Maturity towards Co-Development

A maturity model of co-development and guidelines for the set up of co-development

master thesis by:

Bertus de Boer

University of Twente | MSc in Business Administration – Innovation & Entrepreneurship

Supervisors:

EsperantoXL: Bram Berkelaar

University of Twente: Dr. Ir. A.A.M. Spil
                        Ir. J.W.L. van Benthem

I. Acknowledgement

This report describes my master thesis at EsperantoXL, which has taken me into the world of collaborative product development or co-development in short. The combination of collaboration and product development has been a great interest of mine. I had been introduced to product development from a design perspective in my bachelor studies of Industrial Design Engineering. Despite the interesting perspective from product design I became interested in how organizations handle new product development from an organizational perspective. This led me to study Business Administration as a master student. Collaboration is something I find interesting because of the many group projects that I have done during my studies. Some group assignment went great and others went poorly often related to the different skills of all of us in the group. Because of this I am very interested in how successful combinations are made to create successful collaborations. I am grateful for the opportunity EsperantoXL has given me to research this in practice. Also EsperantoXL has introduced me into the field of IT which was new and interesting.

The project was challenging and fun, with exposure to real life business dynamics I had not yet experienced before. I enjoyed working at EsperantoXL. Despite the fact that I was there only part-time all colleagues made me welcome and I felt part of the team.

This project would not have been successful without the input and efforts of many people which I would like to give special thanks to. My appreciation goes out to my supervisor Bram Berkelaar and the rest of the colleagues at EsperantoXL that have helped and guided me during this thesis. I also wish to thank Ton Spil and Jann van Benthem for the meetings we had that provided me with constructive feedback focussed guidance.

Great appreciation also goes out to several people at 'Syntens Innovation Centrum' that have helped me get into contact with some of my interviewees. Valuable information would not have been available without, Bas Ramaker, Bon Uijting, Sonoco Takahashi, Tjerk Gorter, Lute Broens, Arjan Minck, Wilbert Bogers and Patrick Okkersen, for which I am grateful. Last but not least I would like to thank my family, friends and girlfriend for their input, feedback and support during the time of this thesis.

Hopefully this report will provide you with valuable information about co-development and give you insights, similar to those that I have gotten during this project. I am excited to see what this knowledge will bring EsperantoXL and other organizations as well as myself in future endeavours.

I hope you enjoy reading this report!

Kind regards,

Bertus de Boer

II. Summary

Innovation is recognized as a necessary activity to grow and stay in business (Trott, 2012). Product development is challenging because technologies in products are numerous and more complex creating pressure on allowed costs for research & development. Product life cycles become shorter, leaving companies to fight over small margins. Organizations strive to reduce costs, improve time to market (Trott, 2012) and make more costumer oriented products (Prahalad & Ramaswamy, 2004; Trott, 2012) with the idea of creating truly differentiated value. Many different competences are needed to provide integrated system solutions that comply to current customer needs (Chesbrough & Schwartz, 2007; Deck & Strom, 2002). Utilizing competencies of others can be done through co-development.

Literature exists on different dimensions of the process but lacks a complete co-development model. Many co-developments fail or are perceived as a failure (Büyüközkan & Arsenyan, 2012; Littler, Leverick, & Bruce, 1995). Choosing for a co-development is mainly a strategic operation therefore a model is needed to aid the decision whether co-development is a process worth doing.

The aim of this research was to provide a maturity model of co-development which allows practitioners to assess their place in co-development and provide directions for advancements in the model or guidance for the set up of a new co-development project.

A development design approach was used in this research. A preliminary model was made based on academic and management literature. Empirical data was gathered through interviews from best practises for evaluation and adaptation of the preliminary model. The results were compared with literature to propose a maturity model. The maturity model was evaluated for its use in the project holding company, EsperantoXL.

The proposed maturity model of co-development aids in the assessment of current co-development projects as well as the set up of a new project. It is comprised of three parts.
The first part describes the four stages that define the desired direction for an organization towards maturity of co-development. The second part characterizes each of those stages allowing organizations to determine their position in the model. This part also provides important selection criteria to find a suitable collaboration partner and information on essential arrangements that need to be made when setting up the co-development. The last part describes influential success factors and pitfalls during each stage of the maturity model which help to explain how advancements are stimulated. The most influential of these are:

- Mutual trust
- Commitment (at top management level)
- Alignment/Misalignment of expectations
- Complementarity of resources
- Clear governing structures

This research is interesting for practitioners who have realized that co-development is the next step for their organization to create new distinctive value for their customers via competences that lay beyond their borders.

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1. Introduction

1.1 Changes in the innovative environment

Innovation is the process of turning ideas into something tangible from which value can be captured (Tidd & Bessant, 2009). Generally these ideas and knowledge are turned into know-how and technology and they have become a large piece of an organization's competitive advantage. Staying innovative and developing technology is vital for an organization's competitive advantage as competition is growing around the world (Trott, 2012, p.346).

Technology is becoming more prominent in products and increasingly more complex, requiring knowledge and skills from more and more market areas (Evans & Jukes, 2000). The advancements of these technologies succeed each other quickly reducing product life cycles. Consequently R&D costs rise quickly. To counter this internal R&D activities of an organization focus on core competencies (Spina, Verganti, & Zotteri, 2002). This leaves supplementary technologies that are needed to complete or add functionality to the product being sought after via collaboration partners (Trott, 2012).

The resulting activities can be described by the model of open innovation (Chesbrough, 2003). This model describes the possibilities of internal ideas to be developed outside the organization and outside ideas to flow into the own organization (Chesbrough, 2003). Practising open innovation allows for sharing of knowledge, skills and resources to develop new products in a more effective manner together with other organizations. As ideas and resources not only flow out of your organization but also into your organization enabling the possibility to capitalize on external ideas.

The process described above by itself however does not yet allow companies to develop products which require a great deal of knowledge and skills from different markets. To do this organizations need to look at collaborative efforts beyond its own borders for value adding competences.

1.2 Collaborations in development

Border crossing collaborations in research and development will be more extensive in the future (Deck & Strom, 2002) and will involve a great variety of participants (Chesbrough, 2012). Managing these border crossing activities to develop new products is the process of co-development.

Several descriptions of collaborative product development exist within literature, each underlining various aspects of the process and with several different focus points (Büyüközkan & Arsenyan, 2012). Within this thesis, collaborative product development or in short, co-development is defined in the following way:

"Co-development is the process by which two or more parties share knowledge, (non-equity) resources and or experiences with the mutual aim of designing or developing a new or improved (customer focussed) product or service". (adapted from (Büyüközkan & Arsenyan, 2012))

The contributions made by the parties must be of significant value for the end result and do not include strictly equity related contributions, nor 'off-the shelf' products or services that require minor inter-organizational interactions (Emden, Calantone, & Droge, 2006)

According to Evans & Jukes (2000) Co-development is the process of creating products that are oriented at customer needs and are developed with an organization's suppliers (Evans & Jukes, 2000). However within this research co-development is not limited to suppliers but can also involve new partners and customers.

As co-development incorporates needs from customers and knowledge from suppliers it is a complex process. It is; directly related to the topics of Collaborative Product Development (CPD) (Büyüközkan & Arsenyan, 2012); closely related to literature on supplier involvement(van Echtelt, Wynstra, van Weele, & Duysters, 2008); and the studies focussing on the success of supplier integration (Fliess & Becker, 2006; Lakemond, Berggren, & Weele, 2006; Lynch, O'Toole, & Biemans, 2013) and selection of partners(Emden et al., 2006; Feng, Fan, & Ma, 2010). Many factors influence successful co-development (Arino & de la Torre, 1998) and it requires a great deal of attention to focus all participating organizations. Because of the growing need for faster, cheaper developments and better alignment with customer needs co-development is of great importance to organizations. Co-development within the innovative strategy brings along a great deal of challenges with respect to finding and selecting partners, making pre-development arrangements and managing the process during development. Little literature exists on the process of collaborative product development (Emden et al., 2006) especially research that unifies all the dimensions involved in the process (Büyüközkan & Arsenyan, 2012).

Chesbrough & Schwartz (2007) describe that innovating business models is the next step in innovation. It goes beyond just innovating technologies which is usually part of the business model. Business model innovation actually places the business model up for innovation. Business model innovation is necessary to profit even more from external ideas and to create new ways of exploiting knowledge and technology and going onto new markets. (Chesbrough & Schwartz, 2007)

The co-development process is found to be a very effective manner of innovating the business model and has a great influence on business performance (Chesbrough & Schwartz, 2007; Deck & Strom, 2002b; van Echtelt, Wynstra, van Weele, & Duysters, 2008). Using a variety of inter-organizational collaborations has been found to improve the innovative outcomes of an organization (Faems, Van Looy, & Debackere, 2005) and therefore it makes sense to employ co-development processes. Integrating co-development into the business model is a way to use the internal strengths and core competencies of other developing partners to gain effectiveness and efficiency in the development process (Deck & Strom, 2002).

Co- development is a dynamic process. The reasons for initiation and continuation of a co-development process as well as the scope and its form can change significantly over time (Bruce, Leverick, & Littler, 1995). The changing dynamics of co-development over time is a characteristic which makes co-development a process which can be described by a maturity model. Further elaboration, a preview of a model for co-development and reasoning for a maturity model can be found in paragraph 1.7.

1.3 EsperantoXL – Innovation through co-development.

This research was done at EsperantoXL. It is a company with about 30 employees. It specializes in Information and Communication Technologies (ICT) for other businesses and has 10 years of history. EsperantoXL has several focus fields like systems integration, enterprise mobility and (ICT) consultancy and advice. Their goal is to aid customers in the design, management or development of inbound and outbound ICT processes. Despite their small size, EsperantoXL serves several large Dutch companies[1] and has recently engaged in an international syndicate called MobiCloud. This syndicate strives to stimulate the development of cloud applications for mobile employees[2] and expands on current knowledge of mobile information systems that EsperantoXL already has[3].

Currently EsperantoXL functions mainly as a business to business supplier/developer of ICT systems and services. Their innovative power comes from internal development based on their expertise in the field and alignment to customer demands. Even though their focus is to involve the customer as much as possible in the development process[4], the innovation process is rather one directional. Since some time EsperantoXL is engaging in collaborations. They see potential in collaborations to expand new possibilities and create greater innovative output. To maximize their possibilities EsperantoXL is looking for the steps needed to follow along with the changing innovative environment and to use co-development in the innovation process.

In this light there may be potential in projects that are done at EsperantoXL. With several customers they have worked together for years and their relationship is steady and growing tighter with better collaboration. However co-development between the two parties has not yet be achieved. This research will look into the process of co-development to see if advancements can be made.

1.4 Project motivation and relevance to practice and literature

The wish to expand innovative output and fully utilize the sharing of knowledge and technology is the same goal that many organization's have. As stated previously, today's organizations struggle to keep up with technological advancements, rising costs of R&D and shortening of product life cycles. By collaborations and inclusion of supply-chain partners and customers they are trying to create maximum value from internal and external ideas and new ways of capturing that value.
Also applicability of open innovation on different sizes is important to consider as more research seems to be needed at the level of Small and Medium sized Enterprises (SME's). Previous research has focuses mainly on large multinational enterprises. (van de Vrande, Vanhaverbeke, & Gassmann, 2010). Therefore looking how this works for EsperantoXL is valuable.
Co development requires managers and customers to adjust easily and be transparent towards each other. Being able to quickly adapt and experiment with inputs from each other in new product development is important (Prahalad & Ramaswamy, 2004).

Despite the fact that collaborative product development is growing in attention for practitioners, relatively little academic research exists on the process in the field of innovation (Emden et al., 2006).

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[1] http://www.esperantoxl.nl/1_248_Onze_geschiedenis.aspx
[2] http://www.esperantoxl.nl/blogs.aspx
[3] http://www.esperantoxl.nl/1_173_Mobiele_oplossingen.aspx
[4] http://www.esperantoxl.nl/1_167_onze_werkwijze.aspx

The topics addressed above signify the fields in research that are still open for additions and reflects questions EsperantoXL has for future innovation strategies. This research aims to add to the understanding and specifically help EsperantoXL move along in the changing innovation environment toward co-development

1.5 Goal and research questions

The previous section has portrayed that the innovative environment is still as challenging as ever. For EsperantoXL the challenge lies in understanding where they stand in the perspective of co-development and where their customers stand. Also which factors are important and what needs to be done in order for co-development to be a possibility. These understandings are vital in order to make the decision whether co-development should be sought after as a process within the open innovation environment.

The goal of this research therefore is:

"To establish a maturity model of co-development and develop guidelines which describe which steps need to be taken by EsperantoXL and its (prospective) customer(s) to become co-development partners"

1.6 Research questions

The goal above sets the stage for questions related to the research. One main question drives this research and several sub-questions are stated below to structure the research further and make parts of the main question more tangible during research.

Main question:

"How can a maturity model of co-development be created, where does EsperantoXL stand and where does it want to go?

Sub-questions

The following sub questions divide the central question into focussed subsets that are more specific towards the subjects within the central question.

1. How can a maturity model for co-development be created?
2. Which difficulties do organizations face in co-development?
3. How can difficulties in co-development be overcome?
4. Where does EsperantoXL stand in the maturity model of co-development?
5. Which steps do EsperantoXL and possible future partners need to make to become co-developing partners?

The first sub-question is aimed at understanding co-development in general and used for information gathering to develop a maturity model of co-development. The second question rising is what difficulties organizations face and which factors are influential to the process of co-development. Together with the third sub-question the aim is to establish how organizations can move forward towards maturity of co-development. The fourth topic is more specific to EsperantoXL and its place in the model. The answer to question 4 combined with question 5 aims to establish the necessary steps

to move forward together with current or future partners towards maturity to fully exploit co-development in their innovation process.

Further explanation on the gathering and analysis of data can be found in chapter 2 where the methodology behind the research is elaborated upon.

1.7 Maturity models and co-development, a proposed model

Maturity models, also termed stage theories, are models which are build around assumptions and predictable patterns describing the evolution of capabilities along an anticipated or desired maturation path (Pöppelbuß & Röglinger, 2011). The purpose of a maturity model is to describe the characteristics of several stages and to include improvement measures (Pöppelbuß & Röglinger, 2011). These characteristics of a maturity model make it very suitable for this research. Describing the characteristics of the process in several stages and suggesting improvements for advancements within the model will aid organizations like EsperantoXL greatly in their understanding of co-development and assessment of its use for the organization.

The first stage theory that has been widely adopted among academics and practitioners was the model of Nolan (1973) (Pöppelbuß & Röglinger, 2011). Despite critiques about the model it was regarded useful and has led to the widespread use and creation of stage based maturity models (Pöppelbuß & Röglinger, 2011). Stage theories also have been proven to be very useful during the development of knowledge during the formative period of processes (Nolan, 1973). Despite the fact that co-development is not a new process, the stage theory will be useful for knowledge development for the maturity model within this thesis.

Nolan's stage theory was used to describe the use of the computer resource in an organization and was comprised of 4 stages; the initiation-, contagion-, control- and integration stage. At the final stage an organization was regarded to reach maturity. The stages described in Nolan's model are not fit for modelling co-development as they describe a different phenomenon. However generalizing the characteristics within the stages leads to a general model describing the path to maturity.

For universality the 4 stages will be called: 1) conception 2) infancy 3) adolescence and 4) maturity. Conception involves the introduction of a resource into the organization, in this case the process of co-development. Generally the introduction stems from either an organization reaching a certain critical point or the distinct need for the process. The infancy stage is characterised by management activities that are aimed at encouraging parties that are not yet included in the process into the process. Which in this case means efforts aimed at searching and selecting partners. The concept stage is characterised by a first set of tasks being initiated and establishing priorities and plans for future development. At this stage all parties have realized the potential effectiveness of the process. The last stage, maturity is marked by refinement of the process and the control tasks and elimination of inefficiencies. Also evaluation and rethinking of the process is done.

The general path derived from Nolan's model is combined with information about co-development from Deck & Strom (2002) that was gathered early on in this project. Adaptations of these sources together with extensive literature and empirical information is elaborated on in chapters 3. Chapter 5

explains the complete maturity model of co-development that this thesis proposes. A short representation of the model is described below and displayed in figure 1. The full model will be explained in the chapter 5 and is displayed in figure 9 and Appendix E.

The model in figure 1 shows the stages of co-development that an organization is anticipated to follow. The characteristics and improvement measures to advance in the model within the model will be described later in the report based on the empirical findings.
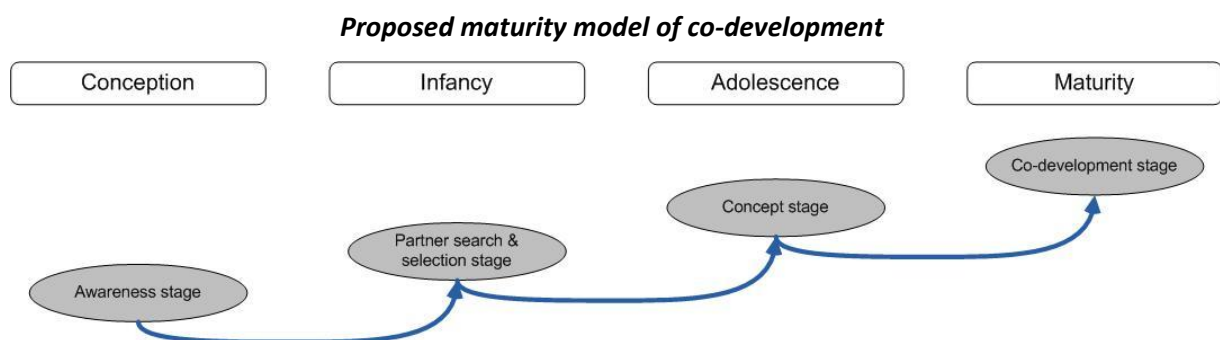
Figure 1: Proposed maturity model of co-development (adapted from Nolan (1973) and Deck & Strom (2002)).

The next chapter will explain the methodology used for the gathering of academic and empirical information for the answering of the main- and sub-questions as well as the development of the proposed model.

2. Methodology

2.1 Research design

For answering of all the questions stated in the previous chapter it is necessary to establish how data was collected, from where, how it was analysed and what the limitations are. The research design steers the research and is needed to understand and judge whether the research reflects reality enough for the findings to be used in practice and evaluate its validity.

First the research design is outlined, then the data collection methods, selection and sampling, analysis methods and the limitations of this research.

The general outset of the research was development oriented as the goal was to gather information to develop an maturity model which can be used by EsperantoXL and its partners to engage in a co-development.

Few best practises were available for co-development limiting the possibility to establish an all encompassing model with valid judgments to its future performance. This advocated the use of a development oriented approach over a design oriented approach (van Aken, Berends, & van der Bij, 2007). Through this approach deductive reasoning was used (Babbie, 2010) for (1) assessment of academic and management literature to develop understanding of the co-development process and its dimensions. With these apprehensions (2) a preliminary model was developed within this thesis to provide directions for (3) empirical data collection via examination if best practises. The empirical results were reflected against literature to ground the results in theory and to (4) adapt and expand the model of co-development. Lastly the model was (5) evaluated within EsperantoXL through a focus group and adapted into a final model as the model is developed with EsperantoXL in mind. Goal of the focus group was to engage with the model and evaluate its use within EsperantoXL to see whether it provides the organization with valuable directions. These directions should clarify how to engage in a co-development process and clarifies the desired path for implementation of, and advancements in, the maturity model. Also the session was used to evaluate the supplied success factors and obstacles for advancement. The research design is pictured in figure 3 with the arrows representing reflective loops back to literature and or previous models for adaptations.

Display of the research design:
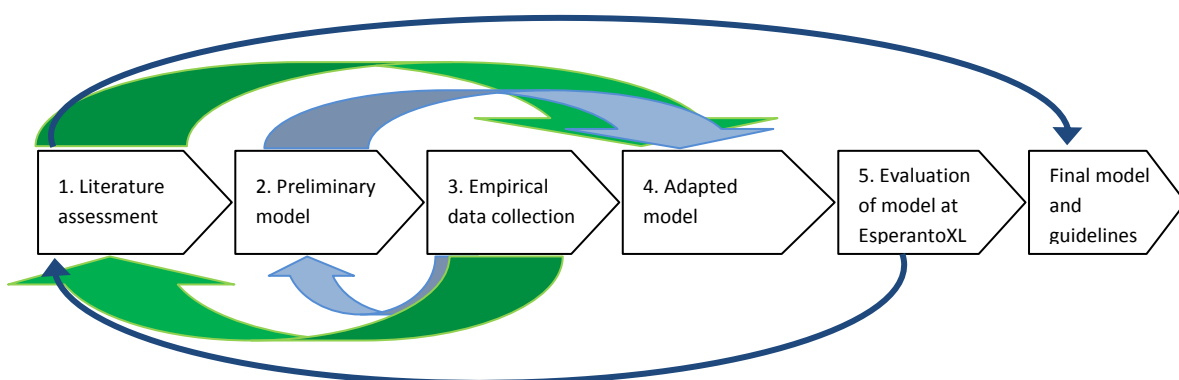
Figure 2: Research design for the development of the maturity model of co-development. The arrows represent reflections on previous stages.

2.2 Data collection methods.

The literature review was done to establish understanding of the co-development process. This focused on co-development and related topics like supplier integration; collaborative alliances and collaborative (new) product. Also the literature review was used to propose a preliminary maturity model that fit to the theory of co-development. To compare the preliminary maturity model with practice empirical data was needed. Therefore interviews were held with practitioners to establish best-practises. Also an interview was held at EsperantoXL and at one of its customers to compare whether goals, expectation and possible selection criteria are similar to those in best-practises.

2.2.1 Interview methodology

A qualitative research method was employed to get in-depth understanding of the various aspects that contribute to the decision process within co-development. In depth interviews are especially suited for these 'how' and 'why' questions (Yin, 2009). The goal of this research was to provide organizations with a practical model which can be used to assess position of the current or set up a new co-development. Therefore the aim was to retrieve the reasons organizations have for co-development as well as determine the vital activities during the set up of a co-development process. Semi-structured interviews where held with all interviewees. A combination was used between open ended and closed ended questions. Open ended questions were used to find out more about the selection of partners and management of the co-development process whereas closed ended questions were used to test several variables found within literature that affect the choice for a partner. For the closed ended questions a 5 point Likert scale was used to allow for a comparison of importance of variables within organizations as well as observing whether differences of importance exist between organizations (Babbie, 2010).

2.2.2 Interview contents

The preliminary model of co-development that resulted from the literature study describes the process from conception of a co-development into maturity (see figure 4 page 28). It must be noted that this preliminary model is not the same as the model described in paragraph 1.7 and is not the same as the final proposed model. The preliminary model was derived from literature and served as a conceptual framework for the empirical research which was done via these interviews. With empirical results this conceptual framework or preliminary model changed into the maturity model proposed by this thesis. In chapter 5 the differences between the preliminary model and the empirical results are explained which resulted in the adaptation of the model into the final proposed model of which figure 1 is a preview.

The preliminary model based on literature expressed the importance of searching and selecting the right partner for co-development. Therefore the conception stage in the model starts with the selection of partners and following stages involve the management of the development process together with partners.

Especially the first stages of co-development are crucial to the success of a co-development and several factors have been derived from literature that are conveyed into important factors for the selection of partners. Strong attention has also been put into the activities related to successful management of the co-development process and suggested success factors mentioned in literature. Based on the literature and prospective value for practitioners 5 main topics of attention where derived and with them examples of questions are given in table 1.

Table 1: Main topics and several examples of questions asked during interview

Main topics	Example of questions
Goals for co-development	Which goals can be distinguished to participate in a co-development?
Selection criteria for collaboration partners	What criteria are used for selecting partners? How important do you consider the following factors when choosing a collaboration partner? (rated 1-5) - The experience with a partner from a previous collaboration - Partial overlap of technical knowledge with the collaboration partner - Having an equivalent development process - The willingness to change the development process if necessary - Commitment for the project at the top of the organization - Shared vision of technology and market developments/ shared destiny of learning and cooperation
Upfront arrangements before co-development	How important is it to arrange the following aspects before the start of a co-development? (rated 1-5) - Having a clear definition of roles for the development of the product - A plan for information sharing on the product and the development process - A clear distribution of contributions and returns - A plan for IP management - A conflict management plan
Managerial activities during co-development	What are the most important activities during the co-development process? What is/are the most effective way(s) to share information?
Success factors and pitfalls in co-development	Are there general obstacles to the co-development process? If so how are they conquered? Are there general factors that contribute to a success of a co-development?

2.3 Selection and sampling

The units of analysis for this research were organizations familiar with the process of co-development in an IT or product development (manufacturing) context and interviewees where selected on that context. The goal was to retrieve best practises and test whether several variables derived from literature correspond with these best practises used by practitioners. The goal was to find (1) the positive effects and conditions under which a co-development process is set up and, (2) why collaborations are needed and under which conditions it does and doesn't work. This information is used for the development of the maturity model and guidelines for its use.

Very few organizations exist with extensive experience with co-development. Many organizations have had good collaborations with suppliers or customers but very little organizations have experienced true co-developments where essential information, people and other resources are shared between organizations.

More experience however was found with consultants and innovation program coordinators or facilitators. These individuals have participated in several projects with different types of organizations which allows them to draw from the experience of multiple organizations.

As the model will be used by organizations with little to no experience with co-development, two less-experienced firms were also included in the sample. These included EsperantoXL and one of its customers the NS. They have been a customer with EsperantoXL for many years and communication between the two organizations is good and there may be possibilities for a co-development. Generally the same questions were asked with respect to selection criteria and management of projects. The answers were used to compare whether selection criteria and management structures possibly used by the non-experienced organizations are similar to those of best practise organizations.

Purposive sampling was used to compare whether differences exist between experienced and less experienced co-developing organizations with respect to goals for collaboration as well as differences in selection criteria. Purposive sampling is suitable to for this type of comparison (Babbie, 2010).
By this sampling 7 interviewees where found. Five interviewees were interviewed with extensive knowledge of collaborations and co-development and two with little experience. The interviewees included:
- A project coordinator and a program director of two regional cooperating innovation centres in product- and business development
- Two innovation consultants with expertise in collaborations (1 interview)
- A consultant of a large consultancy firm with experience in IT co-development projects
- A managing director of a manufacturing company which co-develops all its projects
- A sales and marketing director at EsperantoXL
- An innovation manager at NS

No further details are given for confidentiality reasons. All interviewees represent a position within a project internally or externally that allows their decisions to have effect in the project.

2.4 Processing of interviews

All interviews where held by one person with a standard set of questions (see Appendix C). 6 Were taken in person at the workplace and 1 interview was done via telephone. During interviews notes were made. Also the interviews were recorded, written-up and returned to or discussed with the interviewees for verification.
Individual interview outcomes where scanned and coded via open coding, axial coding and selective coding using topics found in literature as a guideline (Babbie, 2010; Bhattacherjee, 2012). Extra topics outside of literature were added if recognized within multiple interviews.
The results were processed manually using the topics from literature as a base for reinforcement of the proposed model of co-development and adding extra topics from the interviews to extend the maturity model with practical insights and possible extensions for future incorporation.
No statistical analysis has been done as the amount of respondents does not allow for statistical significant answers.

2.5 Analysis

Analysis and understanding of co-development was done through analysis between criteria that are found consistent between the literature and data from empirical cases (Babbie, 2010). The preliminary maturity model that was developed was compared based on analytical generalization between how things should work according to the model and how it does in practice (Yin, 2009).

The focus has been on the first stages of co-development involving the search and selection of collaboration partners as well as factors that are of influence on the start up of a co-development. These are the aspects that are of great relevance to organizations like EsperantoXL who have little experience and are before or at the beginning stages of co-development. The analysis points towards which selection criteria are regarded to be very important by best practise practitioners. Despite lesser attention the analysis also uncovers important activities during the co-development process. These activities are management oriented and help in a good course during the mature co-development stage. The conclusions from the analysis are translated into an improved maturity model in chapter 5.

3. Literature

The literature study was done to gain insight in the overall process of co-development as well as the dynamics of choosing partners and setting up a co-development process. It starts off with how literature was searched and moves on to describe special characteristics of co-development. A model is proposed to structure co-development and the different stages that were found in literature. Each of the stages of co-development are explained next based on relevant literature. Near the end of the chapter a preliminary model is presented which has aided in the empirical part of this research. The last paragraph describes the structure of the taken interviews.

3.1 Literature research

Literature research has been performed using S*copus[5], webofknowledge[6]* and *Google scholar[7].*

Scopus has been the main search engine and was mainly used to filter the first searches relevant to the field of business and management as well as selecting on relevance and checking for the amount of citations as indication of its quality and impact. Google scholar was used later as an easy way for looking into forward and backward citations of specific (leading/highly relevant) articles. The web of knowledge was used as a backup for those articles that could not be retrieved via Scopus or Google scholar.

The search was done on the term *co-development* and derivations; *codevelopment; collaborative development*. The results were limited to the fields of Business and Management and Accounting via the limiting tool of Scopus. These articles where scanned for relevance on title and later by abstract. A crosscheck was done with Google scholar. The term *co-development* was used and the search results were arranged by relevance of which the first 100 results were checked. Based on the title and abstract the same leading articles where found as by Scopus.

After a first overview of the literature on co-development (collaborative development) it became clear that some other fields of research where quite relevant as well. Therefore attention has also been given to the following topics.

- Supplier involvement/supplier integration
- Collaborative (new) product development
- Collaborative - Alliances/Joint ventures in – product development

An overview of the used literature and the distribution to the different topics is given in table 2 displayed below. The different topics derived from literature are explained in the next paragraph.

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[5] https://www.scopus.com/
[6] http://apps.webofknowledge.com
[7] http://scholar.google.nl/

Table 2: Literature distribution table

Writers	Co-...	Co-development	Supplier integration	Collaborative (Alliances/ joint ventures) in (N)PD*	Trust	Open Innovation	Business models	....
(Arino & de la Torre, 1998)				x	x			
(Bruce et al., 1995)				x				
(Bstieler, 2006)				x	x			
(Büyüközkan & Arsenyan, 2012)				x				
(Chesbrough & Schwartz, 2007)		x				x	x	
(Chesbrough, 2003a)						x		
(Chesbrough, 2003b)						x		
(Crespin-Mazet & Ghauri, 2007)		x						Co-dev. in construction
(Deck & Strom, 2002)		x	x				x	
(Dyer, 1996)			x					
(Emden et al., 2006)				x				Selecting partners
(Evans & Jukes, 2000)			x					Process alignment
(Faems et al., 2005)				x				
(Feng et al., 2010)		x						Selecting partners
(Fliess & Becker, 2006)		x	x					
(Lakemond et al., 2006)			x					
(Littler et al., 1995)				x				
(Lynch et al., 2013)		x						Crisis within co-dev.

Reference									
(Neale & Corkindale, 1998)	Co-creation								
(Prahalad & Ramaswamy, 2004)	Co-creation								
(Ring & van de Ven, 1994)				x	x				
(Spina et al., 2002)	Co-design								
(van Echtelt et al., 2008)			x						Process alignment NPD

* (N)PD = (New) Product Development

3.2 Co-development

The definition of co-development is given in paragrapth 1.2 (page 6 and 7). According to Evans & Jukes (2000) co-development is done through the collaboration in development between one organization and its suppliers(s). While this gives direction for looking into supplier integration and supplier involvement in the product development process this research will not limit itself to only suppliers. Customer will also be included as possible partners for co-development.

The description of co-development that was given already illuminates relevant topics to the process. These topics includes customer-focus, collaborative (new product) development and the management/involvement of multiple parties which can be suppliers as well as customers.. There are however some points worth addressing with respect to these topics in the context of co-development. The first thing to note is that from a customer perspective co-development is not the traditional process of trying to fit the product offering of one organizations to the customer (Prahalad & Ramaswamy, 2004). Rather it is the careful collaborative effort of multiple parties sharing their knowledge, skills and resources for the development of a product that truly fits the customer needs. This means that co-development also is not simply outsourcing development and certain management decisions for parts of the product to the collaborating partners. It is the joint development and sharing of responsibilities and benefitting from the results of the collaboration at the end. This makes the process distinctly different from the conventional buyer-supplier relationship and can be seen as the next step in their relationship. This next step however requires a radical change in the development- and management process with implications for a continuous unobstructed two-way flow of knowledge and ideas(Dyer, 1996; Emden et al., 2006).

3.3 The composition of co-development and a preliminary model

Now going into the elements that make up co-development it can roughly be observed as being a process composed of three stages. These stages will be mentioned quickly followed by specifics which are elaborated upon further on in this chapter. The first stage is the search and selection of partners and consequently the formation of rules and getting agreements on how the process will work and how benefits later will be shared. This will lead to selection of the most suited partner and putting rules and agreements into some form of a joint development arrangement. Secondly an orientation stage is entered where both organizations try to get a mutual understanding of each other's development process by for example exchanging employees. Also a further understanding is developed on what the future view of directions will be on the evolvement of the market and technologies and exploring on what the collaborative development process will look like. The third and last stage is the co-development process itself where a collaborative development process is in place where both organizations have one team or several teams working on. Relevant knowledge and expertise is shared and product and management information is exchanged between both organizations as well as the joint allocation of resources to successfully develop the product.

It is being recognized that successful organizations benefit greatly when using co-development as an integrated part of their business model opposed to just using co-development as a single sporadic venture (Chesbrough & Schwartz, 2007; Deck & Strom, 2002). Therefore a fourth stage is added to the preliminary model as a final stage. The fourth stage must be seen as an advanced stage of co-development surpassing the actual process of co-development.

The description above derived from Deck & Strom (2002), Chesbrough & Schwartz (2007) amongst others combined with the adapted steps of Nolan's maturity model (Nolan, 1973) (explained in paragraph 1.7) are combined to make up the preliminary model displayed below in figure 3. This model functions as a conceptual model in the literature review as well as guideline for the interviews. Later on in chapter 5 the model is changed as a result of the empirical evidence.
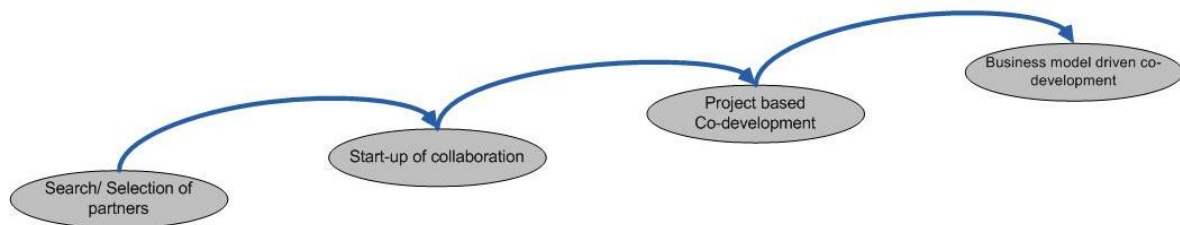
Figure 3: Preliminary maturity model of co-development (adapted from (Chesbrough & Schwartz, 2007; Deck & Strom, 2002; Nolan, 1973)**)**

3.4 Management of the co-development process at different levels and in different arena's

3.4.1 The elements of co-development at different levels

As every new product development process, co-development needs careful management to succeed in producing a product that has value. Especially since the process includes one or several partners. Deck and Strom (2002), have looked at several large organizations who incorporated collaborative development into their business and proposed a model for co-development. This model describes 3 levels being: Strategy, Execution and Infrastructure. These three main levels each can then be subdivided into 2 elements leading to a total of 6 important elements in the co-development model, which is displayed in table 3. The foundational elements are those that exist across all co-development projects an organization has. The situational elements are adapted to fit the individual relationships within one co-development project.

Table 3: The 6 processes in the model of co-development, derived from Deck & Strom (2002)

Level	Process	
	Foundational element	*Situational elements*
Strategy	Development chain design	Partner selection & management
Execution	Governance & Metrics	Teams & Processes
Infrastructure	IT roadmaps	IT tools

Addressing these elements will follow after looking into a proposed framework of the management process for supplier involvement in new product development (van Echtelt et al., 2008).

3.4.2 The managerial arena's

This proposed framework of van Echtelt et al. (2008) introduces two arena's at which managerial activities take place. The first is the *operational project management arena* and the second one

described here is the *strategic management arena*. The operational project management includes activities that focus on planning, managing and evaluating specific collaboration projects and the capturing of results manly from short-term actions. The strategic management arena includes activities that provide strategic direction and guidance for teams that work together with suppliers and looks at mainly long-term results. Between these two arena's there are constant processes of integration, learning and reconfiguring (van Echtelt et al., 2008).

The relation of these managerial arena's to the co-development process from Deck & Strom (2002) is described next.

3.4.3 Elements of co-development in the operational project management arena

Focussing first on the operational project management arena of van Echtelt at al. (2008) the relevant activities from that model will be described in the light of the situational elements from the co-development model from Deck & Strom (2002).

The starting activities to any co-development process are those of the partner selection and management.

3.5 Partner selection stage

3.5.1 Selection criteria

This is the first stage in the maturity model as well as being one of the most difficult activities organizations have. When selecting partners, it is important to not just look at the partner as an individual but to recognize the unique characteristics that arise by the coupling of the partners' core competences combined with your own (Feng et al., 2010). From several sources criteria have been derived that either serve as a hard selection criteria or as contextual factors that need to be kept in mind. The criteria plus the sources from literature have been listed in table 4 and a quick description is given thereafter.

These criteria have been found as selection criteria or success factors in literature about supplier involvement in new product development, collaborative product development and studies focussing on the success of supplier integration.

Table 4: Selection criteria for co-development partners

Criteria/influential factors	Source
Presence of short term returns	(Deck & Strom, 2002)(Evans & Jukes, 2000)
Prospect of long term returns	(Deck & Strom, 2002; Emden et al., 2006; Lakemond et al., 2006)
Shared vision of technology and market developments/ goal correspondence	(Deck & Strom, 2002; Emden et al., 2006)
Shared destiny of learning and cooperation	(Deck & Strom, 2002; Emden et al., 2006; Lakemond et al., 2006)
Shared expectations about collaboration	(Lynch et al., 2013), (Lakemond et al., 2006), (Deck & Strom, 2002), (Crespin-Mazet & Ghauri, 2007)
Commitment (at top level (CEO))	(Bruce et al., 1995; Crespin-Mazet & Ghauri, 2007; Deck & Strom, 2002; Lakemond et al.,

	2006)
Cultural fit	(Deck & Strom, 2002; Emden et al., 2006; Feng et al., 2010)
Complimentary resources	(Emden et al., 2006; Feng et al., 2010)
Overlapping knowledge base	(Emden et al., 2006; Feng et al., 2010)
Technological capabilities	(Deck & Strom, 2002; Emden et al., 2006; Feng et al., 2010)
Financial health	(Feng et al., 2010)
Knowledge and managerial experience	(Deck & Strom, 2002; Feng et al., 2010)
Capability to access new markets	(Feng et al., 2010)
Equivalent development process	(Evans & Jukes, 2000)
Willingness to change the development process	(Emden et al., 2006)
Having an equivalent development process	(Evans & Jukes, 2000)
Previous interactions or relations with partners	(Arino & de la Torre, 1998; Feng et al., 2010; Lynch et al., 2013))

Determining the short term results is the most obvious but also important criterion, without short term returns collaboration is highly unlikely. Beside the short-term returns, long term returns can be an extra incentive to work together, especially if there is potential for opening up new markets. In some cases the long term results may even be so high that a partner is willing to accept low short-term results and aims for future benefits arising from prolonged collaboration. This relates to the points of shared vision, goal correspondence, shared destiny of learning and shared expectations. These topics all relate to whether both parties have similar views of where the market will go and which technology advances will be made and how each partner plays a role in that future. The potential for having learned a lot and both achieving a goal that is similar is a great driver for collaboration. However carful scanning with respect to those topics is critical as well as there must be correspondence at all those topics. They don't have to be exactly the same however there must be no hidden agendas of one partner trying to take over the others market. Commitment at the top is necessary because otherwise resources are not always guaranteed making the project prone to failure (Bruce et al., 1995). As both organizations will be working together quite extensively there must be some sort of cultural fit or at least the willingness of the organizations to create a coherent joint culture. Complimentary resources have been shown to be a critical aspect of efficient and successful co-development. An overlapping knowledge base helps organizations in understanding each other and achieve a common accord of the development. Scanning of technological capabilities, financial health, knowledge and managerial experience helps to assess whether the partner has a good track record and is able to contribute to the development in a positive manner. The capability to access new markets relates to the future prospects for long term results.

3.5.1 Arrangements
If the partners have been evaluated based on the criteria above and have deemed fit then the partners may possibly be ready to participate and commit to the project. At this time arrangements have to be made. The arrangements describe all the different roles and responsibilities the individual partners have. Also procedures and policies should be put into place about the support of the product when it is put on the market. Some of the last arrangements include guidelines for dispute resolution, the distribution of the profits and the handling of intellectual property. These items should be put into some sort of joint development contract (Deck & Strom, 2002)

How the items above are all put into contracts and what type of contracts are used for these practises has not yet been fully distilled from empirical cases in literature. Therefore this topic is worth looking into at more detail with the empirical part of my research.

Evans and Jukes (2000) do describe that after arrangements have been made it is important for both parties to look at the future scenario and possibly rewrite it to fully mach the expectations of all partners. This ideally should be done in a neutral environment by third party support.

3.6 The pre-co-development stage

After the selection of partners, Deck and Strom (2002) describe that time is needed for organizations to get to know each other more. This pre-co-development or concept stage should be used to get acquainted with each other's culture and understand each individual's current development process. Specifically if one of the partners does not have a proven development process this stage may lend itself for that organization to get familiar with a proven process possibly learning from one of the partners. Not running a proven development process increases the chance of challenges and misalignment of expectations. The concept stage can be used to adapt to a more proven development method or reconfiguring expectations.

At the concept stage there is also room for defining the interfaces between people within the organization allowing for the future sharing of knowledge and information about products (Fliess & Becker, 2006). During the this time there should be efforts to work together in establishing the outset of the collaborative development process (Evans & Jukes, 2000). Building trust and commitment at this stage can be done by for example taking on a small project and creating short wins (Deck & Strom, 2002).

After the concept stage both parties must have committed fully to the project and have an outset of the collaborative development process. From here on the next step is the full co-development.

3.7 Co-development stage

3.7.1 The need for commitment at all levels

At this time the co-development process has commenced. Ideally the project is managed as if the development process was done internally. Successful co-developing companies have been found to use a joint management structure at three levels to control the project (Deck & Strom, 2002). With this comes commitment at each level. Commitment together with trust have been found to be discriminating factors between successful and unsuccessful co-developments (Bstieler, 2006). Commitment starts at the top at executive level with a specific person acting as a champion to the project and the partnership. In case of challenges there must be someone that has the authority to set priorities to the joint project and retain the relation.

The second level is senior management. The importance of this level is to be able to allocate and redirect resources if necessary. Also sharing of management and development decisions is critical to the process and therefore involves senior management.

Once commitment at the management levels are in place the progress of development is in the hands of the project team(s). They attend to the day-to-day activities either by working together in the same teams or by working individually at the own organization with close collaboration between them.

3.7.2 Transfer of information across organizations and teams and IT-tools

IT-tools was one of the element from the model of Deck and Strom (2002). This relates to the classic issues which are present at each new product development project. This is communicating the right information so that decisions can be made, resources can be allocated and that everyone in the team is up to date on the progress and can access relevant data on the product or process decisions. It is important to provide development teams with the right tools that allow them to work efficiently on their projects. Information has to flow without trouble between the development teams from the two organizations (Dyer, 1996). IT-tools can be used to answer these requests however it can also just be management by regular meetings and having experts of both organizations work together often. Therefore the goal is to utilize IT-tools if there are suitable options within one of the organizations or can easily be retrieved. Much time can be wasted if organizations try the achieve the perfect system if something more basic will suffice. Great attention however is needed for the sharing of these streams of information as successful product development is dependent on reliable, timely sharing of information of decisions and project progress (Bstieler, 2006; Deck & Strom, 2002; Fliess & Becker, 2006). The communication mechanisms reduce the chance of delay, the waste of resources and create a sense of trust between the cooperating parties (Evans & Jukes, 2000).

3.7.3 Evaluating and feedback

Evaluation is one of the key factors to success of the co-development process and timely and regular evaluations are needed to keep alignment (Evans & Jukes, 2000) and reduce the chance of changing expectations (Deck & Strom, 2002).

The expectations and the related initial conditions and agreements that went along with them at the selection stage are subject to constant re-evaluations. Ariño en de la Torre (1998) go to explain that as the development process takes place , constant cycles of execution and associated learning are happening. Learning relates to the progress that is being made between the partners and the contributions they make during the process. These contributions are constantly compared to the initial expectations. If these expectations are met then the process is continued. However if one partner learns that the contribution does not meet expectations this will result in corrective action. If a good relationship between the partners exist or if guidelines for this discrepancy are in place then the corrective steps will be taken in unison by the two partners leading to renegotiations and adjusted or revised conditions for co-development. When this action results into positive learning then the relationship is strengthened and the co-development continues. If however the relationship is not strong enough or no guidelines for conflict handling exist, one partner may resort to individual action. If the corrective action and associated learning are contributing to the expectations again the process is continued. But if the new steps do not meet expectations -and there is no unified action thereafter- the relationship may spiral into deterioration. The changes in outcomes and expectations can also be due to external changes(Bruce et al., 1995), therefore a good relationship and guidelines for handling altered expectations is keen (Arino & de la Torre, 1998). At first organizations will likely resort to formal contracts and guidelines for handling changes in expectations and conflict resolution. As the relationship grows stronger however organizations may rely on trust more and the goodwill they have build up and use less formal contracts (Ring & van de Ven, 1994). It would be interesting to see in the empirical part of this research whether this holds true in practise.

Nevertheless the process above demonstrates the need for good information sharing systems, codified arrangements and the importance of commitment at all levels. Being able to swiftly take

action is essential and reduces the chance of partners accusing each other of hidden agendas and factors that may lead to dissolving co-developments.

3.8 The business model driven co-development stage

Next to the activities that take place within the operational project management arena there is the strategic management arena. The strategic management arena includes processes that provide long-term directions for an organization as well as operational support for project teams that are in or adopting co-development. Also some elements within this arena are aimed at building willing and capable relations with collaborative partners (van Echtelt et al., 2008).

An organization can utilize the strategic management arena when it has integrated co-development fully into the business model. This exploits the development chain by taking advantage of internal strengths and combining those with core competencies of a development partner (Deck & Strom, 2002). Integrating co-development into the business model however requires an executive team to seriously look at the fundamental questions involving the prospective missions of the business and how value is created and extracted in the future(Deck & Strom, 2002).

One of the processes is the development of strategic roadmaps. These provide guidelines for an organization on where it wants to go and how it sees the future of technologies and the market. Organizations need to scan for developments in the market and technologies as well as keeping track of developments by current and prospective partners. Doing this allows organizations to gather the knowledge for pre-selecting potential partners for future co-developments (van Echtelt et al., 2008).

IT-roadmapping should be done to establish or gradually upgrade systems that support the standard communication guidelines and procedures an organization has(Deck & Strom, 2002; van Echtelt et al., 2008) These IT-roadmaps describe how current communication structures and IT-systems may need investment and how they evolve over time to keep supporting communication functions for future projects.

A successful co-developing organization also has standard templates for contracts for all different future collaborative efforts which it can easily use when a project fits the needs for a collaboration that is in line of the strategic goals. However these templates must be altered to each individual relationship as no relationship is equal and each relationship and product requires a different custom, collaborative development process (Deck & Strom, 2002; Evans & Jukes, 2000)

The success of an organization to fully exploit co-development is by being able to capture value created in the short-term as well as being aware of value that can be obtained in the future. This is achieved by exploiting experiences gained from learning during the co-development process or the opening of new markets. Building a long-term relationship and having extensive learning routines with the partnering organizations ensures that both organizations are aligned and have similar capabilities for future projects (van Echtelt et al., 2008). Despite the fact that success can be achieved by building long-term relationships and learning routines it certainly is not necessary to build strong relationships with every co-development partner. Depending on the context and the goal of the collaboration (Chesbrough & Schwartz, 2007) some relationships may be very deep and others rather

shallow (Deck & Strom, 2002). A clear co-development strategy that is an extension of the business model of an organization will provide the directions on which relationships need to be fostered and which can be managed contextually.

3.9 Preliminary maturity model of co-development

The literature above has given insight into the activities taking place during each stage of the maturity model. These insights are summarized and abbreviated and placed in the preliminary model of co-development that was proposed earlier. The combined picture gives us the model displayed below (figure 4). This model can also be found in Appendix A.

Maturity of Co-Development

| Conception | Infancy | Adolescence | Maturity |

- Search/ Selection of partners
- Start-up of collaboration
- Project based Co-development
- Business model driven co-development

Activities

-Search for partner
-Select partner
-Make arrangements for first collaboration

Selection criteria
-Short term returns
-Prospect of long term returns
-Shared vision of technology and market developments
-Shared destiny of learning and cooperation
-Shared expectations about collaboration
-Commitment at top level (CEO)
-Cultural fit
-Complimentary resources
-Overlapping knowledge base
-Technological capabilities
-Financial health
-Knowledge and managerial experience
- Capability to access new markets

Activities

-Get familiar with each other's development methods
-Create short term wins to help build relationship
-Create/maintain commitment at all levels of the organization:
  ○ CEO level
  ○ Managerial level
  ○ Team level
- Assign a sponsor from each organization to regulate the collaboration for day to day business
- Align expectations and intentions between organizations

Activities

-Established collaborative development method
-Provide development teams with tools that facilitate real-time access to information and decisions.
-Provide possibilities to allocate resources
-Evaluate regularly to assess progress
-Change coordination style if necessary, depending on the phase of development.
-Treat development teams as if it where internal teams

Characteristics

-Management of co-developments is coordinated from a deep- to shallow relationships, based on contextual needs
-Facilitating (IT) structure is in place for managing information and decisions sharing between different organizations and different contextual needs
-Models for each co-development need are available and can easily be fine tuned for the specific relationship

Figure 4: Preliminary model of co-development with corresponding activities per stage (adapted from (Chesbrough & Schwartz, 2007; Deck & Strom, 2002; Nolan, 1973)**.**

3.10 Structure for interviews

The literature above has extensively described the activities and important factors during the stages of co-development. It has described the activities and important factors for; the selection of partners; arrangements that need to be made; the important dimensions for managing the co-

development process and activities taking place when co-developments are driven by business models with long term vision and strategy of collaboration.

The literature that was used to determine the activities and important factors during the different stages was taken from academic research in the fields of co-development as well as supplier integration. Despite the very close relation of supplier integration to co-development we cannot readily assume that the factors are equally important in case of a co-development. Greater or lesser relevance may be assigned in case of a co-development. Therefore empirical research was employed in this thesis to verify the multiple dimensions. As this research has focussed on providing practitioners with guidelines to set up a co-development the attention of the empirical research was on the first 3 stages of the proposed model being; criteria for selection partners for the *search/selection stage*; arrangements that need to be made during the *start-up stage*; the important dimensions for managing the co-development process in the *project based co-development stage*.

Questions will be asked as explained in chapter 2 paragraph 2.2.2. Which mainly includes open questions. However next to open ended question focussed on which criteria are used for selection of partners, some criteria from literature will also be tested across the respondents of the interviews via scale measures. The criteria will be scaled on a scale from very **un**important to very important. The aim is to determine whether consistencies can be found across the respondents. The list of selection criteria for the interviews are summarized in table 5.

For arrangements that need to be made before the start-up stage consistency is also checked via a scale in a similar manner as for the selection criteria. consistencies on arrangements that need to be made before the actual co-development the same procedure will be applied as for the selection criteria with a scale. The items that will be asked are proposed by Deck & Strom (2002) and the importance is checked on whether organizations find it important to establish arrangement on:

The main focus fields within the empirical research therefore will be (also mentioned in table 1 paragraph 2.2.2 page15):
- **The goals organizations have for co-development**
- **The selection criteria organizations employ and the importance thereof**
  (See table 5)
- **Arrangement that need to be made with partners before the start up of co-development**
  (See table 6)
- **Important managerial activities during the co-development process**
- **Success factors and pitfalls in co-development**

The full list of questions corresponding to topics mentioned here can be found in Appendix C

Table 5: Possible selection criteria that will be asked during interviews

Criteria	Source
Previous interactions or relations with partners	(Arino & de la Torre, 1998; Feng et al., 2010; Lynch et al., 2013))
Overlapping knowledge base	(Emden et al., 2006; Feng et al., 2010)
Equivalent development process	(Evans & Jukes, 2000)
Willingness to change the development process	(Emden et al., 2006)
Commitment (at top level (CEO))	(Bruce et al., 1995; Crespin-Mazet & Ghauri, 2007; Deck & Strom, 2002; Lakemond et al., 2006)
Shared vision of technology and market developments/Shared destiny of learning and cooperation	(Deck & Strom, 2002; Emden et al., 2006; Lakemond et al., 2006)

Table 6: Possible upfront arrangements that will be checked during interviews

Possible arrangements needed before start up of a co-development (Deck and Strom (2002))
1. Having a clear definition of roles for the development of the product
2. A plan for information sharing on the product and the development process
3. A clear distribution of contributions and returns
4. A plan for IP management
5. A conflict management plan

A full overview of the questions asked during the interviews is displayed in Appendix B

4. Results

In this paragraph the results retrieved from the interviews are summarized. The results are mainly structured in relevance to the stages of the preliminary maturity model as pictured in figure 4 page 28. As mentioned previously the interviews have heavily focussed on the processes of choosing a partner and finding which factors are considered important during the selection stage as well as the start-up-stage. However some important aspects during the co-development stage as well as additional information for the business model driven co-development stage is given. The interviews also provided information about the goals for co-development as well success factors and pitfalls and the role of facilitators. The results of the interviews are structured in the following way:

4.1 The goals for co-development

4.2 Partner search and selection stage – important selection criteria

4.3 Collaboration start up stage – arrangements and contracts before co-development

4.4 Project based co-development stage – important management activities during co-development

4.5 Business model driven co-development stage – integration into the organization

4.6 General success factors and pitfalls

4.1 The goals for co-development

The goals for co-development that where derived from literature are:

- Creating new differentiating value
- Reducing costs
- Shortening time to market for new technologies

The overall goal organizations have to co-develop is to create new differentiating value that is in line with customer demands(5 out of 7). By combining competencies from different organizations the shared effort is to make more complex integral products that are of higher value to customers. Besides creating greater customer value, interviewees state that synergy between organisations reduces costs by utilizing a partner's expertise and shortening time to market for new technologies.

Finding partners

After realization that extra competencies are needed organizations most often look within their own network or extended networks of suppliers for partners (6 out of 7). In some cases an organization will look via the internet or seek knowledge via institutions.

4.2 Partner search and selection stage – important selection criteria

The importance of careful selection of partners is stressed by interviewees as 6 out of 7 interviewees mention that choosing the right co-development partner is very important. An ineffective partner will cause the project to delay and possibly even fail because of an extensive amount of effort needed to make the project succeed.

Table 7: selection methods used in practise:

Method for selection derived from interviews	Mentions
Technical capabilities	5
Gut feeling/intuition (trust)	5
Cultural factors (*e.g. willingness to cooperate and openness to share information*)	3
Strategic intent (*Clear ideas on how the collaboration is going to bring both organization further and what gains will be*)	3

How organizations select their partners is summarized in table [7].

Interviewees mostly reported that selection takes place based on the technical capabilities a partner has or characteristics of their product. Trust, via a intuition/gut feeling was reported by 5 of the 7 interviewees to affect the choice of a partner. Also factors like cultural fit and willingness to invest where found. Three of the respondents reported explicitly that strategic intent was sought within partners which is characterized by having ideas on how the collaboration is going to bring both organizations further and what their gains will be.

"...implicitly trust always Influences the choice for a partner"

Special attention has been given to determine the most important criteria that practitioners use when selecting their partners. The most important selection criteria are summarized in [figure 5] are; commitment for the project at top management level of the organization; complementary competencies and resources; a shared vision of cooperative technology and/ or market developments.

Most important selection criteria (based off of total of 7 interviewees)

Criteria	very important	important
Commitment for the project at top management level of the organization	5	2
Complementary competencies and resources	5	2
A shared vision of cooperative technology and/ or market developments	4	3
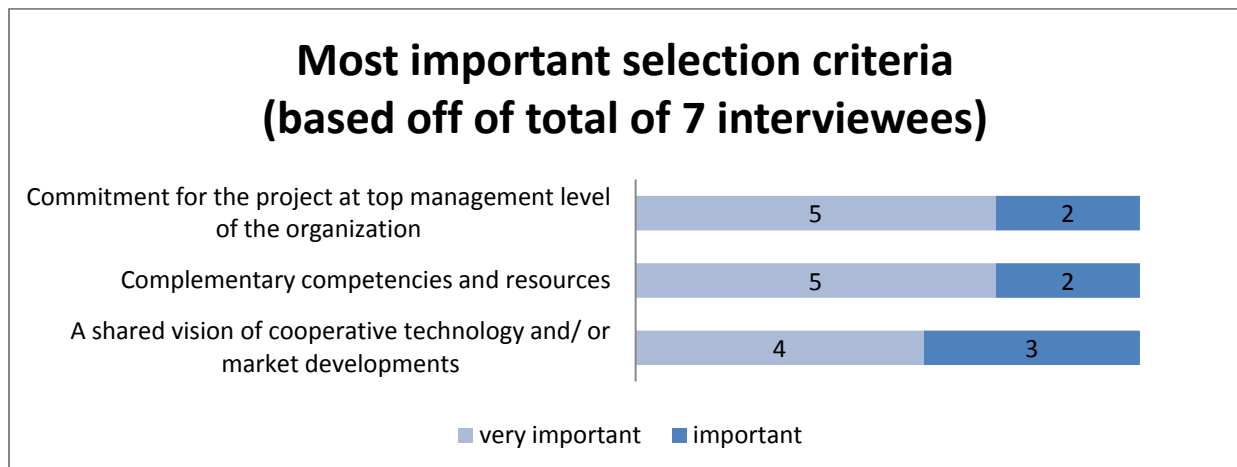
Figure 5: The most important selection criteria according to interviews

Although management structures are somewhat different between each organization, the most important aspect (graded as very important (5) and important (2) of 7 interviewees) is to establish whether commitment for the co-development is carried at a management level that has authority to set priorities and allocate resources and make important decisions. Aside from the commitment of top level management it is important to have shared ideas on where all organizations think the co-

development is going to take each participant and how they expect to profit from it in the future. This can be established by making a business plan at the start of a collaboration. Complementary competences and resources were also rated as important by 5 of 7 respondents.

Other important aspects in order of importance are:

- The experience with a partner from previous collaboration
- Partial overlap of technical competences with the collaboration partner
- The willingness to change the development process if necessary
- Having an equivalent development process

Experience with a partner from a previous collaboration relates to trust that one has towards a familiar partner. From previous experience one can assess if the partner is trustworthy possibly even in moments of crisis. On the other hand, working together with a new partner can bring a new creative dynamic to the collaboration, which is hard to anticipate at the very start. Partial overlap in technical knowledge is convenient when establishing a common language for sharing of knowledge however too much overlap must be avoided. Four of the interviewees stress overlap should not be on core competences as collaborations provide value when complementary competencies are used. The willingness to change the development process and equivalence of development process are interrelated. An equivalent development process may not be needed however being able to change the process due to product requirements is quite important to make all expertises complement each other.

4.3 Collaboration start up stage – arrangements and contracts before co-development

After selection has taken place it is necessary to make arrangements with the partners to establish the field in which the parties can manoeuvre to share important knowledge and information for the development of products. The importance the interviewees gave to several arrangements is displayed in figure 6 (next page).

All interviewees classified the following three topics important, to very important to arrange before the start of the co-development:

- A clear plan for managing (developed) intellectual property (IP)
- A clear distribution of contributions and returns
- A plan for sharing and communication of information about the product and the development process

Two other aspects that were also qualified as significant are:

- A clear definition of roles for the development of the product (important)
- A conflict management plan (relevant)

During the interviews all respondents stressed the importance of a good conflict management plan. Despite the important of such a plan, it often is just a clause in the contract explicating when and how the contract can be disbanded.

With respect to the roles of the partners within the collaboration all interviewees mentioned these roles are subject to change depending on the stage of the development as well as changes due to environment or new insights.

Contracts

The top two arrangements above need to be put in a contract. The contracts must be aimed at creating guidelines wherein partners can transfer information and necessary resources to achieve the common goal and not be limited the by legal restrictions. The rest of the arrangements that are important need to be discussed upfront and are placed in an arrangement which doesn't necessarily have to be a formal contract.

Estimation of the contributions and returns

Determining how much each partner is going to make if the co-development is a success is a very difficult process (7 out of 7). Estimations are made determining financial contributions and non-financial contributions and estimations of time and resources spent during the development. This process happens 'with great difficulty' and requires all parties to give and take and make some compromises. Some non-financial contributions can for example be put in a separate license which can be used by the collaborating partners.
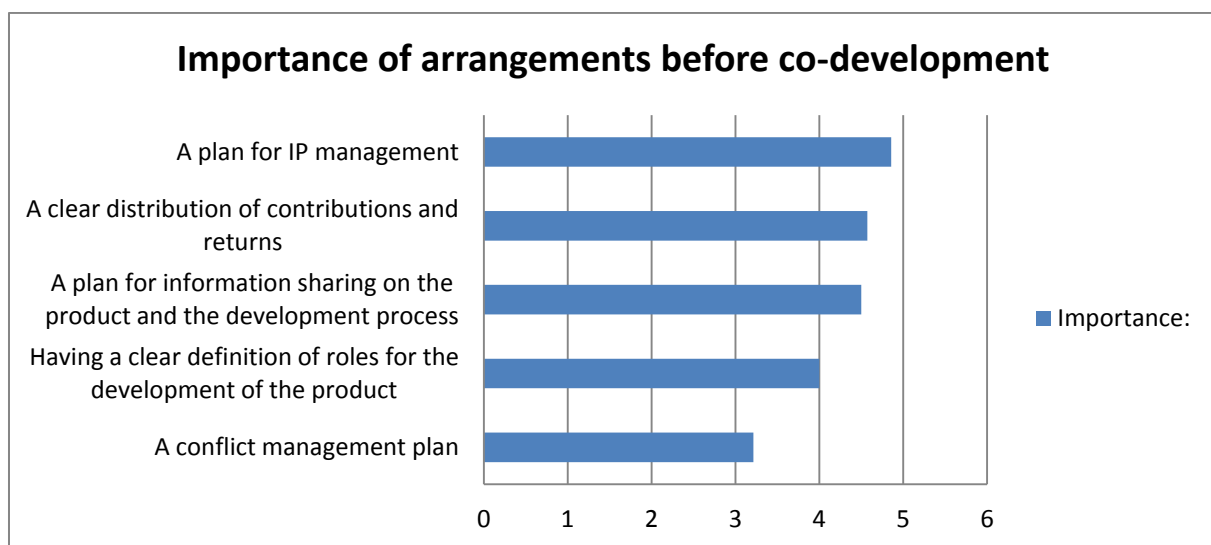
Figure 6: Arrangements that need to be made before the co-development process [0 = very unimportant, 5 = very important]

4.4 Project based co-development stage – important management activities during co-development

When the selection has been made and the necessary contracts are in place the next stage within the preliminary maturity model is the project based co-development. Most attention during the empirical research has been on the selection and start-up stage and less attention was given to the co-development stage. Because of the limited attention in empirical research, questions have been aimed at determining the most important activities during the co-development stage.

The most important management activities during co-development are:
- Strong project management
- Regular meetings
- Sharing of information

Project management within the co-development process is very similar to regular product development within a single organization according to all respondents. The key is to have good project management and project planning with good work breakdown structures and distribution of activities based on each partners' own expert domain. Regular meetings in each individual organization are needed as well as frequent meetings between the co-development partners to discuss progress and resolve possible issues. Two interviewees explicitly mentioned that managing expectations is crucial by which one quote is very signifying: "under promise and over deliver".

As mentioned before, one of the most important aspects in the co-development is sharing of information. Besides regular meetings between the organizations all interviewers are unified in saying that a platform is needed to share essential information. This includes information for analysis about the prospective market as well as crucial information for product development and management decisions. A digital platform must be created for the transfer of these types of information.

Despite the digital platform for sharing information all interviewees indicate that regular physical meetings are important to be able to clarify certain subjects that are difficult to discuss via digital platforms. Physical meetings are therefore essential for information that otherwise may get 'lost in translation'.

Two interviewees also added that during the development process it is also advantageous to have people from both(all) organizations work together at the same place, at least during the stages where knowledge from both organizations is needed for the development of the product.

4.5 Business model driven co-development stage – integration into the organization

This stage has also gotten relatively little attention in the empirical research. Nonetheless information has been retrieved about whether co-development as part of a business' operating procedures or business model is needed.

Co-development requires a different set of competences than regular 'inhouse' development. It is based on the sense of an organization that it needs to look beyond its own borders to create differentiating value. 4 out of 7 interviewees argue that co-development works best if collaboration is integrated into the DNA of the organization and involves all levels of the organization making them open to collaborate. This is most effective when integrated into some kind of operating procedure. However it is not necessary for an organization to have co-development fully integrated into the business model.

4.6 General success factors and pitfalls

Success factors distilled from the interviews

During the interviews several common themes where mentioned that contribute to a successful co-development. *Mutual trust* was identified by each interviewee as the most important aspect. One interviewee argued that trust between partner doesn't guarantee success, however not having trust will certainly make the co-development fail.

- Mutual trust (7)
- Commitment at all levels of the organization starting at the top(7)
- Information sharing on product and process (7)

- Complimentary competencies (6)
- Openness of employees to share information and work together (4)
- Collaboration champion

Pitfalls during the co-development process

Several pitfalls have explicitly been mentioned by a number of interviewees:
- Lack of trust to share information (4)
- Lack of commitment at all levels (3)
- Misalignment of expectations (3)
- Lacking governance structures/escalation procedures (3)
- Not having partners with differentiated competences (2)

How to overcome pitfalls

Some solutions where also presented by several respondents:
- Regular meetings (5):
  To manage expectations and observe possible conflicts early
- Having a good governance structure (3)
  Helps to clarify who makes the decisions during crises
- Good selection procedures with time to discover each other and get to know each other (3)
  Can help identify trust and commitment issues as well as determining whether partners truly have unique contributing value.

Role of a facilitator

6 out of 7 interviewees see value in the use of a facilitator during a project. The amount of guidance depends on the experience partners have with co-development. With inexperienced partners a facilitator can help kickstart the project by observing and removing obstacle (according to 4 interviewees). A facilitator may act as a project champion focussing the project and keeping all participants open for sharing of knowledge and new ideas. With high stake decisions a facilitator can act as an impartial body to keep decisions close to the primary goal.

5. Analysis

The goal of the analysis was to relate the findings from empirical research with those of literature to find the common ground between the dynamics and important factors described by literature and the retrieved best practises from the interviews. The empirical research was used to confirm parts of de preliminary model but also adapt other parts of the model elaborated in chapter 3 to fully fit its purpose.

Although great correspondence was found between the empirical results and the preliminary model from chapter 3 the analysis has led to adaptations of that maturity model. The preliminary model is altered into a new maturity model of co-development and presented fully in appendix D

This section will further expand on the new model and the concordances and differences between the preliminary model, the empirical results and literature in the following way:

5.1 Adapted maturity model of co-development new stages

5.2 The goals for co-development

5.3 The awareness stage

5.4 The partner search and selection stage

5.5 The concept stage

5.6 The co-development stage

5.7 General pitfalls and success factors

5.8 Omission of the business model driven co-development stage

5.9 Focus group for the applicability of the model at EsperantoXL

5.1 Adapted maturity model of co-development – new stages

A preview of the new maturity stages is presented below in figure 7 for clarity. Further details and characteristics are given in the corresponding paragraphs following the model.

The new model starts with the awareness stage, followed by the partners search & selection stage, the concept stage and the co-development stage as the final step of maturity. The details like selection criteria for selecting partners and the arrangements needed in the concept stage preceding the final co-development stage are put underneath the corresponding stages in which they need to be addressed in the model. Also the general success factors and pitfalls are included in the model for a total overview. The new stages are thus like this:

New maturity model of co-development
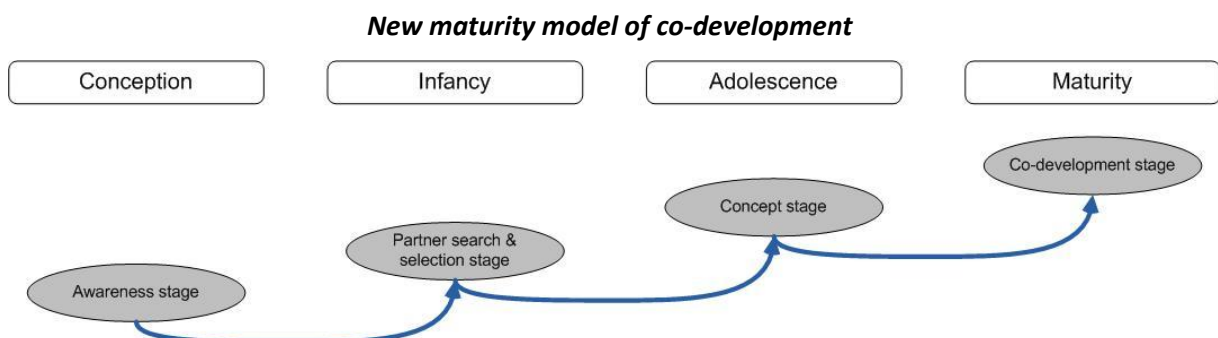
Figure 7: Proposed maturity model of co-development (adapted from Nolan (1973) and Deck & Strom (2002)).

5.2 The goals for co-development

The overall goal organizations have to co-develop is to create new differentiating value that is in line with customer demands(5 out of 7). By combining competencies from different organizations the shared effort is to make more complex integral products that are of higher value to customers. Besides creating greater customer value, interviewees state that synergy between organisations *reduces costs* by utilizing a partner's expertise and *shortening time to market for new technologies* (Bruce et al., 1995).

5.3 The awareness stage

Awareness is the first stage in the maturity process of co-development. The most mentioned goal for co-development from interviews is *'creating new differentiating value that is in line with customer demands'*. Co-development is used to attract external knowledge (Chesbrough & Schwartz, 2007) or utilize competences of partnering organizations(Emden et al., 2006). The goal is to offer truly value adding propositions towards the customer. In many cases differentiated value comes from integral system solutions that provide a customer with a total solution to a problem. The focus shifts from an organization trying to fit it's product offering onto a customer towards a market oriented focus where organizations offer an integrated solution that is truly customer oriented (Prahalad & Ramaswamy, 2004) and deliver differentiated value. Different skills are necessary to achieve this goal and therefore co-developments are sought (Evans & Jukes, 2000).

If an organization has realized that it cannot create differentiating value on its own it can look for partners to collaborate in the development of a new product as mentioned by several interviewees. The partnership can be sought after individually or extra help can be found by joining an innovation program. In either case it is important at this stage that an organization looks at the following aspects:

- Examines its own strengths
- Decides their goals for the collaboration
- Establishes the way in which external competences are leveraged.

These aspects where suggested by one of the interviewees as well as Deck & Strom (2002)

5.4 The partner search & selection stage

According to Emden et al. (2006) partner selection and formation in collaborative product development is a neglected topic. This research however has tried to shed light on exactly those activities and factors that are important in the selection stages of partners for collaborative development.

Interviewees stress that good partner selection is needed to prevent project delays and possibly even fail due to the extensive amounts of effort needed to make the project succeed. Failure in collaborations can be appointed to changing business conditions but also in some cases to inappropriate partner selection (Emden et al., 2006).

From the interviews seven selection criteria were found to be important during the selection of partners according to practitioners. Figure 8 lists the selection criteria supported by the interviews.

The figure also lists the criteria suggested by Emden et al. (2006). A strong correlation can be seen between them and this correlation is shown via arrows. From this figure 2 factors appear not to be related. "having an equivalent development process" does not correspond with the criteria discerned by Emden et al. 2006 nor was it supported by other academics, therefore this criterion is omitted. From the list of Emden et al. (2006) the factors 'technical ability' and 'long term orientation' are not related to empirical items directly. However long term orientation can also be seen as an indication of commitment as it for example involves the willingness of an organization to omit short-term result for long-term results thereby indicating commitment (Emden et al., 2006). Technical abilities have been mentioned by the interviews as the current method of selecting partners together with a trust-related gut feeling. Because of this relation, the 'technical ability' criteria from Emden et al. (2006) will also be used as a selection criteria in the new maturity model as it is also supported by Deck and Strom (2002) and Feng et al. (2010).

Supported criteria from interviews		Suggested criteria from Emden et al 2006.
• commitment for the project at top management level of the organization		Technical ability
• complementary competencies and resources		**Technical resource and market knowledge complementarity** *2. Complementary competencies and resources*
• a shared vision of cooperative technology and/ or market developments		**Overlapping knowledge bases** *5. Partial overlap of technical competences with the collaboration partner*
• The experience with a partner from previous collaboration		**Motivation correspondence** *1.Commitment for the project at top management level of the organization.*
• Partial overlap of technical competences with the collaboration partner		**Goal correspondence** *3. A shared vision of cooperative technology and/or market developments.*
• The willingness to change the development process if necessary		**Compatible cultures** *4. The experience with a partner from a previous collaboration*
• Having an equivalent development process		**Propensity to change** *6. The willingness to change the development process if necessary*
		Long term orientation

Figure 8: Relation between empirically supported selection criteria and those of Emden et al. 2006

The model suggested by Emden et al. (2006) also structures the sequence wherein criteria follow each other going from technological alignment, to strategic alignment to cultural alignment. As the goal of the maturity model is to help practitioners to move within the maturity model the structure proposed by Emden et al. (2006) is found to be particularly useful.

The model proposed by Emden et al. (2006) is incorporated into the model of this research for structuring the selection criteria into three categories. Their structure starts with technological alignment followed by respectively strategic and cultural alignment (table 8). The selection criteria used for the new maturity model are displayed in table 8. After this search & selection stage the concept stage can be entered.

Table 8: Structuring of selection criteria (adapted from Emden et al. (2006)

Technology	Strategy	Relations
Technical ability	Motivation correspondence	Compatible cultures
Technical resource and market knowledge complimentarity	Goal correspondence	Propensity to change
Overlapping knowledge base		Long-term orientation

5.5 The concept stage

Deck and Strom (2002) suggest several stages in the co-development process of which one is the stage suggested for creating short wins. This stage was adopted into the preliminary as being the start-up stage. Several interviewees mentioned the importance of taking time to get to know the partner and feel whether collaboration may be fruitful. This period according to Evans and Jukes (2000) can also be used for getting familiar with each other's development methods. Time for this in the new model is put in the concept stage which replaces the previous start-up stage. The concept stage is the last stage before the co-development therefore, during this stage arrangements must be made on several important aspect. The aspects derived from practise are stated below.

- A clear plan for managing (developed) intellectual property (IP)
- A clear distribution of contributions and returns (Bstieler, 2006, p.68)
- A plan for sharing and communication of information about the product and the development process
- A clear definition of roles for the development of the product
- A conflict management plan

The aspects above have also been recognized in cases described by Deck and Strom (2002). By no means is this list the complete list of arrangements that need to be made in order to have a partnership that will function without any problems. As each project is different, several aspects may require more attention, adding items to this list whereas in some other cases items may be skipped. An example could be partners that have very high trust (Bstieler, 2006) as also one interviewee reports not having formal agreements with its regular partner which it has been working with for over 10 years. The plan for managing intellectual property and the distribution plan for contributions and returns need to be put in a formal contract, the other aspects can be arranged according to the wishes of the collaborating partners.

The goal of the concept stage is to engage in a conversation for setting the field and guidelines in which participants can share necessary information, resources and competences without obstructing progress and preventing unwanted knowledge spillover. Interviews stress that contract negotiations and contracts must be aimed at creating guidelines wherein partners can transfer information and

necessary resources to achieve the common goal and not be limited the by excessive legal restrictions.

5.6 The co-development stage

Important activities for co-development have been distinguished despite the limited attention given to these activities the research. The activities are:

- Strong project management
- Regular meetings
- Regular evaluations
- Extensive sharing of information
- Managing expectations

During the co-development stage interviewees note that organizations must focus on project planning, making good work-breakdown structures and distributing activities based on each partners' own expert domain. Deck and Strom (2002) argue for establishing explicit direct communication linkages between the individual development teams as well as between the development teams from the partnering organizations. Interviewees noted that information sharing was the most important activity during co-development. One interviewee has stated:
"Communication is extremely important, when communication diminishes one must wonder what is going wrong". Regular and continuous information flows are important to allow good product development. Quality of communication is more important than the quantity of sharing information. Communicating too often may even be detrimental to the relationship (Bstieler, 2006). Also stepping back regularly to evaluate is important (Deck & Strom, 2002). These evaluations are needed to control the development process as well as checking for possible unintentional knowledge spillovers leading to opportunistic behaviour. Opportunistic behaviour can be avoided when organizations have a high amount of trust between them (Bstieler, 2006). When during evaluation impediments are found action is required. However one sided actions on conflicts and impediments should be avoided. If one partner decides to react to the conflicts on its own, the conflict may escalate even further leading the organizations drifting farther from each other. Organizations must strive for collaborative responses to conflicts, as this also strengthens the relationship (Arino & de la Torre, 1998). These activities help to keep expectations between organization aligned reducing the chance of failure of the project. Especially 'under promising and over delivering' was mentioned by one interviewee to be influential in strengthening the relationship.

5.7 General pitfalls and success factors

Trust

As reported in literature, in any collaborative relationship trust is the most distinctive factor between successful and unsuccessful collaboration (Littler et al., 1995). The empirical research contributes to this understanding explicating that next to technological capabilities, partners are chosen either implicitly or explicitly based on a trustful feeling. No outspoken attention has been done on the effect of trust in this research but all respondents reported its importance to the collaboration. Also a success factor that was stressed is the openness of employees within the collaborations to share information and work together which can be seen as a result of a trustful relationship. Having trust

between the partners avoids opportunistic behaviour of partners which otherwise may endanger a collaboration (Bstieler, 2006).

Commitment

Commitment was the second important factor found in literature and research. Commitment must come from top level management and must flow down into lower levels of the organization. Having one or more collaboration champions (Littler et al., 1995) or sponsors (Deck & Strom, 2002) from each of the collaborating partners will greatly help overcome difficulties during the co-development process. This collaboration champion must either be at top management level or have full support from top management.

(Mis)Alignment of expectations

During the partner search & selection stage, the concept stage, but especially during the co-development stage aligning expectations is advocated to be an important activity and was recognized as a regular pitfall to co-development efforts. Misalignment of expectations may lead to opportunistic behaviour if there is a lack of trust (Bstieler, 2006) or hidden agendas (Lynch et al., 2013) and jeopardize the collaborative effort if no action is taken in unison the realign expectations (Arino & de la Torre, 1998). Communication and being explicit is key. As one interviewee noted following:

> "Organization X told Y that they probably needed some training in the specific field that organization X was in and that they could give them a training. Y assumed the training would be free, whereas organization X assumed a small fee was reasonable."

Complimentarity competences

According to the interviewees and organizations seek each other for their complimentarity of resources to leverage them in the development process and create new differentiated value. This is the same process which Deck & Strom (2002) describe. Interviews and cases reported in literature have stressed the importance of having partners with distinctive competencies (Emden et al., 2006). The empirical results also noted that having too little differentiation in core competencies will make the division of tasks very difficult as well as dividing the market afterwards. One interviewee mentioned that if partners have too little differentiating competences or supply the same market, they can make arrangements and subdivide the market for each individual organization to launch the product.

Clear governing structures

One final pitfall that must be conquered is the lack of clear governing structures. This was mentioned during multiple interviews. These structures explain who is responsible at certain stages of the development process. It also stipulates how conflicts can be handled or how the collaboration can be disbanded when necessary. Arinõ en de la Torre (1998) support this finding. They state that especially partners which do not yet have strong and trustful relationships will need credible procedures for conflict resolution to prevent disbanding of the collaboration. These upfront arrangements must be made during the concept stage and are important throughout that stage and the co-development stage (paragraph 5.5 and 5.6).

With these success factors and pitfalls described the next step is to specify the different stages within the maturity of co-development that have been developed based off of the results.

5.8 Omission of the business model driven co-development stage

As probably noticed in the new model explained in paragraph 5.1 the business model driven co-development stage is no longer part of the maturity model. This topic has received little attention in the empirical research. Despite 4 out of 7 interviewees reporting that co-development works best when organizations integrate co-developments into the DNA of its organization, all interviewees also mention that it is not a necessary condition to achieve a co-development. The business model driven co-development stage mainly contains activities that are concerned with creating structures and platforms that facilitate setting up and managing future collaboration more effectively.

As the aim of this thesis is to provide a model for practitioners that are rather new to co-development and want to set up a co-development, the relevance of the business model driven co-development stage is rather low. Therefore the this stage was omitted. Consequently the last stage in the new proposed maturity model is the co-development stage. The added value of business models driven co-development can be further developed in future research.

The new maturity model of co-development resulting from the analysis is thus presented in Appendix D. The proposed model is based on literature from the fields of IT (Littler et al., 1995) and manufacturing (automotive) (Deck & Strom, 2002; Evans & Jukes, 2000). Also the empirical results came from sources from the fields of IT and manufacturing. The new maturity model therefore should be applicable to organizations in the field of IT and manufacturing although more empirical testing would be needed to truly validate the model.

The aim of this research however was to supply a model that would be useful for EsperantoXL Therefore the next section describes the last steps towards a model fit for their organization.

5.9 Focus group for the applicability of the model at EsperantoXL

The maturity model of co-development is developed for organizations that want to get a better understanding of the process of co-development and the different dimensions and dynamics surrounding it. The model aids in the insights of companies that have little to no experience with co-development. It will help them in the set up of a co-development processes to exploit external competences and create new customer-focussed, differentiating value propositions.

As the model was developed with EsperantoXL in mind a focus group was held within their organization to evaluate the understanding of the model, its applicability and helpfulness for the assessment and set up of a co-development process.

Goal

The goal of the focus group was to get familiarized with the proposed maturity model and to validate the practical application of the model for the organization. The second objective was to assess whether the model provides guidance for advancements within the model for current or future development projects of EsperantoXL.

Methodology

A focus group was deemed useful to establish this 'in-depth' information as it is a quick, flexible way to generate qualitative data with high face validity (Babbie, 2010). Discussions that happen among the participants generate insights that just one person doesn't have, making it helpful for gathering information on possible future developments of the phenomenon (Verschuren & Doorewaard, 2007).

Five people participated in the focus group representing the relevant functions of; senior management, project management and marketing.

Firstly a presentation was given about the model. This was followed by semi-structured questions and discussions. The first question asked whether the model aids in the understanding of co-development for EsperantoXL. The second question focussed at placing current development projects of EsperantoXL in the model. Thirdly a discussion was held on the use of the model for advancements of current projects and the set up of new projects with future partners.

Results

All participants of the session concluded that the proposed model aided in the understanding of co-development and that it suggested avenues for further directions for their projects within the model of co-development. However some limitations emerged and a few new insights came to light as well.

What differentiates co-development from other types of collaborations was an aspect that came up in the discussions often. Especially the difference between equity and non-equity contributing partners seemed to be one of the most distinctive indications. As a result of this it was deemed that extra emphasis was needed in the used definition of co-development. Extra emphasis was put on the contribution of non-equity resources in the definition of co-development.

A limitation that also emerged from the discussions is that the proposed model does not consider how the ideas which are the foundation of a project are managed during co-development. This involves intellectual property (IP)of the idea that sparked the collaboration as well as developed IP during the project. This however lies out of the scope of the project and is therefore an avenue that is reserved for future research.

A second limitation constitutes to the model mainly being developed from the perspective of an organization that tries to set up a co-development project. Some organizations however are not the initiating party but the partners being selected, making them enter the co-development model at the second stage, the selection stage. It is suggested that the selection criteria then change and function as guidelines which help the 'selected' party decide whether they want to participate in the co-development.

Strongly related to being the 'selected' party is the question on how organizations can make themselves be found quickly as an interesting partner for co-development. Emden et al. (2006) discerned from their research that technical competences supplied organizations with differentiating power. Organizations that had a great idea or technology which they promoted where able to be found more easily than others as others wanted to utilize their capabilities. Notwithstanding the

findings of Emden et al. (2006) this question may also be valuable for future research and is therefore redirected to chapter 8.

Results that alter the maturity model to fit EsperantoXL

Three other aspect were discussed and are included in the final proposed maturity model fit for EsperantoXL.

The first addition is that of quality assurance as a selection criteria. This was also mentioned by one interviewee as very important as it stipulates how and with which quality products or services are made and or maintained. This is related to trust as quality assurance ensures that contributions made by each partner comply to an agreed set of quality standards.

The second addition relates to the dynamic nature of co-development. EsperantoXL described that the stages within the co-development model are not static but dynamic. During the concept stage for example the parties may discover that more competencies are needed. These are sought after through new partners moving the project back to the selection stage. The direction of movement within the model therefore isn't one directional but two directional.

The third and final addition to the model include suggestions for the stages at which the success factors and pitfalls are most influential. The maturity stages are numbered with roman numbers, (I,II,III,IV). The stages at which the success factors and pitfalls are most prominent are numbered respectively with those numbers.

The beginning of this chapter described the new maturity model shown as a preview in figure 7 and in full in Appendix D. That model however was not yet fit to EsperantoXL. The results of the focus group described above were used to adapt the new maturity model one more time to create a model that fits EsperantoXL. The quality assurance, dynamic nature and the suggested stages at which the success factors and pitfalls are most influential are added creating the *final proposed maturity model of co-development* displayed in Appendix E and figure 9 displayed below.

Maturity of Co-Development

| Maturity |
| Adolescence |
| Infancy |
| Conception |

I. Awareness stage

II. Partner search & selection stage

III. Concept stage

IV. Co-development stage

Characteristics:

- Realization that external knowledge or competences are needed for a differentiated value adding product offering

Characteristics:

- Identification of partners
- Selecting partner(s)**
- Preliminary choice of partner(s)

Characteristics:

- Familiarizing with partner's people, culture and development process
- Creating short wins via small project
- Formalizing arrangements for co-development (contracts)*

Characteristics:

- Strong project management
- Regular meetings
- Regular evaluations
- Sharing of information
- Managing expectations

** Selection criteria:

Technology:
- Technical ability
- Technical resource and market knowledge complementarity
- Overlapping knowledge base
- Quality assurance

Strategy:
- Motivation correspondence
- Goal correspondence

Relations:
- Compatible cultures
- Propensity to change
- Long-term orientation

* Contractual arrangements:

- Distribution model of contributions and returns
- Management plan for (shared) Intellectual Properties (IP)

* Other formal arrangements:

- An information- and communication sharing plan
- Definition of roles within co-development
- A conflict management plan/ governance structure

Success factors (at respective stages):

- ✓ Mutual trust (all stages)
- ✓ Commitment at all levels of the organization starting at the top (all stages)
- ✓ Sharing of product- and process information (III & IV)
- ✓ Complementarity of competences (II)
- ✓ Openness of employees to work together and share information (II, III & IV)
- ✓ Collaboration champion at each organization (III & IV)

Pitfalls (at respective stages):

- ❖ Misalignment of expectations (all stages)
- ❖ Lacking governance structures (III & IV)
- ❖ Partners with little differentiating value (II)

Figure 9: Final proposed maturity model of co-development (adapted from Nolan (1973) and Deck & Strom (2002) and empirical evidence from this thesis)

6. Conclusion

According to Emden et al. (2006) partner selection and formation in co-development is a neglected topic. This research however has shed light on exactly those selection activities and factors that are important at the beginning of a co-development as well as the rest of the co-development process. Attention has been mainly on the selection of partners and necessary arrangements for co-development as this is of essence to organizations like EsperantoXL that have little to no experience with co-development.

The aim of this research was to supply a model of co-development that practitioners and in particular EsperantoXL could use to assess their position in relation to co-development or the set up of a co-development project with prospective partners. The final proposed maturity model of co-development that is supplied for EsperantoXL aids those functions and operates in threefold.

Firstly the model describes the four maturity stages of co-development and characterizes them. These four stages are:

I. **Awareness stage**
II. **Partner search & selection stage**
III. **Concept stage**
IV. **Co-development stage**

The characterizations given to the stages in the model allow an organization to establish its position in the model. The stages provide the desired direction in which the organization must go to achieve co-development. This can be upward to advance however can also be downward if stages have not yet been completed sufficiently or the need for new partners for example is needed.

Secondly the model provides the means to set up a co-development project. The characteristics provide basic descriptions of the steps needed however specifics are also given. Specific attention has been given to the selection of partners and upfront arrangement that need to be done to reach the co-development stage. Nine selection criteria are given which are subdivided in the categories of *technology, strategy* and *relations*.

The selection criteria focus on:

- Technical abilities
- Complimentarity of technical resources and market knowledge
- Overlapping knowledge base
- Quality assurance measures

- Correspondence in motivation
- Correspondence in goals
- Compatibility of cultures
- The propensity to change
- Long term orientation

The arrangements that need to be made before the final co-development stage are divided into *contractual agreements* and *other formal agreements* and include:

- Distribution models of contributions and returns
- Management plans for (shared) intellectual properties
- Information- and communication sharing plans
- Definitions of roles within co-development
- A conflict management plan or governance structure

These selection criteria and upfront arrangements provide practitioners with specific topics on what must be done during the different stages of co-development. These topics however are not the sole topics as each co-development may have topics that require less attention and others which require more which might not even be in this provided model.

Thirdly and most importantly the model provides practitioners with means on how advancements can be made by guiding them via success factors and pitfalls which help to explain how advancements are stimulated and bottlenecks can be avoided. The maturity model supplied for EsperantoXL provides six success factors and three possible pitfalls. The most influential of these are:
- Mutual trust
- Commitment (at top management level)
- Alignment/Misalignment of expectations
- Complementarity of resources
- Clear governing structures

By this threefold of functions the model is useful and interesting for practitioners who have realized that co-development is the next step for their organization to create new distinctive value for their customers by combining their own competences with competences of (prospective) partners.

Despite the results of this research stemming from literature and empirical data this model should not be seen as a panacea or blueprint to a guaranteed successful co-development. The model should be used as a guideline. As previous academics have mentioned before, many intangible and unpredictable factors exist that influence the success of co-development (Littler et al., 1995).

7. Limitations

The model is intended primarily for practitioners that seek to set up a co-development. It's focus is on a single organization rather than the collaboration. Generally speaking an organization can enter the co-development process either on own initiative or by being approached by a party that has already past the awareness stage and is in the partner selection stage. The model was developed mainly for the initiating party focussing on the selection criteria and necessary arrangements. However a party that is being approached by an initiating party does not go through the same stages of the maturity model because the awareness stage is largely skipped. The partner and selection stage also doesn't really apply as the approached party only has the possibility to agree or not. The model has not been designed for this alternative course into the co-development model. It is suggested that the selection criteria in the search and selection stage will then act as a checklist to verify whether the approached organization will agree to the collaboration. This is not verified and should be tested in later research.

As the research is based heavily on literature and interviews from just a few organizations the results of this research are hard to generalize. This is inherent to the fact of using just several cases. Applicability will be limited to organization either in the IT or manufacturing industry. Generalization can only be made to hose fields of from which data was taken. Though the results from this thesis can be used for future research as a reference and a starting point for expansion of the maturity model and the guidelines for other industries. Preferably the model would be tested several times by implementing it at different organizations and different fields.

The questions for this research have only been used for this research and where not previously tested or reviewed by experts. This was not possible due to constrictions in time. Great care has been given to achieve a comprehensive model and guidance that fit EsperantoXL but it may also apply to other organizations within the same field.

Also some limitations relate to the sources of the empirical data. As firms with much co-development experience are scarce it wasn't possible to find a high amount of firms to represent a homogeneous group of respondents. Therefore the choice was made to interview people from several different sources like, mediators, consultants, innovation program directors and other sources where individuals had extensive exposure to co-development.

No formal testing has been done with respect to the model apart from the focus group at EsperantoXL. Future research is needed to further test the model empirically possibly adding to the model as well as assessing whether the model can be used in other industries than the IT and manufacturing industry. Differences may even be present within the manufacturing industry itself as the sample was too small to validate the model being representative for the complete industry.

8. Future research

This research has not considered how the actual ideas which make up the foundation of a project and the corresponding intellectual property is developed and managed during a co-development project. This is something organizations struggle with during every collaboration especially during co-development. This however was beyond the scope of this thesis. The management of IP during co-development is very complex and it requires a dedicated research on its own. The research may focus on how to protect the ideas during the sharing of resources as well as how developed IP would be protected and divided later.

Secondly the model has mainly been developed from the perspective of an organization that tries to set up a co-development. As discussed previously some organizations are not the initiating party but the party that is selected by others leaving them to enter the co-development model at the second stage, the selection stage. In this case however the selection criteria may then function as guidelines which help the 'selected' party to decide whether they want to participate in the co-development. This use of the model has however not been tested and therefore can only be suggested. Future research may indicate that the criteria can also be used as a decision tool for entering parties at different stages.

Strongly related to being the 'selected' party is the question on how to become 'selected' more easily as a co-development partner. Emden et al. (2006) discerned from their research that technical competences supplied organizations with true differentiated power allowing them to be found easily by other wanting to utilize their capabilities. Notwithstanding the findings of Emden et al. (2006) special interest lies in the activities organizations need to undertake that do not have very differentiated technologies or competences. Future research may therefore focus on how organizations can go about making themselves 'attractive' as a co-development partner.

The preliminary maturity model of co-development incorporated the 'business model driven co-development stage as the mature stage". Insufficient attention was given to this stage as the focus of the research was mainly on the selection and start-up part and therefore little support was found within the interviews and literature to validate whether the last stage for co-development is 'business model driven co-development'. Chesbrough & Schwartz (2007) and Büyüközkan & Arsenjan (2012) do mention collaborative product development as a means within business model innovation. Despite the limited attention the this topic, the insights developed within this thesis give reason to believe that business model innovation has a place overarching the maturity model. This overarching stage would be focussed at strategic orientations that allow organizations to use co-developments within their innovative strategies more often. Also activities in this stage would supply organizations with a set of procedures that allow them to engage in a co-development projects with higher frequency and greater efficiency. Further research is needed to test whether this stage would be an overarching part of the proposed maturity model of this thesis.

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Appendix A: The preliminary maturity model of co-development

Maturity of Co-Development

Conception	Infancy	Adolescence	Maturity

Search/ Selection of partners → Start-up of collaboration → Project based Co-development → Business model driven co-development

Activities

-Search for partner
-Select partner
-Make arrangements for first collaboration

Selection criteria

-Short term returns
-Prospect of long term returns
-Shared vision of technology and market developments
-Shared destiny of learning and cooperation
-Shared expectations about collaboration
-Commitment at top level (CEO)
-Cultural fit
-Complimentary resources
-Overlapping knowledge base
-Technological capabilities
-Financial health
-Knowledge and managerial experience
- Capability to access new markets

Activities

-Get familiar with each other's development methods
-Create short term wins to help build relationship
-Create/maintain commitment at all levels of the organization:
  ○ CEO level
  ○ Managerial level
  ○ Team level
- Assign a sponsor from each organization to regulate the collaboration for day to day business
- Align expectations and intentions between organizations

Activities

-Established collaborative development method
-Provide development teams with tools that facilitate real-time access to information and decisions.
-Provide possibilities to allocate resources
-Evaluate regularly to assess progress
-Change coordination style if necessary, depending on the phase of development.
-Treat development teams as if it where internal teams

Characteristics

-Management of co-developments is coordinated from a deep- to shallow relationships, based on contextual needs
-Facilitating (IT) structure is in place for managing information and decisions sharing between different organizations and different contextual needs
-Models for each co-development need are available and can easily be fine tuned for the specific relationship

Appendix B: Interview questions Dutch and English

Interview questions, general

| … date … |… person… |

Co-development:

About co-development

1. Hoe zou u co-development omschrijven? Is dat voor iedereen hetzelfde?
   How would you describe co-development? Is it the same for everybody?
2. Is co-development een groeiende trend?
   Is co-development a growing trend?

Selectie van partners:

The process of selecting co-development partners

3. Welk(e) doel(en) kunnen worden onderscheiden voor het aangaan van een co-development?
   Which goals can be distinguished to participate in a co-development?
4. Hoe vinden samenwerkingspartners elkaar of hoe worden ze samen gebracht?
   How do co-development partners find each other/ how are they brought together?
5. Op basis van welke criteria worden partners geselecteerd?
   What criteria are used for selecting partners?
6. Zijn er externe partijen geraadpleegd of ingeschakeld als mediator of facilitator voor het samenbrengen of selecteren van de partners?
   Are external partners involved in bringing together or selecting partners. Examples being mediators or facilitators

Het belang van een aantal aspecten bij het selecteren van partners:

Selection criteria

[Add the criteria mentioned by respondent at question 5 to this list]

7. In hoeverre zijn de volgende aspecten een belangrijke meeweegfactor bij het selecteren van een samenwerkingspartner?
   How important do you consider the following factors when choosing a collaboration partner?
   a. De ervaring met een samenwerkingspartner vanuit een samenwerking uit het verleden.
      The experience with a partner from a previous collaboration
   b. Overlap in (technische) kennis met de samenwerkingspartners.
      Partial overlap of technical knowledge with the collaboration partner
   c. Het hebben van een vergelijkbare manier van ontwikkelen.
      Having an equivalent development process
   d. De welwillendheid om het ontwikkelproces aan te passen als dat nodig is.
      The willingness to change the development process if necessary

e. Betrokkenheid vanaf het hoogste niveau (CEO/ RvB) bij het project.
   Commitment for the project at the top of the organization

f. Een overeenkomende visie voor de toekomst
   Shared vision of technology and market developments/
   shared destiny of learning and cooperation

8. Zijn er nog andere belangrijke factoren die worden meegewogen bij de selectie van een partner?
   Are there other importance criteria for selecting partners?

9. Wat zijn de meest doorslaggevende factoren bij het kiezen van een samenwerkingspartner?
   What is/are the most important criterion/criteria for choosing a development partner?

Afspraken en contracten:

10. Hoe belangrijk is het om *vooraf* op de volgende punten overeenstemming bereikt te hebben om de samenwerking succesvol te laten verlopen?
    How important is it for the success of a co-development to agree on the following topics before entering the collaboration?

    a. Een duidelijke rolverdeling voor tijdens de ontwikkeling van het product.
       Having a clear definition of roles for the development of the product

    b. De manier waarop informatie over het product tijdens het ontwikkelproces wordt uitgewisseld.
       A plan for information sharing on the product and the development process

    c. Verdeling van inbreng en opbrengsten.
       A clear distribution of contributions and returns

    d. De manier waarop er met het intellectueel eigendom wordt omgegaan.
       A plan for IP management

    e. Hoe er wordt omgegaan met conflicten
       A conflict management plan

11. Zijn er nog andere aspecten die van belang zijn om vooraf besproken te hebben?
    Are there any additional aspects that that are of importance to agree on before the collaboration.

12. Welke aspecten zijn van essentieel belang voor een succesvolle samenwerking (eventueel ook andere dan hierboven genoemd)?
    Which aspect are essential for the success of a collaboration? (new ones or from the ones mentioned above)

13. Hoe strikt moeten de afspraken (van hierboven) vooraf worden vastgelegd? En welke (contractuele) vormen worden er gebruikt om dit vast te leggen?
    How strict must upfront arrangements be made? Which type of contracts are used for co-development?

14. Hoe wordt vooraf gewaardeerd hoeveel elke partij inbrengt en hoe vertaalt zich dat naar de verdeling van de opbrengsten later?
    How is the assessment of contributions made and how does that translate into a distribution of the returns

Organisatie van het dagelijkse gezamenlijke ontwikkelproces

15. Wat zijn de belangrijkste activiteiten tijdens het gezamenlijke ontwikkelproces?
    What are the most important activities during the co-development process?
16. Wat zijn de meest effectieve manieren om informatie te delen?
    What is/are the most effective way(s) to share information?

Algemene vragen:

17. In hoeverre is het mogelijk om een gezamenlijk ontwikkelproces te hebben zonder de ondersteuning van een externe partij als bijvoorbeeld een bemiddelaar of externe projectcoördinator/facilitator?
    Is it possible to have a co-development without the use of a external project coordinator or facilitator?
18. In hoeverre is het belangrijk om samenwerking doormiddel van co-development opgenomen te hebben in de standaard werkwijze van de samenwerkende organisaties (bijvoorbeeld het business model) om te kunnen werken? Of kan een project ook ad hoc worden aangegaan?
    How important is it to have co-development integrated into the operating procedures of an organization like the business model?
19. Kunt u algemene struikelpunten benoemen tijdens het gehele proces van co-development en hoe deze voorkomen kunnen worden?
    Are there general obstacles to the co-development process? If so how are they conquered?
20. Zijn er ook algemene succesfactoren te noemen voor een co-development proces
    Are there general factors that contribute to a success of a co-development?
21. Is er een vaste werkwijze om een co-development proces aan te pakken?
    Is there a standard approach to co-development?
22. In hoeverre is overheidsfinanciering of subsidie bepalend voor het succes van een samenwerking?
    How important is external funding, like governmental subsidies for the success of a collaboration?
23. Toevoegingen?
    Additional remarks?

Appendix C: Interview template Dutch

Interview vragen algemeen

| … datum … |… persoon… |

Co-development:

1. Hoe zou u co-development omschrijven? Is dat voor iedereen hetzelfde?

   <div style="border:1px solid #000"></div>

2. Is co-development een groeiende trend?

   <div style="border:1px solid #000"></div>

Selectie van partners:

Onderstaande vragen zijn bedoeld om inzicht te krijgen in de beweegredenen voor een co-development en het selectieproces dat gebruikt wordt om samenwerkingspartners te selecteren.

3. Welk(e) doel(en) kunnen worden onderscheiden voor het aangaan van een co-development ?

   <div style="border:1px solid #000"></div>

4. Hoe vinden samenwerkingspartners elkaar of hoe worden ze samen gebracht?

   <div style="border:1px solid #000"></div>

5. Op basis van welke criteria worden partners geselecteerd?

   <div style="border:1px solid #000"></div>

6. Zijn er externe partijen geraadpleegd of ingeschakeld als mediator of facilitator voor het samenbrengen of selecteren van de partners?

   <div style="border:1px solid #000"></div>

Het belang van een aantal aspecten bij het selecteren van partners:

*Het doel van de volgende vragen is om een beeld te krijgen van hoe belangrijk (in het algemeen) men bepaalde aspecten vindt bij het kiezen van een samenwerkingspartner. Hierbij wordt u gevraagd een waardering te geven op een schaal van 1 tot 5, waarbij 1 zeer **on**belangrijk is en 5 zeer belangrijk. De optie 0 (n.v.t.) is mogelijk als het genoemde aspect totaal niet relevant is voor de selectie van de partners. Onder elke deelvraag is eventueel ruimte voor additionele opmerkingen.*

7. In hoeverre zijn de volgende aspecten een belangrijke meeweegfactor bij het selecteren van een samenwerkingspartner?

	1 Zeer onbelangrijk	2 Niet erg belangrijk	3 relevant	4 belangrijk	5 Zeer belangrijk	0 n.v.t
A. De ervaring met een samenwerkingspartner vanuit een samenwerking uit het verleden.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
B. Overlap in (technische) kennis met de samenwerkingspartners.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
C. Het hebben van een vergelijkbare manier van ontwikkelen.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
D. De welwillendheid om het ontwikkelproces aan te passen als dat nodig is.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
E. Betrokkenheid vanaf het hoogste niveau (CEO/ RvB) bij het project.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
F. Een overeenkomende visie voor de toekomst						
Evt. opmerking:						

8. Zijn er nog andere belangrijke factoren die worden meegewogen bij de selectie van een partner?

9. Wat zijn de meest doorslaggevende factoren bij het kiezen van een samenwerkingspartner?

Afspraken en contracten:

De volgende vragen richten zich op het belang van een aantal aspecten die vóór een samenwerking afgesproken moeten worden om ervoor te zorgen dat het project succesvol verloopt. Dit zijn aspecten die vooraf besproken worden en al dan niet contractueel worden vastgelegd.

*Bij vraag 10 wordt hierbij gevraagd om per subvraag een oordeel te geven van belangrijkheid op een schaal van 1 tot 5, waarbij 1 zeer **on**belangrijk is en 5 zeer belangrijk. De optie 0 (n.v.t.) is mogelijk als het genoemde aspect totaal niet relevant is om te bespreken voor de samenwerking. Onder elke deelvraag is eventueel ruimte voor additionele opmerkingen.*

10. Hoe belangrijk is het om *vooraf* op de volgende punten overeenstemming bereikt te hebben om de samenwerking succesvol te laten verlopen?

	1 Zeer onbelangrijk	2 Niet erg belangrijk	3 Relevant	4 Belangrijk	5 Zeer belangrijk	0 n.v.t
A. Een duidelijke rolverdeling voor tijdens de ontwikkeling van het product.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
B. De manier waarop informatie over het product tijdens het ontwikkelproces wordt uitgewisseld.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
C. Verdeling van inbreng en opbrengsten.						
Evt. opmerking:						

	1	2	3	4	5	0

	Zeer onbelangrijk				Zeer belangrijk	n.v.t
D. De manier waarop er met het intellectueel eigendom wordt omgegaan.						
Evt. opmerking:						

	1 Zeer onbelangrijk	2	3	4	5 Zeer belangrijk	0 n.v.t
E. Hoe er wordt omgegaan met conflicten						
Evt. opmerking:						

11. Zijn er nog andere aspecten die van belang zijn om vooraf besproken te hebben?

12. Welke aspecten zijn van essentieel belang voor een succesvolle samenwerking (eventueel ook andere dan hierboven genoemd)?

13. Hoe strikt moeten de afspraken (van hierboven) vooraf worden vastgelegd? En welke (contractuele) vormen worden er gebruikt om dit vast te leggen?

14. Hoe wordt vooraf gewaardeerd hoeveel elke partij inbrengt en hoe vertaalt zich dat naar de verdeling van de opbrengsten later?

Organisatie van het dagelijkse gezamenlijke ontwikkelproces

15. Wat zijn de belangrijkste activiteiten tijdens het gezamenlijke ontwikkelproces?

16. Wat zijn de meest effectieve manieren om informatie te delen?

Algemene vragen:

17. In hoeverre is het mogelijk om een gezamenlijk ontwikkelproces te hebben zonder de ondersteuning van een externe partij als bijvoorbeeld een bemiddelaar of externe projectcoördinator/facilitator?

18. In hoeverre is het belangrijk om samenwerking doormiddel van co-development opgenomen te hebben in de standaard werkwijze van de samenwerkende organisaties (bijvoorbeeld het business model) om te kunnen werken? Of kan een project ook ad hoc worden aangegaan?

19. Kunt u algemene struikelpunten benoemen tijdens het gehele proces van co-development en hoe deze voorkomen kunnen worden?

20. Zijn er ook algemene succesfactoren te noemen voor een co-development proces?

21. Is er een vaste werkwijze om een co-development proces aan te pakken?

22. In hoeverre is overheidsfinanciering of subsidie bepalend voor het succes van een samenwerking?

23. Toevoegingen?

Maturity of Co-Development

| Maturity |
| Adolescence |
| Infancy |
| Conception |

Awareness stage

Partner search & selection state

Concept stage

Co-development stage

Characteristics:

- Realization that external knowledge or competences are needed for a differentiated value adding product offering

Characteristics:

- Identification of partners
- Selecting partners**
- Preliminary choice of partner

Characteristics:

- Familiarizing with partner's people, culture and development process
- Creating short wins via small project
- Formalizing arrangements for co-development (contracts)*

Characteristics:

- Strong project management
- Regular meetings
- Regular evaluations
- Sharing of information
- Managing expectations

** _Selection criteria:_

Technology:
- o   Technical ability
- o   Technical resource and market knowledge complementarity
- o   Overlapping knowledge base

Strategy:
- o   Motivation correspondence
- o   Goal correspondence

Relations:
- o   Compatible cultures
- o   Propensity to change
- o   Long-term orientation

* _Contractual arrangements:_

- o   Distribution model of contributions and returns
- o   Management plan for (shared) Intellectual Properties (IP)
- o   An information- and communication sharing plan

* _Other formal arrangements:_

- o   Definition of roles within co-development
- o   A conflict management plan/ governance structure

Success factors:

- ✓   Mutual trust
- ✓   Commitment at all levels of the organization starting at the top
- ✓   Sharing of product- and process information
- ✓   Complementarity of competences
- ✓   Openness of employees to share information and work together
- ✓   Collaboration champion at each organization

Pitfalls:

- ❖   Misalignment of expectations
- ❖   Lacking governance structures
- ❖   Partners with little differentiating value

Appendix E: Final maturity model of co-development

Maturity of Co-Development

| Maturity |
| Adolescence |
| Infancy |
| Conception |

I. Awareness stage

II. Partner search & selection stage

III. Concept stage

IV. Co-development stage

Characteristics:

- Realization that external knowledge or competences are needed for a differentiated value adding product offering

Characteristics:

- Identification of partners
- Selecting partner(s)**
- Preliminary choice of partner(s)

Characteristics:

- Familiarizing with partner's people, culture and development process
- Creating short wins via small project
- Formalizing arrangements for co-development (contracts)*

Characteristics:

- Strong project management
- Regular meetings
- Regular evaluations
- Sharing of information
- Managing expectations

**** Selection criteria:*

Technology:
o   Technical ability
o   Technical resource and market knowledge complementarity
o   Overlapping knowledge base
o   Quality assurance

Strategy:
o   Motivation correspondence
o   Goal correspondence

Relations:
o   Compatible cultures
o   Propensity to change
o   Long-term orientation

*** Contractual arrangements:*

o   Distribution model of contributions and returns
o   Management plan for (shared) Intellectual Properties (IP)

**** Other formal arrangements:*

o   An information- and communication sharing plan
o   Definition of roles within co-development
o   A conflict management plan/ governance structure

Success factors *(at respective stages)*:

✓ Mutual trust *(all stages)*
✓ Commitment at all levels of the organization starting at the top *(all stages)*
✓ Sharing of product- and process information *(III & IV)*
✓ Complementarity of competences *(II)*
✓ Openness of employees to work together and share information *(II, III & IV)*
✓ Collaboration champion at each organization *(III & IV)*

Pitfalls *(at respective stages)*:

❖ Misalignment of expectations *(all stages)*
❖ Lacking governance structures *(III & IV)*
❖ Partners with little differentiating value *(II)*