by Messerschmitt and Szyperski (2003). Up till now scholars have come up with numerous definitions for SECOs. In this study is chosen to use the definition of Jansen et al. (2009b), because it is a well-defined definition that covers all facets of SECOs. They defined a SECO as: “...*a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.*” (p. 2). A SECO approach implies that the platform developer takes a community perspective. In which external developers, domain experts and users are taken into account (Bosch & Bosch-Sijtsema, 2010). A well-known example of a successful ecosystem is Apple with its Appstore. The large quantity and quality of the product software (i.e. apps) offered in this store could not be devised and produced by Apple on its own. The success of this and other ecosystems lies in the opportunity for a large set of developers to use the platform to create and distribute software.

Basically, two key types of members in SECO literature are recurring (Schuur, Jansen, & Brinkkemper, 2011); the keystone and the niche players. Iansiti and Levien (2004a) state the keystone is: “...*a benevolent hub in the network that provides benefits to the ecosystem and its members.*” (p. 25). They add to this, it typically gives other members (i.e. niche players) the necessary space to grow and prosper. The same authors say about niche players (i.e. the other members of the network) that they do not try to compete with the keystone. They leverage the resources of the network to create solutions which are targeted at niche markets (i.e. specialized areas of the market). Thus, the keystone creates and delivers a keystone product (i.e. the platform) and surrounding services, which enables niche players to create and deliver its niche solutions. The niche players can play all kinds of roles (Kittlaus & Clough, 2009), for example, Value Added Distributors (VADs), Independent Software Vendors (ISVs), System Integrators (SIs) and Technological alliances. For more information on the members and roles in SECOs, see section 3.1.

A key characteristic of the software platform is that it is expandable over the keystone its borders (Alspaugh, Asuncion, & Scacchi, 2009). However, traditionally the software market is (seen as) a closed market (Jansen et al., 2009b). To create an effective and efficient



functioning SECO, members need to open up to each other. In this sense, opening up with regard to its product interfaces, its knowledge bases and sometimes even its software (Geir, 2011; Jansen et al., 2009b). It is a risky and complex task. For example, due to the loss of intellectual capital (Huang, Ceccagnoli, Forman, & Wu, 2009; Jansen et al., 2009a; Välimäki, 2005) or due to the creation of security vulnerabilities (Bosch, 2010). However, it can bring them all kind of new and exciting opportunities as well. One of which is the wisdom of crowds; i.e. crowdsourcing. Collaborating with many members can have a positive effect on the production and innovation of an ecosystem. Innovation is one of the core resources present in society, extracting these resources can have major positive effects (Denning, 2004). Predominately because it is one of the key driving forces for development in software engineering (Campbell & Faheem, 2010). Examples of other reasons for adopting a SECO approach are (Bosch, 2009; Kittlaus & Clough, 2009):

- functionality is developed which fulfills the needs of market segments that the keystone is unable or unwilling to fulfill by itself;
- the (experienced) value of the offering increases;
- it is more attractive for new users;
- higher chance of lock-in to the application platform and its surrounding products;
- acceleration of innovation, by:
  - sharing costs of innovation by collaborating with niche players;
  - incorporate successful functionality developed by niche players;
- decrease the total costs of ownership by collaborating in the maintenance;
- in general, business problems cannot be solved by a single software product, it requires a intertwined composition of software products of different sources;
- decisions for a specific solution are often made by the software vendor or system integrator which choses a base technology, teaming up with these types of niche players can be essential to sell a product.

If a software company chooses a SECO approach and it succeeds in attracting a large number of niche players (i.e. creators of new niche solutions), a snowball effect may arise (Arndt & Dibbern, 2006; Kittlaus & Clough, 2009). In this case, the offerings of a SECO will grow and the SECO becomes more interesting for new customers. The customers will request more solutions and form a larger market outlet, which makes the SECO even more interesting for new niche players.

To sum up, the ultimate objective is to invest and work towards an ecosystem in which all members improve their situation. As opposed to the more traditional approach with separated roles, little cooperation and closed organizations (Geir, 2011). In essence, the success of the complete ecosystem is not the responsibility of a single organization (Arndt & Dibbern, 2006; Dhungana et al., 2010).

## 3.1 Members and roles

### 3.1.1 Keystone

In nature keystone species have particular characteristics that produce benefits for the ecosystem and its species (Iansiti & Levien, 2004a). In contrary to the removal of other members, removing keystone species has devastating effects on ecosystem's health. Due to the fact that other species depend on the provided benefits of the keystone species. Without these resources, vital processes such as food chains are disturbed or stopped. It is a good metaphor for what the role and importance of a SECO keystone is. It tries to improve SECO health by acting accordingly (Iansiti & Levien, 2004a). Iansiti and Levien (2004a) add to it, its actions consist of developing and sharing value (i.e. the platform) with other members by utilizing its central position in the ecosystem (i.e. it brings all the other SECO members and their skills together).

SECO health is determined by three indicators, namely productivity, robustness and niche creation. For more information on the health indicators see section 3.2. The keystone improves health in the following ways (Iansiti & Levien, 2004b). It can raise production by simplifying collaboration and making the development of niches solutions simpler. For example, by creating a(n) (online) community in which every member of the SECO can interact with each other. It can increase robustness by realizing technological innovations and by creating a reliable point of reference that aids members to survive in new and uncertain situations. For example, guiding other SECO members through hard times; by giving directions by means of future plans and new technological innovation. Niche creation can be improved by realizing technological innovations in the platform which can be used by other members to create new niche solutions.

Iansiti and Levien (2004b) say there usually are two prerequisites for which the keystone is responsible to ensure the success of the ecosystem. First, the keystone needs to enable the creation of value by others by developing a platform; i.e. a set of standard services, tools, and/or technologies that function as resources for other members. The platform is crucial for the survival of the ecosystem; here other members (i.e. niche players) create value that legitimates the existence of the ecosystem. A prerequisite also acknowledged by Hagel, Brown and Davison (2008). Another prerequisite, it is mentioned before, is that the keystone shares most part of the value it has created. However, they need to find a balance in what it does and what it does not share. It may be not that easy to find, say Iansiti and Levien (2004b). Van den Berk et al. (2010) add to the prerequisites, a keystone must create a higher degree of connectedness between SECO members (i.e. community building), because it makes the ecosystem more robust. For example, by offering niche players a place to meet.

### 3.1.2 Niche players

Each niche player covers a specific area within the SECO that contributes to its functioning; i.e. its intentions lie in delivering capabilities that differentiate from other members (Iansiti & Levien, 2004b). It leverages complementary resources of other members (i.e. niche players and keystone) and puts all its effort in improving its narrow domain of expertise (Brown et al., 2002; Hacki & Lighton, 2001; Iansiti & Levien, 2004a). The keystone invites them to

participate in a SECO (Schuur et al., 2011). It let them fill the voids of the ecosystem (i.e. the niches); the larger part of the ecosystem. The niches are not reached by the keystone its product and/or services (i.e. the platform). In a sense, niche players complement a keystone in fulfilling their SECO strategy by following a niche strategy. In general, individual niche players do not have extensive impact on other members (Iansiti & Levien, 2004a). Niche players come in multiple forms; see section 3.1.3 for more information which roles exist how these roles look like.

Niche players are essential for a healthy ecosystem; they create the diversity which is so important for SECOs. Over time, niche players will always come into conflict with other members (Iansiti & Levien, 2004a). To survive conflicts innovation is the weapon to use. If a niche player is not able to innovate its product, it is confronted with the dilemma whether it lets the niche solution incorporated into the platform or if it will fight for the existence of the niche solution.

### **3.1.3 Relevant roles of niche players**

Niche players can be categorized in all kind of roles. There exist too many roles to create an exhaustive list. Some authors have tried to sum up relevant roles (Bosch, 2009; Jansen et al., 2008; Kittlaus & Clough, 2009). For example, Value Added Distributors (VADs) to which production and distribution is outsourced to enrich the product with new components for reaching niche markets. Value Added Resellers (VARs), which function as an extended sales channel to reach niche markets and add new components. Independent Software Vendors (ISVs), which build software based on or favor a SECO product. Original Equipment Manufacturers (OEMs), which imbed SECO products into their branded product. System Integrators (SIs), service organizations that take over installation and customization activities. Technological Alliances (TAs), sales cooperation that create complete solution offerings and synergy in marketing.

### **3.1.4 Dominator**

A type of member that (other) SECOs (members) need to be aware of is the dominator. It is an entity that gradually integrates or eliminates other members (i.e. keystones and niche players) in a SECO (Jansen et al., 2009a). Its aim is to own and control as much space in the ecosystem as possible: i.e. it does not want to share any value and tries to capture everything for itself (Kittlaus & Clough, 2009). Taking this role may look successful, but in the long run it will demolish the ecosystem. After it has eaten up or discouraged other SECO members, the ecosystem its critical mass has disappeared (Jansen et al., 2009a). Jansen et al. (2009a) explain, it means the dominator has to deliver all innovation while serving the whole customer base of the SECO. The opposing effect of where the ecosystem is intended for; i.e. stimulating the innovative power of the mass and thereby reaching niche markets.

## **3.2 SECO health**

Several scholars state it is important to actively manage ecosystem health (den Hartigh, Tol, & Visscher, 2006; Dhungana et al., 2010; dos Santos & Werner, 2011; Iansiti & Levien, 2004a;

Jansen et al., 2009a). The concept of ecosystem health is derived from natural ecosystems. The idea is that ecosystems need to be healthy and sustainable to survive. Iansiti and Levien (2004a) coined the health concept; they described three indicators that determine ecosystem health:

- *Productivity* – the ability of the ecosystem to process technology and other materials of innovation, which should lead to reduced expenses (Iansiti & Levien, 2004b). Iansiti and Levien (2004a) state there are at least three productivity-related metrics: factor productivity (e.g. ROI), change in productivity over time, and delivery of innovations (e.g. sharing of innovation between members, or ease of using innovation in an ecosystem)
- *Robustness* - the ecosystem degree of resistance to survive disruptions; e.g. unpredicted technological changes or the loss of key members (Iansiti & Levien, 2004b). Iansiti and Levien (2004a) suggest five robustness-related metrics: (relative) survival rates of members, persistence of ecosystem structure, predictability of change in ecosystem structure, limited deterioration (i.e. redundant capacity due to a disruption), and continuity of use experience and use cases (i.e. retaining experience of users will lead to the gradual evolution of the products).
- *Niche creation* – ecological literature indicates the ecosystem need to possess variety (i.e. diversity), this is analogous with business ecosystems (Iansiti & Levien, 2004b). Namely because, it enlarges the ability to absorb external shocks and it enlarges the ability to innovate. Iansiti and Levien (2004a) suggest two niche creation-related metrics: growth in firm variety, and growth in product and technical variety.

The three indicators are at this moment one of the most widely adopted approach to determine (business) ecosystem health. Den Hartigh et al. (2006) have determined, based on the health indicators described above, several operational health measures for business ecosystems. Their measures are applicable in SECOs as well (Jansen et al., 2009a).

### 3.3 SECO orchestration

Considering the fact that SECOs may be complex and highly connected networks, coordination in some form is required (Arndt & Dibbern, 2006; Bosch, 2006). As a result, a central organization should emerge which takes the lead in the coordination activities by establishing and maintaining relations between all (candidate) members (Jansen et al., 2009a; Jarillo, 1988). Coordination is generally known as SECO orchestration. Jansen et al. (2009b) stated, the orchestrator has the control over the SECO and has to keep it vibrant and beneficial for every member by picking the right SECO policies and strategies. Policies are activities, guidelines, standards and actions to influence the SECO. With strategies they mean things like rewarding active members, setting up workshops and conferences, creating a democratic system, introducing common communication channels, and coordinating marketing and development. The task of orchestrating is usually performed by (one of the) keystone player(s) (Jansen et al., 2009a). In general, the task is not a formalized role and frequently the responsibility of multiple members.

Creating stability (i.e. robustness) is one of the core tasks of orchestration. Since, stability affects the decision-making of (candidate) SECO members to become or stay active members (Jansen et al., 2009a). It is gained by sufficient orchestration say Jansen et al (2009a), by using techniques such as regulation, certification and introducing SECO standards (Bannerman & Zhu, 2009). But they add to it, an orchestrator needs to be careful. If it tips the scales, it creates too restraining regulations and (candidate) members will search for alternatives. One of the mechanisms that SECO orchestrators can use is setting entry barriers (Jansen et al., 2009a). A SECO is structured around its base technologies and platform. It determines what it takes to become a SECO member. Jansen et al. (2009a) give a clear example of low and high entry barriers. Barriers are low if becoming a member only takes adding an application to the component store (e.g. Google Play). Barriers are high if becoming a member means every component need to be certified before it is recognized as an official SECO solution (e.g. SAP with its preferred component program). Other entry barriers exist as well, such as how profit is shared (e.g. the 30% in the case of the Apple Appstore) or how intellectual property rights are arranged. Other common orchestration mechanisms are (Jansen et al., 2009a): creating a common delivery channel (e.g. the Appstore), sharing a SECO vision and formalizing the boundaries of the SECO. Fricker (2010) adds to it an orchestrator can analyze requirement value chains to understand the power balance between stakeholders and/or SECO maturity. The decision on picking certain orchestration mechanism is based on the characteristics of the SECO. For example, how open or closed a SECO is determines how strict rules can be (Jansen et al., 2009a; Viljainen & Kauppinen, 2011).

### 3.4 Directed and undirected approach

An important decision a platform developer (i.e. keystone and/or SECO orchestrator) needs to make is to what extent it will take the directed or undirected approach (Bosch, 2009) in selecting partners and applications.

In the directed approach it identifies specialized market segments (i.e. niche markets) it wants to offer solutions. The niche markets have specific functionality requirements. The platform developer is incapable or reluctant to develop this functionality itself. Therefore, it selects niche players who are willing and able to develop this functionality. They typically agree upon how revenues are shared and how deep niche players have access to the platform and ecosystem products. It should be noted, this does not mean development is outsourced; i.e. a situation in which the niche player only is compensated for the R&D costs and does not have any intellectual property rights on the developed functionality. The directed approach leads to several advantages: it enables the platform to enlarge the offered functionality rapidly, with minor risks and with low initial R&D costs. But as downside, the keystone has to share revenue with niche players.

In the undirected approach the platform developer offers a platform as a foundation on which niche players can build niche solutions. The platform developer does not set up any constrictions with regard to which (candidate) niche player may develop nor does what is developed. The fundamental assumption in this approach is that competing solutions may arise, and competition is the best way to create the best and complete set of offerings to the

customers. But a disadvantage may be that the keystone has little or no control what is made within its ecosystem.

Bosch (2009) acknowledges that the two approaches represent two extremes. He continuous, it is possible and even desirable to have a mix of the two approaches. For this study is chosen to determine how the instruments of the state of the art of SPM need to change for SECOs with a directed approach. As is explained, both approaches differ quite a lot because it are two extremes (Bosch, 2009). Thus, choosing one of two approaches has consequences for how SPM practices need to be arranged. For example, in the undirected approach less management is needed for issues with regard to partnering. In directed approach more emphasis is needed on who will build what. Due to time constraints it was not possible to study SPM in SECOs for both approaches.

## 4. Transitioning to Software Platform Management

The title of this chapter will probably stand out; instead of product the concept platform is used. During the previous chapters this concept is already used several times. Other scholars use this term when talking about the keystone its central software product on which others create new value. For more on this matter see the following section. In the succeeding section is described what characteristics of and practices in SECOs may affect SPM; i.e. the answer on the first sub-question. Based on it candidate changes are defined which could lead in the transitioning of Software Product Management to Software Platform Management; i.e. the answer on the second sub-question. Whether the candidate changes are processed is determined during the interviews (see chapter 5).

### 4.1 Software Platform Management

Many authors use the term platform when they talk about the central product (and its surrounding services) that is provided by the keystone(s) to enable other members to create value (e.g. Campbell & Faheem, 2010; dos Santos & Werner, 2011; Geir, 2011; Iansiti & Levien, 2004a; Iyer, Lee, & Venkatraman, 2006; Kabbedijk & Jansen, 2011; Kilamo, Hammouda, Mikkonen, & Aaltonen, 2012; van den Berk et al., 2010; Viljainen & Kauppinen, 2011). The keystone opens its product to external entities to create a platform by which business and SECO objectives can be reached. Thus, its management needs to be targeted at how the keystone and other members of the SECO can create value. Van den Berk et al. (2010) and Kittlaus and Clough (2009) named this approach platform planning. As mentioned earlier, Robertson and Ulrich (1998) say about companies that conduct successful platform planning realize several benefits. Such as: a greater ability to create niche products for niche markets or customers, lowering the costs to reach these niche markets or customers, and creating niche products that more closely meet the needs of them. Platform planning consists of four processes: Portfolio management, Roadmap definition (i.e. Product planning), Release planning and Requirements management. Similar business functions as in the objects under study. Seen the literature on this matter, Software Product Management with a directed SECO approach in keystone organizations is called Software Platform Management (SPfM).

### 4.2 Niche players and partners

As mentioned earlier, a niche player covers a specific area within the SECO that contributes to its functioning; i.e. its intentions lie in delivering capabilities that differentiate from other members (Iansiti & Levien, 2004b). Relationships between keystones and niche players can be of all type of forms. For example, it can range from a relationship in which everyone who wants to build new functionality on or with the offered platform can do so (i.e. undirected approach). To a relationship that formally needs to be approved by the keystone and for which is stated what will be build (i.e. directed approach). The new model and matrix is intended for a keystone that takes the directed approach; i.e. it identifies specialized market segments (i.e. niche markets) it wants to offer solutions and selects the niche player that is

going to build the functionality. It means formal agreements are made with those niche players about what they make. Thus in essence, niche players are partners of the keystone organization. That is why in the rest of this master's thesis the term partner is used when talking about niche players.

### 4.3 Candidate changes

The following sections will give a clear overview of the relevant literature on the characteristics of and practices in SECOs important for SPfM. By creating an overview, candidate changes for the SPMC Model and SPMM Matrix are elicited. To every candidate change a code is added in order to keep the analysis and its results in the following chapters transparent. The code 'LIT.\*' added to the candidate changes means its source is literature. The second part, the asterisk, is replaced by a number which indicates the specific number of the candidate change elicited from the literature.

#### 4.3.1 Sharing resources

Sharing resources (e.g. information, knowledge, capabilities and artifacts) is acknowledged by many scholars as a key characteristic of a healthy (business or software) ecosystem or partner relation (e.g. Dhungana et al., 2010; dos Santos & Werner, 2010; Duysters, Kok, & Vaandrager, 1999; Iansiti & Levien, 2004b; Jansen et al., 2009b; Kilamo et al., 2012 ; Riedl, Böhmman, Leimeister, & Krcmar, 2009). These and other authors state that it has several positive effects. Such as, more creativity (i.e. more innovation) and higher productivity. The keystone company needs to foster sharing of resources between members of the ecosystem and themselves. However, with a certain amount of caution as well. Van den Berk et al. (2010) state a company must avoid sharing too much, it can lead to losing intellectual property (rights). The keystone need to decide how much information is shared with others in the SECO (Jansen et al., 2009b). Every partner may only have access to a certain level and type of platform knowledge (dos Santos & Werner, 2010). Setting information profiles can be a good instrument to foster knowledge sharing and still avoid the loss of intellectual property (rights). In this way, everybody within the organization knows who has access to what information. It makes sharing of the right knowledge more effective and efficient.

This result in the following candidate changes for the model (see Table 3). First, candidate change LIT.1 is proposed because in this way partners can see what yet needs to be made. It may create new opportunities to share SECO's resources. Second, candidate change LIT.2 is proposed because in this way partners can see what already is made and what is not. It may create new opportunities to share SECO's resources. Third, candidate change LIT.3 is proposed because by identifying core assets created externally by partners (i.e. niche players) as well, the company will know what is already made by them. It may create new opportunities to share SECO's resources. Fourth, candidate change LIT.4 is proposed because setting information profiles can be a good instrument to foster knowledge sharing and may prevent the loss of intellectual property (rights). Each partner will have a profile according to its role with the right to have access to a certain level and type of platform knowledge. Everybody within the organization knows who has access to what information. It makes sharing knowledge more effective and efficient. Fifth, candidate LIT.5 is proposed because by



creating standard templates everybody knows how knowledge should be shared and interpreted. It makes sharing knowledge more effective and efficient.

Table 3 candidate changes to foster the sharing of resources.

#	focus area	candidate change	processed as
LIT.1	Requirements gathering	The central database with the incoming requirements is accessible to partners as well.	Expand capability b. Centralized registration with this change or add it as a new capability.
LIT.2	Requirements organizing	Make the requirements history log accessible for partners (i.e. niche players).	Expand capability b. Requirement lifecycle management with this candidate change or add it as a new capability.
LIT.3	Core asset roadmapping	Common components/functionality (core assets) is systematically identified among the ecosystem's products and deliverables surrounding these products.	Expand capability b. Core asset identification with this candidate change or add it as a new capability.
LIT.4	Partnering & contracting	Determine information profiles for each (type) of the partner according to its roles.	Add it as a new capability.
LIT.5	Partnering & contracting	Create standard templates for information that is shared with and by partners.	Add it as a new capability.

#### 4.3.2 Partner involvement

Bosch (2009) states changing from a product strategy to a platform strategy comes along with profound changes. When adopting a platform strategy it typically are the partners who will create new value for customers. They are essential in creating successful products. In contrary to the traditional situation, in which only the keystone creates new value. Thus, the keystone needs to enable partners in creating this value. For example, more emphasis needs to be on the priorities of requirements given by partners. Plus, Fricker (2010) says the product manager has to manage stakeholders; i.e. he has to know and align their interests. It has consequences for all kinds of facets of SPfM. For example, it could result in more emphasis on partner involvement. Its involvement may be of higher importance than in the current situation. Bosch and Bosch-Sijtsema (2010) add to it in another paper, external developers (i.e. partners) need to be involved in the coordination of the evolution of the software platform or product; they have strong opinions in the sequence and/or priorities of requirements. Partner representatives are important stakeholders in making roadmaps as well (Suomalainen, Salo, Abrahamsson, & Similä, 2011). By involving them in the creation of roadmaps, roadmaps will be widely supported, complete and realistic. Complete and realistic, because they are able to complement roadmaps with every single piece of information that is known within the SECO.

It results in the following candidate changes for the model (see Table 4). First, candidate change LIT.6 is proposed because it may change the possibilities for partners to create new niche solutions. Their requirements for the software platform become more important than in the current model and matrix. Second, candidate change LIT.7 is proposed because keystones may get all kind of relevant information with regard to the niche solutions. Communicating it gives partners the chance to create new value for customers. Third, candidate change LIT.8 is proposed because (as mentioned above) partners (i.e. niche players) need to be involved in

the coordination of the evolution of the software platform. They have strong opinions in the sequence and/or priorities of requirements (Bosch & Bosch-Sijtsema, 2010). Processing certain requirements may enable partners to create new niche solutions. They can indicate which requirements are important for the software platform or product to make the creation of their niche solution possible. Fourth, candidate change LIT.9 is proposed because in this way partners will know what will be realized in the upcoming release; i.e. they can anticipate on the upcoming release. Fifth, candidate change LIT.10 is proposed because it prevents duplication of effort and releases will be better aligned with niche solutions. Resulting in releases that are optimally prepared for and better aligned with niche solutions that are/will be built on top of it. Sixth, candidate change LIT.11 is proposed because in this way releases will be in line with the needs and wishes of partners (i.e. niche players). In this way, they can build the niche functionality they want to add. Seventh, candidate change LIT.12 is proposed because by taking into account what roadmap partners have defined for their niche solutions a keystone is able to better anticipate on future partner plans. Eighth, candidate change LIT.13 is proposed because partners are going to build the new value for customers. Determining themes for external creation as well, provides structures the search for new niche markets, partners or niche solutions. It may be handy in the directed approach. Ninth, candidate change LIT.14 is proposed because (as mentioned earlier) partner representatives are important stakeholders in making roadmaps (Suomalainen et al., 2011). As a result, roadmaps will be widely supported, complete and realistic. Tenth, candidate change LIT.15 is proposed because involving partners (much) more in defining future plans may result in excessive expectations from partners. By having a decision procedure for when problems arise in defining a roadmap (e.g. conflicting expectations of different partners), everybody in the SECO knows what will happen if there is no consensus. As a result, the software company is assured it will have roadmaps for its products and partners know what will happen.

Table 4 candidate changes with regard to partner involvement.

#	focus area	candidate change	processed as
LIT.6	Requirements gathering	Make partner (i.e. niche player) involvement more important	Expand capability d. Internal stakeholder involvement with partners (i.e. niche players), expand capability e. Customer involvement with partners or move capability f. Partner involvement to a lower maturity level.
LIT.7	Requirements organizing	Distinguish the difference between requirements with regard to the product and with regard to the externally created components (i.e. niche solution) and communicate these requirements to the specific partner(s) (i.e. niche player(s)).	Add it as a new capability.
LIT.8	Requirements prioritization	Make partner (i.e. niche player) involvement more important.	Expand capability a. Internal stakeholder involvement with partners (i.e. niche players), expand capability c. Customer involvement with partners or move capability e. Partner involvement to a lower maturity level.
LIT.9	Release definition	The release definition is communicated to the partners.	Expand capability c. Internal communication with partners or add it as a new capability.
LIT.10	Release definition	Take into account what releases partners are going to build and what functionality these releases consist of.	Add it as a new capability.
LIT.11	Release definition validation	The release definition is validated by partners (i.e. niche players) before the software is realized.	Expand capability a. Internal validation with this candidate change or add it as a new capability.
LIT.12	Roadmap intelligence	Make the partner (i.e. niche player) roadmap a more important source for roadmap intelligence.	Moving capability e. Partner roadmap to a lower maturity level.
LIT.13	Product roadmapping	Identify themes for internal and external creation with partners. Store these themes at the same place as the themes identified in capability b. Theme identification.	Expand capability b. Theme identification with this candidate change or add it as a new capability.
LIT.14	Product roadmapping	Product roadmaps are created in consultation with all relevant partners (i.e. niche players).	Expand capability c. Internal consultation with this candidate change or add it as a new capability.
LIT.15	Product roadmapping	Define a decision procedure for when roadmap designers and partners (i.e. niche players) cannot reach consensus. Inform partners about this decision procedure when forming relationships with them.	Add it as a new capability.

### 4.3.3 Requirements communication

Fricker (2009; 2010) states that it is important to model the requirement communication network in SECOS. Keystone organizations need to take a lot of stakeholders into account in defining requirements for its platform(s) (Paech, Dorr, & Koehler, 2005). The chosen manner

for communicating the needs and wishes of stakeholders determines how successful they are in influencing the evolution of the platform. Fricker (2009; 2010) proposes a method for modeling, analyzing and influencing the requirement communication network.

It results in the following candidate change for the model (see Table 5). Candidate change LIT.16 is proposed because it enables the analysis of the communication of requirements and helps in selecting the right tactics, strategy and methods for the communication of interests and expectations of stakeholders. (Fricker, 2009; Fricker, 2010).

Table 5 candidate change for the communication of requirements.

#	focus area	candidate change	processed as
<b>LIT.16</b>	Requirements gathering	Model the requirements communication networks; i.e. the communication flows of requirement among stakeholders to the product manager. And analyze it to choose the right communication tactics, strategy and methods.	Add it as a new capability.

#### 4.3.4 Certification

Applying certificates and (quality) rules for niche solutions and partners makes clear what is expected from it/them and leads to a higher quality (van den Berk et al., 2010). Plus, by adding different ranks to the types of certificates the allowed levels of integration for partners into the keystone its platform will be clear as well (Bosch, 2010). In this way, security and reliability issues can be prevented by blocking defective and/or malicious external code (Bosch, 2010). Certifying results in (a certain degree of) standardization; i.e. no lock-ins, lower integration costs and low verification costs (Viljainen & Kauppinen, 2011). It makes switching of components within the SECO by more competitive ones easier. Resulting in a situation in which only the best niche solutions and partners will succeed. It will motivate partners to make the best niche solution possible. Based on these arguments two candidate changes (i.e. LIT.17 and LIT.18) are proposed (see Table 6).

Table 6 candidate changes for adding certification.

#	focus area	candidate change	processed as
<b>LIT.17</b>	Release build validation	Certify niche solutions based on standard quality rules to change the quality of the niche solutions.	Add it as a new capability.
<b>LIT.18</b>	Partnering & contracting	Certify/license partners divided over different ranks with different obligations and privileges.	Add it as a new capability.

#### 4.3.5 Partner management

Contract negotiation with partners is an important activity in setting proper obligations and rights for new partner relationships. Fricker (2010) says the product manager has to manage stakeholders, and he has to know and align their interests. He needs to establish and maintain relationships with its (candidate) partners. It has major implications for SPfM. During contract negotiations parties have to form a high caliber negotiation team (Pekar Jr.

& Allio, 1994). It can determine realistic objectives, intellectual property rights, partner's contributions and rewards, termination clauses and sanctions for bad performance.

Partner programs have proven its effectiveness at companies such as SAP and FedEx (Duysters, de Man, & Wildeman, 1999): it classifies partners into different groups and lessens the complexity in managing a large amount of partners. For example, by setting clear objectives, contributions, returns, rules and splitting of risks for each group of partners; i.e. the basis for each partnership (Duysters, Kok, & Vaandrager, 1999).

It results in the following candidate changes for the model (see Table 7). First, candidate change LIT.19 is proposed because in this way partners are clustered in groups and expectations will be well managed. Second, candidate change LIT.20 is proposed because a contract negotiation process may be important for SPfM as mentioned above. Third, candidate change LIT.21 is proposed because (as mentioned earlier) the product manager needs to manage partner relationships.

Table 7 candidate changes for partner initiation

#	focus area	candidate change	processed as
LIT.19	Partnering & contracting	Cluster partners into groups with specific functions, goals, etcetera. With the goal of making the management more efficient. It also makes it more clearly for interested candidate partners what it means to become a specific type of partner.	Add it as a new capability.
LIT.20	Partnering & contracting	A contract negotiation process exists.	Add it as a new capability.
LIT.21	Partnering & contracting	Co-ordinate among alliances and alliance partners to avoid conflicts and utilize synergies.	Add it as a new capability.

#### 4.3.6 Partner registration

A lot of organizations do not know who their partners are. The registration of partners in a database may be a good instrument to create and keep overview (Duysters, de Man, & Wildeman, 1999). The same authors add to it, it can be used as an instrument in which knowledge with regard to partner relationships can be shared by and for managers in the field. For example, knowledge can be shared on experiences, performances and made deals. It results in candidate change LIT.22 for the model (see Table 8).

Table 8 candidate change for partner registration.

#	focus area	candidate change	processed as
LIT.22	Partnering & contracting	All partners are registered in a central database which all relevant (internal) stakeholders can access.	Add it as a new capability.

#### 4.3.7 Partner analysis

The choice for a partner is an important factor in the success of the collaboration (Duysters, Kok, & Vaandrager, 1999). Only basing it on financial figures is risky. It means it requires a careful screening and it can be very time-consuming Duysters, Kok and Vaandrager (1999)

say. Partner screening emphasizes creating a database on candidate partners, analyzing their strengths and weaknesses and determining the proper selection criteria (Pekar Jr. & Allio, 1994). This information can be used to start, prolong or end partner relations. To simplify this task, partner score cards can be used. It results in candidate change LIT.23 for the model (see Table 9).

Table 9 candidate change for partner selection.

#	focus area	candidate change	processed as
<b>LIT.23</b>	Partnering & contracting	Partners are analyzed on what they offer, what their strengths and weaknesses are and what they are going to offer in addition to the organization. This can be done in various ways. For example, the product manager can make use of partner score cards to simplify the measurement of the performance of each partner.	Expand capability e. Monitored partner network with this candidate change and split this expanded capability in a partner network/portal part and a partner analysis part.

#### 4.3.8 SECO portfolio management

Each product in an organization its product portfolio needs to complement the other in order to create a healthy portfolio (van de Weerd & Brinkkemper, 2010e). It is also the case in SECOs. An analysis of the SECO product portfolio needs to consider if variability in the ecosystem its product portfolio (i.e. diversity) is sufficient to attract new partners and customers (Darking, Whitley, & Dini, 2008; Dhungana et al., 2010). Gaps in the ecosystem its product portfolio can be the initiation and input for a search for new partners (Duysters, de Man, & Wildeman, 1999).

It results in the following candidate change for the model (see Table 10). First, candidate change LIT.24 is derived from the stated arguments. Second, candidate change LIT.25 is proposed because several reasons may lead to the decision to not support partners (i.e. niche players) in creating and selling (certain) niche solutions. For example, a niche solution may not function well or does not create value for the keystone and/or SECO. By performing this activity, information is gathered to make such a decision.

Table 10 candidate changes for SECO portfolio management.

#	focus area	candidate change	processed as
<b>LIT.24</b>	Product lifecycle management	The scope of the product scope analysis is widened to the complete ecosystems its product portfolio.	Expand capability c. Portfolio scope analysis with this candidate change or add it as a new capability.
<b>LIT.25</b>	Product lifecycle management	The scope of the product life cycle analysis is widened to the complete ecosystems its product portfolio.	Expand capability a. Product life cycle analysis with this candidate change or add it as a new capability.

### 4.3.9 SECO channel development

A lot of software companies find it hard to know in which SECOs they are active and they thereby have difficulty in using these SECOs to their strategic advantage (Brinkkemper et al., 2009). By modeling its SECOs, a software company knows to which complementary resources they have access to via their relationships (Iyer et al., 2006). Jansen, Brinkkemper and Finkelstein (2007) have identified five types of application for modeling SECOs (called Software Supply Networks in their paper): business identification, defining product architecture design, identifying risks in the structure of the SECO, product placement planning and business network redesign.

It results in the following candidate changes for the model (see Table 11). First, candidate change LIT.16 is derived from the stated arguments. Second, candidate change LIT.17 is proposed because it enables partners in selling their niche solution via a designated sales and distribution channel. It can make the SECO more interesting for partners and customers, because it will have a central ‘marketplace’ where supply (i.e. developers) and demand (i.e. customers) can find each other.

Table 11 candidate changes for SECO channel development.

#	focus area	candidate change	processed as
<b>LIT.26</b>	Product lifecycle management	Model the SECO(s) (at its different levels) and determine its sales and distribution channels, main competitors, and potential partners.	Add it as a new capability.
<b>LIT.27</b>	Partnering & contracting	Create a common delivery channel (e.g. Apples Appstore) to enable partners to sell their created components.	Add it as a new capability.

### 4.3.10 Company positioning

Kittlaus and Clough (2009) state that in general it is not the responsibility of the product manager to decide what role the organization is going to play in a SECO. It is part of the corporate strategy which is determined by the executive management. Practices with regard to this matter do not become part of the model and matrix. However, the product manager will probably provide input for this decision.

## 5. Interviews

### 5.1 Interviewees

Eleven product managers have been interviewed (see Table 12). Six of them (i1, i3, i4, i7, i10 and i11) currently work at the same company (Everest). The other five (i2, i5, i6, i8 and i9) currently work at five other companies. All of the eleven interviewees are experienced in executing two or more of the business functions described in the SPMC Model and SPMM Matrix. Six interviewees (i2, i3, i5, i7, i9 and i10) are experienced in all four business functions and five interviewees (i1, i4, i6, i8 and i11) lack experience with one or two business functions. These business functions were not part of their interview. However, the sum of all interviewees per business function is more or less in balance. Nine product managers are interviewed on Requirements management, Release planning and Product planning. For each of these three business functions, five product managers of Everest and four of another company are interviewed. Eight product managers are interviewed on Portfolio management; of whom four product managers of Everest and four of another company are interviewed.

Table 12 overview of the interviewees.

#	experience in*				gained at
	RM	RP	PP	PM	
i1	x	x	x		Everest, Ordina Finance Solutions, Infra Design and Unisys
i2	x	x	x	x	PinkRocade Local Government
i3	x	x	x	x	Everest
i4	x	x			Everest and Netaspect
i5	x	x	x	x	Thinkwise Software
i6	x	x			AFAS Personal and Yunoo
i7	x	x	x	x	Everest
i8			x	x	ANVA and Capgemini
i9	x	x	x	x	Backbase, SDL Tridion, Pallas Athena and DataDistilleries
i10	x	x	x	x	Everest
i11			x	x	Everest
total	9	9	9	8	

\*RM = Requirements management, RP = Release planning, PP = Product planning, and PM = Portfolio management

### 5.2 Results

In the following sections the data gathered during the interviews is analyzed. It starts with determining per capability and/or candidate change whether and how it has to become part of a focus area. After for each focus area is known what capabilities are part of it, is calculated what maturity level a capability gets. The calculation is explained at the end of the following section 5.2.1 Requirements gathering.

To every current SPM capability, candidate changes elicited from the literature, rejected candidate changes, relevant changes performed by one or more interviewees and definitive changes concluded after the analysis, a code is added in order to keep the analysis and its



results transparent. The coding process is presented in Figure 7 as a state model. It is executed in the following way (the numbers correspond to the numbers in the figure):

- 1) The interviews are prepared by assigning ‘CAP.\*’ codes to the current capabilities. CAP(ability) means its source is the SPMC Model and SPMM Matrix.
- 2) Candidate changes are elicited from scientific literature and ‘LIT.\*’ codes are added to it. LIT(erature) means its source is scientific literature.
- 3) During this step the interviews are conducted.
- 4) The interview data is analyzed which can lead to three types of output:
  - a) Relevant changes performed by interviewees based on their knowledge and experience. ‘INT.\*’ codes are added these changes. INT(erviewees) means its source (is/) are product manager(s):
    - i) If an interviewee change is performed by a minority, it is added to the questionnaire.
    - ii) If an interviewee change is performed by a majority, it is processed into the model and matrix.
  - b) A candidate change performed by a majority of the interviewees is processed into the model and matrix.
  - c) A candidate change performed by a minority is rejected.
- 5) During this step the questionnaires are filled in (see chapter 6).
- 6) The questionnaire data is analyzed which can lead to two types of output (see chapter 6):
  - a) Interviewee changes presented in the questionnaire performed by a majority of the interviewees are processed into the model and matrix.
  - b) Interviewee changes performed by a minority are rejected.

Step 4.a.ii, 4.b and 6.a result in definitive changes for the model of matrix:

- the code ‘NEW.\*’ is added to a NEW capability;
- the code ‘CHA.\*’ is added to a CHAnged capability;
- the code ‘FOC.\*’ is added to new or changed FOCus area descriptions.

Step 4.c and 6.b result in rejected changes for the model and matrix. The code ‘REJ.\*’ added to a candidate and interviewee change means it is REJected.

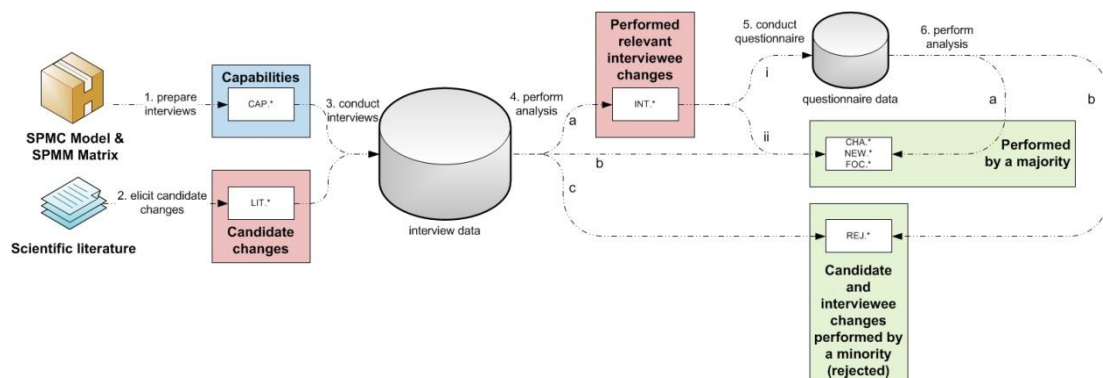


Figure 7 state model of capabilities and performed changes.

To sum up, two types of codes exist; source and result. The source codes (i.e. ‘CAP.\*’, ‘LIT.\*’ and ‘INT.\*’) indicate the source of a specific object. The result codes (i.e. ‘NEW.\*’, ‘CHA.\*’, ‘FOC.\*’ and ‘REJ.\*’) indicate the result of an analysis. See Table 13 for an overview of all codes.

Table 13 codes added to capabilities and (candidate) changes.

type	code	added to
source	CAP.*	capabilities in the current spmc model and spmm matrix
	LIT.*	candidate changes elicited from the literature
	INT.*	relevant changes performed by interviewees
result	NEW.*	new capabilities added to the model and matrix for a directed seco approach
	CHA.*	existing capabilities in the model and matrix changed for a directed seco approach
	FOC.*	new or changed focus area descriptions
	REJ.*	changes rejected by interviewees

At the end of each analysis its result is presented. It is described by using the added codes. For example, one of the results is ‘CAP.16  $\cup$  CAP.18  $\cup$  LIT.8  $\cup$  INT.4 = CHA.9’ (see sub section Stakeholder involvement in section 5.2.4). It means the current capability CAP.16 (i.e. Customer involvement) is combined with the current capability CAP.18 (i.e. Partner involvement), candidate change LIT.8 and a interviewee change INT.4. The result is a changed capability CHA.9 (i.e. External stakeholder involvement).

If during the analysis of the interview data (chapter 5) no conclusion can be drawn, because only a minority performs a change that is considered as relevant, its relevance is determined by means of the questionnaire (chapter 6). Then, the result is yet unknown at this point of the data analysis and it is indicated by a question mark. For example, one of the results is ‘CAP.39  $\cup$  INT.6 = ?’ (see Sales & marketing support in section 5.2.9). It means the current capability CAP.39 (i.e. Sales & Marketing support) is changed by one or more interviewees, coded as INT.6. The result is yet unknown, indicated by ‘?’, and needs to be determined by means of the questionnaire. See Table 14 for an overview of the used symbols.

Table 14 meanings of used symbols.

symbol	meaning
$\cup$	combined with
=	results in
?	relevance of performed interviewee change is determined by means of the questionnaire

### 5.2.1 Requirements gathering

As described in Appendix C the original focus area Requirements gathering consist of six capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Basic registration, Centralized registration, Automation, Internal stakeholder involvement, Customer involvement and Partner involvement. As described in section 4.3 the following candidate changes are proposed by the interviewer: LIT.1 on opening up the central database, LIT.6 on making partner involvement more important and LIT.16 on modeling the requirements communication networks. As explained in section 5.1 only interviewee i1 up to

and including i7, i9 and i10 have been interviewed on this focus area, because it is part of the business function Requirements gathering.

### Basic registration

The current capability CAP.1 looks like this:

CAP.1	a.	Basic Registration	Action: Requirements are being gathered and registered.
			Goal: Create a basis for product development.

The following changes are performed by the interviewees:

- 1) two interviewees (i5 and i6) combine capability CAP.1 with one or two other capabilities:
  - a) interviewee i5 combines it with the current capability CAP.2 Centralized registration;
  - b) interviewee i6 combines it with the capabilities CAP.2 Centralized registration and CAP.3 Automation;
- 2) seven interviewees do not change anything to CAP.1.

Thus, a majority (see change 2) does not change anything to capability CAP.1; i.e. it remains the same.

*Result:*

$$CAP.1 = CAP.1$$

### Centralized registration

The current capability CAP.2 looks like this:

CAP.2	b.	Centralized registration	Action: All incoming requirements are stored in a central database, which is accessible to all relevant stakeholders.
			Goal: Structuring of requirements registration.

Plus, the interviewer presented candidate change LIT.1:

LIT.1	Requirements gathering	The central database with the incoming requirements is accessible to partners as well.	Expand capability b. Centralized registration with this change or add it as a new capability.
-------	------------------------	--	---

The following changes are performed by the interviewees:

- 1) three interviewees (i3, i4 and i7) combine candidate change LIT.1 with the current capability CAP.2 Centralized registration. They see it as one capability in which all requirements are stored in a central database and it is accessible to all relevant internal and external stakeholders;
- 2) five interviewees (i1, i2, i5, i6 and i10) change more or less nothing to capability CAP.2. and add candidate change LIT.1 as a new capability on opening the central database for external stakeholders to this focus area;
- 3) four interviewees (i1 and i4-i6) think that not every external stakeholder may have access to every requirement in the opened up central database. Product managers need to make the requirements only accessible to relevant external stakeholders;
- 4) one interviewee (i9) changes nothing to capability CAP.2 and does not add candidate change LIT.1 in any way to the model and matrix, because he already has experience with such an open database and in his case it was not effective.

A majority of eight interviewees (change 1 and 2) sees opening up the central database to external stakeholders (i.e. candidate change LIT.1) as a relevant change for this focus area. A majority of five interviewees (change 2) thinks it should be added as a new capability. Thus, capability CAP.2 is not changed and a new capability (i.e. NEW.1 on opening up the database to partners) is added to the model plus four interviewees (change 3) only give access to the database to relevant external stakeholders (processed as INT.1). INT.1 is added to NEW.1 as well, because it is a relevant and minor change.

*Result:*

$$CAP.2 = CAP.2$$

$$LIT.1 \cup INT.1 = NEW.1$$

### Automation

The current capability CAP.3 looks like this:

CAP.3	c.	Automation	Action: All incoming requirements are automatically stored in a central database (e.g. by means of an online helpdesk).
			Goal: Reduced workload / changed speed of requirements gathering process, reduced error percentage.

The following changes are performed by the interviewees:

- 1) two interviewees (i5 and i9) say it is not a capability but rather an automation question;
- 2) one interviewee (i3) removes the first two words 'All incoming' from capability CAP.3, because he thinks it is not relevant to store every requirement;
- 3) six interviewees do not change anything to CAP.3.

Change 1 is rejected, because a majority does not have any problems with it as a capability. Change 2 also rejected, because at this point a product manager wants to know every market requirements which enters the organization. At a later point he assesses the relevance of a requirement plus interviewee i3 is the only one who changes CAP.3 in this way. Thus, a majority of the interviewees changed nothing to the content of capability CAP.3; i.e. it remains the same.

*Result:*

$$CAP.3 = CAP.3$$

## Stakeholder involvement

The current capabilities CAP.4, CAP.5 and CAP.6 look like this:

<b>CAP.4</b>	d.	Internal stakeholder involvement	Action: Requirements are gathered from all relevant internal stakeholders: support, services, development, sales & marketing, research & development (parties not present in your organization can be ignored).
			Goal: Changed product quality & increased involvement of internal stakeholders in the product management process.
<b>CAP.5</b>	e.	Customer involvement	Action: Customer and prospect requirements are being gathered and registered, and the customer or prospect is informed of the developments concerning their requirements.
			Goal: Incorporation of customer needs and wishes in the product.
<b>CAP.6</b>	f.	Partner involvement	Action: Requirements are systematically gathered from partner companies.
			Goal: Changed product quality & increased involvement of external stakeholders in the product management process.

Plus, the interviewer presented candidate change LIT.6:

<b>LIT.6</b>	Requirements gathering	Make partner (i.e. niche player) involvement more important	Expand capability d. Internal stakeholder involvement with partners (i.e. niche players), expand capability e. Customer involvement with partners or move capability f. Partner involvement to a lower maturity level.
--------------	------------------------	---	--

The following changes are performed by the interviewees:

- 1) two interviewees (i2 and i9) do not change anything to the three capabilities;
- 2) one interviewee (i10) places CAP.6 Partner involvement on a lower maturity level than CAP.5 Customer involvement;
  - a) interviewee (i10) even thinks CAP.6 Partner involvement demands interaction; i.e. requirements of partners (i.e. niche players) with regard to the keystone product (i.e. the platform) are communicated to the keystone and vice versa (i.e. requirements with regard to niche solutions are communicated to the partners);
- 3) two interviewees (i1 and i6) combine all external stakeholders (i.e. customers and partners) to one External stakeholder involvement capability and place it maturity wise on a lower maturity level than Internal stakeholder involvement;
- 4) four interviewees (i3-i5 and i7) combine all three capabilities to one Stakeholder involvement capability;
  - a) three of them (i3-i5) indicate that per situation (e.g. per organization, per product, per release) the product manager has to determine whose involvement is most important;
  - b) one of them (i7) keeps a loose capability 'Partner involvement' for situations in which the keystone company builds its solution on the platform of another company (i.e. so the organization builds on another keystone its product);
  - c) one of them (i7) says customer involvement is not relevant anymore in a SECO, because partners will filter customer requirements and pass it to you.

Change 2.a is rejected, because this focus area is about the gathering of requirements and not about the communication. In Figure 8 an overview is created of the relative positioning of the specific stakeholders. The position CAP.4 Internal stakeholder involvement is considered as '0'. By looking at how other stakeholders are placed relatively to the involvement of internal stakeholders, is determined how the resulting capabilities should look like. On the x-axis the relative positions are displayed and on the y-axis the numbers of interviewees are displayed.

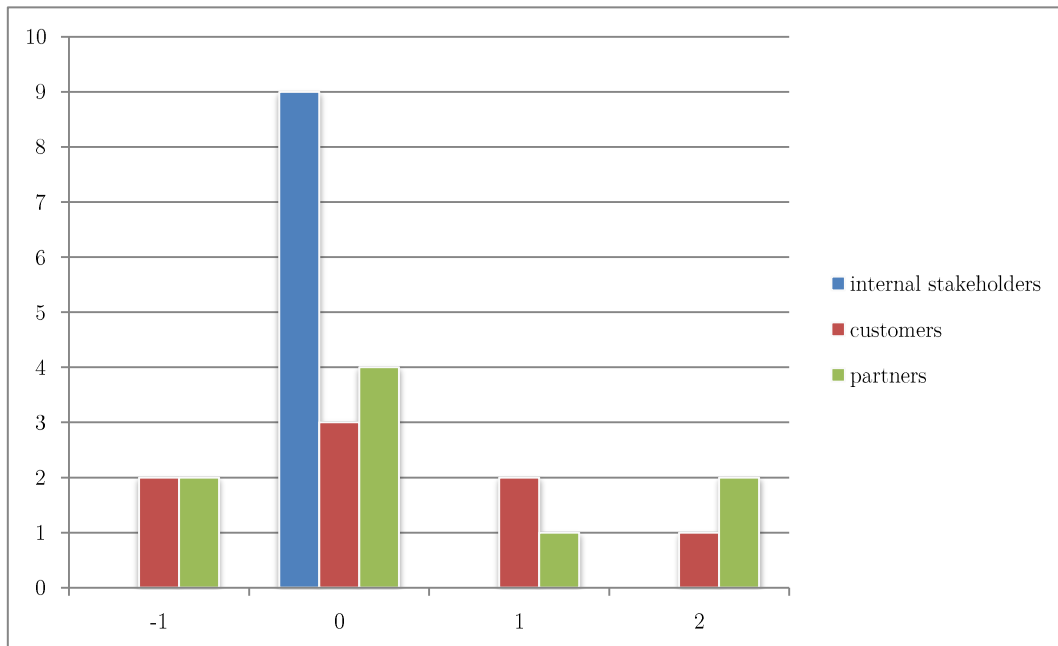


Figure 8 stakeholders involvement in Requirements gathering.

The relative positioning of the stakeholders is more or less in balance with its point of gravity at the position of the internal stakeholders. Two interviewees place the external stakeholders (i.e. customer and partner involvement) in front of the internal stakeholders, three interviewees place it after the internal stakeholders and four interviewees place internal and external stakeholders at the same position. Therefore is concluded to combine internal and external stakeholders into one capability. It is also the conclusion when calculating the median of the relative positions. This variable is chosen because in their study on the current SPMM Matrix van de Weerd, Bekkers and Brinkkemper (2010) used the same variable for determining the maturity levels and in this analysis the relative maturity level is calculated. First, the median of the relative positions of the involvement of customer is:

$$\text{median}(-1, -1, 0, 0, 0, 1, 1, 2) = 0$$

Second, the median of the relative positions of the involvement of partners is:

$$\text{median}(-1, -1, 0, 0, 0, 0, 1, 2, 2) = 0$$

Thus, both medians indicate the relative position of '0' for customer and partner involvement; i.e. combine with internal stakeholder involvement. Thus, all internal and external stakeholders are combined into one capability CHA.2 (i.e. performing candidate change LIT.6) and per situation (e.g. product or release) is determined which stakeholders are

most important to involve. In this way, change 4.a is part of it as well as interviewee change INT.22.

*Result:*

$$CAP.4 \cup CAP.5 \cup CAP.6 \cup LIT.6 \cup INT.22 = CHA.2$$

### Requirements communication networks

The interviewer presented candidate change LIT.16:

<b>LIT.16</b>	Requirements gathering	Model the requirements communication networks; i.e. the communication flows of requirement among stakeholders to the product manager. And analyze it to choose the right communication tactics, strategy and methods.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) seven interviewees (i2-i5, i7, i9 and i10) add candidate change LIT.16 as a new capability to this focus area, because it is important to understand the requirement flows in a SECO before the product managers starts with gathering requirements. In this way he is ensured he will gather every relevant market requirement from every relevant stakeholder;
  - a) one of them (i3) adds it in a slightly different form. He also wants to check whether the input and output are really the same;
- 2) one interviewee (i6) thinks it is already part of the current capability CAP.3 Automation;
- 3) one interviewee (i1) does not see any benefit in performing this activity.

Change 1.a is rejected, because it is already validated in the focus area Requirements identification in capability CAP.8 Requirements validation. Change 2 is rejected, because seven interviewees did not come to the same conclusion. Thus, a majority (change 1) adds candidate change LIT.16 as a new capability (i.e. NEW.3) to this focus area.

*Result:*

$$LIT.16 = NEW.3$$

### Maturity level analysis

The maturity levels of the (new) capabilities are based on the median of the maturity levels given by the interviewees. This approach is chosen because in their study on the current SPMM Matrix van de Weerd, Bekkers and Brinkkemper (2010) used the same variable. However, the analysis differs at four points. First, they ‘prepared’ the capabilities by determining the order of all capabilities based on inter- and intra-process capability dependencies. These rankings were a determining factor for where the capabilities are positioned. In this study the capabilities are not ‘prepared’ in any way. The current focus areas and candidate changes are presented to the interviewees, and they have evaluated or changed the maturity levels. Second, they asked the respondent to scale each capability on a scale of six maturity levels. In this study the capabilities are positioned by using letters. The range of letters depends on the number of capabilities (e.g. three capabilities results in a

range of ‘a’ up to and including ‘c’). Third, they used the median of all respondents to determine the maturity levels. In this study the median is in some cases the same. To determine the levels, the average is used as a second determinant variable. Fourth, respondents had to indicate maturity levels twice, probably to increase the construct validity. In this study there was no time for asking the interviewees to indicate the maturity levels twice.

Some final remarks have to be made on the analysis. First, at the start of this analysis the data is prepared by transforming the maturity level letters given by interviewees into number (e.g. ‘a’ becomes ‘1’ and ‘d’ becomes ‘4’). Second, some interviewees combined several loose capabilities into one. Even some conclusion of the analysis described above led to combined capabilities. To be able to process all interviewees’ data, the maturity levels are determined by determining the levels of the loose variants. For example, if an interviewee places a combined capability Stakeholder involvement on level ‘b’ (i.e. ‘2’ in the analysis) the loose variants Internal stakeholder, Customer and Partner involvement are considered to have a level ‘b’ maturity. At the end of the analysis, if the loose variants are processed as a combined capability, the average of the median and average is used to determine the maturity level of a combined capability. Third, if an interviewee removes a capability from a focus area it does not get any maturity level assigned in the analysis (indicated with ‘x’). It has some (minor) consequences for the analysis, but this was the best way to solve it. See the discussion on this issue in section 8. See Table 15 for the results of the analysis. The analysis of the succeeding focus areas can be found in Appendix D.

Table 15 maturity levels focus area Requirements gathering.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
			median	mean	maturity									
<b>CAP.1</b>	Basic registration		1	1	1	1	1	1	1	1	1	1	1,00	a
<b>CAP.2</b>	Centralized registration		2	6	2	2	1	1	2	2	2	2	2,22	b
<b>NEW.1</b>	Opening central database		3	7	2	2	6	4	2	x	6	3,5	4,00	c
<b>CAP.3</b>	Automation		4	8	4	5	x	1	4	x	3	4	4,14	d
<b>CHA.2</b>	Stakeholder involvement	Internal stakeholder	7	3	5	6	3	6	5	4	4	5	4,78	e
		Customer	5	4	5	6	3	x	5	5	7	5	5,00	
		Partner	5	5	5	6	3	5	5	6	5	5	5,00	
<b>NEW.3</b>	Requirements communication flows		x	2	8	4	7	x	8	3	8	7	5,71	f

### Focus area

The interview analysis results in the following changed focus area (see Table 16). The focus area consists of the resulting evaluated, changed and new capabilities plus a title and description of the focus area. The title remains the same as in the current focus area. The description is expanded; requirements are shared with all relevant and authorized external stakeholders; i.e. change FOC.4. Because, the central database (with all requirements) needs to be accessible for all relevant stakeholders.



Table 16 changed focus area Requirements gathering.

#			
<b>FOC.4</b>	Requirements gathering	Requirements gathering concerns the acquisition of requirements from both internal and external stakeholders, and the sharing of these requirements with all relevant and authorized external stakeholders.	
<b>CAP.1</b>	a.	Basic Registration	Action: Requirements are being gathered and registered.
			Goal: Create a basis for product development.
<b>CAP.2</b>	b.	Centralized registration	Action: All incoming requirements are stored in a central database, which is accessible to all relevant stakeholders.
			Goal: Structuring of requirements registration.
<b>NEW.1</b>	c.	Opening central database	Action: The central database with the incoming requirements is accessible to relevant and authorized external stakeholders.
			Goal: Make the sharing of information, resources and objects more efficient and effective.
<b>CAP.3</b>	d.	Automation	Action: All incoming requirements are automatically stored in a central database (e.g. by means of an online helpdesk).
			Goal: Reduced workload / changed speed of requirements gathering process, reduced error percentage.
<b>CHA.2</b>	e.	Stakeholder involvement	Action: Requirements are gathered from all relevant internal and external stakeholders. For example support, services, development, sales & marketing, research & development, customers and partners. Determine for each stakeholder how important their involvement for the product is.
			Goal: Changed product quality & increased involvement of the right stakeholders in the product management process.
<b>NEW.3</b>	f.	Requirements communication flows	Action: Model the requirements communication networks (i.e. the communication of requirement flows among stakeholders).
			Goal: To enable the analysis of the requirement communication flows for picking the right requirement communication strategies and tactics.

### 5.2.2 Requirements identification

As described in Appendix C the original focus area Requirements identification consist of four capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Uniformity, Requirements validation, Connect similar requirements and Automatically connect similar requirements. As described in section 4.3 there are no candidate changes proposed by the interviewer. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Requirements gathering. The analysis on capability CAP.9 Connect similar requirements is not described, simply because none of the interviewees changed anything to this capability.

## Uniformity

The current capability CAP.7 looks like this:

CAP.7	a.	Uniformity	Action: Market requirements are rewritten to product requirements using a pre-defined template if the market requirement is applicable to a product.
			Goal: Identification of the essence of the requirements, this provides clarity to all involved, enables a meaningful comparison of requirements.

The following changes are performed by the interviewees:

- 1) eight out of nine interviewees (i1, i3-i7, i9 and i10) do not change anything to the content of capability CAP.7;
  - a) one interviewee (i1) says he knows from his own experience that this activity is already well established in the SPM processes of organizations. However, he does not change anything;
- 2) one interviewee (i2) distinguishes more types of requirements; he adds the type 'service requirements'. This type is about what services customers want to have in the platform.

Change 2 is rejected, because only one interviewee proposes it and a service requirement is just a type of market requirement. Thus, nothing is changed to the content of capability CAP.7.

*Result:*

$$CAP.7 = CAP.7$$

## Requirements validation

The current capability CAP.8 looks like this:

CAP.8	b.	Requirements validation	Action: The correctness ("Is the definition correct?"), completeness ("Does the requirement describe all relevant aspects?"), and unambiguousness ("Can the requirement only be interpreted in one way?") of the requirement is validated.
			Goal: Validation of the requirements to prevent rework.

The following changes are performed by the interviewees:

- 1) eight interviewees (i1-i7 and i10) change nothing to capability CAP.8 its content;
- 2) two interviewees (i2 and i3) add a new capability to this focus area on getting extra information from external stakeholders by asking them to give feedback. For example, to check whether requirements are understood correctly or to enrich existing requirements;
- 3) one interviewee (i9) also says it is important to know whether requirements are understood correctly. However, he rejects the solution of interviewee i2 and i3 and says SPM needs to divide the requirement into smaller chunks, incrementally process them in succeeding releases and carefully look how the market responds to it. The last solution does not lead to an extra capability, but is processed into the Requirements validation capability.

Thus, a majority (change 1) changes nothing to the content of capability CAP.8. The addition to check whether requirements are understood correctly (change 2 and 3) is an interesting one, because this can increase the quality of requirements. Whether it is processed is determined by means of the questionnaire as interviewee change INT.2.

*Result:*

*CAP.8 = CAP.8*

*INT.2 = ?*

### Automatically connect similar requirements

The current capability CAP.10 looks like this:

<b>CAP.10</b>	d.	Automatically connect similar requirements	Action: Automatically connect similar requirements by using advanced techniques such as linguistic engineering.
			Goal: Reduce the workload of the connecting of similar requirements.

The following changes are performed by the interviewees:

- 1) four interviewees (i2-i4 and i6) have serious doubts on capability CAP.10;
  - a) three of them (i2, i4 and i6) think it is (too) complex to perform but do not remove it from the focus area;
  - b) one of them (i3) does not see it as a capability but as a supporting tool and removes it from the focus area;
- 2) one interviewee (i9) contradicts change 1 by saying it is easier than they think; it is only about categorizing and consistency checks he says;
- 3) four interviewees (i1, i5, i7 and i10) have no comments on this capability.

To sum up, eight interviewees do not change anything and one interviewee removes it. Seen the fact that a majority does not change anything, capability CAP.10 remains the same.

*Result:*

*CAP.10 = CAP.10*

### Focus area

The interview analysis results in an evaluated focus area; i.e. nothing is changed. No changed or new capabilities are needed to make this focus area SECO proof. The title and description of this focus area remains the same as well. The only question that remains is whether interviewee change INT.2 with regard to external feedback needs to be added. Whether and where INT.2 is added is determined by means of the questionnaire.

### 5.2.3 Requirements organizing

As described in Appendix C the original focus area Requirements organizing consist of three capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Requirement organization, Requirement lifecycle management and Requirement dependency linking. As described in section 4.3 the following candidate changes are proposed by the interviewer: LIT.2 on opening up the requirements history log and LIT.7 on separating

(niche) requirements. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Requirements gathering. The analysis on capability CAP.13 Requirements dependency linking is not described, simply because none of the interviewees changed anything to this capability.

### Requirement organization

The current capability looks like this:

<b>CAP.11</b>	a.	Requirement organization	Action: Product requirements are organized based on shared aspects (e.g. type, function, or core asset).
			Goal: Increase potential of requirements by identifying value outside of the original boundaries, and provide insight into the planning concerning the requirement.

Plus, the interviewer presented candidate change VII:

<b>LIT.7</b>	Requirements organizing	Distinguish the difference between requirements with regard to the product and with regard to the externally created components (i.e. niche solution) and communicate these requirements to the specific partner(s) (i.e. niche player(s)).	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) none of the interviewees changes anything after the interviewer presented current capability CAP.11;
- 2) seven interviewees want to perform candidate change LIT.7, but they all have different ideas on how to process candidate change LIT.7;
  - a) three interviewees (i4-i6) process it into this focus area;
    - i) one of them (i4) processes it as a combination with the current capability CAP.11;
    - ii) one of them (i5) divides it into parts and processes it into two capabilities (i.e. capability CAP.11 Requirement organization and the candidate change LIT.2 on opening up the requirements history log);
    - iii) one of them (i6) adds it as a new loose capability;
  - b) three interviewees (i1, i9 and i10) process candidate change LIT.7 into two other focus areas;
    - i) one of them (i1) processes it into the focus area Requirement identification;
    - ii) two interviewees (i9 and i10) process it into the focus area Requirements gathering;
  - c) two interviewees (i2 and i3) have serious doubts on candidate change LIT.7. They do not see the relevance of it (i3) or think it is already performed at an earlier stage (i2) (i.e. at the focus areas Requirements gathering or Requirements identification);
  - d) during the interview of interviewee i7 there was a miscommunication on the content of candidate change LIT.7. He thought the interviewer described a change in which a product manager looks at its requirement database and can see which partner has which requirements. This is already present in the current focus area, because a product manager must register who submits a requirement in

Requirements lifecycle management. Thus, this interviewee is disregarded in the analysis of candidate change LIT.7.

Change 2.c is rejected, because it is not described at these focus areas. A majority of six interviewees (change 2.a and 2.b) performs candidate change LIT.7 anywhere in the model or matrix. However, their way of performing differs too much to draw a straightforward conclusion on how and where this candidate change should be processed. Going back to the interviewees by means of the questionnaire to let them decide will not result in different data. They all have already given their thoughts on candidate change LIT.7. Therefore, a conclusion is drawn on arguments. First, is looked at which focus area it is most logical to process LIT.7. The purpose of the first two focus area is the gathering of requirements (i.e. nothing is done with the content of requirements) and the identification of requirements (i.e. here is identified what a market requirement means). The purpose of the third focus area is the organization of requirements based on shared aspects. Thus, the most logical focus area is Requirements organizing. At this point it becomes clear how a requirement affects products in the SECO. Second, the following questions are answered: ‘How should the candidate change be processed, as part of another capability or not?’ It should be part of Requirement organization capability, because at this point product requirements are organized on shared aspects (e.g. function or core asset). In the case of SECOs, it would be most logical to analyze it at this point if it concerns organization’ products or not. This is, more or less, what i4 and i5 suggest as well. Thus, candidate change LIT.7 is combined with capability CAP.11 Requirement organization as a changed capability CHA.5.

*Result:*

$$CAP.11 \cup LIT.7 = CHA.5$$

### Requirement lifecycle management

The current capability CAP.12 looks like this:

<b>CAP.12</b>	b.	Requirement lifecycle management	Action: A requirements history is logged by recording who submitted it, when it was submitted, what changes were made to it, what the original description of the requirement was, what the current status of the requirement is (e.g. new, rewritten, validated, organized, scheduled for release X, tested, released in release X, etc.). A requirement remains in the database after it has been built so that it can be reused in a new or related product.
			Goal: Make requirements reusable for other projects, adds traceability for a requirements (easy to gather extra information, discover mistakes).

Plus, the interviewer presented candidate change LIT.2:

<b>LIT.2</b>	Requirements organizing	Make the requirements history log accessible for partners (i.e. niche players).	Expand capability b. Requirement lifecycle management with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) one interviewee (i1) thinks capability CAP.12 does not belong to this focus area but to the Requirements gathering focus area;

- 2) one interviewee (i2) adds new parts to the description of the current capability CAP.12;
  - a) he misses a part on the registration of the sources of requirements;
  - b) he adds registering the different phases of the requirements;
  - c) he wants to see a more clear relationship between the requirements and the product it is intended for;
- 3) one interviewee (i4) combines the current capability CAP.12 with the first capability CAP.11 Requirement organizing;
- 4) two interviewees (i6 and i9) do not think it is relevant to process candidate change LIT.2 on opening the requirements history log. External stakeholders are not interested in this data and/or can already see in the release definition what is or what is not processed;
- 5) seven interviewees (i1-i5, i7 and i10) think it is important to open up the requirements history log for all relevant external stakeholders (i.e. candidate change LIT.2);
  - a) four of them (i1-i3 and i7) think candidate change LIT.2 should be combined with current capability CAP.12 Requirement lifecycle management;
  - b) three of them (i4, i5 and i10) think it should be processed as a new loose capability at a higher maturity level than the current capability;
    - i) one of them (i5) gives a reason why he places it after the current capability CAP.12. He says an organization first wants to organize everything internally well (maturity wise) before it gives external stakeholders access to it;
  - c) one of the interviewees (i5) adds that not every external stakeholder may have access to every requirement in the history log (i.e. INT.3).

Change 1 is rejected, because interviewee i1 is the only one who changes it plus the other focus area is only about the gathering of requirements and is not targeted at organizing; i.e. what is executed in this capability. Change 2.a and 2.b are rejected, because both are not correct. Both are already part of the description of CAP.12. Change 2.c is rejected, because a change to make it clearer than it is right now is not found. Change 3 is rejected as well, because he is the only one who suggests it and no convincing arguments are given. Change 4 is rejected, because a majority of seven interviewees indicates (change 5) it is important to perform candidate change LIT.2. Four interviewees (change 5.a) see opening up (i.e. LIT.2) as part of the current capability CAP.12 and three interviewees (change 5.b) see it as a new capability on a higher maturity. A choice between change 5.a and 5.b on majority cannot be made. Plus, going back to the interviewees to ask them for the second time by means of the questionnaire to determine whether and where they would place it in the focus area makes no sense; i.e. it would result in the same data. Thus, a choice is made based on the arguments given by the interviewees. The argument of interviewee i5 (change 5.b.i) with regard to organizing everything internally first is considered as the best argument given. Change 5.c is accepted, even though only one of the interviewees performs it (i.e. interviewee change INT.3). It is just a minor and relevant addition and it is also suggested and processed in the new capability NEW.1 at the focus area Requirements gathering. Thus, capability CAP.12 remains the same, candidate change LIT.2 is added as a new loose capability NEW.6 and interviewee change INT.3 is also processed into the new capability.

*Result:*

*CAP.12 = CAP.12*

*LIT.2  $\cup$  INT.3 = NEW.6*

### **Focus area**

The interview analysis results in the following changed focus area (see Table 17). The focus area consists of the resulting evaluated, changed and new capabilities plus a title and description of the focus area. The title remains the same as in the current focus area. The description is expanded with: 'It shares this information with all relevant and authorized external stakeholders'; i.e. focus area change FOC.7. Because, the requirement history log is opened for relevant and authorized stakeholders and requirements for niche solutions are communicated to the partners.

Table 17 changed focus area Requirements organization

#			
<b>FOC.7</b>	Requirements organizing	Requirements organizing organizes the requirements throughout their entire lifecycle based on shared aspects, and describes the dependencies between Product Requirements. It shares this information with all relevant and authorized external stakeholders.	
<b>CHA.5</b>	a.	Requirement organization	Action: Product requirements are organized based on shared aspects (e.g. type, function, or core asset). Plus, distinguish the difference between requirements with regard to the product and with regard to the externally created components (i.e. niche solutions). Communicate the requirements for the niche solutions to the specific partners.
			Goal: Increase potential of requirements by identifying value outside of the original boundaries, and provide insight into the planning concerning the requirement. Share information relevant for partners, with them.
<b>CAP.12</b>	b.	Requirement lifecycle management	Action: A requirements history is logged by recording who submitted it, when it was submitted, what changes were made to it, what the original description of the requirement was, what the current status of the requirement is (e.g. new, rewritten, validated, organized, scheduled for release X, tested, released in release X, etc.). A requirement remains in the database after it has been built so that it can be reused in a new or related product.
			Goal: Make requirements reusable for other projects, adds traceability for a requirements (easy to gather extra information, discover mistakes).
<b>NEW.6</b>	c.	Opening requirements history log	Action: The requirements history log is accessible to relevant and authorized external stakeholders.
			Goal: Make requirements reusable for other projects within the SECO (easy to gather extra information, discover mistakes).
<b>CAP.13</b>	d.	Requirements dependency linking	Action: Dependencies between market and product requirements are determined and registered. A dependency exists when a requirement requires the specific action of another requirement. E.g. a requirement requires that another requirement be implemented too, or that another requirement is not implemented in case of conflicting requirements. The linkage can be supported by using advanced techniques, such as linguistic engineering.
			Goal: The existence of requirements interdependencies means that requirements interact with and affect each other. Requirement dependency linking prevents problems that result from these interdependencies, and therewith enables better planning of the development process.

#### 5.2.4 Requirements prioritization

As described in Appendix C the original focus area Requirements prioritization consist of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Internal stakeholder involvement, Prioritization methodology, Customer involvement, Cost revenue consideration and Partner involvement. As described in section 4.3 the following candidate change is proposed by the interviewer: LIT.8 on making partner involvement more



important. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Release planning.

### Stakeholder involvement

The current capabilities CAP.14, CAP.16 and CAP.18 look like this:

<b>CAP.14</b>	a.	Internal stakeholder involvement	Action: All relevant internal stakeholders (e.g. the product manager, support, services, development, sales & marketing, research & development) indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view.  Goal: Changed product quality & increased involvement of internal stakeholders in the product management process.
<b>CAP.16</b>	c.	Customer involvement	Action: Customers and prospects (or representatives thereof) indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view. Customers can also be represented in a delegation, select group of customers, or in other more manageable forms.  Goal: Incorporation of customer needs and wishes in the product.
<b>CAP.18</b>	e.	Partner involvement	Action: Partner companies indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view.  Goal: Changed product quality & increased involvement of external stakeholders in the product management process.

Plus, the interviewer presented candidate change LIT.8:

<b>LIT.8</b>	Requirements prioritization	Make partner (i.e. niche player) involvement more important.	Expand capability a. Internal stakeholder involvement with partners (i.e. niche players), expand capability c. Customer involvement with partners or move capability e. Partner involvement to a lower maturity level.
--------------	-----------------------------	--	--

The following changes are performed by the interviewees:

- 1) seven interviewees (i1, i3-i7 and i9) combines the involvement of partners and customers (i.e. external stakeholders);
  - a) three of them (i1, i3 and i6) even combine the involvement of all relevant internal and external stakeholders into one capability;
  - b) the other four interviewees (i4, i5, i7 and i9) state that the involvement of all relevant external stakeholders should be a separate capability in addition to the Internal stakeholder involvement capability;
    - i) change 2.b is strengthened by the two remaining interviewees i2 and i10 which place the involvement of partners and customers (i.e. external stakeholders) on higher maturity levels than the current capability CAP.14 Internal stakeholder involvement;
- 2) two interviewees (i6 and i7) indicate that per situation should be determined on which stakeholder there will be most emphasis with regard to its view on priorities; i.e. interviewee change;

- 3) one interviewee (i7) keeps a loose capability 'Partner involvement' if the product software company builds its solution on the platform of another company (i.e. so the organization builds on another keystone its product).

Based on the performed changes 1.a, 1.b and 1.b.i, an overview is created of the relative positioning of the specific stakeholders (see Figure 9). The position CAP.14 Internal stakeholder involvement is considered as '0'. By looking at how other stakeholders are placed relatively to the involvement of internal stakeholders, is determined how the resulting capabilities should look like. On the x-axis the relative positions are displayed and on the y-axis the numbers of interviewees are displayed.

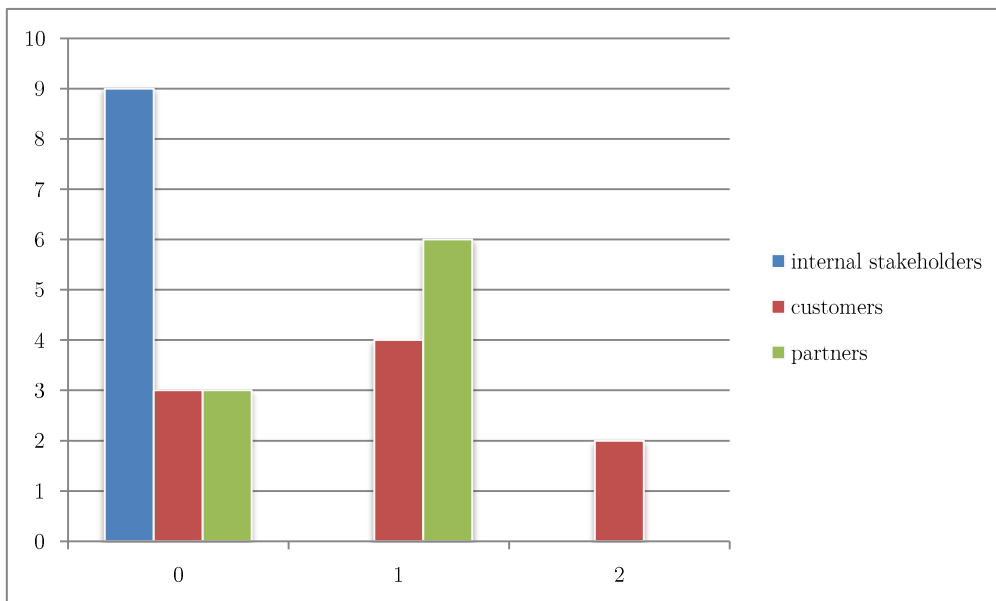


Figure 9 stakeholders involvement in Requirements prioritization.

A majority of seven interviewees combines all external stakeholders (change 1). To determine whether external stakeholder involvement also should be combined with internal stakeholder involvement, the median of the relative positions is calculated. This variable is chosen because in their study on the current SPMM Matrix van de Weerd, Bekkers and Brinkkemper (2010) used the same variable for determining the maturity levels and in this analysis the relative maturity level is calculated. First, the median of the relative positions of the involvement of customer is:

$$\text{median}(0, 0, 0, 1, 1, 1, 1, 2, 2) = 1$$

Second, the median of the relative positions of the involvement of partners is:

$$\text{median}(0, 0, 0, 1, 1, 1, 1, 1, 1) = 1$$

Thus, both medians indicate the relative position of '1' for partner and customer involvement; i.e. combine as CHA.9 External stakeholder involvement capability and remain capability CAP.14 Internal stakeholder involvement.

In addition change 2 is processed as interviewee change INT.4, because it is just a minor and relevant addition and it is also indicated by three other interviewees (i3-i5) when

discussing the CHA.2 Stakeholder involvement capability in the Requirements gathering focus area. Therefore is concluded it is a good addition for capability CAP.14 Internal stakeholder involvement and the combined capability CHA.9 External stakeholder involvement. Even though there is no majority of interviewees which add it. This addition transforms capability CAP.14 into the changed capability CHA.8 and by adding it to the combined CHA.9 External stakeholder involvement capability, change 3 is addressed as well.

*Result:*

$$CAP.14 \cup INT.4 = CHA.8$$

$$CAP.16 \cup CAP.18 \cup LIT.8 \cup INT.4 = CHA.9$$

### Prioritization methodology

The current capability CAP.15 looks like this:

CAP.15	b.	Prioritization methodology	Action: A structured prioritization technique is used (e.g. MOSCOW, Wiegers).
			Goal: Structure the requirement prioritization process and therewith provide a solid prioritization which is balanced, and clear to all parties involved.

The following changes are performed by the interviewees:

- 1) eight interviewees (i1-i3, i5-i7, i9 and i10) do not change anything to the content of capability CAP.15;
- 2) one interviewee (i4) adds the current capability CAP.17 Cost revenue consideration to this capability. He states cost revenue consideration is a type of prioritization technique.

Change 2 is rejected, seen the fact that no other interviewee has the same suggestion. Thus, capability CAP.15 remains the same.

*Result:*

$$CAP.15 = CAP.15$$

### Cost revenue consideration

The current capability CAP.17 looks like this:

CAP.17	d.	Cost revenue consideration	Action: Information about the costs and revenues of each (group of) requirement(s) is taken into account during the requirements prioritization (costs can be expressed in other means than money).
			Goal: Create a financial basis for the prioritization.

The following changes are performed by the interviewees:

- 1) one interviewee (i4) combines capability CAP.17 Cost revenue consideration with the previous analyzed CAP.15 Prioritization capability. He states Cost revenue consideration is a type of prioritization technique
- 2) one interviewee (i7) changes capability CAP.17 to business value consideration, in this way the value consideration is more positive minded;

- 3) one interviewee (i10) expands and splits capability CAP.17 into a Keystone cost revenue consideration and an Ecosystem cost revenue consideration capability. In this way it becomes more clear what the (in)direct costs and revenues are;
- 4) the six remaining interviewees do not change anything.

Change 1 is rejected, because no other interviewee has the same suggestion and no convincing arguments are given. Change 2 is rejected, because in capability CAP.17 is already described that costs can be expressed in other means than money (e.g. business value). Change 3 is rejected, because she is the only interviewee who changes it and if the product manager will conduct a proper Cost revenue consideration it will know all the (in)direct costs and revenues. Thus, a majority does not change anything to the content of capability CAP.17.

*Result:*

*CAP.17 = CAP.17*

### **Final decision**

One interviewee (i4) adds a new capability to this focus area in which is determined who the final call on priorities makes. It is rejected, because that person exists already, namely the product manager.

### **Focus area**

The interview analysis results in the following changed focus area (see Table 18). This focus area consists of the resulting evaluated, changed and new capabilities plus a title and description of the focus area. The title remains the same as in the current focus area. The description is expanded with: 'by the relevant internal and/or external stakeholders'; i.e. change FOC.10. Because, only relevant stakeholders may prioritize requirements.

Table 18 changed focus area Requirements prioritization.

#			
<b>FOC.10</b>	Requirements prioritization	The identified and organized requirements are prioritized by the relevant internal and/or external stakeholders.	
<b>CHA.8</b>	a.	Internal stakeholder involvement	Action: All relevant internal stakeholders (e.g. the product manager, support, services, development, sales & marketing, research & development) indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view. Determine for each stakeholder how important their involvement for the product is.
			Goal: Changed product quality & increased involvement of the right internal stakeholders in the product management process.
<b>CAP.15</b>	b.	Prioritization methodology	Action: A structured prioritization technique is used (e.g. MOSCOW, Wiegers).
			Goal: Structure the requirement prioritization process and therewith provide a solid prioritization which is balanced, and clear to all parties involved.
<b>CHA.9</b>	c.	External stakeholder involvement	Action: External stakeholders (or representatives thereof) indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view. External stakeholders can also be represented in a delegation, select group of customers or partners, or in other more manageable forms. Determine for each stakeholder how important their involvement for the product is.
			Goal: Incorporation of the right external stakeholders needs and wishes in the product.
<b>CAP.17</b>	d.	Cost revenue consideration	Action: Information about the costs and revenues of each (group of) requirement(s) is taken into account during the requirements prioritization (costs can be expressed in other means than money).
			Goal: Create a financial basis for the prioritization.

### 5.2.5 Release definition

As described in Appendix C the original focus area Release definition consist of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Basic requirements selection, Standardization, Internal communication, Advanced requirements selection and Multiple releases. As described in section 4.3 the following candidate changes are proposed by the interviewer: LIT.9 on communicating the release definition to external stakeholders and LIT.10 on taking into account what external stakeholders are going to build. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Release planning. The analyses on capabilities CAP.20 Standardization and CAP.22 Advanced requirements selection are not described, simply because none of the interviewees changed anything to these capabilities.

## Basic requirements selection

The current capability CAP.19 looks like this:

CAP.19	a.	Basic requirements selection	Action: During requirements selection for the next release, constraints concerning engineering capacity are taken into account.
			Goal: Create a realistic release selection.

The following changes are performed by the interviewees:

- 1) one interviewee (i1) adds candidate change LIT.10 on taking into account what external stakeholders are going to build;
- 2) the other eight interviewees do not change anything.

If and how candidate change LIT.10 is added to this focus area, as proposed in change 1, is analyzed further on. Thus, a majority does not change anything and capability CAP.19 remains the same.

*Result:*

$$CAP.19 = CAP.19$$

## Communication

The current capability CAP.21 looks like this:

CAP.21	c.	Internal communication	Action: The release definition is communicated to the internal stakeholders.
			Goal: Inform the internal stakeholders of the upcoming development.

Plus, the interviewer presented candidate change LIT.9:

LIT.9	Release definition	The release definition is communicated to the external stakeholders.	Expand capability c. Internal communication with partners (i.e. niche players) or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) all interviewees add candidate change LIT.9 on external communication to the model;
  - a) seven interviewees (i1, i3-i6, i9 and i10) combine capability CAP.21 Internal communication with candidate change LIT.9 into a capability in which all internal and external stakeholders are communicated;
  - b) one interviewee (i7) adds candidate change LIT.9 as a new loose capability on external communication;
  - c) one interviewee (i2) places it as a new loose capability on external communication in the next focus area Release definition validation. Because, the product manager has to be hundred percent sure that what he communicates is correct. It should prevent the company in setting false expectations.

Thus, a majority of the interviewees (change 1.a) combines candidate change LIT.9 with the current capability CAP.21 Internal communication as changed capability CHA.11.

*Result:*

$$CAP.21 \cup LIT.9 = CHA.11$$

### Multiple releases

The current capability CAP.23 looks like this:

CAP.23	e.	Multiple releases	Action: Multiple releases are included in the requirements selection process.
			Goal: Create a more detailed mid-term vision the product.

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything to the content of capability CAP.23;
- 2) one interviewee (i6) thinks it is not relevant.

Thus, a majority does not change anything to CAP.23.

*Result:*

$$CAP.23 = CAP.23$$

### External alignment

The interviewer presented candidate change LIT.10:

LIT.10	Release definition	Take into account what releases partners are going to build and what functionality these releases consist of.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) six interviewees (i2, i3, i5, i6, i7 and i9) do not add candidate change LIT.10, because of a multitude of reasons;
  - a) three of them (i2, i3 and i5) think it is already handled during previous focus area (e.g. Requirements gathering and prioritization);
  - b) three of them (i6, i7 and i9) thinks the keystone has to take the lead by choosing how releases look like and the partners have to follow;
- 2) three interviewees (i1, i4 and i10) add candidate change LIT.10. They say it is necessary to align the releases and release schedules of the keystone and niche players, otherwise the SECO will not function properly.

The reasons given by both sides for adding or rejecting it can be rejected by using the arguments given by the opposing side. Thus, the conclusion for not adding this capability is only based on the fact that a majority (change 1) thinks it should not be added. The code added to it changes into the rejected candidate change code REJ.1.

*Result:*

$$LIT.10 = REJ.1$$

### Focus area

The interview analysis results in the following changed focus area (see Table 19). This focus area consists of the resulting evaluated and changed capabilities plus a title and description of the focus area. The title and description remains the same as in the current focus area.

Table 19 changed focus area Release definition.

#			
	Release definition	During the 'Release definition' process, the requirements that will be implemented in the next release are selected, based on the prioritization they received in the preceding process. And the release definition is created based on the selection.	
CAP.19	a.	Basic requirements selection	Action: During requirements selection for the next release, constraints concerning engineering capacity are taken into account. Goal: Create a realistic release selection.
CAP.20	b.	Standardization	Action: A standard template is used to write the release definition. The release definition contains aspects such as an overview of the requirements that will be implemented, a time path, and the needed capacity. Goal: Create clarity, enable comparison of releases.
CHA.11	c	Communication	Action: The release definition is communicated to the internal and external stakeholders. Goal: Inform the internal and external stakeholders of the upcoming development.
CAP.22	d.	Advanced requirements selection	Action: The optimal release is automatically calculated based upon the constraints of the requirements. At minimum the engineering capacity, priorities, cost, requirement dependencies are all taken into account. Goal: Optimize the release selection.
CAP.23	e.	Multiple releases	Action: Multiple releases are included in the requirements selection process. Goal: Create a more detailed mid-term vision the product.

### 5.2.6 Release definition validation

As described in Appendix C the original focus area Release definition validation consist of three capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Internal validation, Formal approval and Business case. As described in section 4.3 the following candidate change is proposed by the interviewer: LIT.11 on validating the release by external stakeholders. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Release planning. The analysis on capability CAP.25 Formal approval is not described, simply because none of the interviewees changed anything to this capability.

#### Validation

The current capability CAP.24 looks like this:

CAP.24	a.	Internal validation	Action: Internal stakeholders (consultants, etc.) perform a functional validation of the build release to verify that it meets the expected outcome.
			Goal: Change product quality.

Plus, the interviewer presented candidate change LIT.11:

LIT.11	Release definition validation	The release definition is validated by partners (i.e. niche players) before the software is realized.	Expand capability a. Internal validation with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:



- 1) eight interviewees recognize the importance to validate release definitions by external stakeholders; i.e. candidate change LIT.11;
  - a) four of them (i1-i3 and i6) perform candidate change LIT.11 with regard to external validation as part of capability CAP.24 Internal validation (i.e. it becomes a Validation capability);
  - b) four of them (i4, i5, i7 and i10) perform it as a new loose capability;
- 2) only one interviewee (i9) states that it is not important, he says the keystone chooses a direction and the rest (i.e. partners) has to follow;
- 3) one interviewee (i2) changes something to the goal of the validation capabilities. He adds: ‘create commitment of external stakeholders to the goal of the validation’.

Change 3 is rejected, because it is strange to ask for commitment of external stakeholders. Why should they have to give commitment to a release? They do not have to build it. The only thing they want to do with it is using it. Change 2 is rejected, because a majority does add LIT.11 to the focus area. Drawing a conclusion on how to add it to this focus area based on majority is not possible plus none of the interviewees gives any reason on why they processed it as a combination capability or as a new capability. Therefore, a decision is made based on the fact that one interviewee (change 2) is not convinced about the relevance of this candidate change. LIT.11 is therefore placed as a new capability NEW.12 External validation on a higher maturity level than the current capability CAP.24.

*Result:*

$CAP.24 = CAP.24$

$LIT.11 = NEW.12$

### Business case

The current capability CAP.26 looks like this:

<b>CAP.26</b>	c.	Business Case	Action: A business case (including the ROI) is being written before the software is realized.
			Goal: Verify real world viability of release.

The following changes are performed by the interviewees:

- 1) one interviewee (i4) changes the content of capability CAP.26. He says the business case should not only be written for the software, surrounding products and services need to be considered as well;
- 2) four interviewees (i1, i2, i3 and i7) say capability CAP.26 is not relevant at this specific focus area. Business value needs to be determined on requirement level in a previous focus area (i.e. Requirement prioritization). In that way, all things which are part of the release inherently have value;
- 3) five interviewees (i4-i6, i9 and i10) do not think it needs to be moved to another focus area.

Change 1 is rejected, because the goal of this focus area is to validate a release definition not all surrounding products and services. Change 2 is rejected, because a majority of five interviewees (i4-i6, i9 and i10) do not change anything to the content and/or the focus area it is placed in.

*Result:*

*CAP.26 = CAP.26*

### Focus area

The interview analysis results in the following changed focus area (see Table 20). This focus area consists of the resulting evaluated, changed and new capabilities plus a title and description of the focus area. The title remains the same as in the current focus area. The description is expanded; from now on the release definition is validated by external parties as well (i.e. focus area change FOC.13).

Table 20 changed focus area Release definition validation.

#			
<b>FOC.13</b>	Release definition validation	The 'Release definition validation' is performed before the release is built by the development department. It focuses on the validation of the release definition by internal and external parties.	
<b>CAP.24</b>	a.	Internal validation	Action: The release definition is checked by internal stakeholders, before the software is realized.
			Goal: Increase quality of releases, generate awareness among internal stakeholders.
<b>NEW.12</b>	b.	External validation	Action: The release definition is checked by external stakeholders, before the software is realized.
			Goal: Better alignment of releases with externally created software, increase quality of releases, and generate awareness among external stakeholders.
<b>CAP.25</b>	c.	Formal approval	Action: Approval standards are determined and verified by the board before the software is realized (turned over to development).
			Goal: Increase release quality, change internal acceptance.
<b>CAP.26</b>	d.	Business Case	Action: A business case (including the ROI) is being written before the software is realized.
			Goal: Verify real world viability of release.

### 5.2.7 Scope change management

As described in Appendix C the original focus area Scope change management consists of four capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Event notification, Milestone monitoring, Impact analysis and Scope change handling. As described in section 4.3 there are no candidate changes proposed by the interviewer. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Release planning. The analysis on capabilities CAP.27 Event notification and CAP.29 Impact analysis are not described, simply because none of the interviewees changed anything to these capabilities.

### Milestone monitoring

The current capability CAP.28 looks like this:

<b>CAP.28</b>	b.	Milestone monitoring	Action: Key dates and checkpoints are monitored in the product delivery.
			Goal: Create more insight into the development process by introducing milestones.

The following changes are performed by the interviewees:

- 1) two interviewees (i2 and i6) think capability CAP.28 is not relevant for SPM;
  - a) interviewee i2 thinks it is part of the chosen development method;
  - b) interviewee i6 thinks it is part of expectation management;
- 2) seven interviewees (i1, i3-i5, i7, i9 and i10) do not change anything to the content of capability CAP.28.

Thus, a majority does not change anything to capability CAP.28.

*Result:*

$$CAP.28 = CAP.28$$

### Scope change handling

The current capability CAP.30 looks like this:

CAP.30	d.	Scope change handling	Action: A process is in place to develop alternative plans, with all relevant stakeholders, to react to the effects of the scope change.
			Goal: Minimize effects of scope change.

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything to the content of capability CAP.30;
- 2) one interviewee (i2) expands CAP.30. He thinks Scope change handling is more complex and includes more tasks in a SECO.

Change 2 is rejected, because no other interviewee suggests it. Thus, the current capability CAP.30 does not change.

*Result:*

$$CAP.30 = CAP.30$$

### Focus area

The interview analysis results in an evaluated focus area; i.e. nothing is changed. No changed or new capabilities are needed to make this focus area SECO proof. The title and description of this focus area remains the same as well.

#### 5.2.8 Release build validation

As described in Appendix C the original focus area Release build validation consist of three capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Internal validation, External validation and Certification. As described in section 4.3 the following candidate change is proposed by the interviewer: LIT.17 on certifying niche solutions. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Release planning.

## Validation

The current capabilities CAP.31 and CAP.32 look like this:

<b>CAP.31</b>	a.	Internal validation	Action: Internal stakeholders (consultants, etc.) perform a functional validation of the build release to verify that it meets the expected outcome.
			Goal: Change product quality.
<b>CAP.32</b>	b.	External validation	Action: The build is validated by external parties (customers, partners) to verify the builds quality (e.g. by settings up a pilot).
			Goal: Change product quality.

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything to the content of capabilities CAP.31 and CAP.32;
- 2) one interviewee i3 combines Internal and External validation;
  - a) interviewee i3 also adds an Alpha and Beta releases to its description.

Change 2 is rejected, because none of the other interviewees suggests it. Change 2.a is also rejected, because it is already part of the description in the 'setting up a pilot' part. Thus, a majority does not change anything to the capabilities CAP.31 and CAP.32.

*Result:*

*CAP.31 = CAP.31*

*CAP.32 = CAP.32*

## Certification

The current capability CAP.33 looks like this:

<b>CAP.33</b>	c.	Certification	Action: Certification by an independent external party is acquired for the release.
			Goal: Change product quality, get independent confirmation of product quality to prove the quality of your product.

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything to the content of capability CAP.33;
- 2) one interviewee (i6) thinks capability CAP.33 is not relevant.

Thus, a majority does not change anything to capability CAP.33.

*Result:*

*CAP.33 = CAP.33*

## New capabilities

The interviewer presented candidate change LIT.17:

<b>LIT.17</b>	Release build validation	Certify niche solutions based on standard quality rules to change the quality of the niche solutions.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) eight interviewees add candidate change LIT.17 on certifying external components to this model;
  - a) two of them (i2 and i7) add it as a new capability to this focus area;
  - b) one of them (i11) adds it as a new capability to the Core asset roadmapping focus area;
  - c) the five others (i3, i5, i6, i9 and i10) add it as a new capability to the Partnering & contracting focus area. They say the Release build validation focus area is only targeted at internally created releases. Certifying releases of external created components or solutions is more related to managing partner relationships than to new releases of the keystone its product;
- 2) one interviewee (i9) proposes a new capability. He says it is important to define a validation plan on how the validation is performed;
- 3) one interviewee (i1) is left out of this analysis, because he does not have any experience with it and could not give any suggestions on this topic.

Thus, a majority (change 1.c) adds candidate change LIT.17 as a new capability NEW.14 to the Partnering & Contracting focus area. Whether and where change 2 is processed is determined by means of the questionnaire as interviewee change INT.5, because defining a validation plan can be very important to conduct an accurate validation.

*Result:*

*LIT.17 = NEW.14*

*INT.5 = ?*

### **Focus area**

The interview analysis results in an evaluated focus area; i.e. nothing is changed. At this point, no changed or new capabilities are needed to make it SECO proof. The title and description of it area remains the same as well. The only question that remains is whether a new capability with regard to a validation plan (i.e. change INT.5) needs to be added. Whether and where it is added is determined by means of the questionnaire.

### **5.2.9 Launch preparation**

As described in Appendix C the original focus area Launch preparation consist of six capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Internal communication, Formal approval, External communication, Training, Launch impact analysis and Sales & marketing support. As described in section 4.3 there are no candidate changes proposed by the interviewer. As explained in section 5.1 only interviewee i1 up to and including i7, i9 and i10 have been interviewed on this focus area because it is part of the business function Release planning. The analysis on capability CAP.35 Formal approval is not described, simply because none of the interviewees changed anything to this capability.

## Communication

The current capabilities CAP.34 and CAP.36 look like this:

CAP.34	a.	Internal communication	Action: Information about the upcoming new release is communicated to the internal stakeholders. This information contains a description of the most important changed and added features, the estimated release date, possible costs involved, information about how the new release can be obtained, possible training dates, etc.
			Goal: Inform all internal parties involved of the upcoming release.
CAP.36	c.	External communication	Action: Information about the upcoming new release is communicated to the external stakeholders. This information contains a description of the most important changed and added features, the estimated release date, possible costs involved, information about how the new release can be obtained, possible training dates, etc.
			Goal: Inform all external parties involved of the upcoming release.

The following changes are performed by the interviewees:

- 1) two interviewees (i3 and i6) combine capability CAP.34 Internal communication and CAP.36 External communication, because they think both types of communication are of the same maturity level;
- 2) seven interviewees do not change anything to the content of both capabilities;
- 3) one interviewee (i7) adds a Partner communication capability to this focus area. He thinks partners are more important than the other external stakeholders.

Change 1 and 3 of interviewees i3, i6 and i7 are rejected, because they are the only one which perform these changes. Thus, a majority does not change anything to the capabilities CAP.34 and CAP.36.

*Result:*

$$CAP.34 = CAP.34$$

$$CAP.36 = CAP.36$$

## Training

The current capability CAP.37 looks like this:

CAP.37	d.	Training	Action: Trainings are organized and documentation is updated for both internal parties (e.g. service desk, consultants) and external parties (e.g. customers, partner companies) to help educate them in the new release.
			Goal: Ensure a smooth transition to the new version, enable optimal use of the new version.

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything to the content of capability CAP.37;
- 2) one interviewee (i3) makes a combination of it with capability CAP.39 Sales & Marketing support capability. He thinks it is all the same and should therefore be placed on the same maturity level.

Change 2 is rejected, because none of the other interviewees have made a similar suggestion. Thus, a majority does not change anything to capability CAP.37.

*Result:*

*CAP.37 = CAP.37*

### Launch impact analysis

The current capability CAP.38 looks like this:

<b>CAP.38</b>	e.	Launch impact analysis	Action: Determine how much time it is going to take to implement the new release at the individual customers, and what type of experts are needed to perform the implementation (e.g. database experts).
			Goal: Ensure a smooth transition to the new version (on time, without problems).

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything to the content of capability CAP.38;
  - a) one of them (i7) moves the complete capability the focus area Release definition;
- 2) one interviewee (i1) moves a part of it to the focus area Release definition.

Change 1.a and 2 are rejected, because a majority does not change anything in this sense. Thus, a majority does not change anything to capability CAP.38.

*Result:*

*CAP.38 = CAP.38*

### Sales & marketing support

The current capability CAP.39 looks like this:

<b>CAP.39</b>	f.	Sales & Marketing support	Action: Create a checklist of all external expression of the product (e.g. fact sheets, demo's, presentations) that may need to be updated by changes made in latest release of the product. These items must be checked, and possible updated before they are available to external parties (e.g. customers, partners).
			Goal: Ensure external corporate expressions are correct.

The following changes are performed by the interviewees:

- 1) seven interviewees do not change anything to the content of capability CAP.39;
  - a) two of them (i1 and i4) even think it is pre-conditional for creating software, but this does not lead to changes;
- 2) the two remaining interviewees (i3 and i6) expand capability CAP.39;
  - a) by adding the CAP.37 Training capability to it (i3);
  - b) by adding an extra department to the title (i6).

Change 2.a of interviewee i3 is already rejected in the capability CAP.37 Training analysis. Change 2.b of interviewee i6 may be an interesting one; he adds the software support department to capability CAP.39. When a new release is launched this department can expect a lot of questions. To determine whether it needs to be added is determined by means of the questionnaire as interviewee change INT.6. Thus at this point, a majority does not change anything to this capability.

*Result:*

$CAP.39 \cup INT.6 = ?$

### New capabilities

The following changes are performed by the interviewees:

- 1) one interviewee (i2) proposes a new capability with regard to performing a pre-release during launch preparation;
- 2) one interviewee (i4) proposes a capability on executing a risk impact analysis on what risks exist during the launch and what their impact could be.

Change 1 is rejected, because a similar capability already exists in the Release build validation focus area (i.e. CAP.32 External validation). If, how and where change 2 is added to the model and matrix is determined by means of the questionnaire as interviewee change INT.7. Determining whether risks exist and what the impacts of risks are can be very important to be able to set proper countermeasures.

*Result:*

$INT.7 = ?$

### Focus area

The interview analysis results in an evaluated focus area; i.e. nothing is changed. At this point, no changed or new capabilities are needed to make this focus area SECO proof. The title and description of this focus area remains the same as well. The only questions that remain are whether the current capability CAP.39 needs to be expanded with the software support department (i.e. interviewee change INT.6) and whether a new capability with regard to a risk impact analysis needs to be added (i.e. interviewee change INT.7). Whether and where these changes are added is determined by means of the questionnaire.

#### 5.2.10 Roadmap intelligence

As described in Appendix C the original focus area Roadmap intelligence consist of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Product analysis, Society trends, Technology trends, Competition trends and Partner roadmap. As described in section 4.3 the following candidate change is proposed by the interviewer: LIT.12 on making the partner roadmap more important. As explained in section 5.1 only interviewee i1 up to and including i3, i5, i7 up to and including i11 have been interviewed on this focus area because it is part of the business function Product planning.

### Product analysis

The current capability CAP.40 looks like this:

CAP.40	a.	Product analysis	Action: The organization's products are analyzed to determine the product's strong and weak points on both functional and technical aspects. Relevant stakeholders, such as the development department for the technical part, are involved in this analysis.
			Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.



The following changes are performed by the interviewees:

- 1) eight of nine interviewees do not change anything to the content of capability CAP.40;
- 2) one interviewee (i10) combines it with capability CAP.44 Partner roadmap.

Change 2 is only suggested by one interviewee and its combination is analyzed and rejected further on (in the CAP.44 Partner roadmap analysis) as well. Thus, capability CAP.40 remains the same.

*Result:*

$$CAP.40 = CAP.40$$

## Trends

The current capabilities CAP.41, CAP.42 and CAP.43 look like this:

<b>CAP.41</b>	b.	Society trends	Action: An overview is created showing the big picture of important trends in society in the coming years. This picture contains a general view and a view specific for your products industry.
			Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
<b>CAP.42</b>	c.	Technology trends	Action: An overview is created showing the big picture of important developments in terms of technology in the coming years. This picture contains a general view and a view specific for your products industry.
			Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by current and up-and-coming technologies.
<b>CAP.43</b>	d.	Competition trends	Action: An overview is created showing what competing products are doing in terms of their product development in the coming years. The general developments trends among your competitors are shown, and the developments of the most important competing products are depicted with special attention.
			Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by your partners.

The following changes are performed by the interviewees:

- 1) seven interviewees (i1, i2, i5, i7, i8, i10 and i11) want keep these three capabilities exist as loose capabilities;
  - a) one of them (i1) combines capability CAP.44 Partner roadmap with CAP.43 Competition trends;
- 2) one interviewee (i3) thinks that capabilities in which these trends are considered need to be placed on the same maturity level and he combines the three capabilities into one capability;
- 3) one interviewee (i9) combines capability CAP.41 Society trends and CAP.42 Technology trends, because he thinks these trends are not relevant.

Change 1.a is analyzed and rejected further on. Change 2 and 3 are rejected, because a majority (change 1) does not combine them. Thus, a majority does not change anything to the content of the capabilities CAP.41, CAP.42 and CAP.43.

*Result:*

$CAP.41 = CAP.41$

$CAP.42 = CAP.42$

$CAP.43 = CAP.43$

## Partner roadmap

The current capability CAP.44 looks like this:

CAP.44	e.	Partner roadmap	Action: An overview is created showing what your partners will be developing the coming period. Examples of partner products are operating systems, development environments, database, etc. The overview shows what will be happening with the core platform software as well as what the partner organization will be delivering in terms of their own products and development tools that your organization can or will need to use to support the partner products/components.
			Goal: Show how your organization responds to developments of partner products and which your own products rely.

Plus, the interviewer presented candidate change LIT.12:

LIT.12	Roadmap intelligence	Make the partner (i.e. niche player) roadmap a more important source for roadmap intelligence.	Moving capability e. Partner roadmap to a lower maturity level.
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The following changes are performed by the interviewees:

- 1) one interviewee (i2) does not change anything to capability CAP.44;
- 2) one interviewee (i9) removes it from the model and matrix, because he thinks it is not important. The keystone will lead and the partners have to follow;
- 3) two interviewees (i1 and i10) combine capability CAP.44 with another capability;
  - a) one interviewee (i1) combines it with capability CAP.43 Competition trends;
  - b) one interviewee (i10) combines it with capability CAP.40 Product analysis;
- 4) five interviewees (i3, i5, i7, i8 and i11) process candidate change LIT.12.

Change 2 is rejected, because he is the only interviewee who wants to remove it from this focus area. Change 3.a and 3.b are both rejected, because both interviewees want to combine it with two different capabilities and nobody else makes the same suggestion. Thus, a majority (change 4) does not change anything to the content of capability CAP.44 and a majority lowers its maturity level (i.e. candidate change LIT.12). To which maturity level is determined in Appendix D.

*Result:*

$CAP.44 \cup LIT.12 = CHA.15$

## Legislation

The following changes are performed by the interviewees:

- 1) three interviewees (i1, i8 and i11) perform a change in which changes in legislation is tracked (i.e. interviewee change INT.8);

- a) one of them (i1) adds it to the External stakeholders involvement capability in the focus area Requirements gathering;
- b) the other two (i8 and i11) add it as a new capability in this focus area.

Whether and where change 1.a or 1.b is added to the model and matrix is determined by means of the questionnaire as interviewee change INT.8, because being compliant with legislation can be essential for the success of the SECO.

*Result:*

*INT.8 = ?*

### Focus area

The interview analysis results in a changed focus area (see Table 26 on page 119). It consists of the resulting evaluated and changed capabilities. At this point, no new capabilities are needed to make it area SECO proof. The title and description of it remains the same. The only question that remains is whether a new capability with regard to tracking changing legislation (i.e. INT.8) needs to be added. Whether and where this capability is added is determined by means of the questionnaire.

#### 5.2.11 Core asset roadmapping

As described in Appendix C the original focus area Core asset roadmapping consist of four capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Centralized registration, Core asset identification, Make or buy decision and Core asset roadmap construction. As described in section 4.3 the following candidate change is proposed by the interviewer: LIT.3 on identifying SECO core assets as well. As explained in section 5.1 only interviewee i1 up to and including i3, i5, i7 up to and including i11 have been interviewed on this focus area because it is part of the business function Product planning. The analysis on capability CAP.48 Core asset roadmap construction is not described, simply because none of the interviewees changed anything to this capability.

#### Centralized registration

The current capability CAP.45 looks like this:

CAP.45	a.	Centralized registration	Action: All core assets are registered in a standardized manner, and are stored in a central location.
			Goal: Enable the reuse of components.

The following changes are performed by the interviewees:

- 1) eight interviewees do not change anything capability CAP.45;
- 2) one interviewee i11 adds mapping dependencies between core assets to it. He says it should be leading in how to handle core assets.

Change 2 is rejected, because he is the only one who suggests it and his motivation is not convincing enough. Thus, a majority does not change anything to capability CAP.45.

*Result:*

*CAP.45 = CAP.45*

### Core asset identification

The current capability CAP.46 looks like this:

<b>CAP.46</b>	b.	Core asset identification	Action: Common components/functionality (core assets) is systematically identified among the organizations products and deliverables surrounding the product.
			Goal: Increase and simplify the reuse and maintenance of components.

Plus, the interviewer presented candidate change LIT.3:

<b>LIT.3</b>	Core asset roadmapping	Common components/functionality (core assets) is systematically identified among the ecosystem's products and deliverables surrounding these products.	Expand capability b. Core asset identification with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) all interviewees add candidate change LIT.3 to the model and matrix;
  - a) five interviewees (i1-i3, i8 and i10) add it to the current capability CAP.46 Core asset identification;
  - b) three interviewees (i5, i7 and i10) place it as a new loose capability in this focus area;
  - c) one interviewee (i9) places it at another focus area but he does not indicate at which one.

Thus, a majority (change 1.a.) is in favor of improving the current capability CAP.46 Core asset identification capability to a changed capability CHA.16 in which SECO core assets are identified.

*Result:*

$$CAP.46 \cup LIT.3 = CHA.16$$

### Make or buy decision

The current capability CAP.47 looks like this:

<b>CAP.47</b>	c.	Make or buy decision	Action: A process is in place to actively investigate make-or-buy decisions: external sources are investigated based on ROI in the search for core asset acquisition: partners, outsourcing or subcontracting of development.
			Goal: Cost and time savings by using external parties.

The following changes are performed by the interviewees:

- 1) six interviewees (i1, i3, i5, i7, i9 and i11) do not change anything to the content of capability CAP.47;
- 2) one interviewee (i8) removes it, because it does not belong to this focus area in his view;
- 3) two interviewees (i2 and i10) add a co-creation decision to it, because they think it is very relevant decision to make in a SECO.

Whether change 2 is added is determined by means of the questionnaire as interviewee change INT.9, because deciding whether or not functionality is co-created with partners can be very relevant when taking a directed SECO approach. Thus at this point, a majority does not change anything to capability CAP.47.

*Result:*

$CAP.47 \cup INT.9 = ?$

### **New capability**

The following change is performed by an interviewee:

- 1) one interviewee (i8) adds some sort of a software operation knowledge capability to this focus area, to determine who uses what core asset and when.

Whether and where change 1 needs to be added is determined by means of the questionnaire as interviewee change INT.10, because it can be very important information for making decision on whether core assets are updated, enhanced or removed.

*Result:*

$INT.10 = ?$

### **Focus area**

The interview analysis results in a changed focus area (see Table 27 on page 120). It consists of the resulting evaluated and changed capabilities. No new capabilities are needed to make it SECO proof. The title of it area remains the same. The scope of the description is expanded to all products in the SECO; i.e. focus area change FOC.17. The only question that remains is whether two additions with regard to co-creation decisions (i.e. change INT.9) and core asset usage (i.e. change INT.10) need to be added. Whether and where both changes are added is determined by means of the questionnaire.

#### **5.2.12 Product roadmapping**

As described in Appendix C the original focus area Product roadmapping consist of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Short-term roadmap, Theme identification, Internal consultation, Long-term roadmap and External variants. As described in section 4.3 the following candidate changes are proposed by the interviewer: LIT.13 on identifying themes for and with external stakeholders, LIT.14 on consulting external stakeholders as well and LIT.15 on defining a decision procedure. As explained in section 5.1 only interviewee i1 up to and including i3, i5, i7 up to and including i11 have been interviewed on it because it is part of the business function Product planning. The analysis on capabilities CAP.49 Short term roadmap and CAP.53 External variants are not described, simply because none of the interviewees changed anything to both capabilities.

## Theme identification

The current capability CAP.50 looks like this:

<b>CAP.50</b>	b.	Theme identification	Action: Release themes are identified and maintained. Themes are decided on together with the internal stakeholders. Identification of the themes results in a list of release themes that are stored centrally, so that requirements, core assets, market trends etc. can be linked to it.
			Goal: Structuring of releases and roadmaps: themes are used give a clear direction to the roadmap and later on to structure the requirements.

Plus, the interviewer presented candidate change LIT.13:

<b>LIT.13</b>	Product roadmapping	Identify themes for internal and external creation with partners. Store these themes at the same place as the themes identified in capability b. Theme identification.	Expand capability b. Theme identification with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) seven interviewees (i1-i3, i7, i8, i10 and i11) add candidate change LIT.13 to capability CAP.50;
- 2) one interviewee (i9) says they already identify themes for external creation, however without involving the external stakeholders. He adds it in a slightly different form to this capability;
- 3) one interviewee (i5) adds it as a new loose capability;
- 4) one interviewee (i2) combines capability CAP.50 and the following capability CAP.51 Internal consultation;
- 5) one interviewee (i8) thinks capability CAP.50 should be part of an earlier focus area. Namely, the Roadmap intelligence focus area.

Change 4 and 5 are rejected, because both changes are only proposed by one interviewee. Thus, a majority adds candidate change LIT.13 to capability CAP.50. It is expanded with theme identification for external creation with external stakeholders (i.e. changed capability CHA.18).

*Result:*

$$CAP.50 \cup LIT.13 = CHA.18$$

## Consultation

The current capability CAP.51 looks like this:

<b>CAP.51</b>	c.	Internal consultation	Action: Product roadmaps are created in consultation with all relevant internal stakeholders.
			Goal: Organization wide acceptance of the product roadmap. Optimal use of all knowledge in the organization to create more rich and realistic product roadmaps

Plus, the interviewer presented candidate change LIT.14:

<b>LIT.14</b>	Product roadmapping	Product roadmaps are created in consultation with all relevant partners (i.e. niche players).	Expand capability c. Internal consultation with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) five interviewees (i1-i3, i8 and i10) expand the current capability CAP.51 Internal consultation to a capability in which external stakeholders are consulted as well (i.e. they add candidate change LIT.14);
- 2) three interviewees (i5, i7 and i11) process candidate change LIT.14 by adding it as a new loose capability on External consultation;
- 3) one interviewee (i9) does not add candidate change LIT.14. In his organization' approach they do not consider external stakeholders much. He says the keystone gives direction and the partners simply have to follow.

Thus, a majority (change 1 and 2) consults external stakeholders as well (i.e. candidate change LIT.14) and five of them combine it with the current capability CAP.51 Internal consultation. It results in the changed capability CHA.19.

*Result:*

$$CAP.51 \cup LIT.14 = CHA.19$$

### Long-term roadmap

The current capability CAP.52 looks like this:

<b>CAP.52</b>	d.	Long-term roadmap	Action: The roadmap spans a time period of at least four years.
			Goal: Development of a long-term vision of the product(s).

The following changes are performed by the interviewees:

- 1) four interviewees (i1, i2, i5 and i8) do not change anything to capability CAP.52;
- 2) four interviewees (i3, i7, i10 and i11) have serious doubts about whether the time span is correct;
- 3) one interviewee (i9) even thinks capability CAP.52 is not relevant anymore.

With regard to change 2, to be able to draw a conclusion the interviewees are asked to determine the time span of a long-term roadmap by means of the questionnaire as interviewee change INT.11. At this moment CAP.52 remains the same because a majority does not change the same.

*Result:*

$$CAP.52 \cup INT.11 = ?$$

### Roadmap procedure

The interviewer presented candidate change LIT.15:

<b>LIT.15</b>	Product roadmapping	Define a decision procedure for when roadmap designers and partners (i.e. niche players) cannot reach consensus. Inform partners about this decision procedure when forming relationships with them.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) seven interviewees (i1-i3, i5, i7, i10 and i11) think candidate change LIT.15 should be added to the model and matrix;
  - a) five of them (i1, i5, i7, i10 and i11) place it in this focus area;

- b) two of them (i2 and i3) place it in de Partner & Contracting focus area;
- 2) two interviewees (i8 and i9) do not add candidate change LIT.15. They think every relevant information is already known assessed on it relevance; a decision procedure would be superfluous.

Thus, a majority adds candidate change LIT.15 as a new capability NEW.20 and places it in this focus area.

*Result:*

*LIT.15 = NEW.20*

### **New capability**

The following change is performed by an interviewee:

- 1) one interviewee i5 proposes a new capability in which the roadmap is validated by the board.

Whether and where change 2 should be added to this focus area is determined by means of the questionnaire as interviewee change INT.12, because in the roadmap future plans are defined and it can be very important to validate it by the board.

*Result:*

*INT.12 = ?*

### **Focus area**

The interview analysis results in an evaluated and changed focus area (see Table 28 on page 122). At this point, it consists of the evaluated, changed and new capabilities. The title and description of the focus area remains the same. The only question that remains is whether the change with regard to the time span of the roadmap (i.e. change INT.11) and the addition with regard to the roadmap validation (i.e. change INT.12) need to be processed. Whether and where these changes are added is determined by means of the questionnaire.

#### **5.2.13 Market analysis**

As described in Appendix C the original focus area Market analysis consist of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Market trend identification, Market strategy, Customer win/loss analysis, Competitor analysis and Custom market trend identification. As described in section 4.3 there are no candidate changes proposed by the interviewer. As explained in section 5.1 only interviewee i2, i3, i5, i7 up to and including i11 have been interviewed on this focus area because it is part of the business function Portfolio management.



## Market trend identification

The current capability CAP.54 looks like this:

CAP.54	a.	Market trend identification	Action: There is an active search for market opportunities to either expand existing products to, or create new products for. This search exists of doing market research in markets related to or similar to your organizations markets, visiting conferences, listening to customers, etc. All search findings are documented.
			Goal: Widen your product base.

The following changes are performed by the interviewees:

- 1) two interviewees (i3 and i10) change capability CAP.54;
  - a) one interviewee (i3) splits it up into a capability that looks for opportunities and in a capability on reporting the opportunities;
  - b) one interviewee (i10) adds the gathering of information from partners. In this way organizations can make use of the knowledge of the partners;
- 2) the remaining interviewees do not change anything.

Change 1.a of interviewee i3 is rejected, because none of the other interviewees change it. Change 1.b of interviewee i10 is accepted, because it is just a minor addition to the search examples and it is a relevant addition for SPfM (i.e. interviewee change INT.20). Thus, capability CAP.54 is kept in a slightly different form; i.e. changed capability CHA.21.

*Result:*

$$CAP.54 \cup INT.20 = CHA.21$$

## Market strategy

The current capability CAP.55 looks like this:

CAP.55	b.	Market strategy	Action: A plan is created showing which markets your product will be going after and how you plan to develop the products for each segment. Eg., in year one you may want to enter healthcare by partnering with another company. Or you may want to enter the financial market in year two by building products in-house or acquiring products.
			Goal: Plan which markets you will target and how you will enter them.

The following change is performed by an interviewee:

- 1) one interviewee i10 adds 'searching for markets opportunities via partners' to capability CAP.55, because in SECOs (niche) markets are reached by using partners;
- 2) the remaining interviewees do not change anything.

Whether change 1 is processed is determined by means of the questionnaire as interviewee change INT.13, because it can be a relevant change for keystones that take a directed SECO approach. Thus, at this point a majority does not change anything to the content of CAP.55.

*Result:*

$$CAP.55 \cup INT.13 = ?$$

## Customer win/loss analysis

The current capability CAP.56 looks like this:

CAP.56	c.	Customer win/loss analysis	Action: A win/loss analysis is performed to research why customers chose or did not choose to buy your organizations products. This capability looks further than just the product features, e.g. the sales process is reviewed.
			Goal: Learn about your customers/prospects, to generate more future customers by tuning product development to them.

The following change is performed by the interviewees:

- 1) two interviewees (i3 and i10) broaden the scope of the customer win/loss analysis to the SECO;
- 2) the remaining interviewees do not change anything.

Whether change 1 is added is determined by means of the questionnaire as interviewee change INT.14, because it can be a relevant change for keystones that take a SECO approach. Thus, at this point a majority does not change anything to the content of capability CAP.56.

*Result:*

$$CAP.56 \cup INT.14 = ?$$

## Competitor analysis

The current capability CAP.57 looks like this:

CAP.57	d.	Competitor analysis	Action: A competitor analysis is performed on an organizational level to analyze what competitors offer, what their strengths are and are going to offer compared to your organizations.
			Goal: Learn from competitors and do not fall behind product-wise.

The following change is performed by an interviewee:

- 1) one interviewee (i10) broadens the scope of capability CAP.57 to all ecosystem' competitors.

Whether change 1 is processed is determined by means of the questionnaire as interviewee change INT.15, because it can be a relevant change for keystones that take a SECO approach. Thus, at this point a majority does not change anything to the content of capability CAP.57.

*Result:*

$$CAP.57 \cup INT.15 = ?$$

## Custom market trend identification

The current capability CAP.58 looks like this:

CAP.58	e.	Custom market trend identification	Action: External market research parties are used to perform a market analysis specifically for the organizations product portfolio.
			Goal: Gain unique information (that your competition does not have) specific to your own organization. Gain an unbiased insight into your market and/or operations.

The following change is performed by an interviewee:

- 1) one interviewee (i10) broadens the scope of this analysis to the ecosystem' product portfolio.

Whether change 1 is processed is determined by means of the questionnaire as interviewee change INT.16, because it can be a relevant change for keystones that take a directed SECO approach. Thus, at this point a majority does not change anything to the content of capability CAP.58.

*Result:*

$$CAP.58 \cup INT.16 = ?$$

## New capabilities

The following changes are performed by the interviewees:

- 1) one interviewee (i2) adds a capability to determine the current market position of the products, by using techniques such as SWOT and the Six forces model;
- 2) one interviewee (i9) adds a capability with regard to non-functional market demands. Non-functional market demands are requirements for the organization that need to be met to be able to be successful in a specific market. The interviewee gives an example, if a software company wants to do serious business in Germany it needs to have SAP certification. Even if the product manager only certifies its shoe, in a manner of, it is good enough.

Change 1 is rejected, because beside that he is the only one that adds it; it is already covered by another capability. Namely, by the Product analysis capability in the Roadmap intelligence focus area. Whether change 2 is added is determined by means of the questionnaire as interviewee change INT.17, because it can be a determining factor in the success of reaching certain market segments.

## Focus area

The interview analysis results in the following evaluated and changed focus area (see Table 29 on page 123). It consists of the evaluated and changed capabilities. The title and description of it remains the same. The only questions that remain is whether the scopes of multiple capabilities needs to be broaden to the SECO (i.e. interviewee change INT.13 up to and including INT.16) and whether a capability on non-functional market demands needs to be added (i.e. interviewee change INT.17). Whether and where these changes are added is determined by means of the questionnaire.

### 5.2.14 Partnering & contracting

As described in Appendix C the original focus area Partnering & contracting consist of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Service level agreements, Intellectual property management, Investigate distribution channels, Establish and evaluate pricing models and Monitored partner network. As described in section 4.3 the following candidate changes are proposed by the interviewer: LIT.4 on information profiles for partners, LIT.5 on standard templates for information, LIT.18 on certifying partners, LIT.19 on clustering partners, LIT.20 on a contract negotiation process, LIT.21 on coordinating partner(s) (alliances), LIT.22 on registering partners in a central database, LIT.23 on partner analysis and LIT.27 on creating a common delivery channel. As explained in section 5.1 only interviewee i2, i3, i5, i7 up to and including i11 have been interviewed on this focus area, because it is part of the business function Portfolio management. During this focus area the interviewees are not asked to determine the maturity levels of each capability. In advance is estimated that this focus area will be heavily expanded, seen the number of candidate changes found. The objective of this part (i.e. this focus area) of the interview is to determine which capability and candidate changes should become part of the model. After it is determined the interviewees are asked to give two or more distinctive categories (i.e. new focus areas) in which the (new) capabilities can be positioned. Because, the current focus area probably cannot consist of all (new) capabilities. Based on their suggestion two or more new focus area are devised that contain all (new) capabilities. These new focus areas are presented to the interviewees via the questionnaire to let them determine the maturity levels afterwards.

#### Service level agreements

The current capability CAP.59 looks like this:

CAP.59	a.	Service level agreements	Action: (Standard) service level agreements (SLA's) are set up for customers.
			Goal: Manage customer expectations.

The following changes are performed by the interviewees:

- 1) one interviewee (i2) thinks capability CAP.59 and two other capabilities (i.e. CAP.60 Intellectual property management and CAP.62 Establish and evaluate pricing model) are covered by candidate change LIT.20 on a contract negotiation process;
- 2) four interviewees (i2, i7, i8 and i10) expand the description of capability CAP.59 to partners as well.

Change 1 is rejected, because no other interviewees suggest the same and interviewee (i10) even explicitly rejects it. Change 2 is added (i.e. interviewee change INT.21), even though four interviewees is only halve of the interviewees, because it is a very relevant addition for SECOs and they made the same suggestion completely independent of each other (it is not suggested by the interviewer). Thus, it results in an expanded capability CAP.59.

*Result:*

$$CAP.59 \cup INT.21 = CHA.22$$

## Intellectual property management

The current capability CAP.60 looks like this:

CAP.60	b.	Intellectual property management	Action: Measures are in place to protect the intellectual property of the own organization, and to manage the used intellectual property from other organizations.
			Goal: Protection of the organizations intellectual property, and prevention of problems due to misuse of the intellectual property of other organizations.

As mentioned in the previous analysis, the suggestion of interviewee i2 with regard to combining capability CAP.60 with two others is rejected. None of the other interviewees changed anything to it. Thus, the content of it remains the same.

*Result:*

$$CAP.60 = CAP.60$$

## Investigate distribution channels

The current capability CAP.61 looks like this:

CAP.61	c.	Investigate distribution channels	Action: A process is in place to periodically verify the current distribution channels, and identify alternative distribution channels.
			Goal: Change sales process.

The following changes are performed by the interviewees:

- 1) two interviewees (i3 and i5) indicate that they think capability CAP.61 should be placed under another focus area, namely Market analysis;
- 2) one interviewee (i7) splits it up in an Investigate keystone distribution channels and an Investigate partner distribution channels capability;
- 3) one interviewee (i10) adds 'include partnering opportunities';
- 4) four interviewees do not change anything.

Change 1 is rejected, because they are the only two interviewees who change it. Change 2 is rejected, because the other interviewees do not change it which implies that they think the current capability does both things and does need to be split in two loose capabilities. Change 3 is rejected, because no other interviewee suggests it. Thus, seen that all changes are rejected nothing is changed to the content of capability CAP.61.

*Result:*

$$CAP.61 = CAP.61$$

## Establish and evaluate pricing model

The current capability CAP.62 looks like this:

CAP.62	d.	Establish and evaluate pricing model	Action: A process is in place to establish the pricing model and periodically verify whether it still fits the market.
			Goal: Change sales process.

As mentioned in the analysis on capability CAP.59 Service level agreements, the suggestion of interviewee i2 with regard to combining capability CAP.62 with two others is rejected. The following change is also performed by an interviewee:

1) one interviewee (i8) changes the content of CAP.62. He expands the description with establishing the pricing model with regard to partners.

Change 1 is rejected, because he is the only one who suggests it and the current capability already covers it. Thus, the content of this capability CAP.62 remains the same.

*Result:*

$$CAP.62 = CAP.62$$

### Monitored partner network

The current capability CAP.63 looks like this:

<b>CAP.63</b>	e.	Monitored partner network	Action: A partner network and/or partner portals are used to regulate partnering. Key performance indicators are set up to monitor the performance of partners on a regular basis.
			Goal: Set up partner networks to gain synergetic advantages.

Plus, the interviewer presented candidate change LIT.23:

<b>LIT.23</b>	Partnering & contracting	Partners are analyzed on what they offer, what their strengths and weaknesses are and what they are going to offer in addition to the organization. This can be done in various ways. For example, the product manager can make use of partner score cards to simplify the measurement of the performance of each partner.	Expand capability e. Monitored partner network with this candidate change and split this expanded capability in a partner network/portal part and a partner analysis part.
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The following changes are performed by the interviewees:

- 1) all interviewees want to process candidate change LIT.23. The interviewer suggested during the interview to divide the combination of capability CAP.63 and candidate change LIT.23 into two loose capabilities. One capability with regard to using partner networks and/or portals to regulate partnering (i.e. the first sentence of current capability CAP.63) and another capability with regard to a partner performance analysis capability. All interviewees agreed with the interviewer.

Thus, two loose capabilities are added to the model instead of the current capability CAP.63; i.e. CHA.23 Set up partner network and CHA.24 Partner performance analysis.

*Result:*

$$CAP.63 \cup LIT.23 = CHA.23 \cup CHA.24$$

### Determine information profiles

The interviewer presented candidate change LIT.4:

<b>LIT.4</b>	Partnering & contracting	Determine information profiles for each (type) of the partner according to its roles.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) seven interviewees add candidate change LIT.4 as a new capability to the model;
- 2) one interviewee (i9) rejects it, because he says it is not important for SPM.

Thus, a majority adds candidate change LIT.4 as a new capability NEW.25 Determine information profiles.

*Result:*

$$LIT.4 = NEW.25$$

### Create information templates

The interviewer presented candidate change LIT.5:

<b>LIT.5</b>	Partnering & contracting	Create standard templates for information that is shared with and by partners.	Add it as a new capability.
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Only seven interviewees have given their view on candidate change LIT.5. Interviewee i8 did not give its view due to time-related problems during the interview. The following changes are performed by the interviewees:

- 1) three interviewees (i7, i10 and i11) add it as a new capability;
- 2) three interviewees (i2, i3 and i5) say it is pre-conditional for every organization and should not be a capability in a SPM framework;
- 3) one interviewee (i9) thinks it is not relevant for SPM.

Thus, there is no majority for candidate change LIT.5, it is not added to the model and its code changes into REJ.2.

*Result:*

$$LIT.5 = REJ.2$$

### Certify partners

The interviewer presented candidate change LIT.18:

<b>LIT.18</b>	Partnering & contracting	Certify/license partners divided over different ranks with different obligations and privileges.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) all interviewees are in favor of candidate change LIT.18;
  - a) one interviewee (i3) adds examples of gold, silver and bronze partners to it.

Change 1.a is combined as interviewee change INT.18 with LIT.18, because it is just a minor addition and it can make the description clearer. Thus, a majority adds candidate change LIT.18 as a new capability NEW.26. Certify partners.

*Result:*

$$LIT.18 \cup INT.18 = NEW.26$$

## Cluster partners

The interviewer presented candidate change LIT.19:

<b>LIT.19</b>	Partnering & contracting	Cluster partners into groups with specific functions, goals, etcetera. With the goal of making the management more efficient. It also makes it more clearly for interested candidate partners what it means to become a specific type of partner.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) seven interviewees add candidate change LIT.19 to the model;
  - a) two of them (i3 and i5) recognize an overlap with the previous analyzed candidate change LIT.18;
- 2) one interviewee (i9) rejects candidate change LIT.19, because he says it is only important for the marketing department.

Thus, a majority adds candidate change LIT.19 as a new capability NEW.27 Cluster partners.

*Result:*

*LIT.19 = NEW.27*

## Contract negotiation process

The interviewer presented candidate change LIT.20:

<b>LIT.20</b>	Partnering & contracting	A contract negotiation process exists.	Add it as a new capability.
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Only seven interviewees have given their view on candidate change LIT.20. Interviewee i8 did not give its view due to time-related problems during the interview. The following changes are performed by the interviewees:

- 1) three interviewees (i3, i10 and i11) add candidate change LIT.20;
- 2) two interviewees (i2 and i7) want it in a slightly different form;
  - a) interviewee i7 sees an overlap with the current capability CAP.59 Service level agreement capability and adds SLAs to the description of it;
  - b) interviewee i2 sees an overlap with three current capabilities (i.e. capabilities CAP.59 Service level agreements, CAP.60 Intellectual property management and CAP.62 Establish and evaluate pricing model) and joins the three capabilities into candidate improvement LIT.20;
- 3) Two interviewees (i5 and i9) do not see the relevance of candidate change LIT.20 for SPM.

Change 2.a and 2.b are rejected, because candidate change LIT.20 covers the complete contract negotiation process with all its facets, while the existing capabilities only cover some small parts (i.e. not all parts). Thus, a majority (change 1 and 2) is in favor of adding it to the model as a new capability NEW.28 Contract negotiation process. They only disagree to what extent it covers activities described in other capabilities. However, a majority still keeps



the other capabilities. Thus, a new capability NEW.28 is added in addition to the existing capabilities.

*Result:*

*LIT.20 = NEW.28*

### Coordinate partner alliances

The interviewer presented candidate change LIT.21:

<b>LIT.21</b>	Partnering & contracting	Co-ordinate among alliances and alliance partners to avoid conflicts and utilize synergies.	Add it as a new capability.
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Only seven interviewees have given their view on candidate change LIT.21. Interviewee i8 did not give its view due to time-related problems during the interview. The following changes are performed by the interviewees:

- 1) four interviewees (i3, i7, i10 and i11) are in favor of adding it as a new capability to the model;
- 2) three interviewees (i2, i5 and i9) do not think it is relevant.

Thus, a majority add candidate change LIT.21 as a new capability NEW.29 Coordinate partner alliances to the model.

*Result:*

*LIT.21 = NEW.29*

### Register partner

The interviewer presented candidate change LIT.22:

<b>LIT.22</b>	Partnering & contracting	All partners are registered in a central database which all relevant (internal) stakeholders can access.	Add it as a new capability.
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The following changes are performed by the interviewees:

- 1) six interviewees (i2, i3, i7, i8, i10 and i11) add candidate change LIT.22 as a new capability to the model;
- 2) one interviewee (i5) does say it is relevant but he does not think it is a capability but a tool;
- 3) one interviewee (i9) does not think it is relevant.

Change 2 is rejected. because (e.g.) in the Centralized registration capability in the Requirements gathering focus area a database is prescribed as well. Thus, a majority is in favor of adding candidate change LIT.22 as a new capability NEW.30 Register partners to the model.

*Result:*

*LIT.22 = NEW.30*

## Common delivery channel

The interviewer presented candidate change LIT.27:

<b>LIT.27</b>	Partnering & contracting	Create a common delivery channel (e.g. Apples Appstore) to enable partners to sell their created components.	Add it as a new capability.
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Only seven interviewees have given their view on candidate change LIT.27. Interviewee i8 did not give its view due to time-related problems during the interview. The following changes are performed by the interviewees:

- 1) five interviewees (i2, i5, i9, i10 and i11) say it has to become part of it as a new capability;
  - a) one of them (i11) adds a hierarchy in the component store, because in their case not every customer may have access to every (type of) component.
- 2) one interviewee (i3) says he sees an overlap with capability CAP.61 Investigate distribution channels, but no changes are made;
- 3) one interviewee (i7) does not think it is relevant;

Change 1.a is relevant, but no other interviewee suggested the same. If a software organization sets up a common delivery channel it always will determine how security and confidentiality issues are solved. Thus, it is not added to it because it is superfluous to prescribe. Thus, a majority is in favor of adding candidate change LIT.27 as a new capability NEW.31 Common delivery channel to the model.

*Result:*

*LIT.27 = NEW.31*

## New focus areas

As mentioned earlier, the current focus area Partnering & contracting cannot contain all fifteen (new) capabilities. Thus, it is split up into two or more new focus areas. Only seven interviewees have given their view on dividing the (new) capabilities over two or more new focus areas. Interviewee i8 did not give its view due to time-related problems. Three interviewees (i2, i3 and i10) do not have an own suggestion. However, they agreed with dividing the current focus area into a partnering and a contracting focus area. This looked like a proper division, because about halve of the (new) capabilities could be put in the partnering focus area and the other halve in the contracting focus area. One interviewee (i5) suggests dividing the current focus area in a customer and a partner part. However, none of the (new) capabilities is completely and only aimed at customers. Partners play (to a certain degree) in every capability a role. Thus, none of the capabilities can be placed solely in a customer focus area. Interviewee (i7) suggests dividing the current focus area in a contracting and a channel development focus area. But this misses still a part in which the partnering capabilities can be placed. Pure partnering activities (e.g. registering and clustering partners) cannot be placed in one of both. Interviewee (i8) suggests dividing the current focus area in an ecosystem positioning and partner analysis focus area. Its suggestion misses a part as well. For example, the new capability NEW.29 on coordinating among alliances cannot be placed in one or both. Plus, a downside is that one of the two focus areas will have too many

capabilities to distribute over the maturity levels. The restriction of ten maturity levels leads to a wrong picture of their relative maturity level to each other when placing too many capabilities in one focus area. Interviewee (i11) suggests dividing the current focus area in an administration, communication, process and component focus area. However, four separate focus area would be over the top. Two or three focus areas should be enough.

Thus, most of the interviewees agreed on dividing this focus area in a Partnering and a Contracting focus area. However, during the assignment of each capability to one of both focus areas, the Partnering focus area became too big. It created the same downside as mentioned by the division suggested by interviewee i8. A third focus area is necessary to create well-defined and well set up focus areas. As third focus area a Channel development focus area is defined, like interviewee i7 suggests. It is the perfect solution, because four capabilities that are targeted at developing the organization and SECO its channels can be assigned to this focus area. It resulted in the following new focus areas: FOC.32 Contracting (see Table 21), FOC.33 Partnering (see Table 22) and FOC.34 Channel development (see Table 23). The only question that remains is what the maturity level of each capability is, indicated by the question mark. This is determined by means of the questionnaire.

Table 21 new focus area Contracting.

#			
<b>FOC.32</b>	Contracting	Contracting focuses on establishing relations with external stakeholders by creating proper and clear agreements with them.	
<b>CHA.22</b>	?	Service level agreements	Action: (Standard) service level agreements (SLA's) are set up for customers and partners. Goal: Manage customer and partner expectations.
<b>CAP.60</b>	?	Intellectual property management	Action: Measures are in place to protect the intellectual property of the own organization, and to manage the used intellectual property from other organizations. Goal: Protection of the organizations intellectual property, and prevention of problems due to misuse of the intellectual property of other organizations.
<b>NEW.25</b>	?	Determine information profiles	Action: Determine information profiles for each (type of) partners (according to their role)s in which is clear who has access to which information. Goal: To simplify sharing information.
<b>NEW.28</b>	?	Contract negotiation process	Action: A partner contract negotiation process is set up. In which e.g. realistic objectives, agreements on earnings, intellectual property rights, termination clauses, penalties for bad performance, arbitration procedures are determined. Goal: Manage external stakeholder expectations.

Table 22 new focus area Partnering.

#			
<b>FOC.33</b>	Partnering	Partnering focuses on managing relations with external stakeholders and supporting them in creating the biggest possible value for the ecosystem.	
<b>NEW.30</b>	?	Register partners	Action: All partners are registered in a central database which all relevant (internal) stakeholders can access
			Goal: Create an overview of all partners. Share knowledge with regard to partners (e.g. experiences, best practices, agreements) with all relevant internal stakeholders.
<b>CHA.23</b>	?	Set up partner network	Action: A partner network and/or partner portals are used to regulate and promote partnering.
			Goal: Set up partner networks to gain synergetic advantages.
<b>CHA.24</b>	?	Partner performance analysis	Action: A partner analysis is performed on an organizational level to analyze what partners offer, what their strengths and weaknesses are and are going to offer compared to and in addition to your organization. For example, by making use of partner score cards.
			Goal: Create a clear and correct picture of the performance and value of partners.
<b>NEW.29</b>	?	Co-ordinate partner alliances	Action: Co-ordinate among alliances and alliance partners to avoid conflicts and utilize synergies.
			Goal: Create a stronger and more coherent SECO.
<b>NEW.27</b>	?	Cluster partners	Action: Cluster partners into groups with specific functions, goals, etcetera.
			Goal: Making the management of partners more efficient by setting clear objectives, obligations, earnings, risks.
<b>NEW.26</b>	?	Certify partners	Action: Certify/license partners divided over different ranks (e.g. gold, silver and bronze) with different obligations and privileges.
			Goal: To make clear what is expected of a partner to raise quality of niche solutions.
<b>NEW.14</b>	?	Certify external components	Action: Certification of externally created components, based on the standard quality rules to raise the quality of niche solutions.
			Goal: Change the quality of ecosystem's products. Partners get keystone confirmation of product quality to prove the quality of their product. It may simplify component integration by standardizing.

Table 23 new focus area Channel development.

#			
<b>FOC.34</b>	Channel development	Channel development focuses on establishing and managing distribution channels.	
<b>CAP.61</b>	?	Investigate distribution channels	Action: A process is in place to periodically verify the current distribution channels, and identify alternative distribution channels.
			Goal: Change sales process.
<b>NEW.31</b>	?	Common delivery channel	Action: Set-up a common distribution channel (e.g. the Apple Appstore).
			Goal: To enable partners to sell their created components to a large customer base.
<b>NEW.37</b>	?	Model the SECO	Action: Model the SECO (at its different levels).
			Goal: Identify its distribution channels, main competitors, and potential partners.
<b>CAP.62</b>	?	Establish and evaluate pricing model	Action: A process is in place to establish the pricing model and periodically verify whether it still fits the market.
			Goal: Change sales process.

### 5.2.15 Product lifecycle management

As described in Appendix C the original focus area Product lifecycle management consists of five capabilities. From the lowest maturity level to the highest maturity level its capabilities are: Product lifecycle analysis, Portfolio innovation, Portfolio scope analysis, Business case and Product lines. As described in section 4.3 the following candidate changes are proposed by the interviewer: LIT.24 on broadening the scope of the product scope analysis to the whole SECO, LIT.25 on broadening the scope of the product lifecycle analysis to the whole SECO and LIT.26 on modeling the SECO. As explained in section 5.1 only interviewee i2, i3, i5, i7 up to and including i11 have been interviewed on this focus area because it is part of the business function Portfolio management.

#### Product lifecycle analysis

The current capability CAP.64 looks like this:

<b>CAP.64</b>	a.	Product life cycle analysis	Action: The current life phase is determined, at least once per year, for each product in the organizations portfolio. This analysis is based on both financial and technical aspects. Information is thus gathered from all relevant internal stakeholders (e.g. company board, sales, development).
			Goal: Ensure that there is a healthy balance between new and old products in the product portfolio, create awareness of the products life expectations.

Plus, the interviewer presented candidate change LIT.25:

<b>LIT.25</b>	Product lifecycle management	The scope of the product life cycle analysis is widened to the complete ecosystems its product portfolio.	Expand capability a. Product life cycle analysis with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) six interviewees (i2, i3, i7, i8, i10 and i11) expand the scope of capability CAP.64 Product life cycle analysis by processing candidate change LIT.25;
  - a) three of them (i3, i7 and i8) perform extra additions;
    - i) interviewee i3 and i7 say it is important to make use of information from all relevant internal and external stakeholders;
    - ii) interviewee i7 suggests it should happen continuously and not at least once per year;
    - iii) interviewee i8 adds more explanation on how the analysis must be performed;
- 2) one interviewee i9 adds a new capability in which not niche products but niche markets are analyzed.

Change 1.a.i is accepted, because it is a minor and relevant addition, it makes the analysis easier to perform (i.e. interviewee change INT.19). Change 1.a.ii is rejected, because the product manager must decide itself how often an analysis needs to be performed and a minimum of once per year is considered as enough by the rest of the interviewees. Change 1.a.iii is rejected, because it is already described by the new capability how an analysis is performed and the description would become too elaborately. Plus, a majority does not ask for a more elaborate description. Change 2 is rejected, because it does not differ much from the expanded capability and since only one interviewee suggests it, it is rejected. Thus, a majority expands capability CAP.64 with candidate change LIT.25 and interview change INT.19 is added as well.

*Result:*

$$CAP.64 \cup LIT.25 \cup INT.19 = CHA.35$$

### Portfolio innovation

The current capability CAP.65 looks like this:

<b>CAP.65</b>	b.	Portfolio innovation	Action: A decision process is in place to decide whether or not to incorporate trends in one of the current products or in newly to be developed products.
			Goal: Balance the products in the product portfolio to make sure that products do not become competitors.

The following change is performed by an interviewee:

- 1) one interviewee i2 adds the capability CAP.67 Business case to the analyzed capability CAP.65, but he gives no clear explanation.

Change 1 is rejected, because he is the only one who combines it. Thus, a majority does not change anything to it.

*Result:*

$$CAP.65 = CAP.65$$

## Portfolio scope analysis

The current capability CAP.66 looks like this:

CAP.66	c.	Portfolio scope analysis	Action: A product scope analysis is performed to identify overlaps and gaps between the products in the organizations product portfolio.
			Goal: Balance products in the portfolio and identify opportunities for reuse (overlap) and discover possible new market segments (gaps).

Plus, the interviewer presented candidate change LIT.24:

LIT.24	Product lifecycle management	The scope of the product scope analysis is widened to the complete ecosystems its product portfolio.	Expand capability c. Portfolio scope analysis with this candidate change or add it as a new capability.
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The following changes are performed by the interviewees:

- 1) four interviewees (i2, i3, i8, and i10) expand capability CAP.66 Portfolio scope analysis with candidate change LIT.24;
  - a) one of them (i3) even expands it further by executing it together with partners;
- 2) three interviewees (i5, i7 and i11) add it as a new capability on partner portfolio scope analysis;
  - a) one of them (i5) even places it at another focus area (i.e. Market analysis);
- 3) one interviewee (i9) does not add candidate change LIT.24.

A majority (i2, i3, i5, i7, i8, i10 and i11) broadens the scope of the portfolio scope analysis in this model to niche solutions as well; i.e. they process candidate change LIT.24. Four of them process it by expanding the current capability CAP.66. Thus, a majority of four interviewees (of the seven interviewees that are in favor of this candidate change) expand the current capability; i.e. expanded capability CHA.36.

*Result:*

$$CAP.66 \cup LIT.24 = CHA.36$$

## Business case

The current capability CAP.67 looks like this:

CAP.67	d.	Business case	Action: A business case is performed for major product revisions (revisions spanning multiple release) or when the product strategy is changed. We use Kittlaus & Clough (2009) definition in which a business case is the “comparison of the costs associated with the product or project to the quantified economic benefits or value to be derived”.
			Goal: Validation of major future plans before they are put into practice.

The following changes are performed by the interviewees:

- 1) two interviewees (i2 and i3) think capability CAP.67 is not complete;
  - a) interviewee i2 thinks its description should be more detailed and combined with capability CAP.65 Portfolio innovation;
  - b) interviewee i3 thinks the scope should be expanded to the whole ecosystem.

Change 1.a is rejected, because he is the only one who suggests it. Change 1.b is rejected, because he is the only one who suggests it and it does not make sense to perform business

cases for releases and product strategies defined by partners. A majority does not change anything to capability CAP.67.

*Result:*

*CAP.67 = CAP.67*

### Product lines

The current capability CAP.68 looks like this:

<b>CAP.68</b>	e.	Product lines	Action: Product lines are developed. The architecture of the product line is documented, and its goal is clearly defined. A software product line is defined as a set of software intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way (Clements & Northrop, 2002).
			Goal: Enable maximum reuse of resources and simplify the creation of new products.

The following change is performed by an interviewee:

- 1) one interviewee (i3) broadens the scope of capability CAP.68 to the whole ecosystem. However, he adds to it that he thinks it is already meant with the current capability.

Seen the fact that change 1 is only suggested by one interviewee and he is not sure about his suggestion, it is rejected. Thus, a majority does not change anything to capability CAP.68.

*Result:*

*CAP.68 = CAP.68*

### SECO modeling

The interviewer presented candidate change LIT.26:

<b>LIT.26</b>	Product lifecycle management	Model the SECO(s) (at its different levels) and determine its sales and distribution channels, main competitors, and potential partners.	Add it as a new capability.
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The interviewer presented interviewees i1 and i4 candidate change LIT.26 as well, because it was a relevant suggestion for the topic they were talking about. The following changes are performed by the interviewees:

- 1) ten (!) interviewees think candidate change LIT.26 is a very important and relevant new capability;
  - a) four of the interviewees (i2, i8, i9 and i11) place it in this focus area;
  - b) two interviewees (i7 and i10) place it in the (old) Partnering & contracting focus area;
  - c) two interviewees (i3 and i5) place it in the Market analysis focus area;
  - d) two interviewees (i1 and i4) could not indicate in which focus areas they want to place it. They have not seen the focus areas of this business function, because it was not part of their interview.

Taking only into consideration the eight interviewees that could indicate where it should be placed, no majority is found for its placement. Four interviewees (i2, i8, i9 and i11) said it



should be placed in this focus area and four (i3, i5, i7 and i10) place it at two other focus areas. Change 1.a on putting it in this focus area is rejected, even though it is presented in this focus area and most of the interviewees place it here. Capability NEW.37 should be placed at the new Channel development focus area, because at this focus area sales and distribution channels are managed (i.e. the object under study in this capability). On which maturity level, is determined by means of the questionnaire.

*Result:*

*LIT.26 = NEW.37*

### **Focus area**

The interview analysis results in the following changed focus area (see Table 50). It consists of the evaluated and changed capabilities. The title of it remains the same. The scope of the description is expanded to the entire SECO; i.e. change FOC.38.

Table 24 changed focus area Market analysis.

#			
<b>FOC.38</b>	Product lifecycle management	Product lifecycle management concerns the information gathering and key decision making about product life and major product changes across the entire SECO its product portfolio.	
<b>CHA.35</b>	a.	SECO product life cycle analysis	Action: The current life phase is determined, at least once per year, for each product in the ecosystems portfolio. This analysis is based on both financial and technical aspects. Information is gathered from all relevant internal and external stakeholders (e.g. company board, sales, development and partners).
			Goal: Ensure that there is a healthy balance between new and old products in the product portfolio, create awareness of the products life expectations.
<b>CAP.65</b>	b.	Portfolio innovation	Action: A decision process is in place to decide whether or not to incorporate trends in one of the current products or in newly to be developed products.
			Goal: Balance the products in the product portfolio to make sure that products do not become competitors.
<b>CHA.36</b>	c.	SECO portfolio scope analysis	Action: A product scope analysis is performed to identify overlaps and gaps between the products in the ecosystems product portfolio.
			Goal: Balance products in the portfolio and identify opportunities for reuse (overlap) and discover possible new market segments (gaps).
<b>CAP.67</b>	d.	Business case	Action: A business case is performed for major product revisions (revisions spanning multiple release) or when the product strategy is changed. We use Kittlaus & Clough (2009) definition in which a business case is the “comparison of the costs associated with the product or project to the quantified economic benefits or value to be derived”.
			Goal: Validation of major future plans before they are put into practice.
<b>CAP.68</b>	e.	Product lines	Action: Product lines are developed. The architecture of the product line is documented, and its goal is clearly defined. A software product line is defined as a set of software intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way (Clements & Northrop, 2002).
			Goal: Enable maximum reuse of resources and simplify the creation of new products.

## 6. Questionnaire

After analyzing the data gathered during the interviews, some issues exist with regard to changes that are not suggested by a majority of the interviewees but may be relevant to add to the model and matrix. To determine whether these interviewee changes should be performed in the model and matrix, the product manager had to fill in a questionnaire during a second round of data gathering.

### 6.1 Interviewee changes

At the Requirements validation analysis in section 5.2.2 interviewees i2 and i3 add a new capability INT.2 on getting external feedback on product requirements. In this way SPM can raise the quality of product requirements by enriching its content. It should be placed at the Requirements identification focus area and looks like this:

<b>INT.2</b>	External feedback	Action: Get extra feedback on product requirements from external stakeholders.
		Goal: Raise the quality of product requirements by enriching the content.

At the New capabilities analysis in section 5.2.8 interviewee i9 adds a new capability INT.5 on creating a validation plan. A validation plan describes how a validation of a build release should be performed. He says it is important to define such a plan, because validation is a complex task and a plan contributes to a good validation. It should be placed at the Release build validation focus area and looks like this:

<b>INT.5</b>	Validation plan	Action: Define a plan for how internal and external validation is performed (e.g. niche by niche, who validates what, for who is a release intended).
		Goal: Validation can be a complex task, a plan contributes to a good validation.

At the Sales & marketing support analysis in section 5.2.9 interviewee i6 expand the scope of the current capability on sales and marketing support; i.e. interviewee change INT.6. He thinks it is important to expand the scope of it to the Software support department as well, because when a new release is launched they can get much more support requests than usually. Plus, they need to be prepared for supporting external parties with the new release. The expanded capability remains at the same focus area (i.e. Launch preparation) and looks like this:

<b>INT.6</b>	Software, Sales & Marketing support	Action: Create a checklist of all external expression of the product (e.g. fact sheets, demo's, presentations) that may need to be updated by changes made in latest release of the product. These items must be checked, and possible updated before they are available to external parties (e.g. customers, partners).
		Goal: Ensure external corporate expressions are correct.

At the New capabilities analysis in section 5.2.9 interviewee i4 adds a new capability INT.7 on performing a risk impact analysis. He says it is important to determine before the launch of the release what risks exist and what their impact is. In this way the company is prepared for possible problems during the launch. It should be placed at the Launch preparation focus area and looks like this:

<b>INT.7</b>	Risk impact analysis	Action: Analyse risk impacts.
		Goal: To be prepared for possible problems during the launch.

At the Legislation analysis in section 5.2.10 interviewees i1, i8 and i11 add a new capability INT.8 on keeping track of changing legislation. They say it is important to know what is changing with regard to legislation for a software company its product industry. At present, legislation is changing at a high rate. Legislation to which the software company, partner companies and/or customer companies need to apply. Capability INT.8 can be placed at two focus areas. Namely, at the Requirements gathering focus area by which new requirements are elicited from legislation or at the Roadmap intelligence focus area by which future plans are influenced to keep compliant with legislation. It looks like this:

<b>INT.8</b>	Legislation	Action: Continuously create an overview of what is changing with regard to legislation for your products industry.
		Goal: To keep compliant with laws and regulations.

At the Make or buy decision analysis in section 5.2.11 interviewees i2 and i11 expand the scope of capability CAP.47 by adding a co-creation decision to it; i.e. interviewee change INT.9. They say that making this type of decisions is very relevant in SECOs, because in an ecosystem collaboration in creation is desirable. The expanded capability remains at the same focus area (i.e. Core asset roadmapping) and looks like this:

<b>INT.9</b>	Make, buy or co-creation decision	Action: A process is in place to actively investigate make, buy or co-create decisions: external sources are investigated based on ROI in the search for core asset acquisition or co-creation: partners, outsourcing or subcontracting of development.
		Goal: Cost and time savings by using and/or co-creating with external parties.

At the New capability analysis in section 5.2.11 interviewee i8 adds a new capability INT.10 on recording core asset usage. He says it is important to keep track of who, how and when uses a core asset. This information is very important in the decision for upgrading a core asset. It should be placed at the Core asset roadmapping focus area and looks like this:

<b>INT.10</b>	Core asset usage	Action: Record core asset usage by keeping a log of which core asset is used by who, how and when.
		Goal: To create a clear insight into what it means if a core asset is upgraded/enhanced.

At the Long-term roadmap analysis in section 5.2.12 interviewees i3, i7, i10 and i11 have serious doubts about the time span of this current capability; i.e. interviewee change INT.11. They think a time span of four years is too long. Everything in the software industry is changing too fast to be able to make correct long-term roadmaps for four years or longer. Thus, the time span of the long-term roadmap is evaluated by means of the questionnaire.

At the New capability analysis in section 5.2.12 interviewee i5 adds a new capability INT.12 on letting the board validate new roadmaps. In this way, commitment of the board is

ensured for future product plans. It should be placed at Product roadmapping focus area and looks like this:

<b>INT.12</b>	Roadmap validation	Action: Validate the roadmap by the board.
		Goal: Get commitment to the product roadmap

At the Market strategy analysis in section 5.2.13 interviewee i10 expands the scope of capability CAP.55; i.e. interviewee change INT.13. She adds to the description that (niche) markets may be reached by making use of partners. In SECOs most of the market segment will be reached via partners. She says, determining with which partners and how a (niche) market is reached is important to define in the market strategy plan. The expanded capability remains at the same focus area (i.e. Market analysis) and looks like this:

<b>INT.13</b>	Market strategy	Action: A plan is created showing which markets your ecosystem's products will be going after and how you plan to develop the products with partners for each segment. Eg., in year one you may want to enter healthcare by partnering with another company. Or you may want to enter the financial market in year two by building products in-house or acquiring products.
		Goal: Plan which markets you will target and how you will enter them.

At the Customer win/loss analysis capability analysis in section 5.2.13 interviewees i3 and i10 expand the scope of capability CAP.56 to the whole ecosystem; i.e. interviewee change INT.14. They say a software company can learn a lot of the customer wins and losses of all SECO products. The expanded capability remains at the same focus area (i.e. Market analysis) and looks like this:

<b>INT.14</b>	SECO customer win/loss analysis	Action: A win/loss analysis is performed to research why customers (of partners) chose or did not choose to buy your ecosystems products. This capability looks further than just the product features, e.g. the sales process is reviewed.
		Goal: Learn about your customers/prospects, to generate more future customers for your SECO by tuning product development to them.

At the Competitor analysis capability analysis in section 5.2.13 interviewee i10 expand the scope of capability CAP.57 to all SECO competitors; i.e. interviewee change INT.15. She says the software company tries to manage its platform in a SECO and it can learn much from SECO competitors. The expanded capability remains at the same focus area (i.e. Market analysis) and looks like this:

<b>INT.15</b>	SECO competitor analysis	Action: A competitor analysis is performed on an ecosystem's level to analyze what ecosystem's competitors offer, what their strengths are and are going to offer compared to your ecosystem.
		Goal: Learn from ecosystem competitors and do not fall behind product-wise.

At the Customer market trend identification analysis in section 5.2.13 interviewee i10 expand the scope of capability CAP.58 to the complete SECO portfolio; i.e. interviewee change INT.16. She says the software company tries to manage its platform in a SECO and it can learn much from all products made in the SECO. The expanded capability remains at the same focus area (i.e. Market analysis) and looks like this:

<b>INT.16</b>	Custom market trend identification	Action: External market research parties are used to perform a market analysis specifically for the ecosystem's product portfolio.
		Goal: Gain unique information (that your competition does not have) specific to your own ecosystem. Gain an unbiased insight into your ecosystem's markets and/or operations.

At the New capabilities analysis in section 5.2.13 interviewee i9 adds a new capability INT.17 on determining non-functional market demands. He says each market segment can have its own market specific demands. A software company needs to know and consider these demands. Otherwise, reaching specific market segments can fail and the company will not sell its products. Capability INT.17 should be placed at the Market analysis focus area and looks like this:

<b>INT.17</b>	Non-functional market demands	Action: Non-functional market demands are identified. These demands do not affect the functionality of the product but are required for having a successful product in a specific market.
		Goal: Typical market demands are not overlooked.

The analysis performed for the Partnering & contracting focus area have led to a lot of new capabilities and three new focus areas. The new focus areas are a substitute for the current Partnering & contracting focus area. For all capabilities distributed over the new focus area a maturity level needs to be determined by means of the questionnaire.

## 6.2 Shortening the questionnaire

Due to time constraints of the interviewees it was not possible to ask them questions on every remaining interviewee change. On average each interviewee is already interviewed for almost two and a half hour. If every remaining interviewee change would be part of the questionnaire, it would take them more than a half hour to fill it in. Thus, a selection is made of the remaining interviewee changes based on how many interviewees suggested a change. Only the interviewee changes that are suggested by two or more interviewees are processed in the questionnaire. Changes that are part of the questionnaire are INT.2 on getting external feedback on product requirements, INT.8 on keeping track of legislation, INT.9 on making co-creation decisions for core assets, INT.11 on determining the time span of a long-term roadmap, INT.14 on broadening the scope of the customer win/loss analysis to the whole SECO, and determining the maturity levels of the capabilities in the three new focus areas. The last topic is not a change that is suggested by two or more interviewees. But it has to be determined to complete the study. Leaving out the interviewee changes that are not suggested by two or more interviewees does not mean it are not relevant changes for the model.

### 6.3 Questionnaire results

All interviewees are asked to fill in the questionnaire. They only had to give their view on the changes with regard to the business functions they are experienced in, just like during the interviews (see section 5.1). Not every interviewee responded and filled in the questionnaire. 82% of the interviewees responded and interviewees i2 and i9 did not respond. The complete questionnaire can be found at Appendix E (written in Dutch).

#### External feedback

Nine interviewees (i1-i7, i9 and i10) are asked to give their view on interviewee change INT.2 with regard to adding an External feedback capability to the Requirements identification focus area. The new capability looks like this:

INT.2	External feedback	Action: Get extra feedback on product requirements from external stakeholders.
		Goal: Raise the quality of product requirements by enriching the content.

The following changes are performed by the interviewees:

- 1) five interviewees (i3-i5, i7 and i10) process it into the Requirements identification focus area;
- 2) two interviewees (i1 and i6) do not process it;
- 3) two interviewees (i2 and i9) did not response. However, interviewee i2 is one of the product managers that suggested it change during the interviews.

Thus, a majority of the respondents (five out of seven) add interviewee change INT.2 to the focus area Requirements identification; i.e. a new capability NEW.39. With regard to its maturity level:

- interviewees i4, i7 and i10 place it between the maturity level ‘b’ (i.e. Requirements validation) and ‘c’ (i.e. Connect similar requirements);
- interviewee i5 places it in front of ‘a’ (i.e. Uniformity);
- and interviewee i3 adds it to the Requirements validation capability on level ‘b’.

In Figure 10 an overview is created of the relative maturity levels of the new capability given by the interviewees. On the x-axis the relative maturity levels are displayed and on the y-axis the numbers of interviewees are displayed. To determine its maturity level the median is used as determinant variable, just as in the previous maturity level analyses. The median of the relative maturity levels lies at ‘c-1’; i.e. between ‘b’ and ‘c’. Thus, it is placed between the current levels ‘b’ and ‘c’ (see Table 25).

*Result:*

$$INT.2 = NEW.39$$

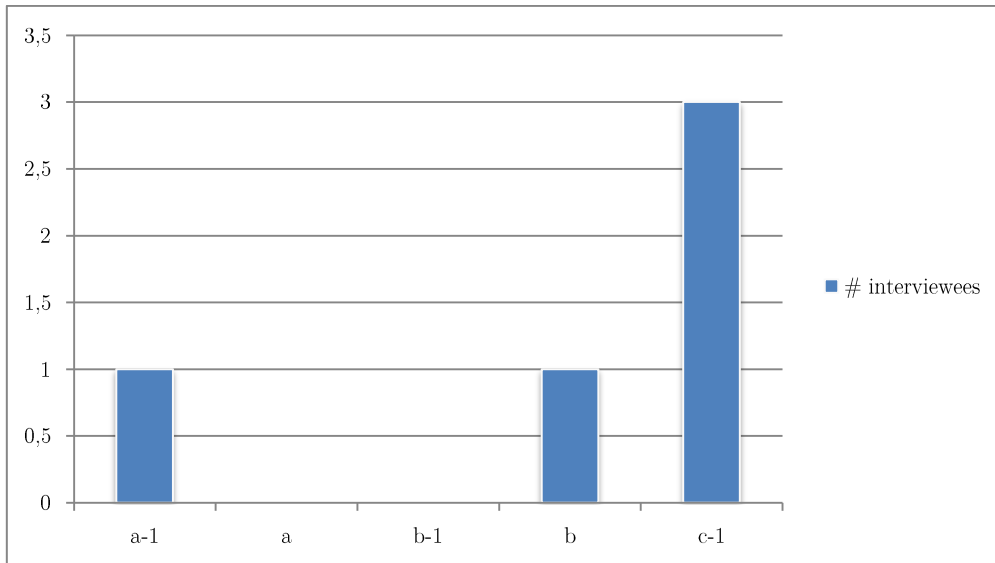


Figure 10 maturity levels of capability NEW.39 External feedback.

Table 25 changed focus area Requirements identification.

#			
	Requirements identification	Requirements identification identifies the actual Product Requirements by rewriting the Market Requirements to understandable Product Requirements, and connecting requirements that describe similar functionality.	
CAP.7	a.	Uniformity	Action: Market requirements are rewritten to product requirements using a pre-defined template if the market requirement is applicable to a product.
			Goal: Identification of the essence of the requirements, this provides clarity to all involved, enables a meaningful comparison of requirements.
CAP.8	b.	Requirements validation	Action: The correctness (“Is the definition correct?”), completeness (“Does the requirement describe all relevant aspects?”), and unambiguousness (“Can the requirement only be interpreted in one way?”) of the requirement is validated.
			Goal: Validation of the requirements to prevent rework.
NEW.39	c.	External feedback	Action: Get extra feedback on product requirements from external stakeholders.
			Goal: Raise the quality of product requirements by enriching the content.
CAP.9	d.	Connect similar requirements	Action: Group together market requirements which describe similar functionality by linking market requirements and product requirements to each other.
			Goal: Identify the true need for requirements (e.g. two requirements that individually are not valued high enough could be valued high enough when merged), prevention of double requirements.
CAP.10	e.	Automatically connect similar requirements	Action: Automatically connect similar requirements by using advanced techniques such as linguistic engineering.
			Goal: Reduce the workload of the connecting of similar requirements.



## Legislation

All interviewees are asked to give their view on interviewee change INT.8 with regard to tracking changing legislation. All interviewees, because it can be processed into the Requirements gathering and Roadmap intelligence focus area. It looks like this:

INT.8	Legislation	Action: Continuously create an overview of what is changing with regard to legislation for your products industry.
		Goal: To keep compliant with laws and regulations.

The following changes are performed by the interviewees:

- 1) six interviewees (i3, i4, i7, i8, i10 and i11) process it into the Roadmap intelligence focus area;
- 2) three interviewees (i1, i5 and i6) process it into the Requirements gathering focus area;
- 3) two interviewees (i2 and i9) did not response.

Thus, a majority of the respondents (six out of nine) adds interviewee change INT.8 to the Roadmap intelligence focus area; i.e. a new capability NEW.40. With regard to its maturity level:

- interviewees i3 and i8 place it in front of maturity level 'c' (i.e. Society trends);
- interviewee i7 adds it to the capability Society trends on level 'c';
- interviewees i10 and i11 place it after maturity level 'c';
- and one interviewee (i4) places it in front of maturity level 'f' (i.e. Competition trends).

In Figure 11 an overview is created of the relative maturity levels of the new capability given by the interviewees. On the x-axis the relative maturity levels are displayed and on the y-axis the numbers of interviewees are displayed. To determine its maturity level the median is used as determinant variable, just as in the previous maturity level analyses. The median of the relative maturity levels lies between 'c' and 'd-1'. Thus, it cannot be positioned based on the median. As second variable the average is used, just as in the previous maturity level analyses. Its average is 'd-1', thus it is placed between the current levels 'c' and 'd' (see Table 26).

*Result:*

$$INT.8 = NEW.40$$

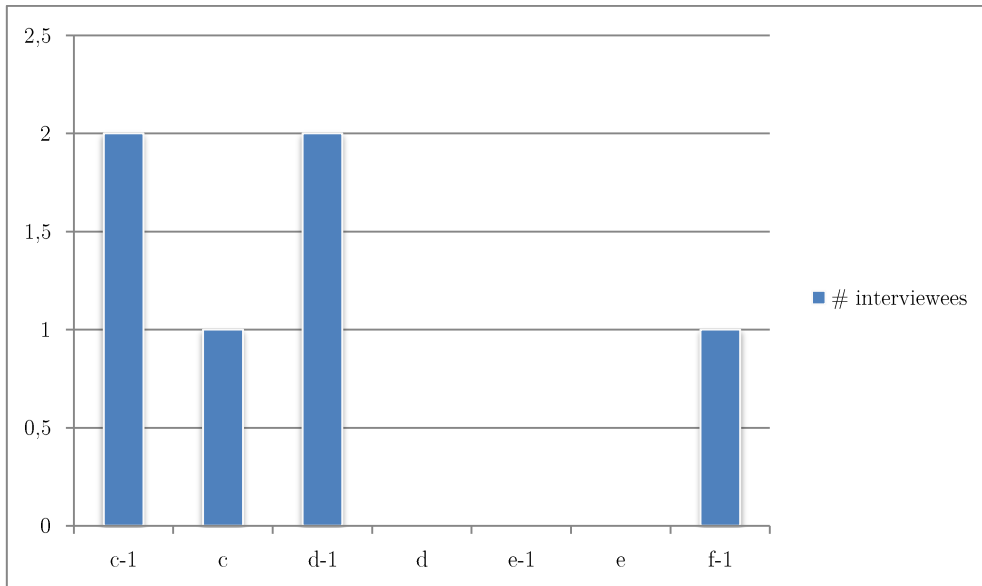


Figure 11 maturity levels NEW.39 External feedback.

Table 26 changed focus area Roadmap intelligence.

#			
	Roadmap intelligence	Roadmap intelligence gathers decision supporting information needed in the creation of the product roadmap and presents it in summary style suited for management information. It does not include the requirements gathered in Requirements management.	
CAP.40	a.	Product analysis	Action: The organization's products are analyzed to determine the product's strong and weak points on both functional and technical aspects. Relevant stakeholders, such as the development department for the technical part, are involved in this analysis.
			Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
CHA.15	b.	Partner roadmap	Action: An overview is created showing what your partners will be developing the coming period. Examples of partner products are operating systems, development environments, database, etc. The overview shows what will be happening with the core platform software as well as what the partner organization will be delivering in terms of their own products and development tools that your organization can or will need to use to support the partner products/components.
			Goal: Show how your organization responds to developments of partner products and which your own products rely.
CAP.41	c.	Society trends	Action: An overview is created showing the big picture of important trends in society in the coming years. This picture contains a general view and a view specific for your products industry.
			Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
NEW.40	d.	Legislation	Action: Continuously create an overview of what is changing with regard to legislation for your products industry.
			Goal: To keep compliant with laws and regulations.
CAP.42	e.	Technology trends	Action: An overview is created showing the big picture of important developments in terms of technology in the coming years. This picture contains a general view and a view specific for your products industry.
			Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by current and up-and-coming technologies.
CAP.43	f.	Competition trends	Action: An overview is created showing what competing products are doing in terms of their product development in the coming years. The general developments trends among your competitors are shown, and the developments of the most important competing products are depicted with special attention.
			Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by your partners.

## Co-creation decision

Nine interviewees (i1-i3, i5 and i7-i11) are asked to give their view on interviewee change INT.9 with regard of making a co-creation decision for core assets. It looks like this:

<b>INT.9</b>	Make, buy or co-creation decision	Action: A process is in place to actively investigate make, buy or co-create decisions: external sources are investigated based on ROI in the search for core asset acquisition or co-creation: partners, outsourcing or subcontracting of development.
		Goal: Cost and time savings by using and/or co-creating with external parties.

The following changes are performed:

- 1) six interviewees (i3, i5, i7, i8, i10 and i11) process it into capability CAP.47 Make or buy decision in the Core asset roadmapping focus area;
- 2) one interviewee (i1) says it is already part of the current capability and it should be processed in the description at most;
- 3) two interviewees (i2 and i9) did not response. However, interviewee i2 is one of the product managers that suggested this change during the interviews.

Thus, a majority of the respondents (six out of seven) processes interviewee change INT.9 into the current capability resulting in an expanded capability CHA.41 (see Table 27).

*Result:*

$$CAP.47 \cup INT.9 = CHA.41$$

Table 27 changed focus area Core asset roadmapping.

#			
<b>CHA.17</b>	Core asset roadmapping	Core asset roadmapping concerns the planning of future development of core assets (components that are shared by multiple products within the SECO).	
<b>CAP.45</b>	a.	Centralized registration	Action: All core assets are registered in a standardized manner, and are stored in a central location.
			Goal: Enable the reuse of components.
<b>CHA.16</b>	b.	SECO core asset identification	Action: Common components/functionality (core assets) is systematically identified among the ecosystems products and deliverables surrounding the products.
			Goal: Increase and simplify the reuse and maintenance of components in the SECO.
<b>CHA.41</b>	c.	Make, buy or co-creation decision	Action: A process is in place to actively investigate make, buy or co-create decisions: external sources are investigated based on ROI in the search for core asset acquisition or co-creation: partners, outsourcing or subcontracting of development.
			Goal: Cost and time savings by using and/or co-creating with external parties.
<b>CAP.48</b>	d.	Core asset roadmap construction	Action: A roadmap is created for the core assets, this roadmap shows how the core assets are sustained, upgraded, and enhanced. This roadmap contains both existing core assets, and core assets that are in development.
			Goal: Provide insight in the future plans for the core assets to ensure that this is incorporated in the product roadmap in a realistic and optimal form.

### Long-term roadmap

Nine interviewees (i1-i3, i5 and i7-i11) are asked to give their view on interviewee change INT.11 with regard to the time span of a long-term roadmap. The following changes are performed by the interviewees:

- 1) four interviewees (i2, i5, i7 and i11) lower the time span to a maximum of 2 years;
- 2) one interviewee (i1) lowers it to 1 year, because 1 year is already long term in information technology;
- 3) one interviewee (i10) says the time span totally depends on the product its industry. He cannot give a generic answer that counts for every industry;
- 4) one interviewee (i8) says the current time span does not need to change;
- 5) two interviewees (i2 and i9) did not response.

Thus, a majority of the respondents (four out of seven) indicate that the time span has to be changed to a maximum of 2 years resulting into changed capability CHA.42 (see Table 28).

*Result:*

$$CAP.52 \cup INT.11 = CHA.42$$

Table 28 changed focus area Product roadmapping.

#			
	Product roadmapping	Product roadmapping deals with the actual creation of the product roadmap itself.	
<b>CAP.49</b>	a.	Short-term roadmap	Action: A roadmap is developed detailing the short-term plans. The plans span more than one release. Goal: Development of a short-term vision of the product(s).
<b>CHA.18</b>	b.	Theme identification	Action: Release themes are identified and maintained for internal and external creation. Themes are decided on together with all relevant stakeholders (i.e. internal and external). Identification of the themes results in a list of release themes that are stored centrally, so that requirements, core assets, market trends etc. can be linked to it. Goal: Structuring of releases and roadmaps: themes are used give a clear direction to the roadmap and later on to structure the requirements.
<b>CHA.19</b>	c.	Consultation	Action: Product roadmaps are created in consultation with all relevant internal and external stakeholders. Goal: Ecosystem wide acceptance of the product roadmap. Optimal use of all knowledge in the ecosystem to create more rich and realistic product roadmaps
<b>CHA.42</b>	d.	Long-term roadmap	Action: The roadmap spans a time period of maximum 2 years. Goal: Development of a long-term vision of the product(s).
<b>NEW.20</b>	e.	Roadmap procedure	Action: Define a decision procedure for when roadmap designers and external stakeholders (i.e. partners) cannot reach consensus. Inform external stakeholders about this decision procedure when forming relationships with them. Goal: Making the roadmap construction process transparent, understandable and predictable for external stakeholders.
<b>CAP.53</b>	f.	External variants	Action: Less detailed variants of the internal roadmap are created for specific external parties (e.g. customers, partners, investors). Goal: Informing of customers/managing customers expectations, marketing tool. Informing external parties using information they want.

### SECO customer win/loss analysis

Eight interviewees (i2, i3, i5 and i7-i11) are asked to give their view on interviewee change INT.14 with regard to expanding the scope of the customer win/loss analysis to the whole SECO. It looks like this:

<b>INT.14</b>	SECO customer win/loss analysis	Action: A win/loss analysis is performed to research why customers (of partners) chose or did not choose to buy your ecosystems products. This capability looks further than just the product features, e.g. the sales process is reviewed.
		Goal: Learn about your customers/prospects, to generate more future customers for your SECO by tuning product development to them.

The following changes are performed by the respondents:

- 1) four interviewees (i3, i8, i10 and i11) process it into capability CAP.56 Customer win/loss analysis into the Market analysis focus area;

- 2) two interviewees (i5 and i7) do not process it;
- 3) two interviewees (i2 and i9) did not response.

Thus, a majority of the respondents (four out of six) process it into the current capability resulting in the expanded capability CHA.43 (see Table 29).

*Result:*

$$CAP.56 \cup INT.14 = CHA.43$$

Table 29 changed focus area Market analysis.

#			
	Market analysis	Market analysis gathers decision supporting information about the market needed to make decisions about the product portfolio of an organization.	
<b>CHA.21</b>	a.	Market trend identification	Action: There is an active search for market opportunities to either expand existing products to, or create new products for. This search exists of doing market research in markets related to or similar to your organizations markets, visiting conferences, listening to customers, gathering market specific information from partners, etc. All search findings are documented.
			Goal: Widen your product base.
<b>CAP.55</b>	b.	Market strategy	Action: A plan is created showing which markets your product will be going after and how you plan to develop the products for each segment. Eg., in year one you may want to enter healthcare by partnering with another company. Or you may want to enter the financial market in year two by building products in-house or acquiring products.
			Goal: Plan which markets you will target and how you will enter them.
<b>CHA.43</b>	c.	SECO customer win/loss analysis	Action: A win/loss analysis is performed to research why customers (of partners) chose or did not choose to buy your ecosystems products. This capability looks further than just the product features, e.g. the sales process is reviewed.
			Goal: Learn about your customers/prospects, to generate more future customers for your SECO by tuning product development to them.
<b>CAP.57</b>	d.	Competitor analysis	Action: A competitor analysis is performed on an organizational level to analyze what competitors offer, what their strengths are and are going to offer compared to your organizations.
			Goal: Learn from competitors and do not fall behind product-wise.
<b>CAP.58</b>	e.	Custom market trend identification	Action: External market research parties are used to perform a market analysis specifically for the organizations product portfolio.
			Goal: Gain unique information (that your competition does not have) specific to your own organization. Gain an unbiased insight into your market and/or operations.

### New focus areas

Eight interviewees (i2, i3, i5 and i7-i11) are asked to indicate the maturity levels of the capabilities in the three new focus areas. Two interviewees (i2 and i9) did not response and are not included in the analysis. For this analysis the same approach is used as in chapter 5.

However, a remark has to be made on how the data sets are prepared. Some of the respondents did not understand correctly that per new focus area every capability had to be scaled over ten maturity levels. For example, some thought that if a focus area had four capabilities the maturity levels would range from 1 to 4. To solve it all respondents' data is transformed to such a distribution. Plus, if a respondent places two capabilities on one maturity level the following capability is placed on one extra level higher. For example, if respondent places capability 'X' and 'Y' on level 1 the following capability 'Z' is placed on level 3 instead of 2. This is decided because two capabilities (e.g. 'X' and 'Y') are placed in front of it and not one capability. To make it clearer, see for example the distribution of maturity levels of interviewee and i11 in Table 31. See Table 30, Table 31 and Table 32 for the results of the analysis.

Table 30 maturity levels new focus area Contracting.

#	interviewee capability	i3	i5	i7	i8	i10	i11	Analysis		
								Median	Mean	Maturity
CHA.22	Service level agreements	1	2	3	1	1	1	1	1.5	a
CAP.60	Intellectual property management	2	1	2	4	3	2	2	2.33	b
NEW.28	Contract negotiation process	4	3	1	2	2	4	2.5	2.67	c
NEW.25	Determine information profiles	3	4	4	3	4	2	3.5	3.33	d

Table 31 maturity levels new focus area Partnering.

#	interviewee capability	i3	i5	i7	i8	i10	i11	Analysis		
								Median	Mean	Maturity
NEW.30	Register partners	1	1	4	3	1	4	2	2.33	a
CHA.23	Set-up partner network	2	6	1	1	2	7	2	3.17	b
NEW.27	Cluster partners	2	2	5	4	4	1	3	3	c
NEW.29	Coordinate partner alliances	5	3	6	2	4	1	3.5	3.5	d
CHA.24	Partner performance analysis	4	5	7	7	3	1	4.5	4.5	e
NEW.26	Certify partners	6	4	2	6	6	4	5	4.67	f
NEW.14	Certify external components	6	7	3	5	6	4	5.5	5.17	g



Table 32 maturity levels new focus area Channel development.

#	interviewee capability	i3	i5	i7	i8	i10	i11	Analysis		
								Median	Mean	Maturity
<b>CAP.62</b>	Establish and evaluate pricing model	1	1	1	2	3	4	1.5	2	a
<b>CAP.61</b>	Investigate distribution channels	1	2	2	3	1	2	2	1.83	b
<b>NEW.31</b>	Common delivery channel	4	3	3	1	2	1	2.5	2.33	c
<b>NEW.37</b>	Model the SECO	3	4	4	4	4	2	4	3.5	d

## 7. Result

As mentioned in section 4.1 SPM with a SECO approach in keystone organizations is called Software Platform Management. Thus, a Software Platform Management Competence (SPfMC) Model and Software Platform Management Maturity (SPfMM) Matrix for keystones with a directed approach are developed and validated. This chapter will describe the results of the study; i.e. the resulting focus areas and capabilities. Most emphasis is on what is changed compared to the current SPMC Model and SPMM Matrix. It starts with describing the focus areas, its capabilities and focus area specific maturity levels. Whether maturity levels are changed is described at the end of the chapter in Figure 12.

### 7.1 The new model and matrix

#### Requirements management

The Requirements gathering focus area (see Table 16 on page 61) concerns the acquisition of requirements from both internal and external stakeholders. Its description is expanded with the sharing of requirements with relevant and authorized external stakeholders, because of the changes made with regard to new and changed capabilities. The first capability, a. Basic registration, is not changed; requirements are still gathered and registered. The second capability, b. Centralized registration, is not changed as well; incoming requirements are stored in a central database accessible for relevant internal stakeholders. The third capability, c. Opening central database, is a new capability; the central database with incoming requirements is opened for relevant and authorized external stakeholders. It must foster the sharing of resources between SECO members. The fourth capability, d. Automation, is not changed; all incoming requirements are still automatically stored in a central database (e.g.) by means of an online helpdesk. The fifth capability, e. Stakeholder involvement, is a combination of three existing capabilities; it consists of the Internal stakeholder involvement, Customer involvement and Partner involvement capabilities. In it all relevant internal and external stakeholders are involved by gathering their requirements. Plus, per product is determined which stakeholder involvement is most important; leading to the involvement of the right stakeholders. The sixth capability, f. Requirements communication flows, is a new capability; the requirements communication networks are modeled and analyzed to determine the proper communication tactics.

The Requirements identification focus area (see Table 25 on page 116) identifies product requirements by rewriting market requirements to understandable product requirements and connecting requirements that describe similar functionality. The focus area description is not changed. The first capability, a. Uniformity, is not changed as well; market requirements are still rewritten to product requirements (by using a standard template) if the market requirement is applicable to a product. The second capability, b. External feedback, is a new capability; extra feedback on product requirements is gathered from external stakeholders. It raises the quality of product requirements by enriching its content. The third capability, c. Requirements validation, is not changed; the correctness, completeness, and unambiguousness of the requirements are still validated. The fourth capability, d. Connect similar

requirements, is not changed as well; market requirements are grouped together which describe similar functionality by linking market and product requirements to each other. The fifth capability, e. Automatically connect similar requirements, also is not changed; requirements still have to be automatically connected by using advanced techniques (e.g. linguistic engineering).

The Requirements organization focus area (see Table 17 on page 68) organizes the requirements throughout their entire lifecycle based on shared aspects, and describes the dependencies between product requirements. Its description is expanded with: sharing this information with all relevant internal and external stakeholders. Because of the changes made with regard to new and changed capabilities. The first capability, a. Requirement organization, is changed; requirements are organized on shared aspects and requirements for externally build products are recognized and communicated to the specific external developer (i.e. partner). In this way, partners get all the relevant information they need to improve their niche solutions. The second capability, b. requirement lifecycle management, is not changed; a requirement history log is logged by recording who submitted a requirement, when it was submitted, what changes were made to it, what the original description was, and what the current status is. It remains at this place after it has been built, to make reuse in other products possible. The third capability, c. Opening requirements history log, is a new capability; it makes the history log accessible to relevant and authorized external stakeholders. It is opened to foster the sharing of resources within the SECO, because it makes requirements reusable for other external projects. The fourth capability, d. Requirements dependency linking, is not changed; dependencies between market and product requirements are still determined and registered.

### **Release planning**

The Requirements prioritization focus area (see Table 18 on page 73) prioritizes the identified and organized requirements. Its description is expanded by letting the requirements prioritized by relevant internal and external stakeholders, because of the changes made to capabilities. The first capability, a. Internal stakeholder involvement, is changed. Still all relevant internal stakeholders indicate the requirements that should be incorporated in future releases. However, for each stakeholder is determined how important their involvement for the product is. The second capability, b. Prioritization methodology, is not changed; a structured prioritization technique is used. The third capability, c. External stakeholder involvement, is a combination of two existing capabilities; it consists of the Customer involvement and Partner involvement capabilities. In it, all relevant external stakeholders are involved by prioritizing the requirements and per product is determined which stakeholder involvement is most important; leading to the incorporation of the right requirements. The fourth capability, d. Cost revenue consideration, is not changed; information on the cost and revenues (monetary or not) of each (groups of) requirement(s) is taken into account during the prioritizations.

The Release definition focus area (see Table 19 on page 76) selects the requirements that will be implanted in the next release based on the prioritization they received in the previous process. The release definition is created based on the selection. The first capability, a. Basic

requirements selection, is not changed; constraints concerning engineering capacity are taken into account during the selection of requirements for the next release. The second capability, b. Standardization, is not changed as well; a standard template is used to write the release definition. It consists of (e.g.) the selected requirements, a time path and the desired engineering capacity. The third capability, c. Communication, is a changed capability; the original Internal communication capability is expanded with external communication (i.e. communicating the release definition to external stakeholders). Now, partners will know what will be developed and they can prepare and/or improve their niche solutions based on the new or changed features. The fourth capability, d. Advanced requirements selection, is not changed; optimal releases are automatically calculated based on the constraints of the requirements (i.e. engineering capacity, priorities, cost and requirement dependencies). The fifth capability, e. Multiple releases, also is not changed; during the selection of requirements multiple releases are considered.

The Release definition validation focus area (see Table 20 on page 78) is performed before the release is built by the development department. It is targeted at the validation of the release definition by internal and external parties. It is expanded with external parties, because of the changes made with regard to a new capability. The first capability, a. Internal validation, is not changed; the release definition is checked by internal stakeholders before it is realized by the development department. The second capability, b. External validation, is a new capability; the release definition is checked by external stakeholders as well. It creates a better alignment with externally created products, increases its quality, and generates awareness among the external stakeholders. The third capability, c. Formal approval, is not changed; before the software is realized approval standard are determined and verified by the board. The fourth capability, d. Business case, is not changed as well; a business case is being written before the software is realized.

In the Scope change management (see Table 58 on page 168), Release build validation (see Table 59 on page 168) and Launch preparation (see Table 60 on page 169) focus areas nothing is changed for a directed SECO approach. For more information on which capabilities these focus areas consist of, see the references added in the text.

## **Product planning**

The Roadmap intelligence focus area (see Table 26 on page 119) gathers decision supporting information (with the exception of requirements) necessary for the creation of the product roadmap, presented in summary style suited for management information. The first capability, a. Product analysis, is not changed; products are still analyzed on an organizational level to determine the product its strong and weak points on both functional and technical aspects. Relevant stakeholders, such as the development department for the technical part, are involved in this analysis. The second capability, b. Partner roadmap, is not changed as well; an overview is created on what partners are going to develop the coming period. The third capability, c. Society trends, also is not changed; an overview is created on the important trends in society in the coming years (for the organization its product industry and in general). The fourth capability, d. Legislation, is a new capability; continuously an overview needs to be created with regard to changing legislation for the organization its

product industry in order to keep compliant with laws and regulations. The fifth capability, e. Technology trends, is not changed; an overview is created on the important trends in technology in the coming years (for the organization its product industry and in general). The sixth capability, f. Competition trends, is not changed as well; an overview is created on how competing products evolve the coming years (the most common trends and the trends of the most important competing products).

The Core asset roadmapping focus area (see Table 27 on page 120) concerns the planning of future development of core assets; components shared by multiple products within the SECO. Its description is widened to the whole SECO, because of the changes made to capabilities. The first capability, a. Centralized registration, is not changed; all core assets are stored and registered in a standardized manner and at a central location. The second capability, b. SECO core asset identification, is a changed capability; core assets are systematically identified among and surrounding the deliverables of SECO's products. It is expanded to all products created by the SECO, because this increases and simplifies the reuse and maintenance of SECO's core assets. The third capability, c. Make, buy or co-creation decision, is a changed capability as well; a process needs to be in place to actively investigate make, buy or co-creation decisions. It is expanded with co-creation decisions, because costs can be reduced and time can be saved by using and/or co-create with external parties. The fourth capability, d. Core asset roadmap construction, is not changed; still a roadmap is created for (organization's) core assets (existing or in development) showing how the core assets are sustained, upgraded and enhanced.

The Product roadmapping focus area (see Table 28 on page 122) deals with the actual creation of product roadmaps. The first capability, a. Short-term roadmap, is not changed; a roadmap spanning more than one release is created showing the plans. The second capability, b. Theme identification, is a changed capability; release themes are identified and maintained together with relevant internal and external stakeholders for internal and external creation. It is expanded with external stakeholders, themes and creation, because external parties (i.e. partners) are going to develop the new value in a SECO. The third capability, c. Consultation, is a changed capability as well; relevant internal and external stakeholders are consulted for the creation of a product roadmap. It is expanded to external stakeholders to have SECO wide acceptance of the product roadmap and to use the knowledge of all relevant members to create richer and more realistic product roadmaps. The fourth capability, d. Long-term roadmap, is also a changed capability; a long-term roadmap is created that spans a time period of maximum two years. The time span is shortened, because the software industry is changing so fast it is not possible to create valuable roadmaps that span more than two years. The fifth capability, e. Roadmap procedure, is a new capability; a decision procedure has to be defined to make partners aware what will happen if no consensus is reached between the keystone and them in the future plans for the platform. The sixth capability, f. External variants, is not changed; less detailed variants of product roadmaps are created targeted at specific external parties.

## Portfolio management

The Market analysis focus area (see Table 29 on page 123) gathers decision supporting information about the market necessary to make decisions about the product portfolio of an organization. The first capability, a. Market trend identification, is a changed capability; there is an active search for market opportunities to expand existing or create new products for, by doing market research at all kinds of places (e.g. related markets and visiting conferences). It is expanded by adding market research via the use of information gathered from partners, because in SECOs the keystone closely collaborates with the partners. The second capability, b. Market strategy, is not changed; still a plan has to be created on which markets products are focusing on and how an organization plans to develop products for each market segment. The third capability, c. SECO customer win/loss analysis, is a changed capability; a win/loss analysis is performed to determine why customers (of partners) did or did not choose to buy SECO products (i.e. the sales process is reviewed). It is expanded to all products in the ecosystem to learn more about how to generate more customers by tuning the development of the platform. The fourth capability, d. Competitor analysis, is not changed; competitor analyses are performed on organizational level to analyze what they offer and what their strengths (and weaknesses) are. The fifth capability, e. Custom market trend identification, is not changed as well; external market research parties are used to do a market analysis for the organization its product portfolio.

The Partnering & contracting focus area in the SPMC Model and SPMM Matrix is split up into three new focus areas, due to the fact that nine new capabilities are added to it. For more information on this decision, see section 5.2.14. The three new focus areas are Contracting, Partnering and Channel development. The new Contracting focus area (see Table 30 on page 124) focuses on establishing relations with external stakeholders by creating proper and clear agreements with them. The first capability, a. Service level agreements, is changed; SLAs are set up for customers and partners. Thus, it is expanded to partners as well since they will ask for specific services on which agreement have to be made. The second capability, b. Intellectual property management, is not changed; intellectual property is protected and managed. The third capability, c. Contract negotiation process, is a new capability; a contract negotiation process is set up in which (e.g.) realistic objectives, agreements on earnings, intellectual property rights, termination clauses, penalties for bad performance and arbitration procedure are determined. The fourth capability, d. Determine information profiles, is a new capability; information profiles are determined for each (type of) partner(s) (according to their role) in which is clear which partner has access to which information to simplify the sharing of information.

The new Partnering focus area (see Table 31 on page 124) focuses on managing relations with external stakeholders and supporting them in creating the biggest possible value for the ecosystem. The first capability, a. Register partners, is a new capability; all partners are registered in a central database which all (relevant) internal stakeholders can access. To create an overview of all partners and share knowledge (e.g. best practices and experiences) with regard to the partners. The second capability, b. Set up partner network, is a changed capability; partner networks and/or portals are used to regulate and promote partnering. It was part of another capability which is split up in this capability and the fifth capability e.

Partner performance analysis. The third capability, c. Cluster partners, is a new capability; partners are clustered into groups with specific goals, functions, etcetera to simplify the management of them. The fourth capability, d. Coordinate partner alliances, is a new capability; partner(s) (alliances) are coordinated to avoid conflicts and to foster synergy to create a stronger and more coherent SECO. The fifth capability, e. Partner performance analysis, is a changed capability; a partner analysis is performed on an organizational level to analyze what partners have to offer, what their strengths and weaknesses are, and are going to offer. To create a clear and correct picture of the performance of partners which is the basis on which decisions can be made about maintaining or ending partner relations. The sixth capability, f. Certify partners, is a new capability; partners are certified divided over different ranks with different obligations and privileges to make clear what is expected to raise quality. The seventh capability, g. Certify external components, is a new capability; certify external created components on standard quality rules to raise the quality of niche solutions.

The new Channel development focus area (see Table 32 on page 125) focuses on establishing and managing distribution channels. The first capability, a. Establish and evaluate pricing model, is not changed; a process is in place to establish the pricing model and evaluate it periodically to verify whether it still fits the market. The second capability, b. Investigate distribution channels, is not changed; a process is in place to (periodically) analyze the current distribution channels and identify alternative ones. The third capability, c. Common delivery channel, is a new capability; set up a common delivery channel (e.g. the Apple Appstore) to enable partners to sell their products to a large customer base. It makes the SECO more attractive for new partners. The fourth capability, d. Model the SECO, is a new capability; model the SECO at its different levels (e.g. within the SECO and between SECOs) to identify distribution channels, main competitors and potential partners.

The Product lifecycle management focus area (see Table 24 on page 110) concerns the information gathering and key decision making about product life and major product changes across the entire SECO its portfolio. Its description is widened to the entire SECO, because of the changes made to capabilities. The first capability, a. SECO product lifecycle analysis, is a changed capability; at least once per year the current life phase of each product in the SECO is determined based on technical and financial aspects. Plus, information is gathered from internal and external stakeholders. The capability is expanded to the whole ecosystem and by using information from external stakeholders as well. It is important to determine if the keystone still want to support the creation of certain niche solutions and for this external stakeholders have to provide information on externally created products. The second capability, b. Portfolio innovation, is not changed; a decision process is in place to decide whether or not trends are incorporated into one of the current or newly to be developed products. The third capability, c. SECO portfolio scope analysis, is a changed capability; a product scope analysis is performed to identify overlaps and gaps between the products in the whole SECO. The scope is widened to all products in the SECO, because it is important to create a healthy (i.e. diverse) SECO product portfolio. The fourth capability, d. Business case, is not changed; a business case is still performed for major product revisions or in the case of changing product strategies. The fifth capability, e. Product lines, is not changed as

well; product lines are developed, its architecture is documented, and its goal is clearly defined.

### 7.1.1 The Software Platform Management Competence Model

In Figure 12 the SPfM Model is presented. Just like the old model, it consists of four business functions: Requirements management, Release planning, Product planning and Portfolio management. The only changes that are visible are the three new focus areas Contracting, Partnering and Channel development. The three focus areas are a substitution of the Partnering & contracting focus area in the old model. Per focus area is indicated if changes are made with regard to its description, new capabilities, changed capabilities and maturity levels. First, at the upper left corner is indicated in orange with the letter 'D' if its description is changed. Second, at the upper right corner is indicated in blue how many new capabilities are added to it. Third, at the lower left corner is indicated in green how many capabilities are changed. Fourth, at the lower right corner is indicated in yellow if maturity levels of capabilities are changed.

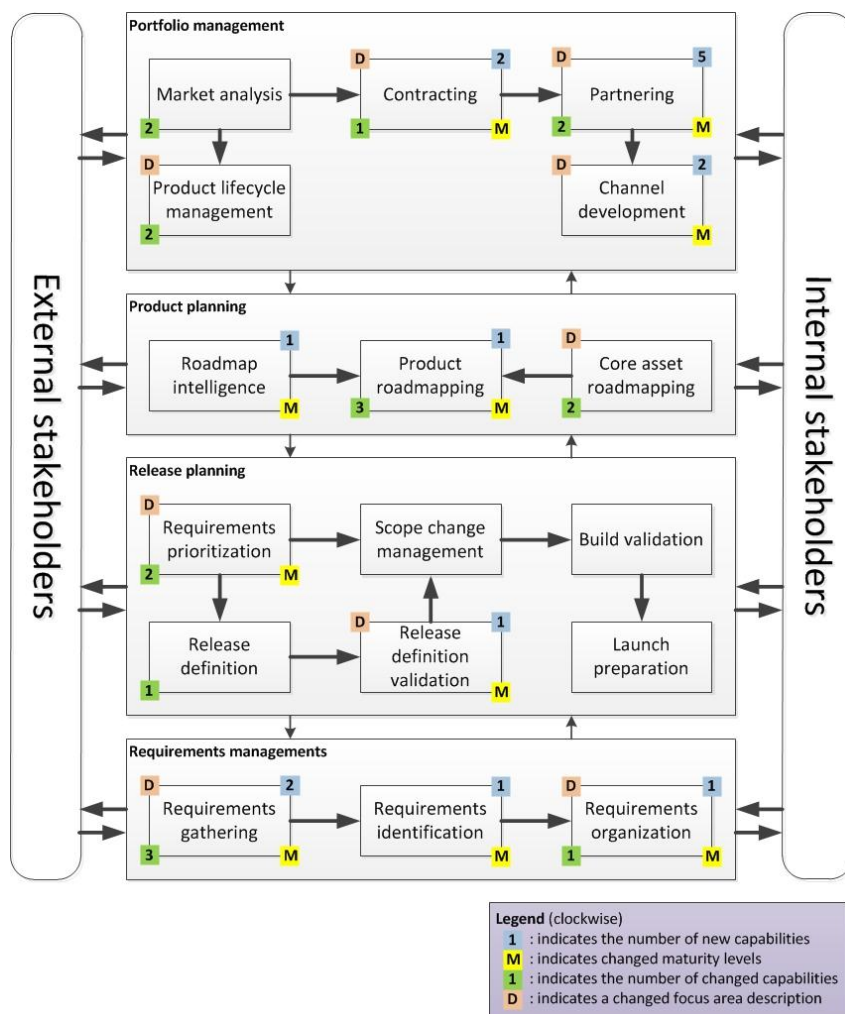


Figure 12 the Software Platform Management Competence Model.



## 7.2 Sources of changes

The sources, analysis and output of each step which resulted in the concluding SPfMC Model and SPfMM Matrix are presented in a super table (see Table 33, Table 34, Table 35 and Table 36). From the leftmost column to the rightmost column the following is indicated:

- the focus areas;
- the capabilities indicated by means of a name;
- the capability codes by means of ‘CAP.\*’ code (see Appendix C for the specific capability);
- any affecting candidate changes derived from the literature indicated by means of a ‘LIT.\*’ code (see section 4.3);
- any relevant changes performed by product managers indicated by means of an ‘INT.\*’ code (see section 5.2);
- the specific source of a change (candidate or performed by a product managers);
- any resulting capabilities presented in the ‘interview result’ and ‘questionnaire result’ columns:
  - an unchanged capability is indicated by means of a ‘=’ symbol;
  - a changed capability is indicated by means of a ‘CHA.\*’ code;
  - a new capability is indicated by means of a ‘NEW.\*’ code;
  - a rejected change is indicated by means of a ‘REJ.\*’ code;
  - a relevant change for the questionnaire is indicated by means of a ‘?’ symbol;
  - a relevant change that is not selected for the questionnaire is indicated by means of a ‘<>’ symbol;
- any changed name of a new or changed capability;
- any changed focus area descriptions and names indicated by means of a ‘FOC.\*’ code.

The target of this super table is to give a complete overview of the study, by presenting the unchanged SPMC Model and SPMM Matrix in the blue columns (i.e. the initial situation), the proposed and performed changes in the red columns (i.e. the execution phase) and the resulting SPfMC Model and SPfMM Matrix in the green columns (i.e. the final situation). In this way, it is possible to trace (e.g.) why a capability is changed by going back to the source sections and looking for the specific codes.

Table 33 first part of the master's thesis super table.

focus area	capability name (Appendix C)	capability code (Appendix C)	candidate change literature (§ 4.3)	relevant change product manager(s) (§ 5.2)	source change	interview result (§ 5.2)	questionnaire result (§ 6.3)	changed/new capability name	focus area change (§ 5.2)
Requirements gathering	Basic registration	CAP.1				=			FOC.4
	Centralized registration	CAP.2				=			
			LIT.1		4.3.1	NEW.1		Opening central database	
				INT.1	5.2.1				
	Automation	CAP.3				=			
	Internal stakeholder involvement	CAP.4	LIT.6		4.3.2	CHA.2		Stakeholder involvement	
	Customer involvement	CAP.5							
	Partner involvement	CAP.6		INT.22	5.2.1				
		LIT.16		4.3.3	NEW.3		Requirements communication flows		
Requirements identification	Uniformity	CAP.7				=			
	Requirements validation	CAP.8				=			
				INT.2	5.2.2	?	NEW.39	External feedback	
	Connect similar requirements	CAP.9				=			
	Automatically connect similar requirements	CAP.10				=			
Requirements organizing	Requirements organization	CAP.11	LIT.7		4.3.2	CHA.5		=	FOC.7
	Requirements lifecycle management	CAP.12				=			
			LIT.2		4.3.1	NEW.6		Opening requirements history log	
				INT.3	5.2.3				
Requirements prioritization	Internal stakeholder involvement	CAP.14		INT.4	5.2.4	CHA.8		=	FOC.10
	Customer involvement	CAP.16	LIT.8		4.3.2	CHA.9		External stakeholder involvement	
	Partner involvement	CAP.18							
	Prioritization methodology	CAP.15				=			
	Cost revenue consideration	CAP.17				=			
Release definition	Basic requirement selection	CAP.19				=			
	Standardization	CAP.20				=			
	Internal communication	CAP.21	LIT.9		4.3.2	CHA.11		Communication	
	Advanced requirements selection	CAP.22				=			
	Multiple releases	CAP.23				=			
			LIT.10		4.3.2	REJ.1			

Table 34 second part of the master's thesis super table.

focus area	capability name (Appendix C)	capability code (Appendix C)	candidate change literature (§ 4.3)	relevant change product manager(s) (§ 5.2)	source change	interview result (§ 5.2)	questionnaire result (§ 6.3)	changed/new capability name	focus area change (§ 5.2)
Release definition validation	Internal validation	CAP.24				=			FOC.13
			LIT.11		4.3.2	NEW.12		External validation	
	Formal approval	CAP.25				=			
	Business case	CAP.26				=			
Scope change management	Event notification	CAP.27				=			
	Milestone monitoring	CAP.28				=			
	Impact analysis	CAP.29				=			
	Scope change handling	CAP.30				=			
Release build validation	Internal validation	CAP.31				=			
	External validation	CAP.32				=			
	Certification	CAP.33				=			
				INT.5	5.2.8	?	<>		
Launch preparation	Internal communication	CAP.34				=			
	Formal approval	CAP.35				=			
	External communication	CAP.36				=			
	Training	CAP.37				=			
	Launch impact analysis	CAP.38				=			
	Sales & Marketing support	CAP.39		INT.6	5.2.9	?	<>		
				INT.7	5.2.9	?	<>		
Roadmap intelligence	Product analysis	CAP.40				=			
	Society trends	CAP.41				=			
	Technology trends	CAP.42				=			
	Competition trends	CAP.43				=			
	Partner roadmap	CAP.44	LIT.12		4.3.2	CHA.15*		=	
				INT.8	5.2.10	?	NEW.40	Legislation	
Core asset roadmapping	Centralized registration	CAP.45				=			FOC.17
	Core asset identification	CAP.46	LIT.3		4.3.1	CHA.16		=	
	Make or buy decision	CAP.47		INT.9	5.2.11	?	CHA.41	Make, buy or co-creation decision	
	Core asset roadmap construction	CAP.48				=			
				INT.10	5.2.11	?	<>		

\*Change CHA.15 is not processed into Figure 12 as a changed capability (i.e. the number in the green box at the lower left corner at the focus area Roadmap intelligence), because it is a maturity level change (i.e. indicated by the 'M' in the yellow box at the lower right corner).

Table 35 third part of the master's thesis super table.

focus area	capability name (Appendix C)	capability code (Appendix C)	candidate change literature (§ 4.3)	relevant change product manager(s) (§ 5.2)	source change	interview result (§ 5.2)	questionnaire result (§ 6.3)	changed/new capability name	focus area change (§ 5.2)	
Product roadmapping	Short-term roadmap	CAP.49				=				
	Theme identification	CAP.50	LIT.13		4.3.2	CHA.18		=		
	Internal consultation	CAP.51	LIT.14		4.3.2	CHA.19		=		
	Long-term roadmap	CAP.52		INT.11	5.2.12	?	CHA.42	=		
	External variants	CAP.53				=				
				LIT.15		4.3.2	NEW.20	Roadmap procedure		
					INT.12	5.2.12	?	◇		
Market analysis	Market trend identification	CAP.54		INT.20		CHA.21		=		
	Market strategy	CAP.55		INT.13	5.2.13	?	◇			
	Customer win/loss analysis	CAP.56		INT.14	5.2.13	?	CHA.43	SECO customer win/loss analysis		
	Competitor analysis	CAP.57		INT.15	5.2.13	?	◇			
	Custom market trend identification	CAP.58		INT.16	5.2.13	?	◇			
					INT.17	5.2.13	?	◇		
Partnering & contracting	Service level agreements	CAP.59		INT.21		CHA.22		=	(Contracting) FOC.32	
	Intellectual property management	CAP.60				=				
				LIT.4		4.3.1	NEW.25	Determine information profiles		
				LIT.20		4.3.5	NEW.28	Contract negotiation process		
				LIT.22		4.3.6	NEW.30	Register partners	(Partnering) FOC.33	
	Monitored partner network	CAP.63	LIT.23			4.3.7	CHA.23			Set up partner network
							CHA.24			Partner performance analysis
				LIT.21		4.3.5	NEW.29			Co-ordinate among alliances
				LIT.19		4.3.5	NEW.27			Cluster partners
				LIT.18		4.3.4	NEW.26			Certify partners
					INT.18	5.2.14				
				LIT.17		4.3.4	NEW.14			Certify external components
	Investigate distribution channels	CAP.61					=		(Channel development) FOC.34	
	Establish and evaluate pricing model	CAP.62					=			
			LIT.27		4.3.9	NEW.31		Common delivery channel		
			LIT.26		4.3.9	NEW.37		Model the SECO		
			LIT.5		4.3.1	REJ.2				

Table 36 fourth and last part of the master's thesis super table.

focus area	capability name (Appendix C)	capability code (Appendix C)	candidate change literature (§ 4.3)	relevant change product manager(s) (§ 5.2)	source change	interview result (§ 5.2)	questionnaire result (§ 6.3)	changed/new capability name	focus area change (§ 5.2)
Product lifecycle management	Product lifecycle analysis	CAP.64	LIT.25	INT.19	4.3.8 5.2.15	CHA.35		SECO product life cycle analysis	FOC.38
	Portfolio innovation	CAP.65				=			
	Portfolio scope analysis	CAP.66	LIT.24		4.3.8	CHA.36		SECO portfolio scope analysis	
	Business case	CAP.67				=			
	Product lines	CAP.68				=			

## 8. Discussion

As is the case with all research, there exist limitations in this study. The limitations are discussed briefly in this chapter.

### Validity

An appropriate way to prove validity of the resulting SPfMC Model and SPfMM Matrix is by means of an in depth longitudinal case study; i.e. applying the model and matrix and measuring its effectiveness on predefined criteria. Implementing the new artifact(s) in a working system is important to prove feasibility and to enable real valuation of the model and matrix's suitability to its intended purposes (Hevner et al., 2004). Hevner et al. (2004) add to it, it enables learning on how the real world works, how the resulting model and matrix affects it, and how product managers appropriate it. However, the time for completing the master's thesis was limited. Performing an in depth longitudinal case study would take years and is therefore not possible. To solve validity issues, specific tactics are used within the chosen research approach which resulted in a valid model and matrix for SPfM. First, tactics with regard to content validity were:

- studying the instruments of the state of the art of SPM (i.e. the SPMC Model and SPMM Matrix);
- performing a literature study on the topics of SPM, SECOs;
- performing a literature study on activities related to these research domains.

It resulted in knowing every relevant facet of the object under study. Second, tactics with regard to construct validity were using structured predefined approaches in which no room for own interpretations was possible during the gathering and analysis of the data. To ensure the product managers knew whether and how they had to perform changes, an introduction on the model, matrix, SECOs and the research objective was given. Third, tactics with regard to external validity were using product managers as the developers and validators of the new model and matrix. They are the intended population of the resulting artifacts. Not all product managers were familiar with the concept SECOs. However, they all performed their SPM activities within companies working closely together with partners. Almost every change performed is supported by a majority of the product managers and thus important to alter into the model and matrix. Only minor changes (e.g. expanding action examples in a capability) are processed without a majority. A reduction of external validity results from the fact that only Dutch product managers are used as developers and validators. Thus, the question remains if the result of this study is generalizable to other countries and/or cultures. Fourth, the result is reliable because for every activity a predefined and structured approach is used. Thus, if this study is replicated it will lead to the same output. Plus, every output and every step is backward traceable, because every part (e.g. capability, candidate change and new capability) is coded.

## **Splitting up Partnering & Contracting**

One change was not minor and was not based on what the majority of the product managers thought. It is the alteration with regard to the split up of the Partnering & contracting focus area into three new focus areas Contracting, Partnering and Channel development and the distribution of the capabilities over these focus areas. First of all, the focus area had to be spilt into two or more focus areas. There were too many new capabilities to put into one focus area. None of the product managers disagreed on this matter. Choosing the right new focus areas is based on what all product managers suggested. Thus, it does reflect the vision of the product managers. Distributing the capabilities over the focus area is based on its most common characteristics and thereby creating three groups of capabilities. It is maybe not the most ideal way to determine new focus areas, but each group (i.e. focus area) reflects a group of capabilities that has certain characteristics in common. And in fact, the objective of this study was only to determine the relevant practices for SPfM; the new focus areas consist of the practices (with regard to contracting, partnering and channel development) relevant for SPfM.

## **Directed SECO approach**

As mentioned earlier, the designed SPfMC Model and SPfMM Matrix are created for keystone organizations using the directed SECO approach. The (new) focus areas and capabilities are important for product managers that conduct SPfM with this approach in mind. They want to identify specialized market segments (i.e. niche markets) to offer solutions. However, the organization is incapable or reluctant to develop the required functionality itself. Therefore, it selects the partners who are willing and are able to develop this functionality. SPfM with a directed approach requires much more emphasis on the initiation and management of partner relationships, as opposed to the undirected approach. Thus, this model and matrix is only validated for the directed approach. How a SPfMC Model and SPfMM Matrix should look like for undirected approach, felt beyond the scope of this master's thesis.

## **Maturity levels and prerequisites**

Important parts of the maturity matrix are its maturity levels and prerequisites of the capabilities. First, maturity levels are indicated in two forms: focus area and matrix specific maturity levels. The focus area specific maturity levels indicate per focus area what maturity level each capability has relative to the other capabilities belonging to that focus area (i.e. indicated by the letters). The matrix specific maturity levels indicate the relative maturity levels of all capabilities belonging to the matrix (i.e. indicated by the numbers ranging from 1 up to 10). This type of maturity levels is not studied. Due to time constraint it felt beyond the scope of this study. Second, the same applies for the prerequisite capabilities; i.e. capabilities which need to be present to enable an effective functioning of other capabilities.

## **Partnering capabilities**

During de interviews some product managers questioned if there should be that much emphasis on the management of partner relationships within SPfM. They indicated partnering activities are more appropriate at some sort of a partner management department

within the organization. Even though, they still added new capabilities with regard to this matter. It initiated the idea to create two versions of the new model and matrix; one with the partner management activities and one without. However, several arguments are found in favor of making only one version with all new partnering capabilities included. First, in the current SPMC Model and SPMM Matrix partner management activities are part of it as well (i.e. at the Partnering & contracting focus area). Second, in the case of SPfM with a directed approach are partners very important. Those stakeholders ensure that new value is created in the SECO. They create the functionality for end-users that was formerly made by the organization. It is therefore very important for a product manager to be deeply involved in activities that manage partner relationships. Third, other scholars agree with this conclusion as well. Fricker (2010) says: “*Software product management establishes and maintains a software ecosystem by managing stakeholders and studying and aligning their interests.*” (p. 62). Bekkers, van de Weerd, Spruit and Brinkkemper (2010) say the product manager is located at the center of the company; from its position he needs to keep contact with every relevant stakeholder to collaboratively reach goals derived from (business) strategy. Ebert (2007) says the product manager needs to find a balance between the needs and wishes of external entities (i.e. customer, markets and stakeholders) and guide them in the right direction. Fourth, due to time constraints it was not possible to create two high quality models and matrices. Fifth, it would do the result of this study no good, because it would make unclear what the best way is to conduct SPfM.

### **Focus area maturity model**

Some of the interviewees had difficulties with the way of describing the maturity levels. They are used to see maturity models in which every level matures incrementally. For example, like the CMMI approach. This type of approaches is considered by them to be much clearer. Studying whether this approach is really better, felt beyond the scope of this study. Plus, the creators of the current model and matrix have explained why they have chosen to make a focus area oriented model (e.g. in Bekkers, Spruit, van de Weerd, Van Vliet, & Mahieu, 2010).

### **Young research domain**

During the literature study on the topic of SECOs, soon became clear the research domain is still very young. For example, several authors use different definitions of SECOs and different terms to describe the same concepts. This made it sometimes hard to create a good and clear overview of all important SECO characteristics and practices. Literature used and described is chosen because it reflects the most widely accepted view on SECOs. For the sake of brevity and keeping it understandable, is chosen not to describe every sub research domain.

### **Scoping the questionnaire**

After the data of the interviews was analyzed, several issues existed with regard to changes of product managers that were not suggested by a majority. In this case there were two options. First, perform it if it was just a minor and legitimate change. Second, for major changes ask the product managers by means of the questionnaire if they would add it to the model and matrix. The second option led to a lot of candidate changes for the questionnaire. Due to



time constraints, not every candidate change could be part of it. Therefore is chosen to only add the changes that were processed by two or more product managers. This led to the situation in which may be relevant changes of product managers (described in section 6.1) would not be assessed on their importance for SPfM.

### **Maturity levels calculation**

The chosen approach for calculating the (new) maturity levels had a small downside. If an interviewee removed multiple capabilities from a focus area, the highest maturity level in a focus area would be lower than in the case of others. For example, interviewee i9 did not add the capabilities on External consultation, Long-term roadmap and Roadmap procedure to the focus area Product roadmapping (see Appendix D). He positioned the External variants capability on the highest maturity level, i.e. level '5' in the analysis. Another interviewee (i7) did add those three mentioned capabilities and positioned External variants on the highest maturity level as well. However, in his case it resulted in a maturity level of '8' for External variants. Thus, creating a difference of three maturity levels. While, maybe in both cases they value the capability intrinsically of the same maturity. An option to solve this problem is not found. Fortunately, it was the only case that an interviewee removed three capabilities.

## 9. Conclusion & future research

In this chapter the research questions will be answered in order to draw conclusions. The answers will be tested against the research objectives to determine if the study has been successful. The objectives of this master's thesis are:

- 1) Study the characteristic and practices of Software Product Management in theory.
- 2) Study the characteristics and practices of Software Ecosystems in theory.
- 3) Create a model and matrix that covers all practices relevant for Software Product Management in Software Ecosystems.

To achieve the research objectives the following main research question is formulated:

- 1) How should a keystone with a directed Software Ecosystem approach organize its Software Product Management?

In order to answer the main research question three sub research questions are formulated. The first sub research question is:

- a) What characteristics of and practices in Software Ecosystems affect Software Product Management in product software companies?

SPM is executed by a product manager, the person who is responsible for an efficient and effective arrangement of the SPM practices. To aid product managers Bekkers, van de Weerd, Spruit, and Brinkkemper (2010) and van de Weerd et al. (2006b) created the SPMC model; it gives an overview of all key areas of SPM. Bekkers and van de Weerd (2010) based the SPMM Matrix on it. The maturity matrix has the same structure (i.e. four business functions) and the same components (i.e. focus areas and capabilities) as the competence model. However, in the maturity matrix the capabilities (i.e. SPM practices) are spread over several maturity levels. In this way, product managers and software organizations can determine how mature the organization of their SPM is (i.e. the level corresponding to their capabilities) and what the areas of improvement are (i.e. the missing capabilities corresponding to the desired level).

The SPMC Model and SPMM Matrix are not specifically made and validated for keystone organizations with a directed SECO approach. For example, the members and environment of a SECO need more attention than in the current model and matrix is the case. By reading literature on the topics of the SPMC Model, the SPMM Matrix, SPM, SECOs, and activities akin to SECOs and SPM, a clear view is obtained of the current status of the relevant research domains. It resulted in three chapters: in chapter 2 SPM literature is described, in chapter 3 SECO literature is described and in chapter 4 SECO characteristics and practices that affect SPM are described. As concluded in section 4.1, SPM in keystone organizations with a directed SECO approach is renamed to Software Platform Management (SPfM). The keystone opens its product to external entities to create a platform by which business and SECO objectives can be reached. The keystone is a software vendor which provides the SECO a platform.

As described in chapter 4, the key topics of the characteristics and practices of SECOs that affect SPfM are: foster the sharing of resources, manage the involvement of partners, manage the communication of requirements, raise the quality by means of certification, initiate and manage (new) partner relationships, create a healthy SECO product portfolio and initiate and manage (new) SECO (sales and distribution) channels. By conducting a literature study and describing its results in chapter 2, 3 and 4 the first and second research objectives are achieved. The SECO characteristics and practices that affect SPM are the answer to the first sub research question and made it possible to answer the second sub research question:

b) What candidate changes can be derived?

By knowing how SECO characteristics and practices could affect SPM to become SPfM, candidate changes are derived. Twenty-seven candidate changes were formulated for potential missing practices or characteristics in the SPMC Model and SPMM Matrix with regard to SPfM. All candidate changes are described in section 4.3. By defining candidate changes the third objective is achieved for a part; the candidate changes made it possible to determine if and how SECO' characteristics and practices affect the current SPMC Model and SPMM Matrix. By answering the third and last sub research question, is (inter alia) determined if the candidate changes need to be performed into the model and matrix for SPfM:

c) What is (not) important for Software Product Management with a directed Software Ecosystems approach?

During the interviews the product managers had to evaluate and change the instruments of state of the art of SPM. They altered the SPMC Model and SPMM Matrix by indicating what had to be changed for SPfM. Their changes were only processed if a majority made the same suggestion. In this stage, the candidate changes (derived in the previous sub research question) are presented as well. Giving the product managers the chance to determine if and how the candidate changes should become part of the model and matrix; i.e. they determined if and how SECO characteristics and practices affect SPfM. The data gathered during the interviews is analyzed in chapter 5. It resulted in fourteen new capabilities, sixteen changed capabilities, nine focus areas with changed maturity levels and nine focus areas with changed descriptions. During the interview analysis, changes made by product managers that are not performed by a majority but are considered as relevant to add are selected for the questionnaire (with the exception of candidate changes). Changes that are performed by two or more interviewees are presented to and assessed by the product managers (analyzed in chapter 6). The questionnaire resulted into two new capabilities, three changed capabilities and one focus area with changed maturity levels. In chapter 7 all (new) capabilities, changed capabilities and changed focus area descriptions are presented.

Based on the analysis of the interviews and questionnaire a new model and matrix is created. It describes how keystone organizations should organize their SPfM practices with a directed approach. A Software Platform Management Competence (SPfMC) Model and Software Platform Management Maturity (SPfMM) Matrix are developed and validated that answers the main research question. By developing the new model and matrix the third research objective is achieved as well. Implementing the capabilities of the new SPfM Model

and Maturity Matrix will increase the chances of creating a successful platform. If a keystone implements these capabilities, it can manage stakeholders, know and align their interest, and thereby enabling new value creation by itself and ecosystem members.

The limitations of this study section can be the initiation for further research. First, new studies could focus on what the relevant SPfM practices are for software vendors which take an undirected SECO approach. Second, future research could focus on the matrix specific maturity levels and prerequisites of capabilities of the SPfMM Matrix. Third, the relevant changes proposed by product managers that were not part of the questionnaire can be the topic of future work. As mentioned earlier, not including these candidate changes in the questionnaire does not mean it are not relevant changes. Fourth, the SPfM practices concluded are only validated by product managers coming from and mostly working in the Netherlands. Further research could focus on whether the results of this study are generalizable to other countries and cultures as well.

## 10. Appendices

### Appendix A.      Keywords literature search

In the following table all keywords are presented used for finding relevant literature. At the beginning of the search is started with looking for literature via the Omega Library UU search engine. But after discussion with other scholars is concluded it was better to use Google Scholar; it covers (almost) the complete array of top ranked management information system journals. The numbers under the search engine columns are structured in the following way: [number of search results viewed]-[number of abstracts read]-[number of literature objects picked for further analysis after reading the abstract]. For example, '100-14-3' means 100 titles are read in the search results, based on the titles 14 abstracts are read and based on the abstracts 3 literature objects are picked for further analysis.

Table 37 keywords used for searching relevant literature.

keywords searched	date	via Omega Library: Elsevier (ScienceDirect) JSTOR EBSCOhost SpringerLink and others	Google (scholar)
software product management ecosystem	10-1-2012	100-14-3	
	12-1-2012		40-14-5
software product management partner	13-1-2012		30-4-0
product management ecosystem	10-1-2012	100-11-3	
	12-1-2012		30-2-1
product management partner	13-1-2012		30-6-1
software ecosystem management	10-1-2012	75-8-2	
	12-1-2012		30-3-1
software partner management	13-1-2012		30-3-2
software ecosystem maturity	10-1-2012	96(all)-6-2	
	12-1-2012		30-5-2
software partner maturity	13-1-2012		30-7-2
software ecosystem	10-1-2012	100-6-3	
	12-1-2012		30-3-0
software ecosystem portfolio management	10-1-2012	60-4-1	
	12-1-2012		30-4-1
software partner portfolio management	13-1-2012		30-5-2
software ecosystem portfolio	10-1-2012	75-1-1	
	12-1-2012		30-9-2
software partner portfolio	13-1-2012		30-4-1
software ecosystem market analysis	10-1-2012	50-0-0	
	12-1-2012		12(all)-1-0
software partner market analysis	13-1-2012		30-3-0
software ecosystem lifecycle management	10-1-2012	50-0-0	
	12-1-2012		17(all)-5-2
software partner lifecycle management	13-1-2012		30-4-1
software ecosystem lifecycle	12-1-2012		30-7-4
software partner lifecycle	13-2012		30-3-0
software ecosystem partnering	10-1-2012	50-0-0	
software ecosystem partners	10-1-2012	50-0-0	
	12-1-2012		30-3-1
software partners	13-1-2012		30-5-1
software ecosystem platform planning	10-1-2012	50-0-0	
	12-1-2012		1(all)-0-0
software partner platform planning	13-1-2012		30-4-2
software ecosystem product planning	10-1-2012	75-3-3	
	12-1-2012		10(all)-4-2
software partner product planning	12-1-2012		30-8-2
software ecosystem roadmap	10-1-2012	100-3-1	
software partner roadmap	12-1-2012		30-5-1
software ecosystem core asset	12-1-2012		10-1-0
software partner core asset	12-1-2012		30-6-2
software ecosystem release planning	12-1-2012		21(all)-3-0
software partner release planning	12-1-2012		30-2-0
software ecosystem release	12-1-2012		30-4-2
software partner release	12-1-2012		30-4-1
software ecosystem scope change	12-1-2012		No found
software partner scope change	12-1-2012		30-3-0
software ecosystem build validation	12-1-2012		1(all)-0-0
software partner build validation	12-1-2012		30-1-0
software ecosystem release validation	12-1-2012		1(all)-0-0
software partner release validation	12-1-2012		25-4-2
software ecosystem launch	12-1-2012		30-4-0
software partner launch	12-1-2012		30-1-0
software ecosystem release heartbeat	12-1-2012		1(all)-0-0
partner release heartbeat	12-1-2012		6(all)-0-0
software ecosystem requirements management	12-1-2012		27(all)-3-2
software partner requirements management	12-1-2012		30-5-1
software ecosystem requirements	12-1-2012		30-2-1
software partner requirements	12-1-2012		30-8-3

## **Appendix B. Interview protocol**

Comment: This protocol is largely written in Dutch.

### **Preparation**

#### **The interview**

The interviews are highly structured interviews. Each interviewee is asked to give his or her view on each focus area and capabilities of the SPMC Model and the SPMM Matrix to make Software Product Management in Software Ecosystems possible. The interviewer will start with an introduction on what the SPMC Model, the SPMM Matrix and Software Ecosystems are to give the interviewee a clear scope of what type of knowledge the interviewer is looking for.

#### **Recording data**

The complete interview is audio-recorded. Per interview two interview protocols are printed on which the interviewer and the interviewee can make notes which represent the message he or she explains. The interviewer explains this at the beginning of the interview. The interviewer will ask the interviewee before the start of the interview how confidential the data needs to be processed.

#### **Guidelines**

If an answer is unclear the interviewer will rephrase the question. Or the interviewer will summarize the answer in a way he thinks the interviewee means it and asks the interviewee to (dis)approve. The interviewer will avoid using suggestive questions. All bold parts are parts which need to be told to the interviewee.

#### **Language**

Both the interviewee as the interviewer is Dutch, so the interview will be held in Dutch. The rest of this document is mainly written in Dutch.

## Inleiding

Ik zal eerst beginnen met een introductie over het Software Product Management Competence Model en de bijbehorende Maturity Matrix. Daarna zal ik uitleggen wat Software Ecosystems zijn en welke aspecten belangrijk zijn voor SPM.

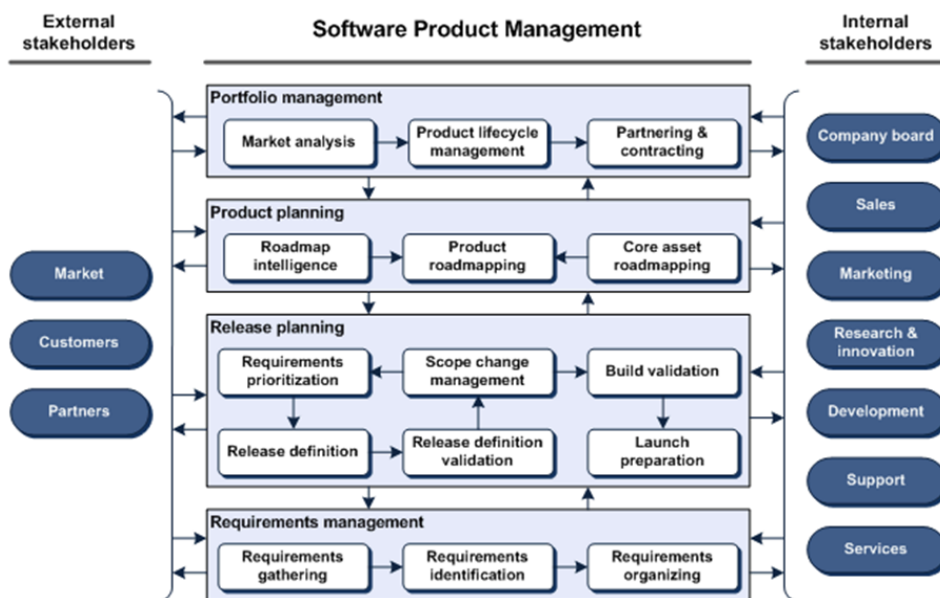


Figure 1. Het Software Product Management Competence Model

Het SPM Competence Model (zie bovenstaand figuur) geeft een overzicht van alle gebieden die belangrijk zijn binnen het terrein van SPM. Deze gebieden worden focus areas genoemd. Alle relevante externe en interne stakeholders staan aan de zijkanten.

Dit model bezit geen ontwikkel activiteiten van de product software organisatie. Ontwikkeling is gewoonweg geen onderdeel van SPM, zij zijn één van de stakeholders die voor input in het SPM proces zorgen.

De vier business functions waaruit SPM wel uit bestaat zijn: Requirements management, Release planning, Product planning, en Portfolio management. Deze business functions zijn gebaseerd op de structuur waarin een portfolio uit producten bestaat, een product bestaat uit releases en releases bestaan uit requirements. Elke business function bestaat uit een aantal focus areas. Elke focus areas vertegenwoordigen een sterk samenhangende groep capabilities (vaardigheden) binnen een business function. Daarnaast zijn er nog allerlei pijlen tussen stakeholders en de business functions. Dit staat voor de interactie tussen hen. Ook is er interactie tussen business functions. De pijlen tussen de focus areas staan voor de stroom van het proces en de interactie tussen de focus areas.



	0	1	2	3	4	5	6	7	8	9	10
<i>Requirements management</i>											
Requirements gathering		A		B	C		D	E	F		
Requirements identification			A			B		C			D
Requirements organizing				A		B		C			
<i>Release planning</i>											
Requirements prioritization			A		B	C	D			E	
Release definition			A	B	C				D		E
Release definition validation					A			B		C	
Scope change management				A		B		C		D	
Build validation					A			B		C	
Launch preparation		A		B		C	D		E		F
<i>Product planning</i>											
Roadmap intelligence				A		B	C		D	E	
Core asset roadmapping					A		B		C		D
Product roadmapping			A	B			C	D		E	
<i>Portfolio management</i>											
Market analysis					A		B	C	D		E
Partnering & contracting						A	B		C	D	E
Product lifecycle management					A	B			C	D	E

Figure 2. De Software Product Management Maturity Matrix

De SPM Maturity Matrix (zie bovenstaande figuur) is gebaseerd op het SPM Competence model. Het geeft een overzicht van alle capabilities geordend in een best practice volgorde. Daarbij staan de letters in bovenstaande matrix voor de capabilities en de cijfers voor de maturity levels. Hoe hoger het cijfer hoe rijper (meer mature) de SPM is georganiseerd. Op deze manier hebben organisatie een leidraad voor de verbetering van hun SPM.

## Software Ecosystems

Een definitie van Software Ecosystems is: “... *a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.*” (Jansen, Finkelstein & Brinkkemper, 2009b, p. 2)

Volgens bepaalde wetenschappers (Iansiti en Levien) zijn twee belangrijke rollen die in een (bedrijven) ecosysteem worden vervuld de volgende:

- **Keystone:** Een welwillende entiteit die een centrale rol vervult in het netwerk. Deze organisatie biedt het netwerk voordelen door software beschikbaar te stellen (betaald of onbetaald). Het streeft er niet naar om zelf alle (niche) markten te bereiken met het product, maar laat dit over aan de andere leden.
- **Niche players:** Het overgrote deel van de leden van een ecosysteem. Zij maken gebruik van de software die de keystone beschikbaar stelt. Zij proberen niet te concurreren met een keystone. Maar ze proberen bij te dragen aan een ecosysteem door een specifiek en speciaal gebied te bereiken (de niches in de markt).

Software bedrijven krijgen steeds beter in de gaten dat ze geen geïsoleerde entiteiten zonder relaties met en afhankelijkheden van andere externe entiteiten. Deze externe entiteiten kunnen allerlei rollen vervullen, bijvoorbeeld:

- **Value Added Distributors (VADs):** “...for outsourcing of production and distribution activities, often for enrichment of products with solution components, for management of smaller partners and a better market penetration.” (Kittlaus & Clough, 2009, p. 25)
- **Independent Software Vendors (ISVs):** “...vendors of application software whose solutions are based on or favor a vendor’s own products. ISVs play a special role as a sales and distribution channel insofar as they frequently install the other vendor’s software in their own products and encapsulate the interfaces. This may make the software invisible and no longer capable of being used separately, or else the right to use is contractually limited to the ISV’s solution.” (Kittlaus & Clough, 2009, p. 25)
- **System integrators (SIs):** “...service companies that add solution components and take over the customer-specific installation and customizing up to the overall project responsibility.” (Kittlaus & Clough, 2009, p. 25)
- **Technological alliances:** “...as sales cooperation, for preinstallation, for completeness of solution offers and synergy in marketing.” (Kittlaus & Clough, 2009, p. 25)

Het inzicht krijgen dat ze geen geïsoleerde entiteiten zijn kan waardevol zijn als software bedrijven zich ‘openen’ voor deze externe entiteiten. In dit geval erkennen zij dat ze onderdeel zijn van een ecosysteem en gaan ze in dit ecosysteem leven op een manier dat zij én het ecosysteem hier beter van worden. Als men een probleem probeert op te lossen of goed werk probeert af te leveren, dan gaat het op dat hoe meer mensen hierbij betrokken zijn des te beter het resultaat is. Dit is ook wel bekend als de ‘wisdom of crowds’ of nog bekender ‘crowdsourcing’. Dit is eigenlijk de kern van een Software Ecosystems, waarin het nauw samenwerken met elkaar tot meer en betere resultaten zal leiden. Neem bijvoorbeeld Apple met hun Appstore. De hoeveelheid en kwaliteit van de verschillende soorten software producten die hierin worden aangeboden konden met geen mogelijkheid door Apple alleen worden bedacht en ontwikkeld. Het succes van dit ecosysteem (en andere!) zit hem in het feit dat een grote groep ontwikkelaars ervoor zorgen dat het aanbod enorm is. Hiermee wordt elke bekende niche markt aangeboord.

## Doel

Ik wil met dit interview achterhalen hoe u denkt hoe een keystone zijn Software Product Management moet inrichten om samen met niche players een zo waardevol Software Ecosystem te creëren. Waardevol in de zin van:

- alle niche markten die bekend zijn bij de keystone of niche player en waar de keystone aanwezig wil zijn worden bereikt met het eigen product dan wel een niche oplossing, dit moet leiden tot een bredere markt penetratie en meer innovatie;
- de producten die gecreëerd worden (zowel door de keystone als de niche players) zijn van de juiste (prijs-)kwaliteit (verhouding);

- er wordt naar gestreefd om tot een markt dominantie te komen doordat potentiële niche players de waarde van het ecosysteem zien en hier ook onderdeel van willen worden. Dit zal een sneeuwbal effect veroorzaken die nog meer niche players aantrekt wat weer moet leiden tot het worden van een *de facto standard*. Het laatste zorgt ervoor dat ook nog meer nieuwe eind gebruikers worden aangetrokken en het moeilijker is om niet van de producten uit het ecosysteem gebruik te maken.

Ter afbakening wil ik u nog het volgende vertellen:

- ik wil het SPMC Model en de SPMM Matrix zo aanpassen (en valideren) dat het geschikt is voor de Directed approach. Dit betekent dat de keystone bepaalde niche markten heeft ontdekt en men wil deze klanten een geschikt product aanbieden. Maar ze kunnen of willen deze niche markten niet zelf bedienen. In dit geval, kiezen ze zelf de niche players die wel in staat zijn deze niche oplossingen te maken. Dit in tegenstelling tot de Undirected approach. Deze aanpak kan gezien worden als het andere uiterste van het spectrum. De keystone levert een product welke als basis voor applicatie ontwikkeling dient. Daarop kan elke externe ontwikkelaar die dat wil (m.a.w. niche players), zonder enige restrictie met betrekking tot wie of wat iets ontwikkelen op of met dit product. Het creëren van niche oplossingen wordt in dit laatste geval compleet losgelaten door de keystone;
- het valt normaal gesproken niet onder de verantwoordelijkheid van een product manager om te bepalen welke rol zijn of haar bedrijf wil spelen in een ecosysteem. Dit is onderdeel van de bedrijfsstrategie en wordt bepaald door het hogere management;
- Software Product Management organiseert en onderhoudt een ecosysteem door het managen van belanghebbenden (o.a. niche players) en het bestuderen en afstemmen van hun interesses;
- realistisch antwoorden a.u.b.:
  - geen antwoorden met de gedachte: “*Dat zou wel leuk zijn.*”;
  - maar antwoorden geven waarvan u echt denkt dat het echt iets bij zou dragen;
  - kort & bondig antwoorden a.u.b.

## Interview

Comment: For brevity sake is chosen to only give an example of one focus area. The subsequent focus areas (see Appendix C) and candidate changes (see section 4.3) are discussed in the same way by using the same questions.

## Business function Requirements Management.

Requirements management concerns the management of the requirements themselves outside of the releases.

## Requirements gathering

Hieronder staat de huidige focus area Requirements gathering. Lees door en beantwoord daarna de volgende vragen (deze vragen zullen herhaald worden voor alle huidige focus areas):

- Welke capabilities moeten worden gewijzigd voor een SECO aanpak? Geef eventueel aan wat m.b.t. de omschrijving, de naam en het doel.
- Hebben bepaalde capabilities een hogere of lagere prioriteit bij SECO aanpak?
- Zijn er bepaalde capabilities niet relevant voor een SECO aanpak?

Requirements gathering	Requirements gathering concerns the acquisition of requirements from both internal and external stakeholders	
a.	Basic Registration	Action: Requirements are being gathered and registered. Goal: Create a basis for product development.
b.	Centralized registration	Action: All incoming requirements are stored in a central database, which is accessible to all relevant stakeholders. Goal: Structuring of requirements registration.
c.	Automation	Action: All incoming requirements are automatically stored in a central database (e.g. by means of an online helpdesk). Goal: Reduced workload / improved speed of requirements gathering process, reduced error percentage.
d.	Internal stakeholder involvement	Action: Requirements are gathered from all relevant internal stakeholders: support, services, development, sales & marketing, research & development (parties not present in your organization can be ignored). Goal: Improved product quality & increased involvement of internal stakeholders in the product management process.
e.	Customer involvement	Action: Customer and prospect requirements are being gathered and registered, and the customer or prospect is informed of the developments concerning their requirements. Goal: Incorporation of customer needs and wishes in the product.
f.	Partner involvement	Action: Requirements are systematically gathered from partner companies. Goal: Improved product quality & increased involvement of external stakeholders in the product management process.

Hieronder staan de kandidaat verbeteringen. Lees ze door en beantwoord daarna de volgende vragen (deze vragen zullen herhaald worden voor alle kandidaat verbeteringen):

- Welke kandidaat verbeteringen moeten door worden gevoerd?
- Welke kandidaat verbeteringen moeten gewijzigd door worden gevoerd?
- Heeft u nog suggesties voor capabilities die onderdeel zouden moeten zijn? Geef aan m.b.t. de omschrijving, de naam en het doel.

En per gekozen of voorgestelde capability:

- Waar moeten de (nieuwe) capabilities geplaatst worden qua maturity?

	Candidate changes	Argument
b.*	...accessible to all relevant internal stakeholders and partners.	Partners can see what yet needs to be made. This may create new opportunities to share SECO's resources
new	The central database with the incoming requirements is accessible to partners.	
d.	Involve partners as well.	It may improve the possibilities for partners to create new niche solutions. Their requirements for the software product or platform become more important than in the current model and matrix.
e.	Involve partners as well.	
f.	Change to partners and give it a higher priority.	
new	Model the requirements communication networks (i.e. the communication of requirement flows among stakeholders).	It enables the analysis of the communication of requirements and helps in selecting the right tactics, strategy and methods for the communication of interests and expectations of stakeholders.

\*Als in de uiterst linkse rij een letter staat dan betekent dit dat het een uitbreiding is op de huidige capability met die letter. Als er het woord 'new' staat dan betekent dit dat deze kandidaat verbetering wordt verwerkt als een nieuwe losse capability.

## Afsluiting interview

Neem alle bevestigde of door u voorgestelde verbeteringen nog eens globaal in uw gedachte. Zorgen de verbeteringen ervoor dat de nadruk binnen Software Product Management te veel op externe belanghebbenden is komen te liggen of denkt u dat het model met verbeteringen nog steeds in balans is?

## Appendix C. Focus areas

### Requirements management

Requirements management concerns the management of the requirements themselves outside of the releases.

Table 38 the focus area Requirements gathering.

#	Requirements gathering	Requirements gathering concerns the acquisition of requirements from both internal and external stakeholders	
<b>CAP.1</b>	a.	Basic Registration	Action: Requirements are being gathered and registered. Goal: Create a basis for product development.
			Prerequisite: Requirements gathering A
<b>CAP.2</b>	b.	Centralized registration	Action: All incoming requirements are stored in a central database, which is accessible to all relevant stakeholders. Goal: Structuring of requirements registration.
			Prerequisite: Requirements gathering A
<b>CAP.3</b>	c.	Automation	Action: All incoming requirements are automatically stored in a central database (e.g. by means of an online helpdesk). Goal: Reduced workload / improved speed of requirements gathering process, reduced error percentage.
			Prerequisite: Requirements gathering A
<b>CAP.4</b>	d.	Internal stakeholder involvement	Action: Requirements are gathered from all relevant internal stakeholders: support, services, development, sales & marketing, research & development (parties not present in your organization can be ignored). Goal: Improved product quality & increased involvement of internal stakeholders in the product management process.
<b>CAP.5</b>	e.	Customer involvement	Action: Customer and prospect requirements are being gathered and registered, and the customer or prospect is informed of the developments concerning their requirements. Goal: Incorporation of customer needs and wishes in the product.
<b>CAP.6</b>	f.	Partner involvement	Action: Requirements are systematically gathered from partner companies. Goal: Improved product quality & increased involvement of external stakeholders in the product management process.

Table 39 the focus area Requirements identification.

#	Requirements identification	Requirements identification identifies the actual Product Requirements by rewriting the Market Requirements to understandable Product Requirements, and connecting requirements that describe similar functionality.	
<b>CAP.7</b>	a.	Uniformity	Action: Market requirements are rewritten to product requirements using a pre-defined template if the market requirement is applicable to a product.
			Goal: Identification of the essence of the requirements, this provides clarity to all involved, enables a meaningful comparison of requirements.
			Prerequisite: Requirements gathering A
<b>CAP.8</b>	b.	Requirements validation	Action: The correctness (“Is the definition correct?”), completeness (“Does the requirement describe all relevant aspects?”), and unambiguousness (“Can the requirement only be interpreted in one way?”) of the requirement is validated.
			Goal: Validation of the requirements to prevent rework.
			Prerequisite: Requirements gathering A
<b>CAP.9</b>	c.	Connect similar requirements	Action: Group together market requirements which describe similar functionality by linking market requirements and product requirements to each other.
			Goal: Identify the true need for requirements (e.g. two requirements that individually are not valued high enough could be valued high enough when merged), prevention of double requirements.
			Prerequisites: Requirements gathering A and B
<b>CAP.10</b>	d.	Automatically connect similar requirements	Action: Automatically connect similar requirements by using advanced techniques such as linguistic engineering.
			Goal: Reduce the workload of the connecting of similar requirements.
			Prerequisites: Requirements gathering A and B

Table 40 the focus area Requirements organizing.

#	Requirements organizing	Requirements organizing organizes the requirements throughout their entire lifecycle based on shared aspects, and describes the dependencies between Product Requirements.	
CAP.11	a.	Requirement organization	Action: Product requirements are organized based on shared aspects (e.g. type, function, or core asset).
			Goal: Increase potential of requirements by identifying value outside of the original boundaries, and provide insight into the planning concerning the requirement.
			Prerequisite: Requirements gathering A
CAP.12	b.	Requirement lifecycle management	Action: A requirements history is logged by recording who submitted it, when it was submitted, what changes were made to it, what the original description of the requirement was, what the current status of the requirement is (e.g. new, rewritten, validated, organized, scheduled for release X, tested, released in release X, etc.). A requirement remains in the database after it has been build so that it can be reused in a new or related product.
			Goal: Make requirements reusable for other projects, adds traceability for a requirements (easy to gather extra information, discover mistakes).
			Prerequisite: Requirements gathering A
CAP.13	c.	Requirements dependency linking	Action: Dependencies between market and product requirements are determined and registered. A dependency exists when a requirement requires the specific action of another requirement. E.g. a requirement requires that another requirement be implemented too, or that another requirement is not implemented in case of conflicting requirements. The linkage can be supported by using advanced techniques, such as linguistic engineering.
			Goal: The existence of requirements interdependencies means that requirements interact with and affect each other. Requirement dependency linking prevents problems that result from these interdependencies, and therewith enables better planning of the development process.
			Prerequisite: Requirements gathering A



## Release planning

Release planning consists of the SPM capabilities needed to successfully create and launch a release.

Table 41 the focus area Requirements prioritization.

#	Requirements prioritization	The identified and organized requirements are prioritized.	
CAP.14	a.	Internal stakeholder involvement	Action: All relevant internal stakeholders (e.g. the product manager, support, services, development, sales & marketing, research & development) indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view.
			Goal: Improved product quality & increased involvement of internal stakeholders in the product management process.
			Prerequisite: Requirements gathering A
CAP.15	b.	Prioritization methodology	Action: A structured prioritization technique is used (e.g. MOSCOW, Wieggers).
			Goal: Structure the requirement prioritization process and therewith provide a solid prioritization which is balanced, and clear to all parties involved.
			Prerequisite: Requirements gathering A
CAP.16	c.	Customer involvement	Action: Customers and prospects (or representatives thereof) indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view. Customers can also be represented in a delegation, select group of customers, or in other more manageable forms.
			Goal: Incorporation of customer needs and wishes in the product.
			Prerequisites: Requirements gathering A and B
CAP.17	d.	Cost revenue consideration	Action: Information about the costs and revenues of each (group of) requirement(s) is taken into account during the requirements prioritization (costs can be expressed in other means than money).
			Goal: Create a financial basis for the prioritization.
			Prerequisite: Requirements gathering A
CAP.18	e.	Partner involvement	Action: Partner companies indicate the requirements that should be incorporated in future releases by assigning priorities to the requirements from their point of view.
			Goal: Improved product quality & increased involvement of external stakeholders in the product management process.
			Prerequisite: Requirements gathering A

Table 42 the focus area Release definition.

#	Release definition	During the 'Release definition' process, the requirements that will be implemented in the next release are selected, based on the prioritization they received in the preceding process. And the release definition is created based on the selection.	
CAP.19	a.	Basic requirements selection	Action: During requirements selection for the next release, constraints concerning engineering capacity are taken into account. Goal: Create a realistic release selection.
CAP.20	b.	Standardization	Action: A standard template is used to write the release definition. The release definition contains aspects such as an overview of the requirements that will be implemented, a time path, and the needed capacity. Goal: Create clarity, enable comparison of releases.
CAP.21	c.	Internal communication	Action: The release definition is communicated to the internal stakeholders. Goal: Inform the internal stakeholders of the upcoming development. Prerequisite: Release definition A
CAP.22	d.	Advanced requirements selection	Action: The optimal release is automatically calculated based upon the constraints of the requirements. At minimum the engineering capacity, priorities, cost, requirement dependencies are all taken into account. Goal: Optimize the release selection. Prerequisites: Release definition A and Requirements organizing C
CAP.23	e.	Multiple releases	Action: Multiple releases are included in the requirements selection process. Goal: Create a more detailed mid-term vision the product.

Table 43 the focus area Release definition validation.

#	Release definition validation	The 'Release definition validation' is performed before the release is built by the development department. It focuses on the validation of the release definition by internal parties.	
CAP.24	a.	Internal validation	Action: The release definition is checked by internal stakeholders, before the software is realized. Goal: Increase quality of releases, generate awareness among internal stakeholders. Prerequisite: Release definition A
CAP.25	b.	Formal approval	Action: Approval standards are determined and verified by the board before the software is realized (turned over to development). Goal: Increase release quality, improve internal acceptance. Prerequisite: Release definition A
CAP.26	c.	Business Case	Action: A business case (including the ROI) is being written before the software is realized. Goal: Verify real world viability of release. Prerequisite: Release definition A and Requirements prioritization D

Table 44 the focus area Scope change management.

#	Scope change management	Scope change management handles the different kinds of scope changes that can occur during the development of a release.	
CAP.27	a.	Event notification	Action: A formal scope change management process is in place, in which all involved stakeholders are informed. Goal: Create awareness of the problem, learn from the problem for future projects.
CAP.28	b.	Milestone monitoring	Action: Key dates and checkpoints are monitored in the product delivery. Goal: Create more insight into the development process by introducing milestones.
CAP.29	c.	Impact analysis	Action: An impact analysis is performed to determine the effects of the scope change. Goal: Determine the impact of the problems to be able to inform all stakeholders.
CAP.30	d.	Scope change handling	Action: A process is in place to develop alternative plans, with all relevant stakeholders, to react to the effects of the scope change. Goal: Minimize effects of scope change.
			Prerequisite: Scope change management C

Table 45 the focus area Release build validation.

#	Release build validation	The Release build validation is performed after the release has been built by the development department. It focuses on the validation of the built release before the release candidate is launched.	
CAP.31	a.	Internal validation	Action: Internal stakeholders (consultants, etc.) perform a functional validation of the build release to verify that it meets the expected outcome. Goal: Improve product quality.
CAP.32	b.	External validation	Action: The build is validated by external parties (customers, partners) to verify the builds quality (e.g. by settings up a pilot). Goal: Improve product quality.
CAP.33	c.	Certification	Action: Certification by an independent external party is acquired for the release. Goal: Improve product quality, get independent confirmation of product quality to prove the quality of your product.

Table 46 the focus area Launch preparation.

#	Launch preparation	Launch preparation prepares the internal and external stakeholders for the launch of the new release. It addresses issues ranging from communication, to documentation, training, and the preparations for the implementation of the release itself.	
CAP.34	a.	Internal communication	Action: Information about the upcoming new release is communicated to the internal stakeholders. This information contains a description of the most important changed and added features, the estimated release date, possible costs involved, information about how the new release can be obtained, possible training dates, etc.
			Goal: Inform all internal parties involved of the upcoming release.
CAP.35	b.	Formal approval	Action: A formal 'go', based upon standard quality rules, must be obtained from the board before the launch can begin.
			Goal: Higher quality of releases.
CAP.36	c.	External communication	Action: Information about the upcoming new release is communicated to the external stakeholders. This information contains a description of the most important changed and added features, the estimated release date, possible costs involved, information about how the new release can be obtained, possible training dates, etc.
			Goal: Inform all external parties involved of the upcoming release.
CAP.37	d.	Training	Action: Trainings are organized and documentation is updated for both internal parties (e.g. service desk, consultants) and external parties (e.g. customers, partner companies) to help educate them in the new release.
			Goal: Ensure a smooth transition to the new version, enable optimal use of the new version.
CAP.38	e.	Launch impact analysis	Action: Determine how much time it is going to take to implement the new release at the individual customers, and what type of experts are needed to perform the implementation (e.g. database experts).
			Goal: Ensure a smooth transition to the new version (on time, without problems).
CAP.39	f.	Sales & Marketing support	Action: Create a checklist of all external expression of the product (e.g. fact sheets, demo's, presentations) that may need to be updated by changes made in latest release of the product. These items must be checked, and possible updated before they are available to external parties (e.g. customers, partners).
			Goal: Ensure external corporate expressions are correct.

## Product planning

Product planning is concentrated around the gathering of information for, and creation of a roadmap for a product or product line, and its core assets.

Table 47 the focus area Roadmap intelligence.

#	Roadmap intelligence	Roadmap intelligence gathers decision supporting information needed in the creation of the product roadmap and presents it in summary style suited for management information. It does not include the requirements gathered in Requirements management.	
CAP.40	a.	Product analysis	Action: The organization's products are analyzed to determine the product's strong and weak points on both functional and technical aspects. Relevant stakeholders, such as the development department for the technical part, are involved in this analysis.
			Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
CAP.41	b.	Society trends	Action: An overview is created showing the big picture of important trends in society in the coming years. This picture contains a general view and a view specific for your products industry.
			Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
CAP.42	c.	Technology trends	Action: An overview is created showing the big picture of important developments in terms of technology in the coming years. This picture contains a general view and a view specific for your products industry.
			Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by current and up-and-coming technologies.
CAP.43	d.	Competition trends	Action: An overview is created showing what competing products are doing in terms of their product development in the coming years. The general developments trends among your competitors are shown, and the developments of the most important competing products are depicted with special attention.
			Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by your partners.
			Prerequisite: Roadmap intelligence A
CAP.44	e.	Partner roadmap	Action: An overview is created showing what your partners will be developing the coming period. Examples of partner products are operating systems, development environments, database, etc. The overview shows what will be happening with the core platform software as well as what the partner organization will be delivering in terms of their own products and development tools that your organization can or will need to use to support the partner products/components.
			Goal: Show how your organization responds to developments of partner products and which your own products rely.

Table 48 the focus area Core asset roadmapping.

#	Core asset roadmapping	Core asset roadmapping concerns the planning of future development of core assets (components that are shared by multiple products).	
CAP.45	a.	Centralized registration	Action: All core assets are registered in a standardized manner, and are stored in a central location. Goal: Enable the reuse of components.
CAP.46	b.	Core asset identification	Action: Common components/functionality (core assets) is systematically identified among the organizations products and deliverables surrounding the product. Goal: Increase and simplify the reuse and maintenance of components.
CAP.47	c.	Make or buy decision	Action: A process is in place to actively investigate make-or-buy decisions: external sources are investigated based on ROI in the search for core asset acquisition: partners, outsourcing or subcontracting of development. Goal: Cost and time savings by using external parties.
CAP.48	d.	Core asset roadmap construction	Action: A roadmap is created for the core assets, this roadmap shows how the core assets are sustained, upgraded, and enhanced. This roadmap contains both existing core assets, and core assets that are in development. Goal: Provide insight in the future plans for the core assets to ensure that this is incorporated in the product roadmap in a realistic and optimal form.
			Prerequisite: Core asset registration A

Table 49 the focus area Product roadmapping.

#	Product roadmapping	Product roadmapping deals with the actual creation of the product roadmap itself.	
<b>CAP.49</b>	a.	Short-term roadmap	Action: A roadmap is developed detailing the short-term plans. The plans span more than one release. Goal: Development of a short-term vision of the product(s).
<b>CAP.50</b>	b.	Theme identification	Action: Release themes are identified and maintained. Themes are decided on together with the internal stakeholders. Identification of the themes results in a list of release themes that are stored centrally, so that requirements, core assets, market trends etc. can be linked to it. Goal: Structuring of releases and roadmaps: themes are used give a clear direction to the roadmap and later on to structure the requirements.
<b>CAP.51</b>	c.	Internal consultation	Action: Product roadmaps are created in consultation with all relevant internal stakeholders. Goal: Organization wide acceptance of the product roadmap. Optimal use of all knowledge in the organization to create more rich and realistic product roadmaps
<b>CAP.52</b>	d.	Long-term roadmap	Action: The roadmap spans a time period of at least four years. Goal: Development of a long-term vision of the product(s). Prerequisite: Product roadmapping A
<b>CAP.53</b>	e.	External variants	Action: Less detailed variants of the internal roadmap are created for specific external parties (e.g. customers, partners, investors). Goal: Informing of customers/managing customers' expectations, marketing tool. Informing external parties using information they want.

## Portfolio management

Portfolio management concerns the strategic information gathering and decision making across the entire product portfolio.

Table 50 the focus area Market analysis.

#	Market analysis	Market analysis gathers decision supporting information about the market needed to make decisions about the product portfolio of an organization.	
CAP.54	a.	Market trend identification	Action: There is an active search for market opportunities to either expand existing products to, or create new products for. This search exists of doing market research in markets related to or similar to your organizations markets, visiting conferences, listening to customers, etc. All search findings are documented.
			Goal: Widen your product base.
CAP.55	b.	Market strategy	Action: A plan is created showing which markets your product will be going after and how you plan to develop the products for each segment. Eg., in year one you may want to enter healthcare by partnering with another company. Or you may want to enter the financial market in year two by building products in-house or acquiring products.
			Goal: Plan which markets you will target and how you will enter them.
CAP.56	c.	Customer win/loss analysis	Action: A win/loss analysis is performed to research why customers chose or did not choose to buy your organizations products. This capability looks further than just the product features, e.g. the sales process is reviewed.
			Goal: Learn about your customers/prospects, to generate more future customers by tuning product development to them.
CAP.57	d.	Competitor analysis	Action: A competitor analysis is performed on an organizational level to analyze what competitors offer, what their strengths are and are going to offer compared to your organizations.
			Goal: Learn from competitors and do not fall behind product-wise.
CAP.58	e.	Custom market trend identification	Action: External market research parties are used to perform a market analysis specifically for the organizations product portfolio.
			Goal: Gain unique information (that your competition does not have) specific to your own organization. Gain an unbiased insight into your market and/or operations.



Table 51 the focus area Partnering & Contracting.

#	Partnering & Contracting	Partnering & contracting focuses on establishing partnerships, pricing, and distribution aspects in which the product manager is involved.	
<b>CAP.56X</b>	a.	Service level agreements	Action: (Standard) service level agreements (SLA's) are set up for customers. Goal: Manage customer expectations.
<b>CAP.60</b>	b.	Intellectual property management	Action: Measures are in place to protect the intellectual property of the own organization, and to manage the used intellectual property from other organizations. Goal: Protection of the organizations intellectual property, and prevention of problems due to misuse of the intellectual property of other organizations.
<b>CAP.61</b>	c.	Investigate distribution channels	Action: A process is in place to periodically verify the current distribution channels, and identify alternative distribution channels. Goal: Improve sales process.
<b>CAP.62</b>	d.	Establish and evaluate pricing model	Action: A process is in place to establish the pricing model and periodically verify whether it still fits the market. Goal: Improve sales process.
<b>CAP.63</b>	e.	Monitored partner network	Action: A partner network and/or partner portals are used to regulate partnering. Key performance indicators are set up to monitor the performance of partners on a regular basis. Goal: Set up partner networks to gain synergetic advantages.

Table 52 the focus area Product lifecycle management.

#	Product lifecycle management	Product lifecycle management concerns the information gathering and key decision making about product life and major product changes across the entire product portfolio.	
CAP.64	a.	Product life cycle analysis	Action: The current life phase is determined, at least once per year, for each product in the organizations portfolio. This analysis is based on both financial and technical aspects. Information is thus gathered from all relevant internal stakeholders (e.g. company board, sales, development).
			Goal: Ensure that there is a healthy balance between new and old products in the product portfolio, create awareness of the products life expectations.
CAP.65	b.	Portfolio innovation	Action: A decision process is in place to decide whether or not to incorporate trends in one of the current products or in newly to be developed products.
			Goal: Balance the products in the product portfolio to make sure that products do not become competitors.
CAP.66	c.	Portfolio scope analysis	Action: A product scope analysis is performed to identify overlaps and gaps between the products in the organizations product portfolio.
			Goal: Balance products in the portfolio and identify opportunities for reuse (overlap) and discover possible new market segments (gaps).
CAP.67	d.	Business case	Action: A business case is performed for major product revisions (revisions spanning multiple release) or when the product strategy is changed. We use Kittlaus & Clough (2009) definition in which a business case is the “comparison of the costs associated with the product or project to the quantified economic benefits or value to be derived”.
			Goal: Validation of major future plans before they are put into practice.
CAP.68	e.	Product lines	Action: Product lines are developed. The architecture of the product line is documented, and its goal is clearly defined. A software product line is defined as a set of software intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way (Clements & Northrop, 2002).
			Goal: Enable maximum reuse of resources and simplify the creation of new products.

## Appendix D. Maturity levels analysis

Table 53 maturity levels focus area Requirements identification.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
		median	mean	maturity									
<b>CAP.7</b>	Uniformity	2	1	1	1	1	1	1	1	1	1	1,11	a
<b>CAP.8</b>	Requirements validation	1	2	2	2	2	2	2	3	2	2	2,00	b
<b>CAP.9</b>	Connect similar requirements	3	3	3	3	3	3	3	2	3	3	2,89	c
<b>CAP.10</b>	Automatically connect similar requirements	4	4	x	4	4	4	4	4	4	4	4,00	d

Table 54 maturity levels focus area Requirements organizing.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
		median	mean	maturity									
<b>CHA.5</b>	Requirement organization	1	1	1	1	1	1	1	1	1	1	1,00	a
<b>CAP.12</b>	Requirement lifecycle management	2	2	3	1	2	2	2	2	2	2	2,00	b
<b>NEW.6</b>	Opening requirements history log	2	2	3	3	4	x	2	x	3	3	2,71	c
<b>CAP.13</b>	Requirements dependency linking	4	4	2	4	3	3	3	3	4	3	3,33	d

Table 55 maturity levels focus area Requirements prioritization.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis			
		median	mean	maturity										
<b>CHA.8</b>	Internal stakeholder involvement	1	2	1	1	1	1	2	1	1	1	1,22	a	
<b>CAP.15</b>	Prioritization methodology	5	1	4	2	2	4	1	2	3	2	2,67	b	
<b>CHA.9</b>	External stakeholder involvement	Partner	1	5	1	4	3	1	3	4	2	3	2,67	c
		Customer	1	4	1	4	3	1	3	4	4	3	2,78	
<b>CAP.17</b>	Cost revenue consideration	4	3	5	2	5	5	5	3	5	5	4,11	d	

Table 56 maturity levels focus area Release definition.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
		median	mean	maturity									
<b>CAP.19</b>	Basic requirements selection	1	2	1	1	1	3	1	1	1	1	1,33	a
<b>CAP.20</b>	Standardization	2	1	2	3	2	4	2	6	2	2	2,67	b
<b>CHA.11</b>	Internal	3	3	3	4	3	1	3	2	3	3	2,78	c
	External	3	x	3	4	3	1	4	2	3	3	2,88	
<b>CAP.22</b>	Advanced requirements selection	5	4	5	2	5	5	5	4	5	5	4,44	d
<b>CAP.23</b>	Multiple releases	6	5	4	6	6	x	6	5	6	6	5,50	e

Table 57 maturity levels focus area Release definition validation.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
		median	mean	maturity									
<b>CAP.24</b>	Internal validation	1	1	1	1	1	1	1	1	1	1	1,00	a
<b>NEW.12</b>	External validation	1	1	1	3	2	1	2	x	2	1,5	1,63	b
<b>CAP.25</b>	Formal approval	3	3	3	2	3	3	3	3	3	3	2,89	c
<b>CAP.26</b>	Business case	x	x	x	4	4	4	x	2	4	4	3,60	d

Table 58 maturity levels focus area Scope change management.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
		median	mean	maturity									
<b>CAP.27</b>	Event notification	1	1	1	1	2	2	1	3	1	1	1,44	a
<b>CAP.28</b>	Milestone monitoring	2	x	3	2	1	x	2	1	2	2	1,86	b
<b>CAP.29</b>	Impact analysis	3	2	2	3	3	1	3	2	3	3	2,44	c
<b>CAP.30</b>	Scope change handling	4	3	4	4	4	3	4	4	4	4	3,78	d

Table 59 maturity levels focus area Release build validation.

#	interviewee capability	i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
		median	mean	maturity									
<b>CAP.31</b>	Internal validation	1	1	1	1	1	1	1	1	1	1	1,00	a
<b>CAP.32</b>	External validation	2	2	1	2	2	2	2	2	2	2	1,89	b
<b>CAP.33</b>	Certification	3	3	3	3	3	x	3	3	3	3	3,00	c

Table 60 maturity levels focus area Launch preparation.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
												median	mean	maturity
CAP.34	Internal communication		1	1	1	1	1	1	1	1	1	1	1,00	a
CAP.35	Formal approval		2	4	3	2	2	3	2	2	3	2	2,56	b
CAP.36	External communication		4	6	1	3	3	1	3	3	2	3	2,89	c
CAP.37	Training		5	5	5	4	4	4	4	4	4	4	4,33	d
CAP.38	Launch impact analysis		3	2	4	5	5	5	x	5	5	5	4,25	e
CAP.39	Sales & marketing support		6	3	5	6	6	6	5	6	6	6	5,44	f

Table 61 maturity levels focus area Roadmap intelligence.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
												median	mean	maturity
CAP.40	Product analysis		1	1	1	1	1	1	1	1	1	1	1,00	a
CHA.15	Partner roadmap		4	5	2	2	2	4	x	1	2	2	2,75	b
CAP.41	Society trends		2	3	3	4	3	2	3	3	3	3	2,89	c
CAP.42	Technology trends		3	4	3	3	4	3	3	4	4	3	3,44	d
CAP.43	Competition trends		4	2	3	5	5	5	2	5	5	5	4,00	e

Table 62 maturity levels focus area Core asset roadmapping.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
												median	mean	maturity
CAP.45	Centralized registration		1	1	2	1	1	1	1	1	1	1	1,11	a
CHA.16	SECO core asset identification	Internal	2	2	1	2	2	2	2	2	2	2	1,89	b
		External	2	2	1	5	3	2	x	2	3	2	2,50	
CAP.47	Make or buy decision		4	4	4	3	4	x	3	5	4	4	3,88	c
CAP.48	Core asset roadmap construction		5	5	5	4	5	4	4	4	5	5	4,56	d

Table 63 maturity levels focus area Product roadmapping.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
												median	mean	maturity
CAP.49	Short-term roadmap		1	1	1	1	1	1	1	1	3	1	1,22	a
CHA.18	Theme identification	Internal	2	2	2	2	2	6	2	2	1	2	2,33	b
		External	2	2	2	3	2	6	2	2	1	2	2,44	
CHA.19	Consultation	Internal	4	4	4	4	4	2	4	4	7	4	4,11	c
		External	4	4	4	5	6	2	x	4	6	4	4,38	
CAP.52	Long-term roadmap		6	6	6	6	7	4	x	7	8	6	6,25	d
NEW.20	Roadmap procedure		8	x	x	8	5	x	x	6	5	6	6,4	e
CAP.53	External variants		7	7	5	7	8	5	5	8	4	7	6,22	f

Table 64 maturity levels focus area Market analysis.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
			median	mean	maturity									
<b>CHA.21</b>	Market	trend identification	1	1	1	1	1	1	1	1	1	1	1,00	a
<b>CAP.55</b>	Market strategy		4	2	3	2	2	2	2	4	4	2	2,63	b
<b>CAP.56</b>	Customer	win/loss analysis	2	4	2	3	3	4	3	5	2	3	3,25	c
<b>CAP.57</b>	Competitor analysis		3	3	4	4	4	3	4	3	3	3,5	3,50	d
<b>CAP.58</b>	Custom	market trend identification	5	5	5	5	5	5	5	2	5	5	4,63	e

Table 65 maturity levels focus area Product lifecycle management.

#	interviewee capability		i1	i2	i3	i4	i5	i6	i7	i9	i10	analysis		
			median	mean	maturity									
<b>CHA.35</b>	Product	lifecycle analysis	5	1	1	1	6	1	1	1	5	1	2,13	a
<b>CAP.65</b>	Portfolio innovation		3	2	2	2	5	2	2	2	3	2	2,50	b
<b>CHA.36</b>	SECO portfolio scope analysis	External	1	3	x	3	3	x	3	3	1	3	2,67	c
		Internal	1	3	3	x	3	3	3	4	1	3	2,86	
<b>CAP.67</b>	Business case		3	5	4	4	2	4	5	5	3	4	4,00	d
<b>CAP.68</b>	Product lines		6	6	5	5	1	5	6	6	6	5,5	5,00	e

## Appendix E. Questionnaire

Comment: This questionnaire is largely written in Dutch.

### Inleiding

Na het verwerken van alle interviews is gebleken dat bepaalde zaken niet 100% duidelijk waren. Daarom wil ik u vragen om deze enquête in te vullen. Hiermee zou u mij een grote dienst bewijzen.

De enquête bestaat uit zes vragen en zal u ongeveer 15 minuten kosten. Er zijn **géén** uitgebreide antwoorden nodig; het aangeven van uw voorkeur in de oranje vakjes volstaat. Mocht u wel een toelichting willen geven op uw antwoord dan is dat natuurlijk geen probleem.

Het interview is al weer een tijdje geleden afgenomen, daarom eerst een korte samenvatting om uw geheugen op te frissen. Daarna moet u de vragen beantwoorden totdat u het blad met daarop 'EINDE ENQUÊTE' tegenkomt.

### Samenvatting

De definitie van Software Ecosystems gebruikt voor deze studie luidt als volgt: “... *a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.*” (Jansen, Finkelstein & Brinkkemper, 2009b, p. 2)

De twee belangrijkste rollen die in een ecosysteem worden vervuld zijn de volgende:

- **Keystone:** Een welwillende entiteit die een centrale rol vervult in het netwerk. Deze organisatie biedt het netwerk voordelen door software beschikbaar te stellen (betaald of onbetaald). Het streeft er niet naar om zelf alle (niche) markten te bereiken met het product, maar laat dit over aan de andere leden.
- **Niche players:** Het overgrote deel van de leden van een ecosysteem. Zij maken gebruik van de software die de keystone beschikbaar stelt. Zij proberen niet te concurreren met een keystone. Maar ze proberen bij te dragen aan een ecosysteem door een specifiek en speciaal gebied te bereiken (de niches in de markt).

Het doel van deze vragen is om te achterhalen hoe u denkt hoe een **keystone** zijn **Software Product Management** moet inrichten om **samen** met **niche players** een zo **waardevol Software Ecosystem** te creëren.

Ik bestudeer hoe Software Product Management moet worden ingericht voor de **directed approach**:

- de keystone wil klanten uit **bepaalde niche markten** een geschikt product aanbieden, **maar kan dit niet zelf**;
- en kiest zelf de **niche players** die wel in staat zijn deze niche oplossingen te **maken of daarbij kunnen helpen**.

## Begin enquête

### Vraag 1

Tijdens de interviews hebben één of meerdere geïnterviewden aangegeven dat ze nog een capability misten in de focus area Requirements identification. Het gaat om de volgende capability:

	External feedback	Action: Get extra feedback on product requirements from external stakeholders.
		Goal: Raise the quality of product requirements by enriching the content.

Deze nieuwe capability zou dan in de volgende focus area moeten worden geplaatst:

Requirements identification	Requirements identification identifies the actual Product Requirements by rewriting the Market Requirements to understandable Product Requirements, and connecting requirements that describe similar functionality.	
a.	Uniformity	Action: Market requirements are rewritten to product requirements using a pre-defined template if the market requirement is applicable to a product.
		Goal: Identification of the essence of the requirements, this provides clarity to all involved, enables a meaningful comparison of requirements.
b.	Requirements validation	Action: The correctness (“Is the definition correct?”), completeness (“Does the requirement describe all relevant aspects?”), and unambiguousness (“Can the requirement only be interpreted in one way?”) of the requirement is validated.
		Goal: Validation of the requirements to prevent rework.
c.	Connect similar requirements	Action: Group together market requirements which describe similar functionality by linking market requirements and product requirements to each other.
		Goal: Identify the true need for requirements (e.g. two requirements that individually are not valued high enough could be valued high enough when merged), prevention of double requirements.
d.	Automatically connect similar requirements	Action: Automatically connect similar requirements by using advanced techniques such as linguistic engineering.
		Goal: Reduce the workload of the connecting of similar requirements.

Vindt u dat deze capability moet worden toegevoegd aan deze focus area? Zo ja, waar zou u deze capability qua maturity willen plaatsen? Bijvoorbeeld voor a, tussen a en b, enzovoorts.



## Vraag 2

Tijdens de interviews hebben één of meerdere geïnterviewden aangegeven dat ze nog een capability misten in de focus area Requirements gathering of in de focus area Roadmap intelligence. Het gaat om de volgende capability:

	Legislation	Action: Continuously create an overview of what is changing with regard to legislation for your products industry.
		Goal: To keep compliant with laws and regulations.

Deze nieuwe capability zou dan in **één van de volgende twee** focus area moeten worden geplaatst:

Requirements gathering	Requirements gathering concern the acquisition of requirements from both internal and external stakeholders and sharing this information with all relevant and authorised external stakeholders.	
a.	Basic Registration	Action: Requirements are being gathered and registered.
		Goal: Create a basis for product development.
b.	Centralized registration	Action: All incoming requirements are stored in a central database, which is accessible to all relevant stakeholders.
		Goal: Structuring of requirements registration.
c.	Opening central database	Action: The central database with the incoming requirements is accessible to relevant and authorised external stakeholders.
		Goal: Make the sharing of information, resources and objects more efficient and effective.
d.	Automation	Action: All incoming requirements are automatically stored in a central database (e.g. by means of an online helpdesk).
		Goal: Reduced workload / improved speed of requirements gathering process, reduced error percentage.
e.	Stakeholder involvement	Action: Requirements are gathered from all relevant internal and external stakeholders. For example support, services, development, sales & marketing, research & development, customers and niche players. Determine for each stakeholder how important their involvement for the product is.
		Goal: Improved product quality & increased involvement of the right stakeholders in the product management process.
f.	Requirements communication flows	Action: Model the requirements communication networks (i.e. the communication of requirement flows among stakeholders).
		Goal: To enable the analysis of the requirement communication flows for picking the right requirement communication strategies and tactics.

óf in

Roadmap intelligence	Roadmap intelligence gathers decision supporting information needed in the creation of the product roadmap and presents it in summary style suited for management information. It does not include the requirements gathered in Requirements management.	
a.	Product analysis	Action: The organization's products are analyzed to determine the product's strong and weak points on both functional and technical aspects. Relevant stakeholders, such as the development department for the technical part, are involved in this analysis.
		Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
b.	Partner roadmap	Action: An overview is created showing what your partners will be developing the coming period. Examples of partner products are operating systems, development environments, database, etc. The overview shows what will be happening with the core platform software as well as what the partner organization will be delivering in terms of their own products and development tools that your organization can or will need to use to support the partner products/components.
		Goal: Show how your organization responds to developments of partner products and which your own products rely.
c.	Society trends	Action: An overview is created showing the big picture of important trends in society in the coming years. This picture contains a general view and a view specific for your products industry.
		Goal: Show how your product responds to / fits the trends, how you will take advantage of the momentum.
d.	Technology trends	Action: An overview is created showing the big picture of important developments in terms of technology in the coming years. This picture contains a general view and a view specific for your products industry.
		Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by current and up-and-coming technologies.
e.	Competition trends	Action: An overview is created showing what competing products are doing in terms of their product development in the coming years. The general developments trends among your competitors are shown, and the developments of the most important competing products are depicted with special attention.
		Goal: Making sure and being able to show how your product is staying up-to-date and is taking advantage of opportunities provided by your partners.

Vindt u dat deze capability moet worden toegevoegd aan één van deze twee focus area? Zo ja, in welke focus area en waar zou u deze capability qua maturity willen plaatsen? Bijvoorbeeld voor a, tussen a en b, enzovoorts.

Vraag 3

Tijdens de interviews hebben één of meerdere geïnterviewden aangegeven dat een huidige capability in de focus area Core asset roadmapping (zie tweede tabel) uitgebreid moet worden. Het gaat hierbij om de capability c. ‘Make or buy decision’. Hierbij wordt zowel de titel als de omschrijving van de actie uitgebreid met ‘co-creation’. Zodat er dus een make, buy of co-creation besluit moet worden gemaakt i.p.5. alleen een make of buy besluit. Bent u het eens met deze wijziging? (JA/NEE)



c.	Make, buy or co-creation decision	Action: A process is in place to actively investigate make, buy or co-create decisions: external sources are investigated based on ROI in the search for core asset acquisition or co-creation: partners, outsourcing or subcontracting of development.
		Goal: Cost and time savings by using and/or co-creating with external parties.

Core asset roadmapping	Core asset roadmapping concerns the planning of future development of core assets (components that are shared by multiple products).	
a.	Centralized registration	Action: All core assets are registered in a standardized manner, and are stored in a central location.
		Goal: Enable the reuse of components.
b.	SECO core asset identification	Action: Common components/functionality (core assets) is systematically identified among the ecosystems products and deliverables surrounding the products.
		Goal: Increase and simplify the reuse and maintenance of components in the SECO.
c.	Make or buy decision	Action: A process is in place to actively investigate make-or-buy decisions: external sources are investigated based on ROI in the search for core asset acquisition: partners, outsourcing or subcontracting of development.
		Goal: Cost and time savings by using external parties.
d.	Core asset roadmap construction	Action: A roadmap is created for the core assets, this roadmap shows how the core assets are sustained, upgraded, and enhanced. This roadmap contains both existing core assets, and core assets that are in development.
		Goal: Provide insight in the future plans for the core assets to ensure that this is incorporated in the product roadmap in a realistic and optimal form.

## Vraag 4

Tijdens de interviews hebben één of meerdere geïnterviewden aangegeven dat een huidige capability in de focus area Product roadmapping (zie tweede tabel) gewijzigd moet worden. Het gaat hierbij om de vierde capability d. 'Long-term roadmap'. Deze geïnterviewden gaven aan dat zij het niet eens waren met de tijdsperiode. Vindt u dat er iets moet wijzigen in de tijdsperiode van de long-term roadmap? Zo ja, wat zou volgens u de tijdsperiode moeten zijn van een long-term roadmap?



d.	Long-term roadmap	Action: The roadmap spans a time period of at least ... years.
		Goal: Development of a long-term vision of the product(s).

Product roadmapping	Product roadmapping deals with the actual creation of the product roadmap itself.	
a.	Short-term roadmap	Action: A roadmap is developed detailing the short-term plans. The plans span more than one release.
		Goal: Development of a short-term vision of the product(s).
b.	Theme identification	Action: Release themes are identified and maintained for internal and external creation. Themes are decided on together with all relevant stakeholders (i.e. internal and external). Identification of the themes results in a list of release themes that are stored centrally, so that requirements, core assets, market trends etc. can be linked to it.
		Goal: Structuring of releases and roadmaps: themes are used give a clear direction to the roadmap and later on to structure the requirements.
c.	Consultation	Action: Product roadmaps are created in consultation with all relevant internal and external stakeholders.
		Goal: Ecosystem wide acceptance of the product roadmap. Optimal use of all knowledge in the ecosystem to create more rich and realistic product roadmaps.
d.	Long-term roadmap	Action: The roadmap spans a time period of at least four years.
		Goal: Development of a long-term vision of the product(s).
e.	Roadmap procedure	Define a decision procedure for when roadmap designers and external stakeholders (i.e. niche players) cannot reach consensus. Inform external stakeholders about this decision procedure when forming relationships with them.
		Goal: Making the roadmap construction process transparent, understandable and predictable for external stakeholders.
f.	External variants	Action: Less detailed variants of the internal roadmap are created for specific external parties (e.g. customers, partners, investors).
		Goal: Informing of customers/managing customers expectations, marketing tool. Informing external parties using information they want.

## Vraag 5

Tijdens de interviews hebben één of meerdere geïnterviewden aangegeven dat een huidige capability in de focus area Market analysis (zie tweede tabel) uitgebreid moet worden. Het gaat hierbij om de capability c. 'Customer win/loss analysis'. Deze geïnterviewde(n) gaven aan dat de scope van deze capability uitgebreid moet worden naar het hele ecosysteem. Vindt u dat de scope van deze capability moet worden uitgebreid? (JA/NEE)



c.	SECO customer win/loss analysis	Action: A win/loss analysis is performed to research why customers (of niche players) chose or did not choose to buy your ecosystems products. This capability looks further than just the product features, e.g. the sales process is reviewed.
		Goal: Learn about your ecosystem's customers/prospects, to generate more future customers for your SECO by tuning product development to them.

Market analysis	Market analysis gathers decision supporting information about the market needed to make decisions about the product portfolio of an organization.	
a.	Market trend identification	Action: There is an active search for market opportunities to either expand existing products to, or create new products for. This search exists of doing market research in markets related to or similar to your organizations markets, visiting conferences, listening to customers, gathering market specific information from niche players, etc. All search findings are documented.
		Goal: Widen your product base.
b.	Market strategy	Action: A plan is created showing which markets your product will be going after and how you plan to develop the products for each segment. Eg., in year one you may want to enter healthcare by partnering with another company. Or you may want to enter the financial market in year two by building products in-house or acquiring products.
		Goal: Plan which markets you will target and how you will enter them.
c.	Customer win/loss analysis	Action: A win/loss analysis is performed to research why customers chose or did not choose to buy your organizations products. This capability looks further than just the product features, e.g. the sales process is reviewed.
		Goal: Learn about your customers/prospects, to generate more future customers by tuning product development to them.
d.	Competitor analysis	Action: A competitor analysis is performed on an organizational level to analyze what competitors offer, what their strengths are and are going to offer compared to your organizations.
		Goal: Learn from competitors and do not fall behind product-wise.
e.	Custom market trend identification	Action: External market research parties are used to perform a market analysis specifically for the organizations product portfolio.
		Goal: Gain unique information (that your competition does not have) specific to your own organization. Gain an unbiased insight into your market and/or operations.

## Vraag 6

Tijdens het interview heb ik u meerdere nieuwe capabilities voorgesteld. Alle geïnterviewden hebben aan kunnen geven of deze nieuwe capabilities al dan niet moeten worden toegevoegd aan dit model. Dit heeft geresulteerd in drie nieuwe focus areas, namelijk Contracting, Partnering en Channel development.

## Vraag 6a

Geef aan op welke maturity level elke capability zit? Gebruik hiervoor een schaal van 1 t/m 10 en vul het betreffende cijfer in de lege oranje vakjes voor de capabilities.

Contracting	Contracting focuses on establishing relations with external stakeholders by creating proper and clear agreements with them.	
	Service level agreements	Action: (Standard) service level agreements (SLA's) are set up for customers and partners.
		Goal: Manage customer and partner expectations.
	Intellectual property management	Action: Measures are in place to protect the intellectual property of the own organization, and to manage the used intellectual property from other organizations.
		Goal: Protection of the organizations intellectual property, and prevention of problems due to misuse of the intellectual property of other organizations.
	Determine information profiles	Action: Determine information profiles for each (type) of niche players (according to their roles) in which is clear who has access to which information.
		Goal: To simplify sharing information.
	Contract negotiation process	Action: An external stakeholder contract negotiation process is set up. In which e.g. realistic objectives, agreements on earnings, intellectual property rights, termination clauses, penalties for bad performance, arbitration procedures are determined.
		Goal: Manage external stakeholder expectations.

## Vraag 6b

Geef aan op welke maturity level elke capability zit? Gebruik hiervoor een schaal van 1 t/m 10 en vul het betreffende cijfer in de lege vakjes voor de capabilities.

Partnering	Partnering focuses on managing relations with external stakeholders and supporting them in creating the biggest possible value for the ecosystem.	
	Register niche players	Action: All niche players are registered in a central database which all relevant (internal) stakeholders can access
		Goal: Create an overview of all niche players. Share knowledge with regard to niche players (e.g. experiences, best practices, agreements) with all relevant internal stakeholders.
	Set up partner network	Action: A partner network and/or partner portals are used to regulate and promote partnering.
		Goal: Set up partner networks to gain synergetic advantages.
	Partner performance analysis	Action: A partner analysis is performed on an organizational level to analyze what partners offer, what their strengths and weaknesses are and are going to offer compared to and in addition to your organization. For example, by making use of partner score cards.
		Goal: Create a clear and correct picture of the performance and value of partners.
	Co-ordinate niche players alliances	Action: Co-ordinate among alliances and alliance partners to avoid conflicts and utilize synergies.
		Goal: Create a stronger and more coherent SECO.
	Cluster niche players	Action: Cluster niche players into groups with specific functions, goals, etcetera.
		Goal: Making the management of niche players more efficient by setting clear objectives, obligations, earnings, risks.
	Certify niche players	Action: Certify/license niche players divided over different ranks (e.g. gold, silver and bronze) with different obligations and privileges.
		Goal: To make clear what is expected of a niche player to raise quality of niche solutions.
	Certify external components	Action: Certification of externally created components, based on the standard quality rules to improve the quality of niche solutions.
		Goal: Improve the quality of ecosystem's products. Niche players get keystone confirmation of product quality to prove the quality of their product. It may simplifies component integration by standardizing.

### Vraag 6c

Geef aan op welke maturity level elke capability zit? Gebruik hiervoor een schaal van 1 t/m 10 en vul het betreffende cijfer in de lege vakjes voor de capabilities.

Channel development	Channel development focuses on establishing and managing distribution channels.	
	Investigate distribution channels	Action: A process is in place to periodically verify the current distribution channels, and identify alternative distribution channels.
		Goal: Improve sales process.
	Common delivery channel	Action: Set-up a common distribution channel (e.g. the Apple Appstore).
		Goal: To enable niche players to sell their created components to a large customer base.
	Model the SECO	Action: Model the SECO (at its different levels).
		Goal: Identify its distribution channels, main competitors, and potential partners.
	Establish and evaluate pricing model	Action: A process is in place to establish the pricing model and periodically verify whether it still fits the market.
		Goal: Improve sales process.



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