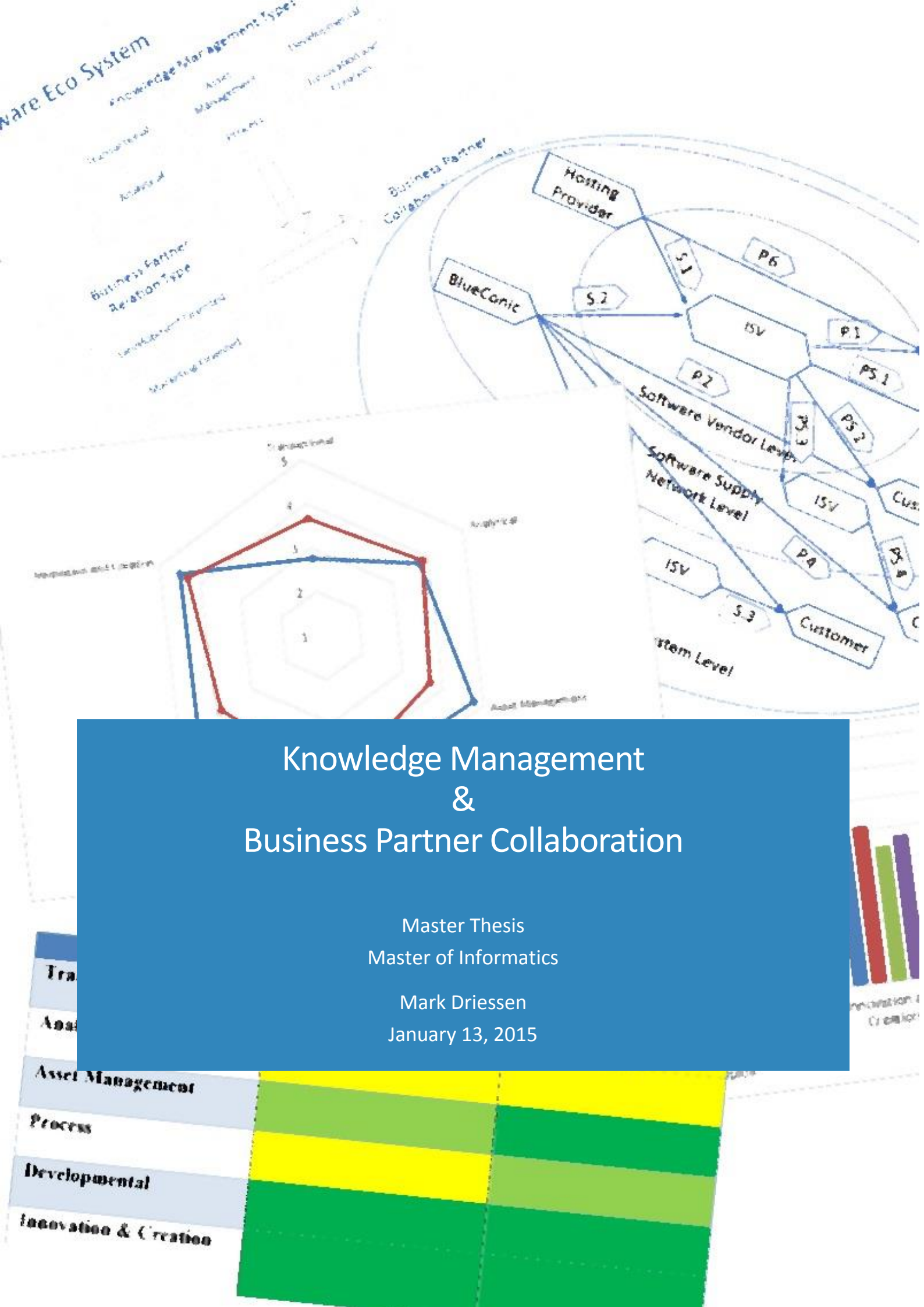

Knowledge Management & Business Partner Collaboration

Master Thesis

Master of Informatics

Mark Driessen

January 13, 2015

Knowledge Management and Business Partner Collaboration

Master Thesis

Masters of Informatics

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Abstract

All organizations collaborate with other organizations, either in a supplier/customer relationship or as business partners. Business partners try to complement each other in a way that allows both to benefit from the collaboration. In order to be able to collaborate, specific information and knowledge needs to be shared between the business partners. Knowledge management systems can be used within these collaborations in order to facilitate this sharing of knowledge.

Organizations need to select which type of knowledge management they are going to use to support the collaboration with their business partners. There are six types of knowledge management systems identified in previous research (Binney, 2001). Which knowledge management type performs well in a specific type of collaboration (Singh & Mitchell, 1996) has not yet been investigated.

This research investigates the relationship between the six knowledge management types, the two most important business partner collaboration types and collaboration success within a software ecosystem (Jansen, Finkelstein, & Brinkkemper, 2009). This contributes to the understanding about knowledge management systems and the relationship between these factors. It gives organizations direction in what type of knowledge management to choose for a specific collaboration.

The research method used is based on the design science research method (Hevner, March, Park, & Ram, 2004). The framework created is based on the results of the literature review and an expert interview. The framework was validated and evaluated by performing another expert interview, an in-depth case study and a quantitative online questionnaire.

The results of the research indicate that the effectiveness of the six types of knowledge management varies between the two collaboration types. This suggests directions for future research. By enlarging the research response in terms of participants and software ecosystems, the validation of the effectiveness of the knowledge management types found can be further investigated in other settings.

Preface

Before you lies the thesis for my Master's degree. It is the final result of my master of informatics study at the University of Applied Sciences Utrecht. Over the last two and a half years I attended a lot of inspiring classes, made numerous business-related assignments and passed a lot of exams.

I started this study's thesis phase in February 2014. After one and a half years of structured classes with clear and short deadlines and a lot of other work to do, the change to the thesis phase was very significant. In May 2014 I received the approval on my thesis proposal with which I was able to continue my thesis research.

The subject for the thesis research came from observations of GX Software and its struggle to create a partner network in its software ecosystem.

While doing the research and writing this thesis, it was very hard for me to use the time reserved for this research efficiently. This caused me to exceed the proposed deadline for the submission of my thesis document in September of 2014. Thanks to these extra months, I am very satisfied with the results and I hope the results can help organizations choose an effective knowledge management system for collaborating with their business partners.

Acknowledgements

I would like to thank GX Software and its employees for giving me the opportunity to sign up for this master's degree and for supporting me throughout the process by providing time, insights, cases and feedback in order for me to be able to complete this study with success.

Furthermore, I would like to thank Martijn Zoet for helping get up and running and pushing me in the right directions during this thesis process. His feedback and ideas were always very helpful to me.

I would also like to thank my classmates for the great times we had together in class and all the times we spent together completing our assignments.

And last but not least, I would like to thank my wife Janneke and our kids Lieke and Tijn, without whom I would never have been able to complete this thesis. Without their endless support and understanding I would never have succeeded.

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1 Introduction & background

1.1 Problem area

The world has changed a lot in the last few decades, especially concerning the way organizations are trying to improve their performance. The growth of globalization has had an impact on the way organizations can do business. Organizations try to be the best at their core business, but they also need other skills in order to be able to make the business successful. Many organizations collaborate with other organizations in order to positively influence their business results and pursue shared objectives (T. K. Das & Bing-Sheng Teng, 1998; Doz, 1996). For example, in production networks, companies only achieve competitive success when the network of companies they assemble knows how to collaborate in order to create value which is difficult to imitate (Dyer, 2000). This is also relevant for software vendors. They may have a very good team of research and development (R&D) engineers who are able to create the products the market wants, however they also need the capacity and knowledge to be able to sell and implement their own products. For a software vendor, maintaining a network of organizations around their business can add the missing skills and expertise to their ecosystem. But to create competitive success, the network of organizations needs to know how to collaborate. For new products, this even can be more complicated.

As organizations try to create new products, they must invest in development, testing, and the marketing the new product. New products need to start all over with gaining trust, recognition or even to be known at all by their potential customers or users, especially when these products are created for a different market segment than the original products of a vendor. This means that the newly created products tend to require a (partially) different market of customers than the other product(s) already developed and marketed by this vendor. When collaborating with partners, these partners can help to achieve the recognition from which both the partner and the software organization will benefit.

There are two possibilities for collaborating with other organizations when creating a new software product within one organization. Collaboration with other organizations in order to bring the product to the market, for example by OEM constructions, is used to try to achieve more success when launching new products. Another example of how organizations try to use collaboration with other organizations in the product development is by using them as an investor for the development. The large amount of money required can be sponsored by the collaborating organization, which in return will get (a part of) the shares of an organization, which can also include a part of the profit. In addition to creating the product, the product also needs to be marketed in order to create turnover for the organization.

Expanding the range of customers is used by organizations to maintain or create growth in the turnover of their products. For software manufacturing organizations, this strategy can also be used. Despite the fact that the reproduction costs of software are next to zero (Jansen, Brinkkemper, & Finkelstein, 2013), expanding the range of customers is important. This is illustrated by the fact that you can only sell your product or products with accompanying services once every few years to the same customer. And depending on the size of the markets whose customers you are trying to reach, the new customers in your market also might become exhausted. Hagedoorn & Schakenraad (1990a) investigated the motives for creating joint ventures and research corporations in several fields of work. A total of 36,8% of the companies in the information technology industry saw the

expansion/new markets as the most important motive for participating in such a cooperation (Hagedoorn & Schakenraad, 1990a).

There are various ways in which companies can collaborate with each other. There are also various motives with which organizations can choose to start a partnership. The most important motives for collaboration in the software field of technology were found to be technology complementarity, reduction of the innovation time span and market access structure (Hagedoorn & Schakenraad, 1990a). Because organizations are trying to gain more profit and are trying to collaborate with these organizations, it is important to know how the success of the collaboration of the organizations can be influenced.

Subramanian & Nilakanta (1996) already described how effective adoption of information technology improves the effectiveness and efficiency of inter-organizational interactions. The variety of information technology which can be used for this purpose has grown over the years, for example the number and types of social media and social collaboration tools that have grown exponentially. These platforms allow individuals to collaborate with and inform the community. While the social media platforms are more and more used by the marketing departments of organizations, the social collaboration tools are being used by the production and project teams within these organizations. These tools are mainly used to share knowledge and collaborate. Knowledge management can perform a role in the exchange of information between business partners as well. The organizations which are trying to collaborate with their business partners in search of expansion and growth look to use these systems to support their collaboration and to share specific knowledge with their partners. Since there are multiple knowledge management types (and systems) (Binney, 2001), there might be a difference in effectiveness and usefulness between these types of systems within a specific type of partner collaboration.

Research has shown that between organizations which are collaborating with other organizations, knowledge sharing with the collaborating partner(s) is influencing the success of the collaboration (Fang, 2008). Within the software development industry, the software ecosystems have similar networks of organizations which are focused on positively influencing business results (Jansen et al., 2013). In a software ecosystem, organizations collaborate in software development as well as marketing.

1.2 Practical trigger

One of the organizations which struggles with creating a network of business partners and sharing information within the partnerships is GX Software. GX Software is a software vendor based in Nijmegen, the Netherlands. They are the creator and supplier of two software products. The main software product of GX Software is a web content management suite called XperienCentral. The business model for earning profit with this product is based on a license fee and building customizations, either by GX Software itself or by an implementation partner. Since developing the previous version of this product (GX WebManager 9), GX has been investing in creating a software ecosystem built around this product. Much effort has been expended searching for partners to sell and market the product. An API has been created which enables other developers to create software components for GX WebManager, referred to as plugins. The concepts of GX WebManager 9 were changed in order to support these plugins which can be deployed in real time, enabling other developers and vendors to enhance the product's capabilities.

The second product created by GX Software is an online engagement tool named BlueConic. This software was first released in the beginning of 2011. The business model for gaining profit with this product is based on a product subscription with software as a service. GX has

put a lot of effort into marketing this product and has also put a lot of effort into finding a large OEM vendor for this product. This effort has at the time of this writing, not been very successful, which recently resulted in the product being privatized, which meant that BlueConic and its creators now have to function as an independent organization because of the ramifications of the investments of an outside venture capitalist who invests in the product in order for it to gain more market share (especially in the USA).

The software ecosystem of GX Software has been investigated by previous research. In this research it was concluded that the product of which GX Software is the owner (XperienCentral) is very suitable for a software ecosystem (Jansen et al., 2013). The research also indicated that the partners in GX Software's ecosystem vary from small to large. The network health though, as indicated by Jansen et al. (2013) (based on theory of den Hartigh, Tol & Visscher (2006)) was low because the smaller partners demand a large portion of the work in the software ecosystem. The larger partner organizations maintain a very small role in the software ecosystem.

At GX Software, the partner strategy, including the software ecosystem strategy, has changed because of the difficulties inherent in collaborating with business partners and the effort required in maintaining a good software ecosystem. One of the main reasons for this change, as indicated by a partner manager of GX Software, is the difficulty of transferring knowledge from GX Software to its partner organizations. The partner manager also indicated that, beside the difficulty of transferring the knowledge and maintaining it, the drive within the GX organization to exchange the knowledge with the partners is not always available.

Because of this failing partner strategy within GX Software, which was under the influence of knowledge transfer and management (as indicated by the partner managers), the question arose as to how an organization which is trying to build its software ecosystem can choose an effective knowledge management solution which positively influences the collaboration with its partners. Not just that, but it must also be determined which (type of) knowledge management the different partners need and how the knowledge can be transferred or made available to them.

1.3 Problem statement and research questions

Knowledge management systems are used within organizations to manage the large variety of knowledge available within an organization. These systems can also be used to support the collaboration between organizations by managing the knowledge available within the collaboration in the system. Since there is a variety of knowledge types and also a variety of knowledge management and knowledge management system types, the goal of this thesis is to determine which knowledge management type best fits the specific collaboration and its knowledge types for organizations in a software ecosystem. The problem statement for this research is:

What knowledge management type should be chosen in order to positively influence the collaboration with a business partner of a specific type?

Earlier studies have been conducted on the influences of knowledge, knowledge management and knowledge management systems on collaboration. However, no studies have been conducted which investigated the direct relation between business partner type and knowledge management type and their combined influence on collaboration success. This study will contribute to this subject by investigating this relationship. The research question which will has been investigated by this study is:

What is the influence of knowledge management types on the relationship between business partner type and collaboration success in a software ecosystem environment?

To be able to answer this main question, it has been divided into sub questions. Each sub question covers a part of the main question. When all questions have been answered by this research, the main question will also be answered.

The sub questions for this research are:

What types of business partners are there?
What is a software ecosystem environment?
What is the software ecosystem as seen from a software vendor?
What types of business partners are specific to software ecosystems?
What types of knowledge management are used in business partner collaboration?
What are the criteria for collaboration success?
What are the difficulties in collaborating with business partners?
In what ways can the partner collaboration be influenced?

By answering these questions, the basis for the contribution of this research is created.

1.4 Scientific and practical contribution

This research contributes scientifically to the body of knowledge about collaboration within a software ecosystem. It especially focusses on the knowledge management systems and system types and their contribution to the collaboration. The results of this research can be used to understand the influence that the knowledge management types have on the collaboration success of business partners in a software ecosystem. It expands the scientific knowledge about knowledge management types, knowledge management systems and collaboration within software ecosystems.

Besides the scientific contribution, the practical contribution of this research will help software organizations select the best knowledge management type for supporting their collaboration with business partners. The results will indicate which knowledge management type is best suited for their situation and will contribute to the successfulness of the collaboration.

1.5 Outline of the research

In this chapter, an introduction to the research was given by describing the problem area, the practical trigger, the problem statement with the research questions and the scientific and practical contribution.

The next chapter will continue with the literature review for this research. It will explain the concepts of software ecosystems, knowledge management and knowledge management types as used in this research. It will also explain the concepts of business collaboration and collaboration success. It concludes with the research model which was created from the research.

After the literature review, the research design and method are explained. They will describe the research method and the results process from the first explorative interviews with the partner managers from GX Software on the subject. It will also elaborate on the creation of the questionnaire used by this research.

The document continues by describing the data collection itself by looking at the data collection method used in the partner manager interviews, qualitative case study interviews and the quantitative research conducted.

After the data collection explanation, this document will describe the software ecosystem of GX Software using the methods and models found during the literature review on software ecosystems. After that, the data analysis will continue by describing the results from the partner interviews, the qualitative and quantitative data collection.

After the data collection, the findings of the research are discussed, combining the results from the partner interviews, the interviews and the online questionnaire, and it will then begin drawing conclusions.

Hereafter, the conclusion and recommendations will be discussed, summarizing the research and its conclusions, describing its limitations and suggesting possibilities for future research. The last chapter reflects on the research process from the author's point of view.

2 Literature review

When studying the relationship between business partner collaboration success and knowledge management type in the context of a software ecosystem, a number of important concepts need to be taken into account. In this chapter, the previous research on the concepts of software ecosystems, Business Collaboration, Collaboration Success and Knowledge Management type are discussed. At the conclusion, the conceptual model created for this research will be discussed.

2.1 Software ecosystem

2.1.1 The definition

Previous research does not define software ecosystems (SECO) consistently. The definitions vary by what they say that a software ecosystem contains. Kittlaus and Clough (2009) state that the description or definition of a software ecosystem should be “an informal network of (legally independent) units that have a positive influence on the economic success of a software product and benefit from it" (Kittlaus & Clough, 2009). Bosch (2009) defined software ecosystems differently. In his description a software ecosystem “consisting of the set of software solutions that enable, support, and automate the activities and transactions by the actors in the associated social or business ecosystems and the organizations that provide these solutions". (Bosch, 2009). And Jansen et al. (2013) even give a more abstract definition of a software ecosystem: “A software ecosystem is a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.”

These definitions all have similarities, but they are not the same. To clarify the difference, the three important concepts of the definitions have been listed in the table 1 below.

Definition	Units	Software	Network/ Business	Actors	Relationships
(Kittlaus & Clough, 2009)	X	X	X		
(Bosch, 2009)	X	X	X	X	
(Jansen et al., 2013)	X	X	X	X	X

Table 1 Comparison of software ecosystem definitions

The definitions all clearly state the concepts of Units, Software and Network or Business, but the definition of Jansen et al. (2013) also use Actors and Relationships in their definition. For this research this definition is selected because the research contains concepts like business partner type and business partnership success. By including actors and especially relationships, this definition matches the constructs of this research better than the others.

2.1.2 Software ecosystem types

The three researches mentioned above (Bosch, 2009; Jansen et al., 2013; Kittlaus & Clough, 2009) all describe their own way of looking at a software ecosystem. Jansen et al. (2013) assert that software ecosystems may have different boundaries. They identified that, from an external view on a software ecosystem, there can be four types of boundaries:

Market

The software ecosystems of this type are focused around one specific type of market, for example the Dutch Geographic Information System market or the portable music player market. The participants in these software ecosystems have at least a very loose coupling. This can mean that they only supply similar products to their customers. The relationships can even be a competitive one.

Technology

The software ecosystems of this type are focused around one specific technology, for example the Java programming language, the IPv6 internet protocol or the standard for Business Process Model & Notation (BPMN). The intellectual property owner of the technology is in most cases a very important player in the ecosystem and the types of participants in this software ecosystem in most cases will vary.

Platform

The software ecosystems of this type are focused around one specific product or platform. Examples of this type of ecosystem are the software ecosystem of Apache Jackrabbit (an open source Java Content Repository) or the Microsoft Windows or Google Android operating systems. These platform types of software ecosystems can be characterized by the possibility to extend their functionality by adding components (such as applications or component bundles) or the availability of an API (Application Programming Interface) which enables the creation of extensions for the product or platform. The components for such platforms are frequently made available through a specific marketplace (for example the Android Market or the various AppStores for the various platforms from Apple). The firm which is the creator and owner of the platform is normally a keystone player of the platform ecosystem.

Firm

The software ecosystems of this type are focused around one specific firm instead of a specific product that the firm produces. Examples are the Google software ecosystem, the Apple ecosystem or the Adobe ecosystem. Depending on the firm's strategy, the participants of the ecosystem can have a cohesion that varies from weak to strong. The firm has several platform ecosystems in which the firm has a keystone role.

The type of software ecosystems as defined by Jansen et al. (2013) are different from those defined by Bosch (Bosch, 2009), but there is also a clear overlap. Using the definitions of Bosch (2009), it is possible to subdivide the platform category of Jansen et al. (2013) in a way that SECOs can be centered on the following three types of platforms:

Operating system-centric software ecosystems

The operating system-centric software ecosystem is a platform ecosystem that is focused around an operating System. These systems are the basic software layer on a hardware platform. This software layer forms the basis for other software to reside upon. The same software cannot operate on various operating systems without being rebuilt. Software vendors therefore can decide to only develop for a specific operating system, making this the center of a software ecosystem. Examples for these kinds of software ecosystems are the ecosystems around Microsoft Windows, Apple IOS, or Google Android.

Application-centric software ecosystems

The application-centric software ecosystem is a platform ecosystem that is focused around an application. In application centric software ecosystems, the applications form the basis for other software/organizations to add features to, for example. The central application, in combination with the add-on application, can provide a customer with the features they require. The add-on applications need to adapt in order to function with the central application. Examples for this kind of SECO are the SECOs around Salesforce (where connectors make it possible for customers to add information), Microsoft Office (with add-ons that, for example, synchronize calendars with Google) and Cisco Callmanager (with add-on applications like Peter Connects for call center functionality).

End user programming software ecosystems

The end user programming software ecosystem is a platform ecosystem that is focused around a specific type of end user programming. The central application in these ecosystems normally has functionality which provides end users the possibility to add features or functionality. Examples are Lego Mindstorms, where end users can create their own "programs" for controlling their creations, and Microsoft Excel, where end users can create macros in Visual BASIC in order to add functionality to a single spreadsheet.

The combination of both the definitions of Jansen et al. (2013) and Bosch (2009) can be visualized in Figure 1.

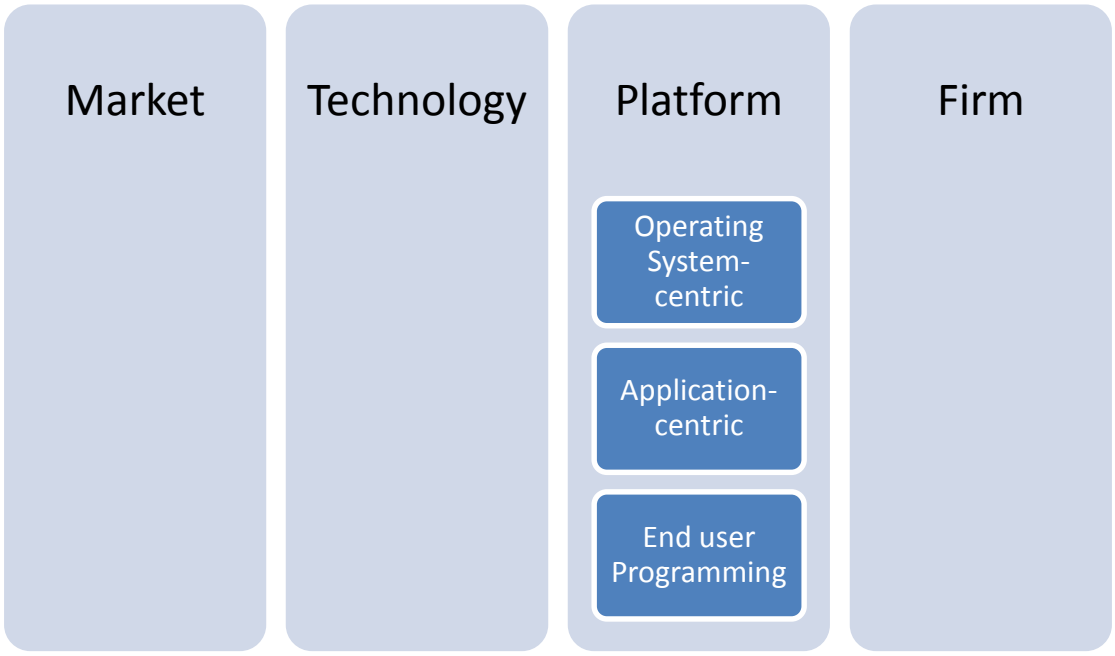

Figure 1 Definitions on software ecosystems combined

2.1.3 Software ecosystem characteristics, success factors and challenges

Bosch (2009) describes the taxonomy of software ecosystems in which there are specific characteristics, success factors and challenges for operating system-centric, application-centric and end user programming software ecosystems. Below, the characteristics, success factors and challenges for an application-centric software ecosystem are described.

Characteristics

- The application-centric software ecosystem starts from a successful online application.
- Other techniques or hosting are provided by the platform provider in order to offer an experience that is as seamless as possible between the 3rd party application and the platform.
- Domain-specific functionality is extended by third party developers.
- Deep integration between extensions and the platform is facilitated. This is available for data, workflow and user experience.

Success factors

- Bosch (2009) describes that for a large set of customers, the ability to extend the platform, or at least the promise to those customers of being able to do so, is the most important success factor. He also contends that the "coolness" factor plays a role, however, the business cases of the business partners in terms of their potential customers is the most important drive for the business partners.
- It is important to simplify the way external developers can contribute new functionality by using easy deployment and integration with platforms for the developed software as well as the availability of expressive and stable interfaces and allowing the use of popular development environments. (This is important when the first success factor is met).
- Providing solutions to integrate in the same user experience framework and extending data models and workflows are important for creating the possibility of seamless integration from the customer's point of view.
- Provide a viable channel for customers on which contributions from external developers are exposed.

Challenges

- The most significant challenge that application platform organizations face is the difficult tension between the product and platform strategy. From a product strategy point of view, the changes made in a platform strategy do not beneficially enhance the product for the customers. This fact focusses primarily on enabling external developers to make these end user-required enhancements. Furthermore, the platform strategy limits the amount of flexibility that there is with regard to changing the user interface, data models and, most importantly, the API's.
- Bosch (2009) sees "anecdotal evidence" which suggests that third party developers have problems creating and realizing a viable business model for most software ecosystems (not just application-centric software ecosystems). These application-centric software ecosystems also face the challenge that it pushes customers to only acquire the application on its own merits if the usefulness of the application platform is sufficient. Otherwise, the number of customers or developers who would actively participate in creating additional functionality for extending the platform would be limited.

The characteristics, success factors and challenges can be compared with the features of a specific software ecosystem. Besides having characteristics, success factors and challenges, a software ecosystem also has relationships with other organizations that they use to create the ecosystem.

2.1.4 Levels in a software ecosystem

In their study, Jansen, Finkelstein & Brinkkemper (2009) stated that a software ecosystem consists of multiple levels. They identified a total of three levels on which software vendors need to focus. This is illustrated in Figure 2.

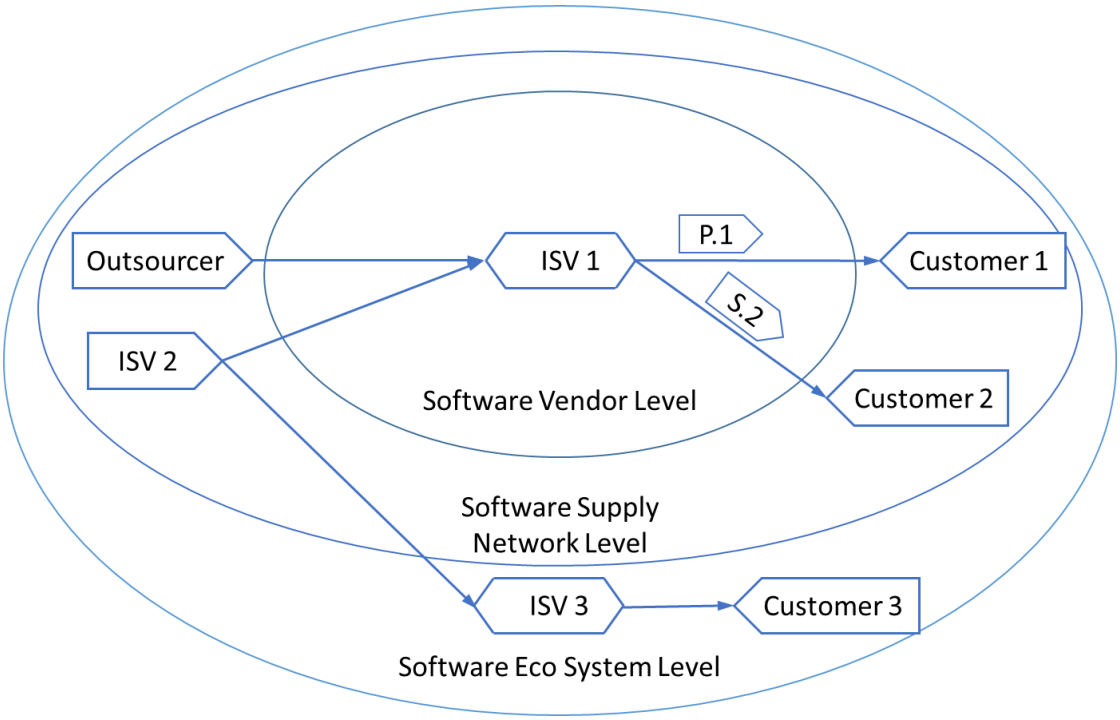

Figure 2 Example of visual representation software ecosystem (Jansen et al., 2009)

Software vendor level

This level contains all services and products which the vendor supplies, including the vendor itself. On this level, strategic choices need to be made regarding how software vendors behave in order to maximize profitability. Figure 2 shows he central software vendor of this software ecosystem (ISV 1). You can see it as an Independent Software Vendor (ISV). In this example, the software vendor supplies its product to one customer (shown as P.1) and its services to a different customer (shown as S.2).

Software supply network level

This level contains all the suppliers and customers which have direct contact with the software vendor. The strategies that they employ on their immediate buyers and suppliers should be considered to be at this level. In Figure 2, the software vendor (ISV 1) receives services supplied from an outsourcer and they acquire the software from another software vendor (ISV 2). For this reason, both are appear in the Software Supply Network Level.

Software ecosystem level

All other related organizations are located at the software ecosystem level. The effects of the software ecosystem on the product and its service portfolios should be seen to have an effect at this level. In Figure 2, the ISV 2 also supplies software to another software vendor (ISV 3). There is no relationship with the central software vendor. ISV 3 is therefore located at the software ecosystem level. That software vendor in turn supplies the software to Customer 3 which is also at the software ecosystem level.

2.1.5 Software vendor challenge

Software vendors face difficult decisions because the market is rapidly opening up. By opening up their knowledge bases, product interfaces and maybe even their software, the decision with regard to what extent it should be opened up to the ecosystem lies with them. New business models, service reuse and new standard components, however, should be considered by the organizations to be surrounded by, or to be at least at the center of, a software ecosystem (Jansen et al., 2009).

2.2 Knowledge management & knowledge management type

The society has changed into a knowledge society as expected and described by previous research (Bell, 1973; Drucker, 1968; Nonaka, 1994). Nonaka (1991) states that customer preferences and the competitive environment are changing constantly, which makes knowledge creation and exploitation for organizations very important.

2.2.1 Knowledge

Before being able to explain knowledge management, the definition of knowledge first needs to be understood. The definition used is the one stated by Alavi & Leidner (2001) which is based on definitions of Nonaka (1994) and Huber (1991).

> *Knowledge is a justified personal belief that increases an individual's capacity to take effective action.*

This definition is clearly talking about knowledge, and not about information or data. The difference in these terms are described by Maglitta (1996):

Data:	Raw numbers and facts;
Information:	Processed data;
Knowledge:	Information made actionable.

2.2.2 Knowledge creation

Polanyi (1967) was the first to state that individuals seem to know more than they can explain. Human knowledge was classified by Polanyi in two categories, tacit knowledge and explicit knowledge. These two types are explained below.

Explicit knowledge

This term refers to knowledge that is transmittable, able to be formatted or systematic language. It is also referred to as codified knowledge (Nonaka, 1994)

Tacit knowledge

Tacit knowledge is knowledge that has a personal quality. This is what makes it difficult to communicate and formalize (Nonaka, 1994). Nonaka (1994) expanded on Polanyi's work that defined the "modes of knowledge creation". Assuming that knowledge is created through conversion between explicit and tacit knowledge, Nonaka (1994) defined four modes:

1. From tacit to tacit knowledge was defined as socialization;
    - This is knowledge created through shared experience between individuals (through an apprenticeship, for example).
2. From explicit to explicit knowledge was defined as combination;
    - This is knowledge created through already existing explicit knowledge which is collected and combined to create new knowledge. (for example through the combining of information from multiple data sources to create new insights).

3. From tacit to explicit knowledge was defined as externalization;
    - This is knowledge created by formalizing existing tacit knowledge to make it possible to share this knowledge with or by others (for example by formalizing a target for an organization and publishing it).
4. From explicit to tacit knowledge was defined as internalization.
    - This is knowledge created when an individual turns explicit knowledge into personal tacit knowledge (for example by reading a manual and performing the described actions, thereby learning how the device or software should be used).

2.2.3 Knowledge management

In their research, Alavi & Leidner (2001) conclude that no single or optimum approach to organizational knowledge management and knowledge management systems can be developed. Knowledge is not easily transmitted and replicated (Kogut, 1992). The transferability and imitability of a firm's knowledge, whether it is in the form of information or know-how, are influenced by several characteristics (Kogut, 1992). Previous research shows that if organizations share important information among themselves, it will reinforce the relationship between information technology adoption and the effectiveness of interorganizational change (Fang, 2008). This indicates that there is a strong relationship between the information sharing and the initiation of collaboration with business partners, since at that moment this can be seen as interorganizational. But information and knowledge can be transferred in many different ways.

Therefore, a variety of knowledge management approaches and systems need to be employed in organizations in order to effectively deal with the diversity of knowledge types and attributes (Alavi & Leidner, 2001). Knowledge management involves four processes. These are knowledge creation and maintenance, knowledge storage and retrieval, knowledge distribution and knowledge application (Alavi & Leidner, 2001). Besides knowledge management processes, a division based on type of knowledge management can be made.

2.2.4 Knowledge management types

Davenport, De Long & Beers (1998) found four types of objectives for organization to use knowledge management systems and to initialize a knowledge management project. These four types are: (1) create knowledge, (2) improve knowledge access, (3) enhance knowledge environment and (4) manage knowledge as an asset (Davenport et al., 1998). Hahn & Subramani (2000) created a knowledge management support framework as shown in Figure 3, which plots the organizational knowledge resources location against the requirement of structure for the Knowledge Management Systems. The location of the knowledge resources of the organization which are managed by the knowledge management system are shown horizontally. The a priori level of structure is shown on the vertical axis. The knowledge management solutions identified by Davenport et al. (1998) are represented in the figure itself. Examples of systems fitting in the category are also indicated.

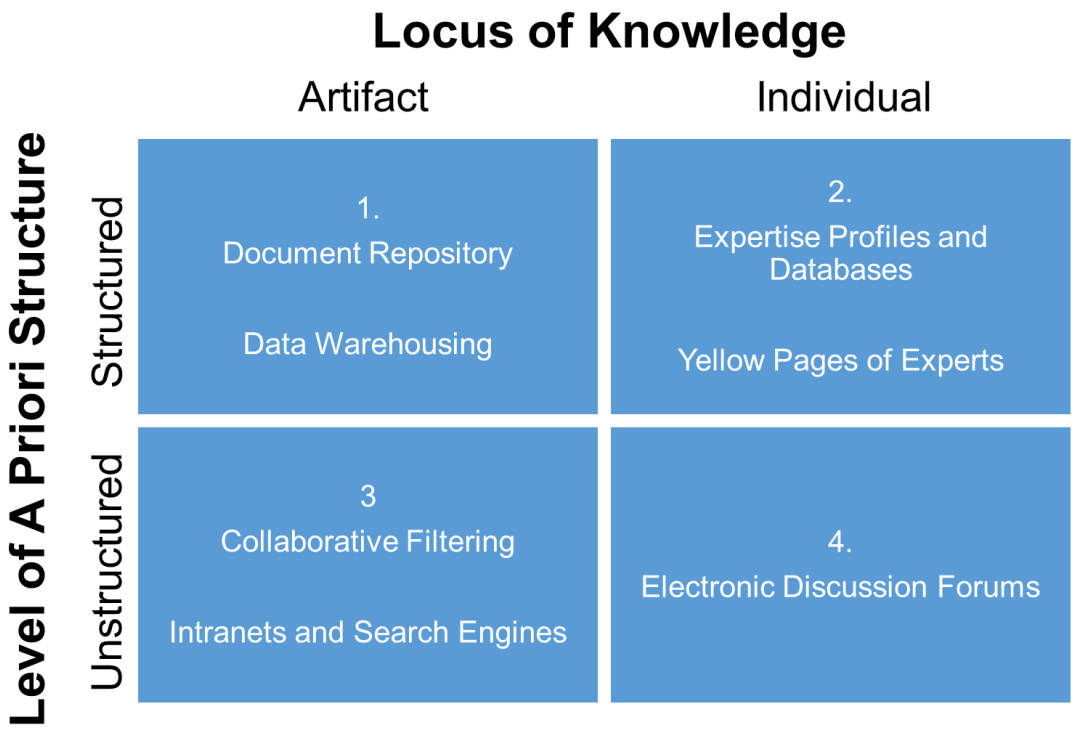

Figure 3 Knowledge management support framework (Hahn & Subramani, 2000)

Besides the difference between the types of systems and the level of structure of the knowledge, there can also be a difference in what is interesting about knowledge in specific circumstances. Gibbert, Leibold & Probst (2002) defined in their research different styles of customer knowledge management which organizations (can) use to identify what their customers know (which is different from what you want to know about your customer). Some very clear differences between Customer Knowledge Management (CKM) and (regular) Knowledge Management (KM) are shown in table 2.

Characteristics	KM	CKM
Axioms	'if we only knew what we know'	'if we only knew what our customers know'
Knowledge sought in	team, employee, company, network of companies	Customer experience, creativity, (dis)satisfaction with services/products
Rationale	Unlock and integrate employees' knowledge about customers, R&D and sales processes	Getting knowledge directly from the customers themselves, sharing and expanding this gathered knowledge
Metrics	Budget against performance	Contribution to customer success, performance against competitors in growth and innovation.
Role of Customer	Passive, only recipient of product/service	Active, creating value
Objectives	Saving costs, gaining efficiency, avoiding of wheel re-invention	Joint value creation by collaboration with customer

Table 2 Differences between knowledge management and customer knowledge management (Gibbert et al., 2002)

Binney (2001) created a knowledge management spectrum on which he mapped the knowledge management applications and the enabling technologies. By performing literature research on previous publications on knowledge management systems, Binney (2001) concluded that all previous publications provide the author's view on the knowledge management landscape. However, the conclusion was that there was still no complete view on the knowledge management landscape available. Binney (2001) created a framework to match all found types on knowledge and grouped the recognized system types in a total of six categories or elements. Below in table 3 is the spectrum as described by Binney (2001).

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Knowledge Management Applications	• Case-Based Reasoning • Customer Services Applications • Help Desk Applications • Order Entry Applications • Service Agent Support Applications	• Business Intelligence • Data Mining • Data Warehousing • Customer Relationship Management (CRM) • Decision Support Systems • Competitive Intelligence	• Content Management • Document Management • Intellectual Property • Knowledge Repositories • Knowledge Valuation	• Benchmarking • Best practices • Business Process (Re) Engineering • Lessons Learned • Methodology • Process Improvement • Process Automation • SEI/CMM/ISO9XXX, Six Sigma	• Learning • Skills Developmental • Staff Competencies • Teaching • Training	• Collaboration • Communities • Discussion Forums • Multi-disciplined Teams • Networking • Research and Development • Virtual Teams
Enabling Technologies	• Cognitive Technologies • Expert Systems • Geospatial Information Systems • Probability Networks • Rule-Based Expert Systems • Rule Induction Decision Trees • Semantic Networks	• Data Analysis and Reporting Tools • Intelligent Agents • Neural Computing • Push Technologies • Relational and Object DBMS • Web Crawlers	• Document Management • Knowledge Maps • Library Systems • Search Engines	• Process Modeling Tools • Workflow Management	• Computer-based training • Online training	• Bulletin Boards • Chat Rooms • E-mail • Groupware • Push Technologies • Search Engines • Simulation Technologies • Video Conferencing • Voice Mail
• **Extranets, Internet, Intranet, Portals**						

Table 3 Knowledge management spectrum (Binney, 2001)

The six categories as shown in table 3 will all be clarified below.

Transactional

The transactional knowledge management element of the knowledge management spectrum treats knowledge in a way that the technology which is used in an application is embedding knowledge in order to assist or support the user with their task. In case-based reasoning systems for example, the system searches for the solution best fitted for a user after first asking the user proactive questions about his or her problem. The user's answers are used by the system to narrow down the possible solutions to be presented to the user. Binney (2001) describes an example of transactional knowledge management found in the descriptions of case-based reasoning in customer service applications (Davenport & Klahr, 1998).

Analytical

The analytical knowledge management element of the knowledge management spectrum provides interpretations and/or creates new knowledge from data and/or information. The data and information are used to detect patterns and trends, thus revealing hidden trends and other insightful patterns. These KM systems can turn data into information, and this information can become knowledge when acted on. Traditional analytical knowledge management applications are data warehousing and management information systems

which are mainly focused on assisting marketing or product development functions by applying the analysis of customer-related information (Yoon, 1999).

Asset management

The asset management knowledge management element of the knowledge management spectrum focusses on processes associated with managing knowledge assets. Binney (2001) found two possible types in previous research:

1. Management of explicit knowledge assets which have been codified (Guthrie & Petty, 1999).
2. The management (including the identification, exploitation and protection) of intellectual property (Teece, 1998).

Process

The process knowledge management element of the knowledge management spectrum is focused on improving and codifying work-practices and procedures. It focusses on improving the process. Binney (2001) notes that previous research indicates that the process knowledge assets in the element are often improved by lessons learned, the formal engineering of processes through internal best practice selections, internal lessons, and codification and external benchmarking.

Developmental

The developmental knowledge management element of the knowledge management spectrum focusses on increasing the capabilities and competencies of an organization's employees. In this element, explicit knowledge can be transferred not just though training, but also through the development of tacit knowledge. An example is the development of tacit knowledge gained by being a member of a community of interest or by executing experimental assignments. This element of the spectrum is referred to in previous research as human capital investing (Edvinsson & Malone, 1997).

Innovation and creation

The innovation and creation element of the knowledge management framework contains the applications which focus on the collaboration between knowledge workers. Through collaboration, knowledge workers from different disciplines can create new knowledge. This element is also described in previous research by Nonaka & Konno (2005)

Knowledge management applications and enabling technologies

The framework (Binney, 2001) mapped knowledge management applications and enabling technologies to every element of the knowledge management spectrum. Common enabling technologies for all elements of the knowledge management spectrum are technologies like portals, internet, intranets and extranets. By mapping technologies and applications to the elements in the framework, the application of the framework can be used by organizations to identify their systems according to their knowledge management type.

More observations on the framework

The knowledge management framework of Binney (2001) has some patterns which are not reflected in the framework itself. The patterns that are interesting for this thesis are:

- The type of knowledge is shown from the most explicit knowledge, shown on the left, to most tacit knowledge, shown on the right.

- The further to the right of the framework you go, the higher the individual choice (or optionality) is. On the left side, the use of knowledge is embedded in the systems, while on the right, the use of knowledge is by the choice of the individual.
- On the right side of the spectrum, the systems are much less prescriptive in the way they can or should be used than on the left side.
- The system are either focusing on human and structural capital, where human capital is focusing on the more tacit knowledge and the increase the skills and knowledge levels of users than the systems focusing on structural capital.

These and all other observations as found by Binney (2001) are shown in table 4.

Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Explicit			Tacit		
Technologist			Organizational Theorist		
Low Optionality			High Optionality		
Technical Mousetrap			Cultural Change		
Single Modality			Multiple Modality		
Internal Structure				Employee Competence	Internal Structure
Structural Capital				Human Capital	

Table 4 Knowledge management framework observations (Binney, 2001)

2.3 Business collaboration

Most organizations have agreements, partnerships or other forms of collaboration with other organizations. This involves coordination between the partners in order to pursue the shared objectives of the partnership. Successful or at least satisfactory cooperation is very important for the success of the partnerships (T. Das & Teng, 1996; Kanter, 1994). The definition for business (or business partner) collaboration is defined in earlier research as the willingness of a partner firm to pursue mutually compatible interests in the alliance rather than act opportunistically (T. K. Das & Bing-Sheng Teng, 1998).

As described by Hagedoorn & Schakenraad (1990a), organizations have particular motives for collaborating and cooperating. Hagedoorn & Schakenraad also suggests that these motives differ for the organizations involved, for each agreement and for each type of collaboration. The literature shows numerous motives which are related to the reasons that organizations collaborate with each other. Hagedoorn & Schakenraad (1990b) identify the following set of motives:

- The extremely high costs and risks of R&D in high-tech industries;
- Quick pre-emption on a world wide scale is preferable, despite the 'loss' of potential monopoly profit;
- Technology transfer and technology complementarity;
- The exploration of new markets and niches;
- The shortening of the period between discovery and market introduction;
- Monitoring the evolution of technologies and opportunities.

Earlier studies have been conducted which focused on the diversity of partnership between organizations. Singh & Mitchell (1996) found in their study that the most common types of collaboration between organizations were development-oriented collaboration and marketing-oriented collaboration.

Development-oriented collaboration consists of collaboration signatures such as the joint development of product interfaces or product compatibility, in-licensing of products of components from another business and Joint R&D (Singh & Mitchell, 1996).

Marketing-oriented collaboration consists of collaboration signatures such as hardware reselling by a software business (this may include information and resource sharing), joint marketing or distribution and marketing or distribution by one business of their partners' products (Singh & Mitchell, 1996).

These examples accounted for 92% of all the organization collaborations in their study. These types also agree with Hagedoorn (1993) who found these two forms to be the most common. These two types of collaboration will therefore be taken into account in this research.

2.4 Collaboration success

Collaboration success and the factors that influence the success have been investigated in previous research. Basselier & Benbasat (2004) conducted research on the contribution of business competences from IT professionals to the development of partnerships between business clients and the IT professionals. They found that IT professionals tend to need more and more non-IT skills in order to contribute to the success of cooperation with business partners. T.K. Das & Bing-Sheng Teng (1998) contend that trust and control are the main factors which influence the confidence of a business partnership.

Hoffmann & Schlosser (2001) studied the critical success factors for forming an alliance with another organization within small- and medium-sized enterprises. They compared the value in successful and unsuccessful alliances of 24 noticed and unnoticed variables. A total of 5 significant variables were found. They also investigated the perceived success factors by the organizations (there were a total of 12). The three perceived success factors which were also found to be critical are:

- Contributing individual strengths and looking for complementary resources;
- The need for a precise definition of rights and duties;
- Deriving alliance objectives from the business strategy.

The two other critical success factors which were not perceived to be important and for which the significance was probably underestimated by the alliance forming organizations were:

- Establishing required resources;
- Speedy implementation and quick results.

T.K. Das & Bing-Sheng Teng (1998) investigated the trust and control in strategic alliances between partners. They concluded that in order to create confidence in these strategic alliances, trust and control function as sources for establishing these partner collaboration relations. According to the research of Mohr & Spekman (1994), the success of all

partnerships is influenced by the following behavioral characteristics, which can be divided into three categories:

- Attributes of the partnership;
- Communication behavior;
- Conflict resolution techniques.

These characteristics are all built up of several characteristics. For example, commitment, coordination, interdependence and trust are all characteristics of the category attributes of partnership. Information sharing, quality and participation are characteristics of the category communication behavior. The characteristics of the category conflict resolution techniques are joint problem solving, persuasion, domination, arbitration, the use of harsh words and the smoothing out of problem areas. These factors are shown in the Figure 4 below.

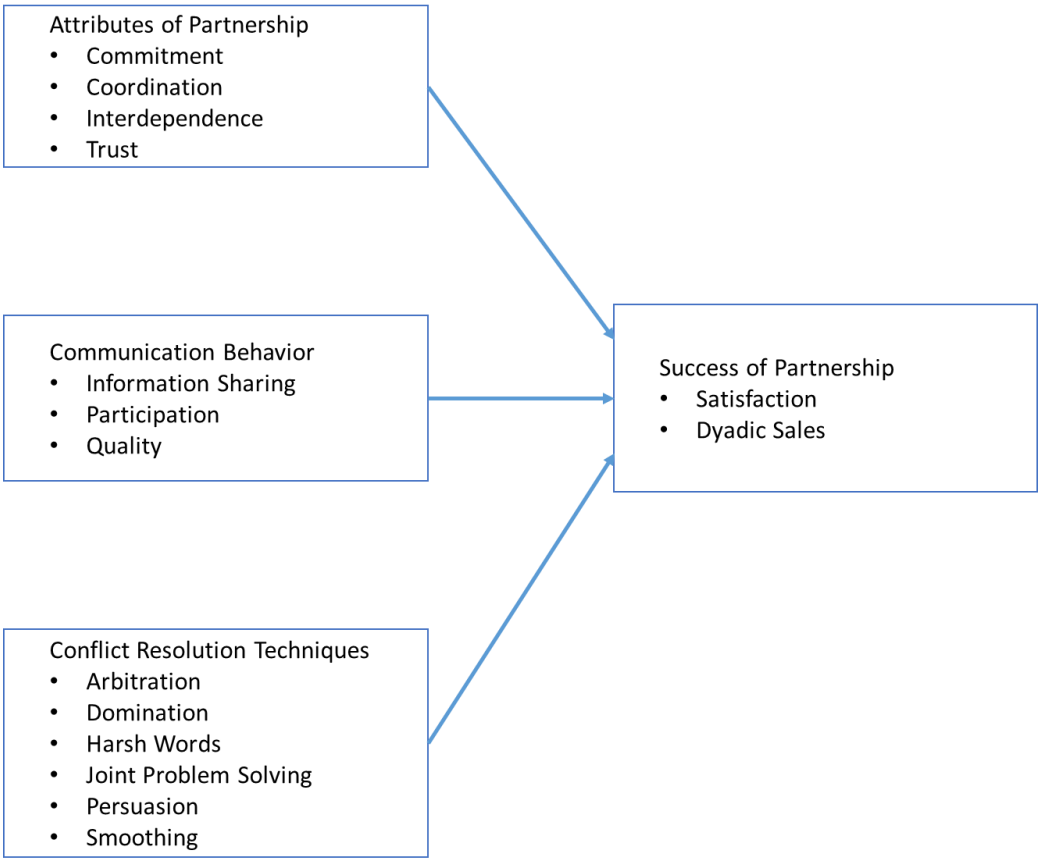

Figure 4 The categories and its factors which influence partnership success (Mohr & Spekman, 1994)

As shown in the Figure 4, “Information Sharing” is one of the factors that makes up communication behavior. Earlier research also indicated that information sharing influences the success of the partnership (Mohr & Nevin, 1990; Mohr & Spekman, 1994). As shown in chapter 2.2, information can become knowledge when it can be made actionable (Maglitta, 1996), which makes this factor important for this study. From the model of Mohr & Spekman (1994), the two main factors for the success of a partnership can be distilled, and those are satisfaction about the partnership and the dyadic sales.

2.5 Previous research regarding multiple topics

In a study that investigated the relationship between knowledge sharing and outsourcing success (Lee, 2001) it was found that knowledge sharing (implicit and explicit) has a positive influence on the outsourcing success. Since the outsourcing party can be seen as a business partner, this might indicate that knowledge sharing is a significant factor in the success of a business partnership, although the context of that research was different.

Gold, Malhorta & Segars (2001) state that organizational effectiveness is influenced by the capability of the knowledge infrastructure and capability of the knowledge process. The question is whether this is also relevant for inter-organizational effectiveness in the case of collaboration. Basselier & Benbasat (2004) conducted research on the development and influence on IT-Business partnerships. Their results show a clear relationship between knowledge networking, interpersonal communication and intentions to develop partnerships.

Previous research indicate a positive relation between collaborative experience, the naturalness in ICT's use and the reliance on Knowledge Management Tools/Systems (Vaccaro, 2010). This in turn has a positive influence on the speed to market and the new product performance as shown in Figure 5. And this was all in the context of inter-firm collaboration (Vaccaro, 2010).

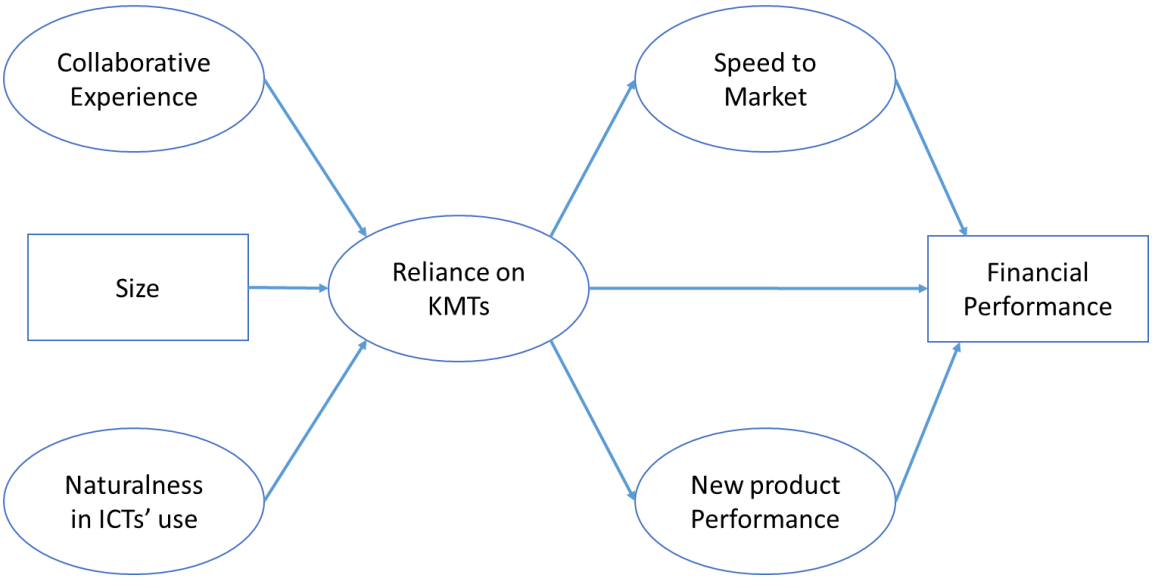

Figure 5 The influence of reliance on knowledge management tools (Vaccaro, 2010)

The direct relationship between knowledge management type and business partner collaboration success in a software ecosystem has not yet been investigated in previous research. This research will extend the knowledge base by investigating this relationship.

2.6 Research model

The final research model, created after literature study and interviews with the partner manager of GX software, is shown in Figure 6.

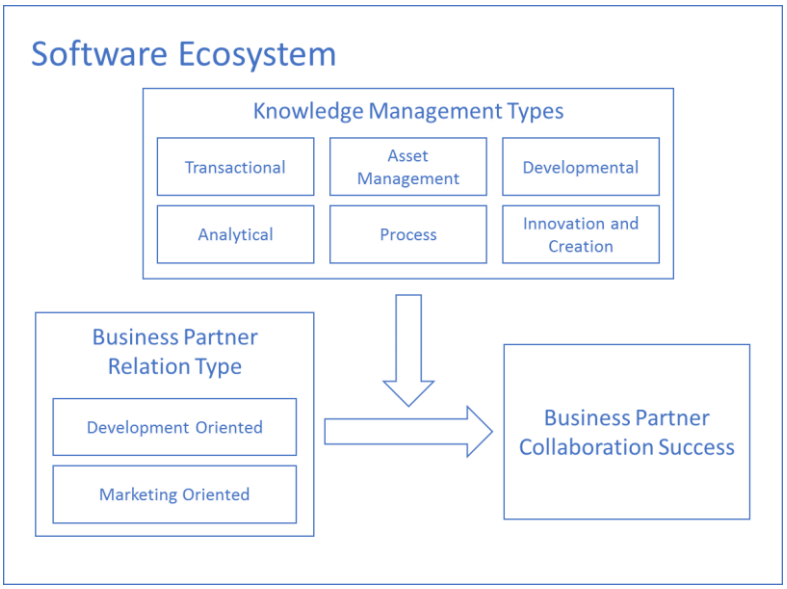

Figure 6 Research model

On the left side, the model shows the business partner relation type. This is one of the independent variables of this research. It specifies two types of collaboration: development-oriented and marketing-oriented (Singh & Mitchell, 1996). As shown in the literature review, these have been identified as the most important types of business partner relations in previous research (Hagedoorn, 1993; Singh & Mitchell, 1996).

The other independent variable of the research is the knowledge management type. This variable specifies six types as described by Binney (2001). This model has been chosen as the basis for the knowledge management type because of the division between functional usability, the link between the knowledge management types and the systems which represent these types, and the logical buildup from explicit to tacit knowledge in the knowledge management framework. The types of knowledge management which are used are Transactional, Asset Management, Developmental, Analytical, Process and Innovation and Creation.

The model also shows the dependent variable, which is business partner collaboration success. It is dependent on both the Business Partner Relation Type and the Knowledge Management Type. As shown in the literature study, business partner success can be measured by dyadic sales and satisfaction. In this research, the dyadic sales are not measured for business partner collaboration success. Only the satisfaction and the factor information sharing influencing this satisfaction (Mohr & Spekman, 1994) are measured.

The research was focused on the context of a software ecosystem. All the variables (Business partner relation type, Business partner collaboration success and Knowledge management type) are placed in that context.

The next chapter will explain the research design and the method of this research by first explaining the type of research which has been performed, explaining the process of questionnaire creation, how the case study interviews were set up and how the online questionnaire was executed.

3 Research design & method

3.1 Research method

In this chapter, the research design and methods are explained. After the first topic regarding the research design framework on which the research is based, the research model and its variables will be explained. This chapter will conclude by explaining which methods are used to collect the data for the research.

The research was performed based on the theory for design science research (Hevner et al., 2004). This framework provides guidelines for the process of design science research by describing the process in its various stages of creating and evaluating a rigorous and relevant research design model, testing the model in the appropriate environment, and drawing conclusions from the research in order to add to the existing knowledge base of science.

A visual representation of the framework from Hevner et al. (2004) has been altered in order to represent the research which has been performed. This representation is shown in Figure 7.

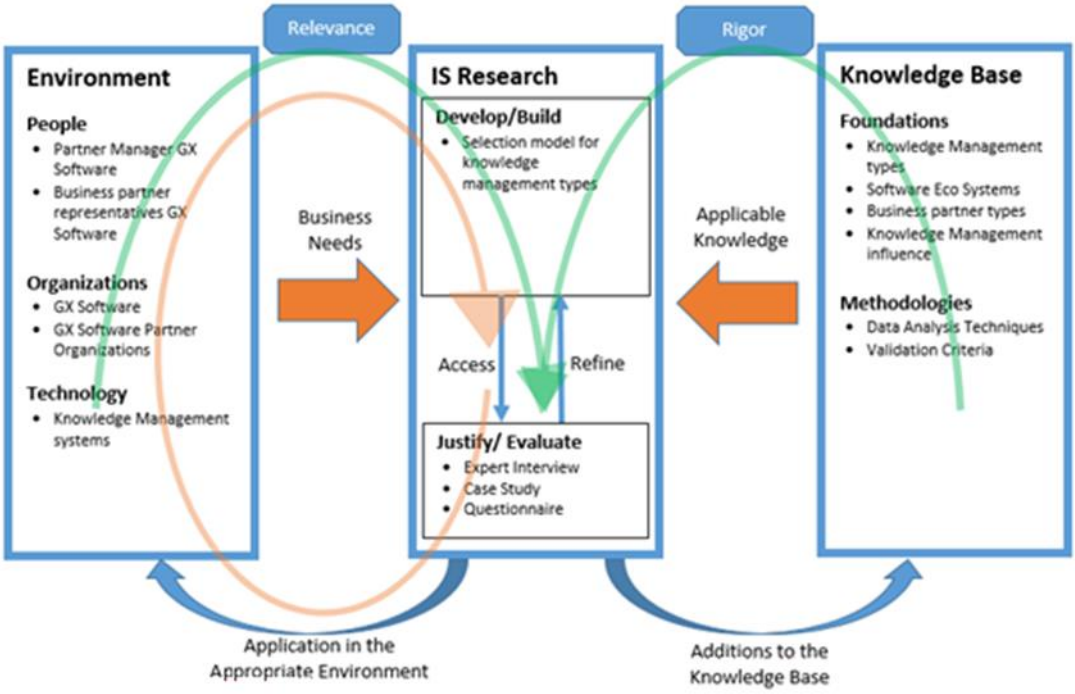

Figure 7 Adapted information systems research framework based on Hevner et al.(2004)

In the process of framework creation (green arrow in Figure 7), a combination of literature research about the main concepts of the topic (knowledge management type, business collaboration, business collaboration success and the software ecosystem) as well as literature research on similar studies by others has been performed. This has been complemented with the results of an interview with the current partner manager of GX Software. These findings were combined into a framework which was validated through an expert interview with the former business partner manager of GX Software.

An evaluation of the framework was executed by performing an in depth case study (Yin, 1994) using structured interviews with representatives from multiple organizations which have partner contracts with GX Software. As the basis for these structured interviews, a questionnaire has been created which was based on all the variables of the framework and the questions used in previous research. The details about the questionnaire are described

in chapter 3.2. In addition to the in depth case study, quantitative research has also been performed by gathering 33 valid responses in an online questionnaire (orange arrow in Figure 7). The questionnaire created and described in chapter 3.2 also formed the basis for the online questionnaire. Data gathered from these interviews and questionnaires have been analyzed in order to validate the conceptual model and verify the influence of knowledge management types on business partner type relationships and their influence on collaboration success. In order to be able to analyze the information about this questionnaire together with the interview results, conclusions and recommendations on this type of analysis from previous research will be taken into account (Dixon-Woods, Booth, & Sutton, 2007). When applicable, triangulation was used to also compare the results from the partner manager interviews with the results from the partner interviews and online questionnaires. The analysis of the data gathered in the research can be found in chapter 5. A complete overview of the research performed is displayed as a research design model in Figure 8 below.

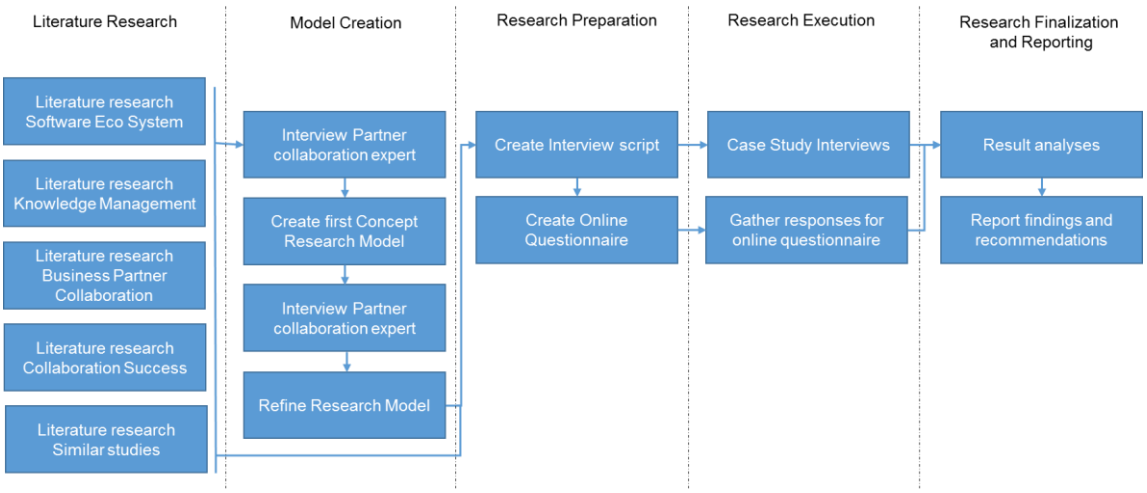

Figure 8 Research design model

3.2 Questionnaire creation

The research was performed using structured interviews and an online questionnaire. The same questions formed the basis for both of the research techniques. This made it possible to compare the answers from both the online questionnaire and the interviews. The interviews gave additional information and motivation about the chosen answer. The complete questionnaire can be found in appendix A.

The questionnaire was made up of 21 questions in a total of six sections. The details of each section of the questionnaire are explained below:

General information

In the general information section, a total of 8 questions were asked. All were basic questions about the person answering the questionnaire which makes it possible to determine the significance of the person answering the questionnaire and the answers given. Some of the questions are open ended, such as “Which country are you from?” and “Which organization do you work for?”. Other answers gave an indication of the experience of the respondent on this specific subject, for example “How many years of experience do you have in working with knowledge management and/or knowledge management tools?”. All questions related to experience had five possible answers: “none”, “< 2 years”, “2 to 5

years", "5 to 10 years" and "> 10 years". After answering the general questions, the questionnaire continued on to the subject software ecosystem.

Software ecosystem

In the software ecosystem section, an explanation was first given about what a software ecosystem is. This explanation was based on the definition of Jansen et al. (2009). In order to further explain the concept of software ecosystem, the definition of Kittlaus & Clough (2009) was also given. In the online questionnaire and in the interviews, the answers to the first question of the software ecosystem section determined what the next three questions about the topic were to be. The purpose of the questions was to specify a relationship between the organization of the respondent and a business partner within a software ecosystem. The first question was "*Is your organization the central organization of a software ecosystem?*". If the answer was "yes", the respondent was asked to specify the name of the ecosystem, the name of the business partner and the role of the business partner in the software ecosystem. All these questions were open ended questions. If the answer to the first question was "no", the respondent was asked to name a software ecosystem his organization was part of, specify the central organization of the software ecosystem and the role of his own organization in the software ecosystem. These questions were also open ended. When all the questions about software ecosystem were answered, the questionnaire continued on to the subject of business partner type.

Business partner type

The main question in the section of business partner type was one that specified the business partner type relationship between the specified software ecosystem and business partner from the previous questions. The possible options are "Development-oriented", "Marketing-oriented" and the open answer "Other". In order to make it possible for the respondents to select the correct orientation of the business partner type, the definitions of both development- and marketing-Oriented are specified in the questionnaire. This section also had two other questions whose goal were, to elicit the personal opinion of the respondent, by asking *"I experience the collaboration with the business partner as successful*" and "*In my opinion knowledge management has an influence on the success of the collaboration*". Both of these questions required an answer on a 5 point Likert scale from "strongly disagree" to "strongly agree". These questions concluded the subject of business partner type. The next subject was partner information sharing.

Partner information sharing

An extra section covering partner information sharing was added to the questionnaire. As the literature review indicates, information sharing is an important indicator of partnership success and it is linked to knowledge management because information can become knowledge when used in a beneficial way. The questions in this section are based on the research questions of Mohr & Spekman (1994). The questions were minimally altered in order to change the research subject from collaboration with manufacturers to collaboration with business partners. Only questions which were also used by Mohr & Spekman (1994) for drawing conclusions were added to the questionnaire. All questions needed to be answered on a 5 point Likert scale. An example of the questions is "*We inform our business partner in advance of changing needs*". When all questions about the partner information sharing subject were answered, the questionnaire continued on to the subject knowledge management type.

Knowledge management type

In order to be able to ask the respondents questions about the six knowledge management types as described by Binney (2001), an explanation of what the six types of knowledge management systems are was first given and the corresponding knowledge management applications for that type was given in a table as found in the research of Binney (2001). After clarifying the types of knowledge management, the respondent was first asked whether the types of systems were used in the collaboration with the business partner. The answer options were “yes”, “no” and “uncertain”. Next, the respondent was asked whether he or she could define the expected usefulness of a knowledge management type in the collaboration with the business partner. This question needed to be answered on a 5 point Likert scale (very useless – very useful).

The last section of the questions about knowledge management type were extracted from the research of Lee (2001). In this research, the impact of knowledge sharing, organizational capability and partnership quality in Information Systems outsourcing was investigated. The questions which were asked in this research about organizational capability were all related to gathering knowledge from other organizations. The questions addressed the range from the scanning of knowledge up to exploiting the knowledge that was gathered from a different organization. These questions were modified in order to fit the current research topic. The questions asked for each type of knowledge management were whether the organization of the respondent had the possibility to scan, acquire, assimilate and exploit the gathered knowledge from the knowledge management system type. These questions all needed to be answered on a 5 point Likert scale. These questions concluded the section on knowledge management type, after which the questionnaire continued on to the last subject about collaboration successfulness.

Collaboration successfulness

The last section of the questionnaire focused on collaboration successfulness. These five questions were also extracted from the research of Lee (2001). The questions from this research about partnership quality were adapted in order to use the correct terms (service provider was replaced by business partner) for this research. These questions had to be answered on a 5 point Likert scale.

The sections of the questionnaire that are described formed the basis for the case study interviews and the online questionnaire as described below.

3.3 Case study interviews

One part of the research process as shown in Figure 8 performs an in depth case study by conducting interviews (Yin, 1994). There were a total of 9 interviews in the case study interviews. These were held with representatives of business partners of GX Software and its software ecosystem surrounding XperienCentral. These interviews were guided by the interview script as described in chapter 3.2. The details about the respondents of the case study interviews will be provided in chapter 4.2.

Besides the information gathered by the case study interviews, additional information was gathered by executing an online questionnaire and the research topic as described in the next chapter.

3.4 Online questionnaire

An online questionnaire based on the questionnaire as described in chapter 3.2 has been created in order to gather additional responses about this research topic. This qualitative component of the research did not intend to focus on a specific software ecosystem in order to be able to validate the responses gathered from the in-depth case study. Information about the gathered responses can be found in chapter 4.3.

The next chapter describes the data collection process. It describes the process of the partner manager interviews, the qualitative in-depth case study and quantitative research component of this research.

4 Data collection

This chapter describes the data collection process of this research. It covers the process of the partner manager interviews, the case study interviews and the online questionnaire process.

4.1 Partner manager interviews

In the first stages of the research, an interview was conducted with the current partner manager of GX software. He is responsible for setting up and maintaining the partner network as well as facilitating the partners with information and support in order for them to be able to execute projects with the software of GX. This interview was held in order to define and correct the research model which stated that knowledge management (types) influence the business partner collaboration success within a software ecosystem. The characteristics of the partner collaboration of GX Software and the available knowledge management systems was also addressed during the interview.

After finalizing the research model, an interview with the former partner manager of GX was conducted. This was held in the same setting as the interview with the current partner manager and it focused on the validation of the research model and gathered information about the characteristics of the partner collaboration of GX Software.

After processing the information gathered from both interviews, the interview script was created and the research was continued by conducting the case study interviews.

4.2 Case study interviews

The software ecosystem of XperienCentral was investigated for its partner collaboration characteristics by conducting a total of 9 script-guided interviews with representatives throughout the software ecosystem. The interviewees varied from representatives of implementation partner Incentro, employees from BlueConic and employees of the hosting provider KPN. The case study interviews did not cover all partners or customers of GX Software. This has an influence on the results of the research because it makes the results less representative for the entire software ecosystem of GX Software. A visual representation of the location of the case study interview respondents within the software ecosystem is given in Figure 9.

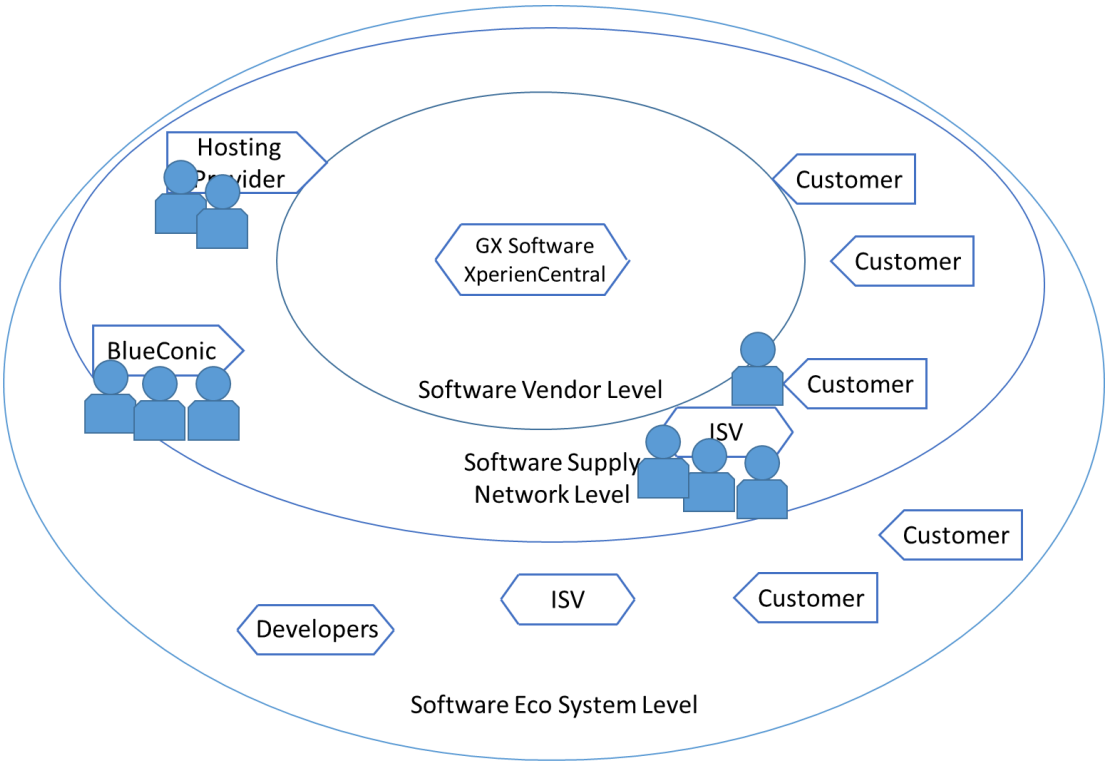

Figure 9 Visual representation interviewees in software ecosystem GX Software/XperienCentral

Two representatives of the organization of KPN were interviewed. KPN is a hosting provider for the software of GX Software. Customers of GX Software who do not want or cannot host the applications themselves can ask KPN to provide this service for them. In order to be able to support these customers, KPN has engineers who are trained in managing the software of GX. Employees of GX software who are involved in projects and customer services communicate directly with KPN for the purposes of supporting and updating the software. The roles of the interviewees at the time of the interviews in the collaboration with GX were service manager and technical specialist.

From the new organization of BlueConic, three representatives were interviewed. The software BlueConic was created and supported by GX Software from 2010 up to January 2014. At that time, the organization of GX Software was spun off, and the product BlueConic got its own organization called BlueConic. This created a new partner relationship for GX with an organization in which a lot of former GX employees are working (at least at the beginning of the separation). GX became the distributor, reseller and implementation partner of the product BlueConic in the Benelux region. The roles of the interviewees in the organization at the time of the interviews were business architect, product marketer and product manager.

There were three representatives from GX's implementation partner and reseller Incentro who volunteered to cooperate by sitting for an interview. Incentro was reseller and implementation partner of the product GX Webmanager/XperienCentral and BlueConic for its customers. Incentro also sells and implements other products from other suppliers for its customers. The roles of the interviewees of Incentro within their organization at the times of the interviews were all-round manager, consultant and manager online marketing.

One interviewee was self-employed. He worked with the software of GX at several organizations (implementation partners and customers) and was at the time of the

interviews working at the GX customer NPL. In his role as senior developer and solutions architect, he worked for several partner organizations of GX Software.

The interviews were guided by a script which asked the representatives to answer the questions as described in chapter 3.2 as well as give extra explanations as to why that was the answer they had given. In all interviews, the context of the questions was the partnership/relationship between their organization and GX Software. The context was therefore always the software ecosystem of GX Software/XperienCentral.

Besides the case study interviews, an online questionnaire was also created and executed, which is described below.

4.3 Online questionnaire

In order to validate the framework and the results from the case study, an online questionnaire has been used to gather additional information on the subject. The online questionnaire was created using the online questionnaire tool from http://www.limequery.org. At this web service/address, a survey was created as described in chapter 3.2.

The survey was divided in 8 subcategories/forms in which all the questions were displayed. The subdivision was based on the topic of the questions, which were “General Questions 1”,”General Questions 2”,”Software Ecosystem” ,”Business Partner Type”, ”Partner Information Sharing”, ”Knowledge Management Type”, ”Collaboration and Knowledge” and ”Collaboration Successfulness”. The definitions of the research terms used (for example “development-oriented” or “marketing-oriented”) were explained on the top of every page of the questionnaire where relevant.

The survey was set up with the options to use cookies in order to prevent users from filling in the survey more than once. Respondents also had the possibility to save the current state of the survey and complete it later.

The online questionnaire was available for submission between the 11th of July and the 31st of August. In order to gather respondents for the survey, several mediums have been used, for example posts in the Linked-in groups “Software VOC ICT Nederland” and “Knowledge Management”. Personal invitations by e-mail were also sent to possible respondents from the author’s network.

This chapter described the process of data collection used for this research. The next chapter describes the case study characteristics and the analyses of the collected data from both the case study interviews and the online questionnaires.

5 Data analysis

In this chapter, the context for the case study interviews is described by examining GX Software and its software ecosystem, after which the data gathered from the partner manager interviews, the case study interviews and the results from the online questionnaire will be analyzed.

5.1 Case study characteristics: GX Software/XperienCentral

5.1.1 Software ecosystems in case study

The software ecosystem of GX Software was the context of the case study for this research. GX Software is an organization which is the creator and owner of a software product called XperienCentral (formally known as GX WebManager). GX Software is also the creator and distributor of BlueConic. Over the past few years, BlueConic was developed by GX by its own means, however, this product was formally privatized at the beginning of 2014. The product owner therefore changed to another organization with different owners and its own personnel. This makes the organization BlueConic a supplier of GX Software. GX is still selling BlueConic as a component of its own product in the form of extra functionality or as an add-on to XperienCentral. GX Software also resells the product separately to customers in the Netherlands and surrounding countries (when opportunities occur).

During the interviews, two central organizations of software ecosystems have been addressed. One was the ecosystem of XperienCentral/GX WebManager. This is the main product of GX Software, which has a surrounding ecosystem of suppliers, developers, resellers and customers. The software ecosystem of the product (and organization) of BlueConic has also been taken into account. In this Software Ecosystem, GX Software is a reseller. In both cases, the software ecosystem can be seen as a Platform based (Jansen et al., 2013)/Application Centric (Bosch, 2009) software ecosystem. According to Jansen et al. (2013), if an organization provides a single software platform, the firm and platform ecosystem are the same. In both the cases, the software ecosystem central platform is an application. Therefore, the software ecosystem of GX Software/XperienCentral is addressed as application-centric.

5.1.2 In software ecosystem characteristics, success factors and challenges

Bosch (2009) describes specific characteristics, success factors and challenges for an application-centric software ecosystem. These descriptions match the software ecosystem of XperienCentral. Below are the characteristics, success factors and challenges from the XperienCentral software ecosystem as reflected in the features described by Bosch (2009).

Characteristics

- The application-centric software ecosystem starts from a successful online application. In the XperienCentral SECO, the application is a Web Content Management platform, although it is not available as Software as a Service.
- In the XperienCentral SECO, backoffice systems provide vital information for the applications hosted in the XperienCentral application. For the backoffice system, available techniques are used to gather this information from these systems (for example: web services, ftp downloads, file shares, direct database connections).
- XperienCentral has an API available for developers to easily create extensions (in the form of component bundles).

- Deep integration between extensions and the platform is facilitated. This is available for data, workflow and the user experience.
- Deep integration between extensions and the platform is available in the XperienCentral SECO through the API.

Success factors

- The potential new customers for XperienCentral are limited. This success factor as described by Bosch (2009) is difficult to meet. The software is complex and expensive, and the number of new customers per year is limited. The business cases of the business partners in terms of their potential customers is the most important drive for the business partners. This conclusion was also indicated by the former partner manager of GX in the interview. In that interview, he stated that the most important factors of a business partnership are filling a gap in the current service or product portfolio of a business partner and the possibility of earning (a lot) of money through the partnership.
- Since XperienCentral is written in Java, it is built in a generic and popular language and the tools to develop it are numerous and not restricted. The interfaces (in the form of the software platform) are very stable, but complaints from partner developers focus on the fact that it is still difficult to develop a good extension because of the complexity of the platform.
- Given the modular setup of XperienCentral, it is very easy for developers to extend the data models and integrate new functionality in the user interface.
- GX developed a portal for registering all its component bundles. Here, all the component bundles should be registered and versioning should take place. However, this channel is not viable. Fewer and fewer extensions are being registered and there are rumors that the platform might even be taken offline.

Challenges

- The challenge described by Bosch (2009) between the product and platform strategy is a challenge GX Software is facing in its XperienCentral software ecosystem. At GX Software, the strategy is mixed between product and platform. There is an important API for external developers and the changes to it are minimized, however changes are made when they are found to be necessary by the product management board. The software development department focuses on the basis of the product.
- The challenge for third party developers to create and realize a viable business model is a real challenge for GX Software and its product XperienCentral. The number of active business partner organizations creating additional features and participating in the software ecosystem is limited. This is due to the difficult market and the small amount of customers available in the market which limits the financial benefits that can be gained and the partners who can profit from that.

5.1.3 XperienCentral software ecosystem visual representation

Looking at GX Software and its software ecosystem around XperienCentral, GX has many types of business partners. Hosting partners, Implementation partners, designing organizations and software suppliers. A representation of the software ecosystem of GX Software's XperienCentral with its major partners is shown in Figure 10.

At the Software Vendor Level, the product owner GX Software with its product XperienCentral is located. There are relationships between GX Software/XperienCentral and several customers as well as other ISV's and hosting providers.

At the Software Supply Network Level, the customers with which GX has a direct connection are located as are the suppliers of software and services to GX Software for XperienCentral. It also has other Software Vendors located at the Software Supply Network level because these vendor resell or implement the software with their customers.

At the Software Ecosystem Level, the customers and software suppliers of other software vendors (in this case BlueConic) are located, as are the independent developers. They normally do not have any direct relationship in terms of services or product supply and the number of independent developers is very small in this software ecosystem.

Relationship P.1 is a relation in which the product is supplied directly to a customer at the Software Supply Network Level. This relation represents the rare cases in which GX Software is not able to sell any services with its product, and these services are not sold by an implementation partner either.

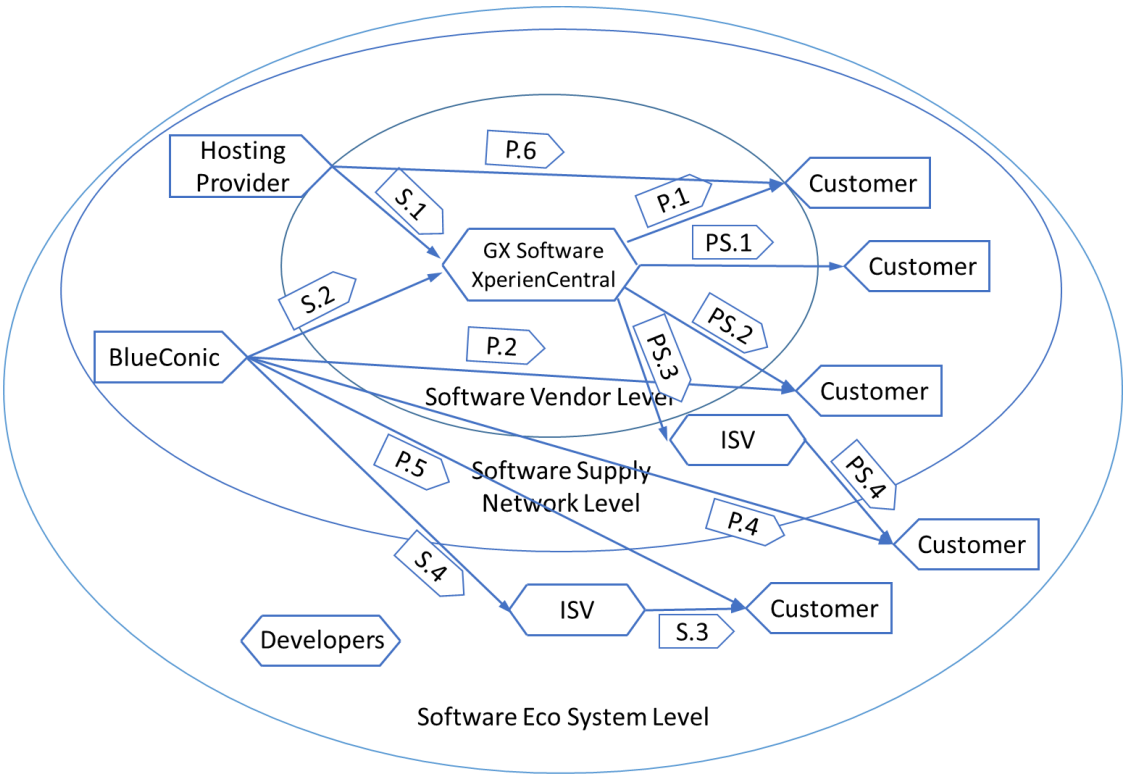

Figure 10 Visual representation software ecosystem GX Software/XperienCentral

Relationship PS.1 is a relationship where the product as well as the services are supplied to the customer. From all the direct customer relationships GX has, this is the relationship GX is trying to create with its customers.

Relation PS.2 is a relationship in which the product XperienCentral is supplied by GX Software to the customer. Relationship P.2 supplies the integrated product BlueConic (as a special component of XperienCentral in the form of the Context Cloud) to the same customer. GX is supplying services for both products through relationship PS.2

PS.3 is the relationship to an Independent Software Vendor which can be seen as a reseller and implementation partner of GX/XperienCentral. The ISV supplies the software and the services to its customer through relationship PS.4.

Relationship S.1 represents a hosting provider which supplies services for GX Software in terms of dedicated hosting and the services for GX to support those. These hosting providers supply their product (in the form of hosting and maintaining the installation) directly to customers, which is shown in relationship P.6.

BlueConic has five types of relationships within the Software Ecosystem of XperienCentral. Relationship S.2 is a service relation for XperienCentral. Support and Consultancy for the product are provided through this Relationship. P.2 provides the product in the form of context cloud to the Customer. GX provides services to the customer for that product through relationship PS.2. P.4 also provides the product to a customer, however, in this case, the customer gets services and XperienCentral is provided by a partner ISV. P.5 is the same relationship as P.4, in which BlueConic provides their software to a customer. The difference between P.4 and P.5 is that the customer does not use the product XperienCentral and therefore the ISV which provides the software to the customer gets their services from BlueConic through S.4. With this complete overview of relationship within the software ecosystem of GX Software, the partner managers of GX Software can provide the required information about the relationships and their requirements.

5.2 Partner manager interviews

The first partner manager interview in which the current partner manager of GX software was interviewed made clear that the assumption that knowledge management has influence on the success of partner collaboration is supported by his experience. He went so far as to state that knowledge transition between GX Software and its partners is one of the obstacles in the collaborations of GX Software.

The second interview, in which the former partner manager of GX software was interviewed, also made clear that knowledge management is important for collaboration. He stated that “easy” is very important for collaborating with partners. Easy information gathering about the product, best practices, example quotes e.g. are also very important for making it easy for a partner to collaborate with an organization and make this collaboration successful.

During the interviews, both the partner managers gave information about what they classify as important information (and type of knowledge/knowledge management) in business partner collaboration. The basis for good knowledge management in the eyes of the partner managers is in the form of training, information retrieval and repetition. In table 5, the knowledge management types of Binney (2001) are shown against the two types of business partner collaboration as indicated by Singh & Mitchell (1996). The table is filled with the types of knowledge and information that the partner managers indicated as being valuable in the collaboration.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Development Oriented			• Component Database • Document Management • Knowledge repositories about product • Release planning	• Best practices • Lessons learned	• Training • Boot camp • Permanent skill development	• Collaboration • Direct contact • Multi-disciplined teams • Developer community
Marketing Oriented			• Release Planning • Future features • Component Database	• Lessons learned • Best Practices • Benchmarking	• Default functionality training	• Collaboration with architects • Direct technical support

Table 5 Knowledge management framework of GX Software according to GX partner managers

Table 5 clearly shows that both of the partner managers found that the most important types of knowledge management in business partner collaboration are Asset Management, Process, Developmental and Innovation and Creation. As Binney found in his framework, these types of knowledge have a more tacit character and higher optionality and modality (see also table 4).

The ease of collaboration (which also includes the ease of information gathering) was indicated by the partner managers as important. According to the former partner manager, the first half of a year needs to demonstrate to the business partner the value of the collaboration in terms of profit and provide the first successful customers, otherwise the collaboration will probably not succeed. From the central organization's point of view, it is important to get the partner to be self-supporting as soon as possible, because in most cases, only then they will be able to contribute to the profit gained by the organization.

The interview with the current partner manager also gave insight into the issue of keeping the skills of the partner's employees up to date. This seems to be creating continuity problems in the services a partner can provide. Training and other knowledge transitions are actively stimulated by GX at the time of the initiation of the partnership. However, maintaining a good level of knowledge over time for the partners seems to be difficult for GX.

The interviews also indicated that the implementation partners of GX Software have a disadvantage as a result of the internal implementation organization of GX. The informal channels which are available for the internal organization do not stimulate the desire for good knowledge management, which is very important for external partners. And besides the management decision to collaborate with business partners, the workforce of GX needs to be willing to collaborate with the partner organization and share important information with the partner in order to adequately support the partnership.

To get the partner to be self-supporting, the partner managers indicate that they need to be provided with the same information as the internal implementation organization of GX Software. And to keep the services of a partner for its customer up to date, knowledge management is important. The partner needs to maintain its level of knowledge about the product, knowledge about future features and they also need support from GX Software while at the same time creating new functionality and/or solving problems. Knowledge management can provide the same information/knowledge to both the internal and the partner implementation organization, facilitate collaboration and provide support.

From the interviews with both the partner managers, information about the motivations and issues of working together with business partners (implementation partners) was gathered. The motivation for a business collaboration should be based on either extending a product range by extending a product or service in the portfolio, the gaining of extra profit, or both. This can be done by earning profit for the product sold or selling extra services (and production hours) to the customers. The motivation for a business partner to start a collaboration with GX Software is mostly based on the business case of being able to earn money by selling services to the customer, for example, creating add-ons and selling support.

The interviews also gave insights into the positive contribution a collaboration can have. These can be in the form of marketing, in which an organization can claim integration with its partner, in the form of a lead machine which creates more scalability and in the form of a money generator in which add-on products and services can be sold.

This information was all distilled from the interviews with the partner managers. The next chapter will continue with the results from the case study interviews.

5.3 Case study interviews

The case study interviews all focused on the relationship between the organization of the respondent and GX Software. This gave insights into the way that the respondents see the relationship between GX Software and their organization as well as their experience with the use of knowledge management and knowledge management tools in this relationship. The information gathered by these script-guided interviews were all registered and, where applicable, also scored on the Likert scales in order to be able to compare them with the results from the online questionnaire. The additional information gathered during the interviews was registered and significant findings or specific reasoning for a specific answer has been interpreted and reported below.

5.3.1 The respondents

Table 6 shows general information about the respondents, such as their place in the organization, age and role in the collaboration between the interviewee's organization and GX Software.

ID	Organization	Role	Age (years)	Experience in collaborating with business partners (years)	Experience in working with knowledge management (and/or system) (years)
1	Incentro	Online Marketer	25-34	2 – 5	2 – 5
2	Incentro	All-round Manager	25-34	5 – 10	5 – 10
3	Incentro	Consultant	25-34	2 – 5	5 – 10
4	Bicco	Senior Developer	35-44	5 – 10	5 – 10
5	BlueConic	Business Architect	35-44	5 – 10	> 10
6	BlueConic	Product Marketer	25-34	2 – 5	2 – 5
7	BlueConic	Product Manager	35-44	5 – 10	>10
8	KPN	Technical Mngt. Appl. Consultant	35-44	5 – 10	>10
9	KPN	Services Manager	45-54	5 – 10	5 – 10

Table 6 Interview respondents

5.3.2 Business partnership types

During the interviews, the question about the type of business partnership the respondent's organization has with GX Software appeared to be a difficult one to answer because of the confusion about the words "marketing-oriented" and "development-oriented". Because both products of GX Software tend to support the marketing of an organization, it required some extra clarification during the interviews in order to explain what was meant by this question.

A total of 3 respondents characterized their business relationship with GX Software as development-oriented. These respondents were all working for an organization which works with the content management product of GX. The motivation for this choice was the extensibility of the product which the implementation partners work with in order to create a suitable solution for their customers.

A total of 5 respondents described their relationship with GX Software as marketing-oriented. These were the respondents of the hosting provider and the representatives of the BlueConic organization. The hosting provider representatives stated that the relationship is marketing-oriented because GX Software has two roles in the relationship. One is the role of supporting their product which the hosting provider is hosting. The other role in the partner relationship with the hosting provider is to funnel customers to the hosting provider. The respondents from the BlueConic organization classified the collaboration with GX Software as marketing-oriented because of the fact that GX representatives resell the BlueConic product. GX Software does not develop any features other than implementing the product and supporting the customer where necessary.

One respondent remarked that the relationship between his organization and GX Software is both marketing- and development-oriented. He stated his organization had a development-oriented relationship with GX Software for the XperienCentral product and a marketing-oriented one for the product BlueConic which they are reselling through GX Software.

A schematic representation of the relationship types indicated by the respondents is shown in Figure 11.

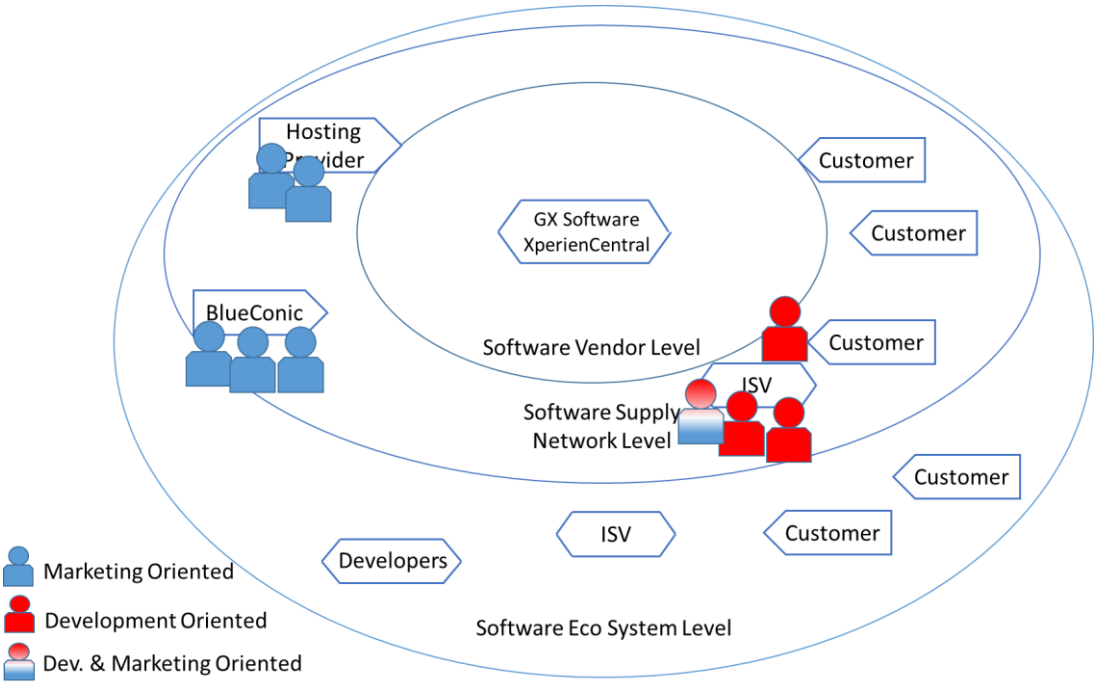

Figure 11 Collaboration orientation interview respondents

After evaluating the type of relationship between the organization of the respondent and GX Software, the first question the respondents answered was whether they experience the collaboration with GX as successful. All respondents answered either agree or strongly agree. Two of the three respondents from the BlueConic organization strongly agreed with the statement. All three of the BlueConic respondents indicated that the relation with GX is still very close and GX Software is at this moment still very important for the continuity of BlueConic.

5.3.3 Knowledge management influence

All the respondents had their own opinion about the influence of knowledge management on the collaboration of their organization's relationship with GX Software. 7 of the 9 respondents think that knowledge management has an influence on the collaboration with its business partner. Four interviewees indicated that they expect the role of knowledge management will become more important when the relationship has transitioned through its first phase of the partnership. This jibes with the statement of the partner manager who claims that knowledge management is very important in sustaining the relationship and less important for building a relationship. In that phase, the potential (financial) benefits of a relationship are the most important.

5.3.4 Partner information sharing

In the questions about partner information sharing, only one question really stood out by its answers. In almost all cases, a positive answer was given to questions regarding proprietary information sharing, sharing information about changing needs and keeping each other informed about events or changes which may affect the other party. However, on the question “In our business partner relationship it is expected that any information which might help the other party will be provided”, all representatives of the implementation partner Incentro answered that this would probably not happen. The explanation they gave for the answers were all related to the relationship GX Software and Incentro have. Since GX Software also performs its own projects and has its own direct customers, information sharing is mostly based on a need to know basis, especially the information that could help the other party, is indicated by the interviewees of Incentro as missing. They indicated that they expect that GX does not provide all the relevant information in order to prevent GX from undermining its own potential.

5.3.5 Knowledge management types

All interviewees were asked which types of knowledge management systems they used in their collaboration with their business partner. Although the answers about the types of knowledge management used varied between the respondents (even within the respondents from the same organization), a pattern became clear which corresponds with the information given by the partner managers. Transactional and Analytical knowledge management systems are clearly used less often in the software ecosystem of GX Software. This is probably caused by the type of software which GX is creating. It is very difficult to add this knowledge about the software in a transactional or analytical system because of the diversity of the usage and functionality within the software used by the customers. Transactional systems were only used by BlueConic in the form of a helpdesk application with step by step answers. For the Analytical type, the CRM system and some data warehousing utilizations used at BlueConic were mentioned. The main answers from all respondents were on the other knowledge management types. Table 7 shows the respondents (by number), the type of collaboration (development- or marketing-oriented) and the system types they mentioned during the interviews which are used in their collaboration with their business partner.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Development Oriented organizations		Interviewee 4	Interviewee 1 Interviewee 2 Interviewee 3 Interviewee 4	Interviewee 2 Interviewee 4	Interviewee 1 Interviewee 2 Interviewee 4	Interviewee 2 Interviewee 3 Interviewee 4
Marketing Oriented	Interviewee 6 Interviewee 7	Interviewee 7	Interviewee 5 Interviewee 6 Interviewee 8	Interviewee 5 Interviewee 6 Interviewee 8 Interviewee 9	Interviewee 5 Interviewee 7 Interviewee 8	Interviewee 5 Interviewee 6 Interviewee 7 Interviewee 8 Interviewee 9

Table 7 Knowledge management framework according to interview respondents

The usage of transactional and analytical systems as shown in Figure 7 is significantly less than the usage of the other knowledge management system types. This finding corresponds with the information given by the partner managers (as shown in table 5). Those interviews indicated that the transactional and analytical systems were less interesting during collaboration. Although in a specific case (by BlueConic), they are used the other types of systems are used much more frequently, as indicated by these interviews. This seems to be the case for both marketing- and development-oriented collaborations.

During the interviews, the respondents were asked to rate the usefulness of the knowledge management systems types for the collaboration with the business partner at hand. Although the usage of the transactional and analytical systems was not very common in the collaborations which have been investigated during the interviews, more interviewees had the opinion that these systems can contribute to the success of the collaboration. One of the respondents had a clear opinion that the value of these systems differed between the two products his organization uses from GX Software. Both his responses have been separately taken into account in Figure 12. This Figure displays the (expected) usefulness of the knowledge management types within the collaboration with GX Software as indicated by the interviewees. In this Figure very useless is ranked as 1 and very useful is ranked as 5.

Figure 12 Expected usefullness of knowledge management types according to interviewees

The figure shows that the respondents from the marketing-oriented collaborations ranked the transactional collaboration types higher than the respondents from the development-oriented collaborations. Also, the respondents from the development-oriented collaborations ranked the usefulness of the asset management and developmental knowledge management types clearly higher than the respondents from the marketing-oriented collaborations. The values of four types (asset management, developmental, Innovation and Creation and Process) are high (between 4 and 5 / useful and very useful). The respondents from the marketing-oriented collaborations ranked only Innovation and creation and Process between useful and very useful.

All respondents were asked to rank their current systems in use within their organization's collaboration with GX Software. For all the types of knowledge management systems, they were asked if they could agree with the statement that business partners have the ability to scan, acquire, assimilate and exploit knowledge found information in the specific system type. The interviewees were only asked to indicate this for the systems which were in use within their collaboration. If they were not sure if this system type was used, it is assumed that they do not use it.

During these interviews it became clear that the variation between whether it was possible to scan or acquire information from a system and to assimilate and exploit the information or knowledge found in the system was very small for the respondents. In most cases they did not indicate a difference between them. Between the ability to scan or acquire information, some respondents clearly indicated that if it is possible to scan for information, you can also acquire it from the systems they use. A total of 75% of the answers on the ability to scan and acquire information from the knowledge management systems of the various types were identical. The questions about the ability to assimilate and exploit the information from the knowledge management types were answered identically in 64% of the responses. The respondents indicated it was very difficult for them to see a difference between the possibilities to use the information found and get benefit from it.

Overall, the interviewees ranked the Innovation and Creation knowledge management type as the most capable of retrieving information from. However, the Asset Management and Transactional systems (when used) were scored high overall on their ability to retrieve knowledge.

Looking at the individual comments and scores the interviewees gave for the systems, there was a clear variability in the usability of the information and the systems. This is probably due to the personal experience of the users with the systems. And since the questions focused on types of systems and not on a specific system, interviewees were referring to various systems within a specific knowledge management type which can also cause a divergence in experiences.

In Figure 13 the average answer of the respondents in a marketing-oriented collaboration are scored. Figure 14 shows the average answers of the representatives of the development-oriented collaborations.

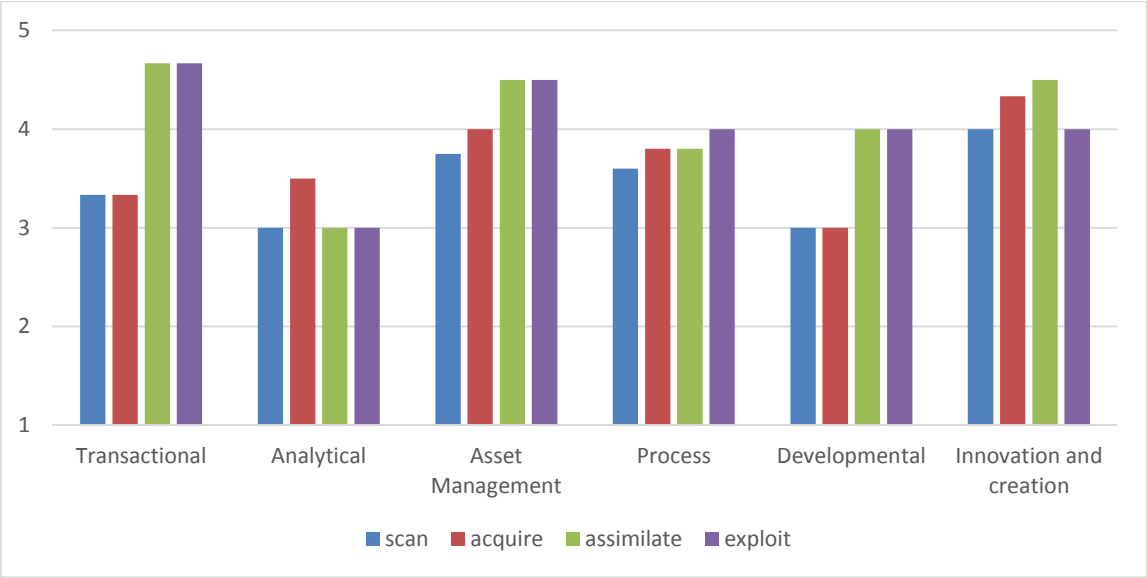

Figure 13 Interview results knowledge management usage marketing oriented

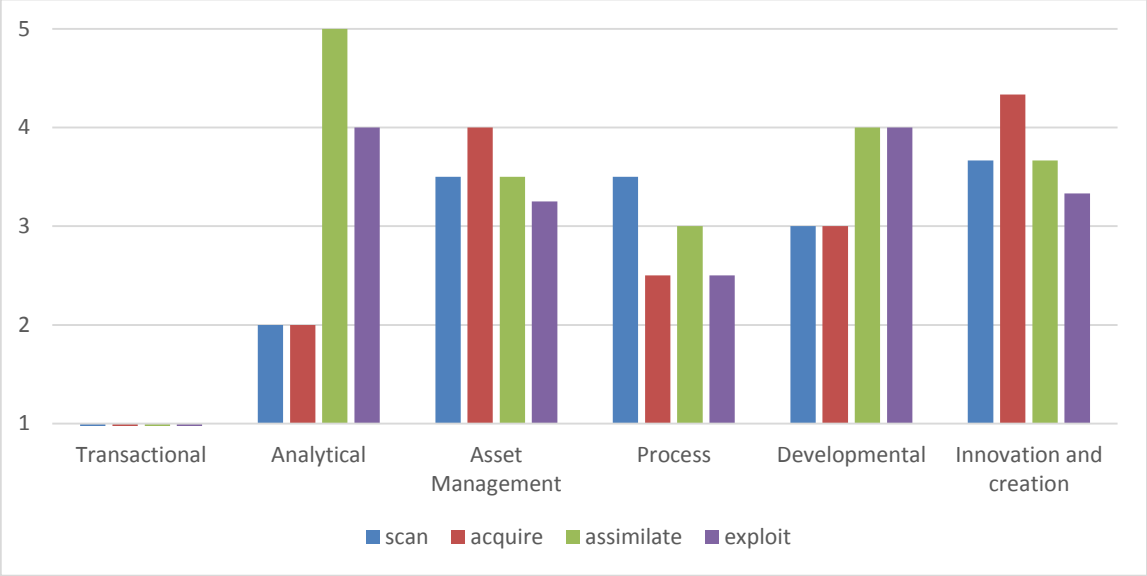

Figure 14 Interview results knowledge management usage development oriented

Due to the small sample size of the interviews, it is very difficult to draw large conclusions from these graphs, but noteworthy is the upward trend in answers in the marketing-oriented interviews and the downward trend in the development-oriented interviews. The upward trend indicates that it is easier for the users to use the information found in the system than it is to find the information in the first place. The downward trend indicates that the information is easier to find than it is to actually use or exploit it.

5.3.6 Collaboration successfulness

In the last section of the interviews, the questions focused on the collaboration successfulness. This was related to the collaboration between GX Software and the organization of the interviewee. The results from these questions were mainly positive. Of the 9 interviewees, only two answered (interviewee 2 and 3) negatively to the questions and one representative (interviewee 4) stayed neutral.

Looking more closely at the interviews, it was clear that mainly in this section the implementation partner of GX software was mostly negative about the collaboration. The

main reasons they gave was the difficult and unclear situation in which GX was positioning itself, by being not only the provider of the software (both XperienCentral and BlueConic) but at the same time also being an implementation partner for customers. This made the motives and incentives for some decisions difficult to understand and they also indicated that this made GX in some circumstances a competitor of its own implementation partner. This was indicated mostly in the questions on sharing risks and benefits (Appendix A: Q21C) and the question on compatible culture (Appendix A: Q21D). On these questions, the answers were at least somewhat disagree or lower for these interviewees. The risks and benefits also triggered some of the implementation partners' representatives to indicate that they felt that the maximum amount of information was not shared in the collaboration. They assumed this to be because of the position GX was trying to gain for itself.

Interviewee 3 motivated his neutral answer by indicating that he noticed that in some cases there was incomprehension regarding the goals and methods used between the business partners.

The representatives of the KPN and BlueConic organization all answered positively to the questions about the collaboration success. The respondents from the BlueConic organization all referred to the history of GX and BlueConic (formerly being one organization) and that the current collaboration is largely based on this history. The cultures of the organizations started from the same point about one year ago, but the expectation was indicated that these will probably evolve differently over time. It was indicated that the organizations understand each other's business processes and objectives but that the main focus for the BlueConic organization has changed from that of GX Software and as a result, they expect that the collaboration might become more difficult in the future because of the increasing separation of the organizations. This was illustrated by the fact that respondents from the BlueConic organization used words like "up until now" when they answered these questions.

This was the information gathered from the data analysis of the case study interviews on the software ecosystem of GX Software. The next chapter will continue with the data analysis results from the online questionnaire.

5.4 Online questionnaire

5.4.1 Generic questionnaire analysis

The results of the online questionnaire were gathered in the period from the 11th of July to the 31st of August 2014. In this period, the survey recorded a total of 75 "unique" visitors of the first answers page of the survey, however few visitors left enough information to be taken into account in this survey. A total of 33 respondents continued at least up to question 13a (Appendix A). This question is the first question which starts to gather information about the relationship between knowledge management and business partner collaboration.

The average time the respondents needed from start to finish for filling in the online questionnaire was 35 minutes. This includes the influence of the possibility to continue the questionnaire at a later point in time. The longest duration was a total of 279 minutes. In order to analyze the real duration for the questionnaire, the answers were compared per question group. When removing all overall times where the duration of filling a single question group in the questionnaire is really out of sync with the other responses (the own responses to the other question groups and when compared to other respondents), and when removing the respondents who were taken into account but did not finish the questionnaire, the average time for filling in the questionnaire was 16 minutes in total. Details about the fill-in durations can be found in Appendix B.

The validity of the questions has been investigated by performing a Cronbach's Alpha analysis on the questions which investigate the same subject. Table 9 below shows the set questions (details on the questions can be found in appendix A) and its alpha.

Test Number	Question set	Cronbach's Alpha
1	Q14A Q14B Q14C Q14D	0.764
2	Q15A Q16A Q17A Q18A Q19A Q20A	0.747
3	Q15B Q16B Q17B Q18B Q19B Q20B	0.743
4	Q15C Q16C Q17C Q18C Q19C Q20C	0.716
5	Q15D Q16D Q17D Q18D Q19D Q20D	0.662
6	Q15E Q16E Q17E Q18E Q19E Q20E	0.591
7	Q15F Q16F Q17F Q18F Q19F Q20F	0.737
8	Q21A Q21B Q21C Q21D Q21E	0.664

Table 8 Question set reliability (1)

This results of the Cronbach's alpha test shows a low result on numbers 5, 6 and 8. The set of questions from question 8 came from the research of Lee (2001) in which a reliability (alpha) of these questions was found of 0.819. This indicates that these questions should be reliable and the sample size may be of influence on the results.

Because of the low scores on test 5 and 6, a Cronbach's Alpha was calculated without including questions Q15A up to Q15F. The results on these new calculations are shown in table 9.

Test Number	Question set	Cronbach's Alpha
1	Q16A Q17A Q18A Q19A Q20A	0.831
2	Q16B Q17B Q18B Q19B Q20B	0.842
3	Q16C Q17C Q18C Q19C Q20C	0.814
4	Q16D Q17D Q18D Q19D Q20D	0.841
5	Q16E Q17E Q18E Q19E Q20E	0.703
6	Q16F Q17F Q18F Q19F Q20F	0.782

Table 9 Question set reliability (2)

Q15 asked the respondent if they use a specific knowledge management type, which is an important question to ask. But the questions did not test the same concept as can be seen from the Cronbach's Alpha values from table 9. The results in this table are much better than the results from table 8. Questions Q16 up to Q20 test the same concept according to these results.

Q21 focused on partner collaboration successfulness. But the Cronbach's alpha on this question is too low to consider the answers to be quantitative results as a collective on this subject and will therefore only be viewed as individual results per (sub) question.

5.4.2 The respondents

The 33 responses which have been classified as useful have been taken into account in the results below. Figure 15 shows the ages of the 33 respondents of the survey.

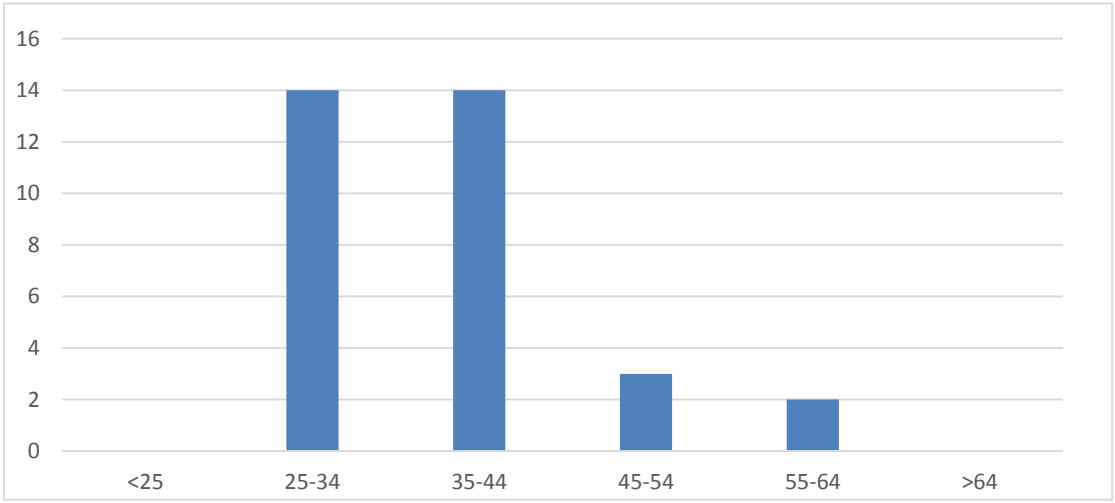

Figure 15 Online questionnaire respondent ages

These numbers show that all respondents were between the ages of 25 and 64. The survey has not been answered by respondents younger than 25 or older than 64.

All 33 respondents also answered the questions regarding their experience with business partnerships, knowledge management and the effects of knowledge management on business partnerships. The answers to these questions given by the respondents are shown in Figure 16.

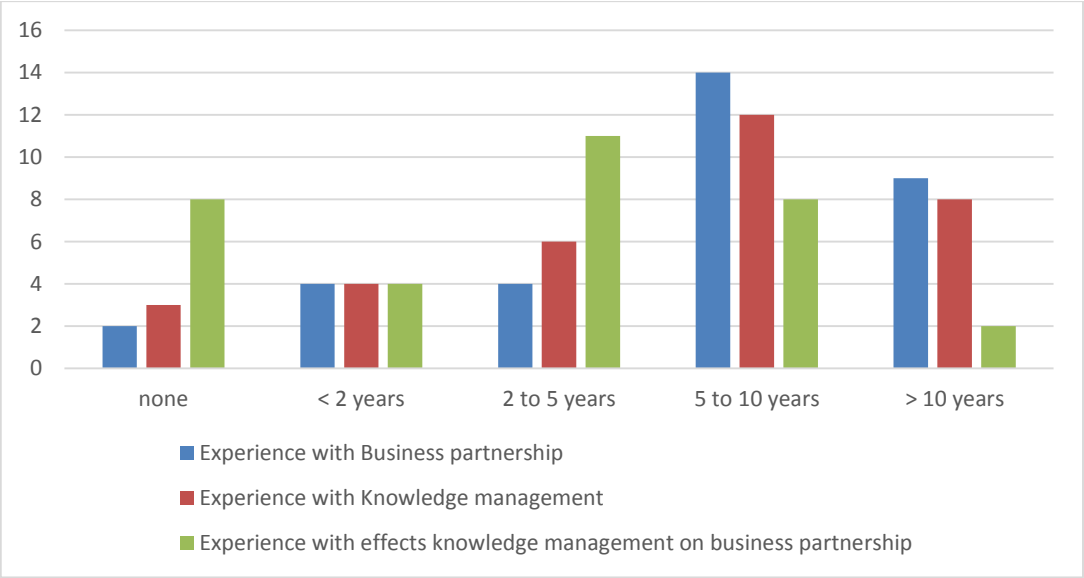

Figure 16 Online questionnaire respondent experience

This clearly shows that the experience of business partnership is highest with the respondents and the experience with knowledge management is slightly less but nevertheless a lot. The experience on the effects of knowledge management regarding the business collaboration was much less. 8 of the respondents even indicated no experience at all with this influence. Nevertheless, the average experience with knowledge management and business partnerships is still higher than 2 years.

The spread of the respondents is low. Although several methods were used to contact respondents outside the organization of GX software, a total of 20 respondents were from the GX organization itself. Only two respondents were from outside the Netherlands. From the results it is clear that a total of 9 respondents responded from outside the software ecosystem of GX Software. This includes one respondent from the USA and one respondent from Iran.

5.4.3 Business partnership types

As described above, a large number of respondents came from GX software. This was probably one of the reasons why a total of more than 80% (27 out of 33) of the respondents came from an organization which was the central organization of a software ecosystem. The responses were evenly distributed between marketing-oriented and development-oriented organizations. These terms were explained with definitions on the page in order to clarify the definitions for the respondents. Of the 33 responses, there were only two (one from the software vendor level and one outside the software vendor level) who answered “other” on the questions of business partnership type. A total of three respondents classified their relationship with their business partner as both marketing- and development-oriented. These answers correspond with the findings from earlier studies on the types of business collaboration (Hagedoorn, 1993; Singh & Mitchell, 1996). From the answers of the respondents, it was not possible to determine with any level of certainty whether the respondents were located within the Software Supply Network Level or on the Software Ecosystem Level. A visual representation of the respondents in relation to a software ecosystem are shown in Figure 17.

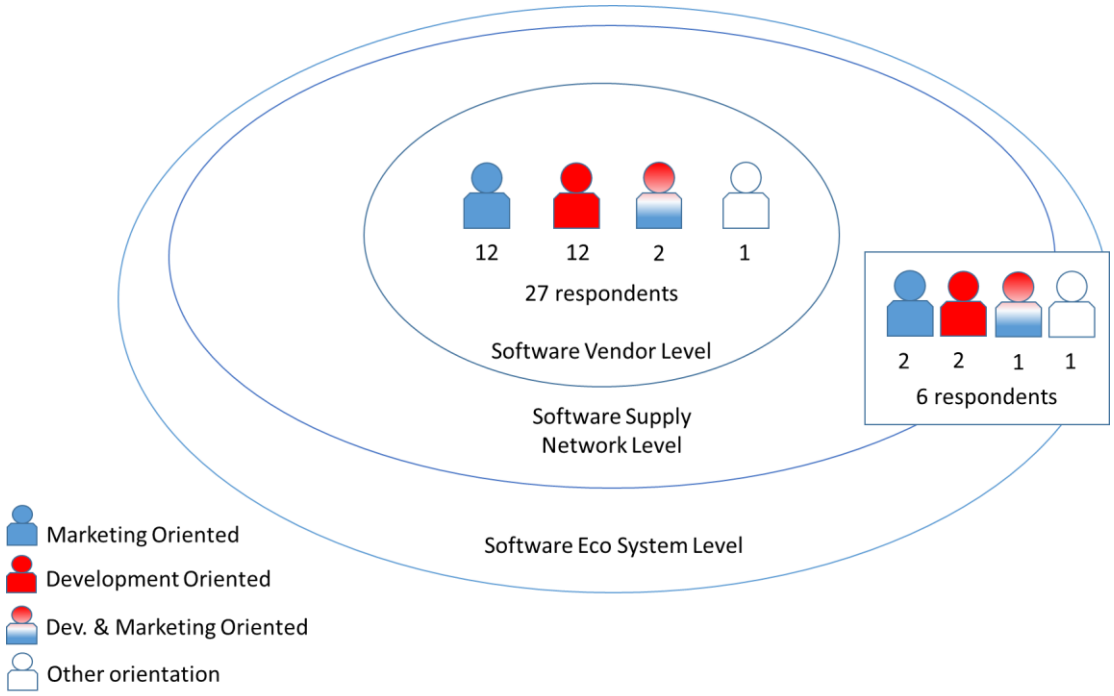

Figure 17 Software ecosystem respondent positions

The respondents all answered the question about the successfulness of their business partnership which they were reviewing in the questionnaire. Figure 18 shows the type of business collaboration against the experienced successfulness of the collaboration in the number of respondents. The respondents who answered that they have both a marketing- and a developmental-oriented collaboration have been taken into account in both the marketing and developmental figures. The respondents from other oriented collaborations are not shown in the Figure.

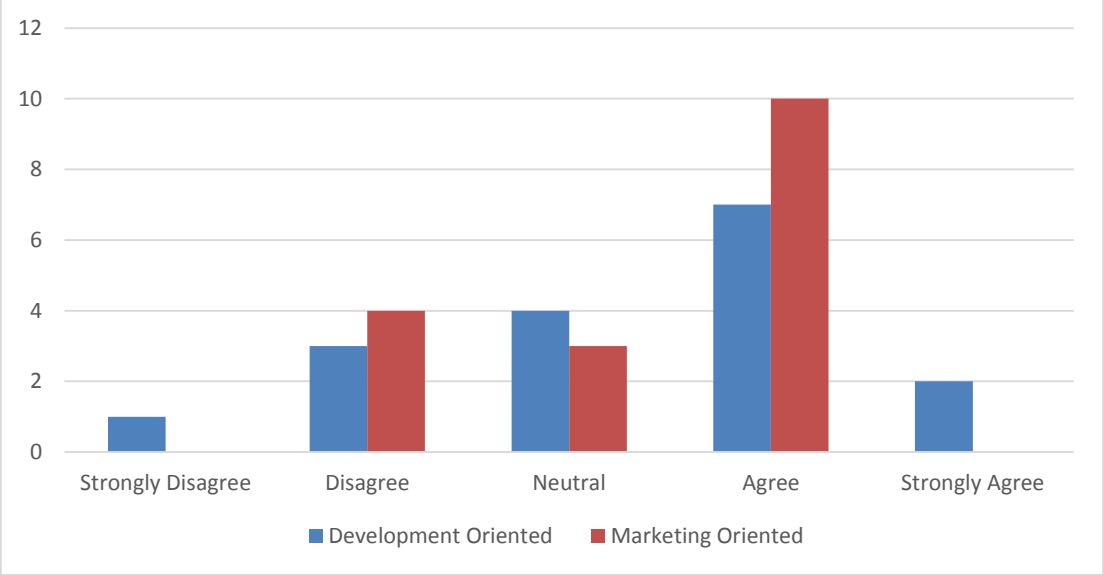

Figure 18 Experienced collaboration successfulness

As shown in Figure 18, the development-oriented respondents and the marketing-oriented respondents both mostly agree with the statement that they experience their collaboration as successful, which made the standard deviation for developmental higher, however, the responses are still very similar between the development-oriented and marketing-oriented collaborations. It can be expected from these results that the minor difference in the

experienced successfulness of the collaboration does not strongly influence the other results. These answers will therefore not be taken into account when analyzing the other responses.

5.4.4 Knowledge management influences

For the question “In my opinion knowledge management has an influence on the success of collaboration”, the responses had a larger variation. Where with the previous question the respondents from a development-oriented collaboration were more explicit (they were the only respondents answering questions with strongly agree and strongly disagree), on this question they were only positive or neutral. The respondents from the marketing-oriented collaborations were more negative regarding the influence of knowledge management on collaboration. Figure 19 shows the answers from all the respondents on this question. Because of the low number of respondents, it is not clear whether this is a coincidence or a pattern, however this response shows a clear difference between the respondents from development-oriented and marketing-oriented collaborations.

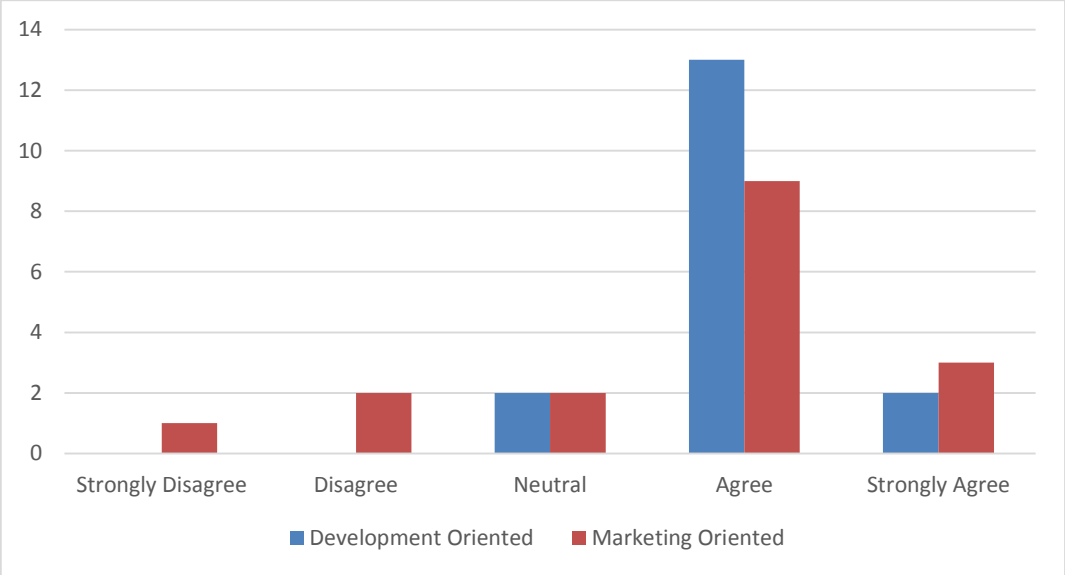

Figure 19 Expected knowledge management influence on collaboration

5.4.5 Partner information sharing

For the set of questions about partner information sharing, the differences in responses between respondents from marketing-oriented and development-oriented collaborations were small. There was a variance in answers, but the trends of the answers were the same. The only question where the respondent clearly answered differently was with regard to the question: “The business partners are expected to keep each other informed about events or changes that may affect the other party”. On this question, the marketing-oriented respondents were more positive, answering more likely and less unlikely than the respondents from development-oriented collaborations. The answers (in numbers) are shown in Figure 20 below. (This question was answered by 16 respondents from development-oriented collaborations and 17 respondents from marketing-oriented collaborations).

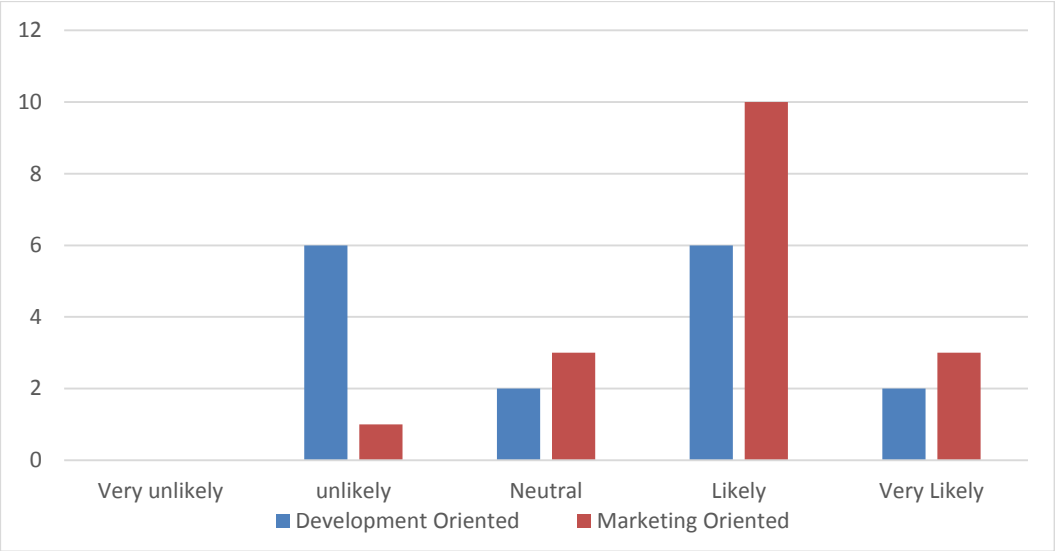

Figure 20 Responses to question about information expectation within partnership

5.4.6 Knowledge management types

In the questionnaire, the respondents were asked to indicate which type of knowledge management system (Binney, 2001) they use within their collaboration. For the development-oriented collaborations a total of 16 respondents answered this question. Figure 21 shows the 16 answers from the respondents in a development-oriented collaboration.

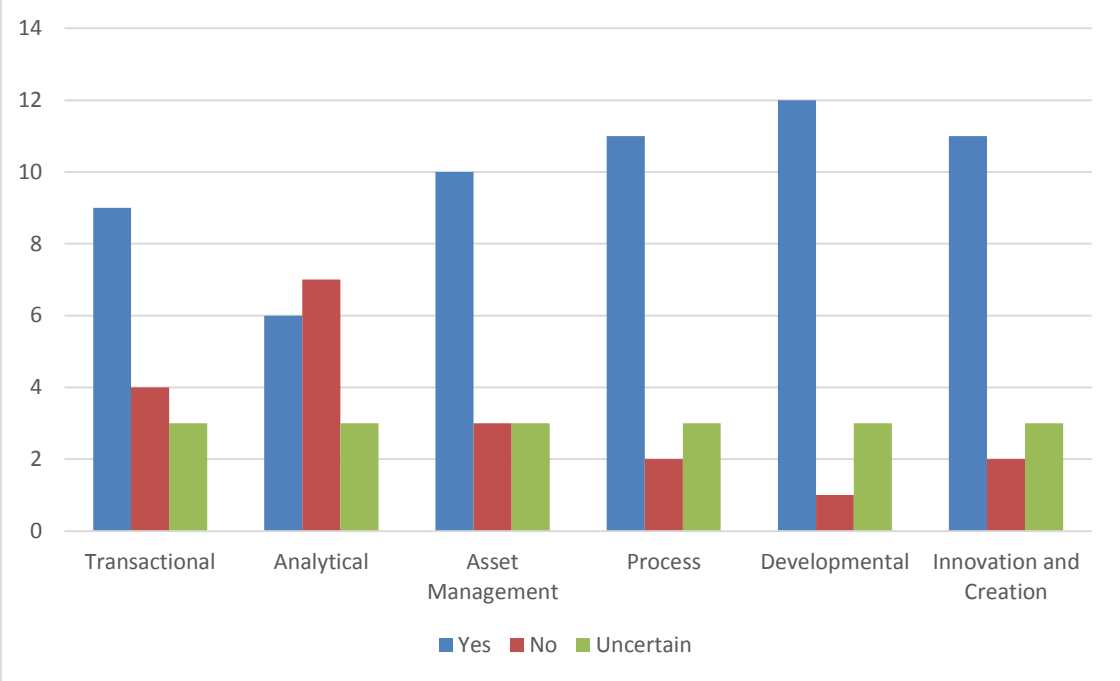

Figure 21 Development oriented knowledge management type usage

According to the responses, the least used knowledge management type in a development-oriented collaboration is the analytical knowledge management type/system. The most used knowledge management type in the development-oriented collaborations is the developmental knowledge management type.

Figure 22 shows the 17 answers from the respondents in a marketing-oriented collaboration for the question about the usage of knowledge management types within their collaboration.

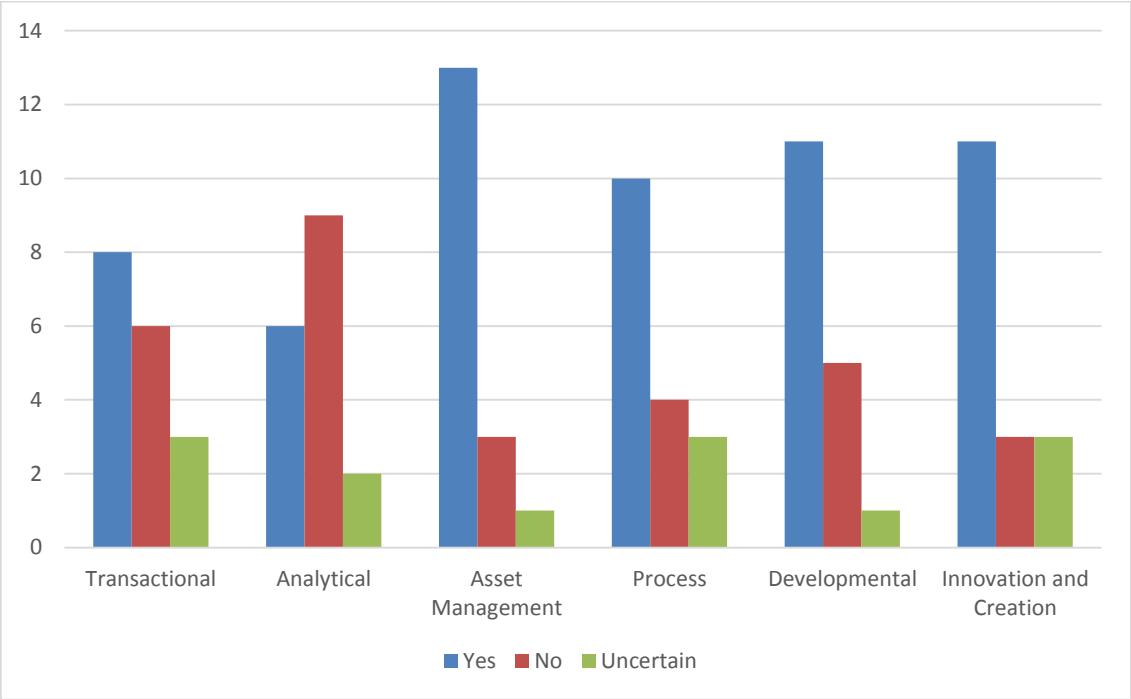

Figure 22 Marketing oriented knowledge management type usage

As for development-oriented collaborations, according to the responses, the analytical knowledge management type is the least used in a marketing oriented collaboration. For the marketing-oriented collaborations in this research, the asset management knowledge management type/systems is most frequently used.

The respondents also answered the question about the (expected) usefulness of the knowledge management system types. They scored the answers from very useless (1) to very useful (5). These answers resulted in Figure 23, which shows the average usefulness of the knowledge management types within business collaboration, separated by business collaboration type.

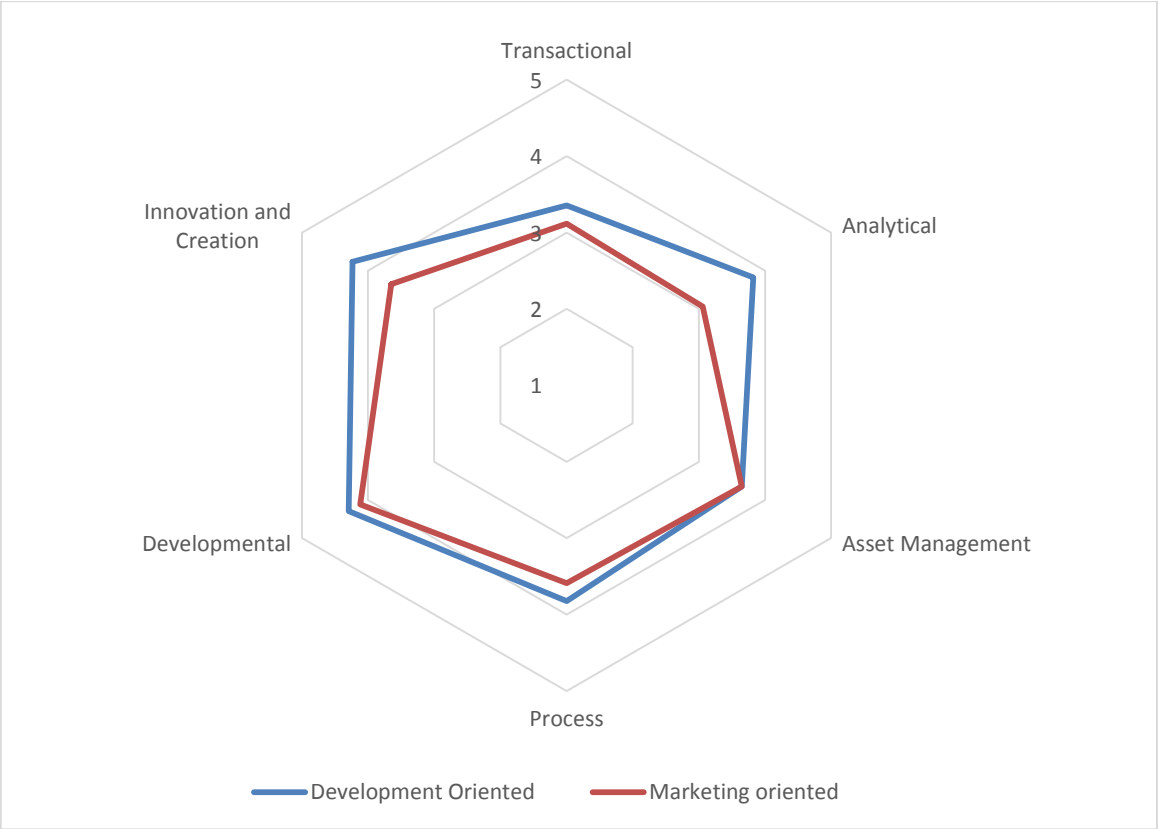

Figure 23 Expected usefulness of knowledge management types according to respondents

It shows that both development- and marketing-oriented collaborations find transactional the least valuable, but it also shows that the analytical type is seen as much more important by development-oriented in this research than by the marketing-oriented. This is interesting because this is the least used knowledge management type for the development-oriented respondents of this research. Innovation and creation are also seen as very valuable for the development-oriented collaborations. This corresponds with the high usage of this knowledge management type.

Figure 24 shows the average result of the questions about the ability to scan, acquire, assimilate and exploit the information from the specific systems used in the collaboration of the respondents. This takes into account all the respondents from development-oriented collaborations who answered the questions. There were 15 respondents for the question about the ability to scan for specific information and 14 respondents for the questions about acquiring, assimilating and exploiting. The scores range from strongly disagree (1) to strongly agree (5).

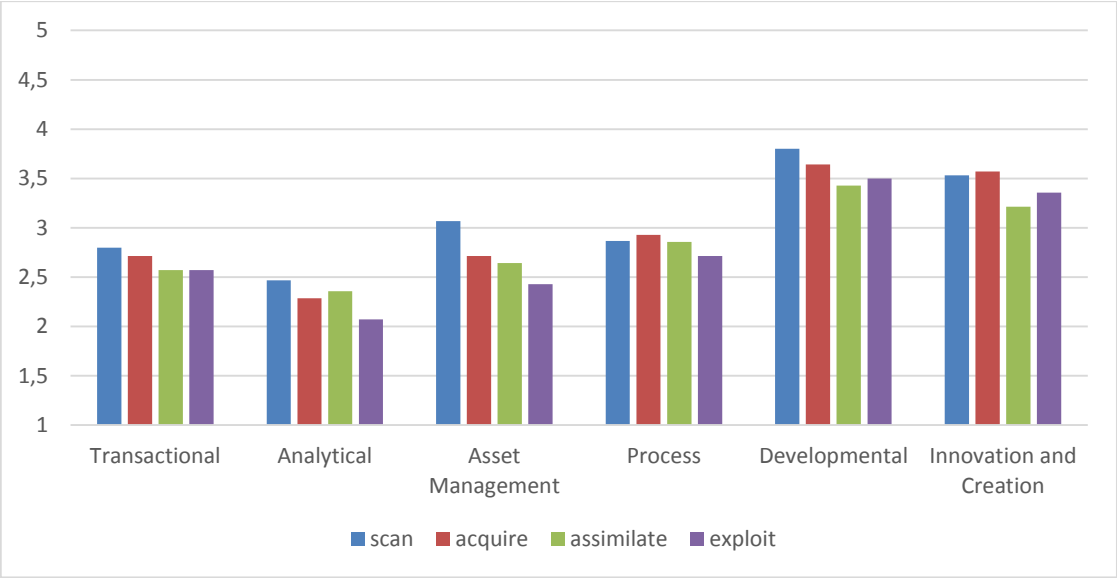

Figure 24 Questionnaire results knowledge management usage development oriented

The figure shows a downward trend for almost all types of knowledge management. This might indicate that, although scanning for information is possible, that does not mean it is possible to acquire knowledge from the system or even to assimilate the knowledge or eventually exploit it. Looking at the scores in general, only developmental and innovation and creation have a score higher than three, meaning that the respondents are at least starting to agree with the statements. These two types of systems were specifically indicated to focus on human capital as described in table 4 (Binney, 2001). Development-oriented collaborations in this study seem to derive more benefits from the knowledge management systems which focus more on human capital than the ones which focus on structural capital.

Figure 25 shows the answers to the same questions as answered by the respondents from marketing oriented-collaborations. In general, these answers show the same downward trends from scanning to acquiring, assimilating and exploiting the information than that found in the specific knowledge management systems. The developmental type of knowledge management is the exception in this set of answers. And although the differences between the knowledge management types for marketing-oriented collaborations seems less explicit than for developmental collaborations, the knowledge management system types which have an overall positive score (>3) are developmental, innovation and creation and asset management.

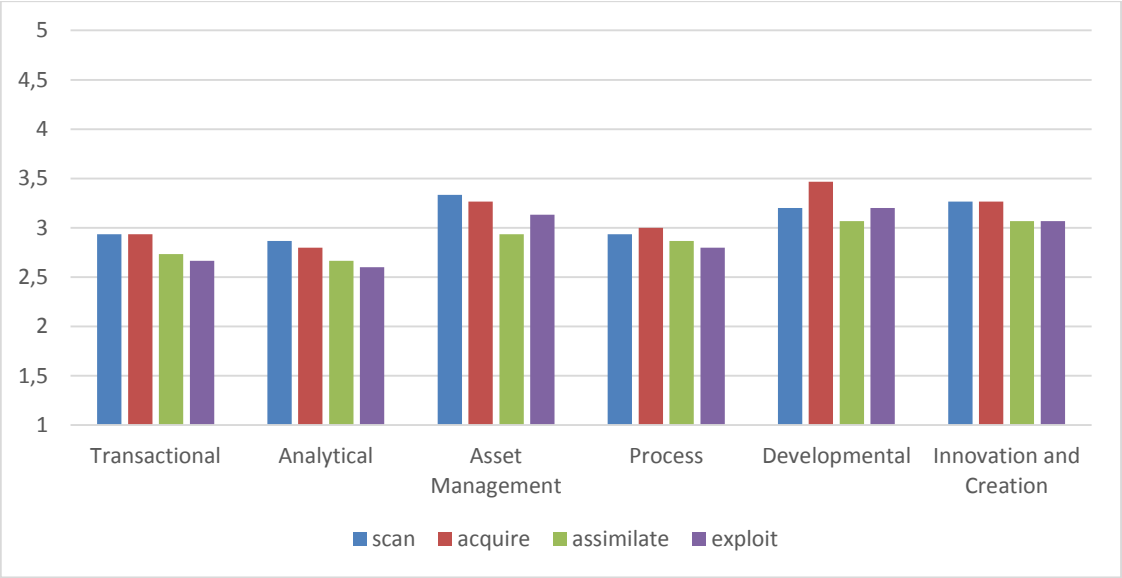

Figure 25 Questionnaire results knowledge management usage marketing oriented

When comparing the differences between the responses from marketing-oriented and development-oriented collaborations, the analytical, asset management and transactional knowledge management type scores higher for the marketing-oriented collaborations. The process type scores are nearly identical (in height and shape) for both the collaboration types.

5.4.7 Collaboration successfulness

The questions about collaboration successfulness were also answered by both the development-oriented and marketing-oriented respondents. A total of 14 answers from development-oriented respondents and a total of 15 from marketing-oriented respondents were valid. The possible answers were strongly disagree (1), somewhat disagree (2), neutral (3), somewhat agree (4) and strongly agree (5). The spread of the answers was very moderate. From the total of 145 answers from the 29 respondents to the 5 questions, only 4 answers were strongly disagree and 9 were strongly agree. 8 out of these 9 “strongly agree” answers were on the question “We and our business partner understand each other’s business objectives and process”. This also makes the answers to this question stand out from the answers to the other questions because in both collaboration types, the average answer to the question about understanding business objectives was approximately 3.5. Benefits and risk sharing was answered (almost) in the same way by both groups of respondents, which indicates that, on average, the organizations and their partners have a slightly positive attitude about benefits and risk sharing in both development- and marketing-oriented collaborations.

The question about making beneficial decisions was answered slightly negatively by the respondents from development-oriented collaborations and slightly positively by the respondents from marketing-oriented collaborations.

Both the question about performance of predefined agreements and the compatible culture and policies were answered positively by the respondents from development-oriented collaborations and negatively by the respondents from marketing-oriented collaborations. Figure 26 shows the average results from the respondents of development- and marketing-oriented collaborations.

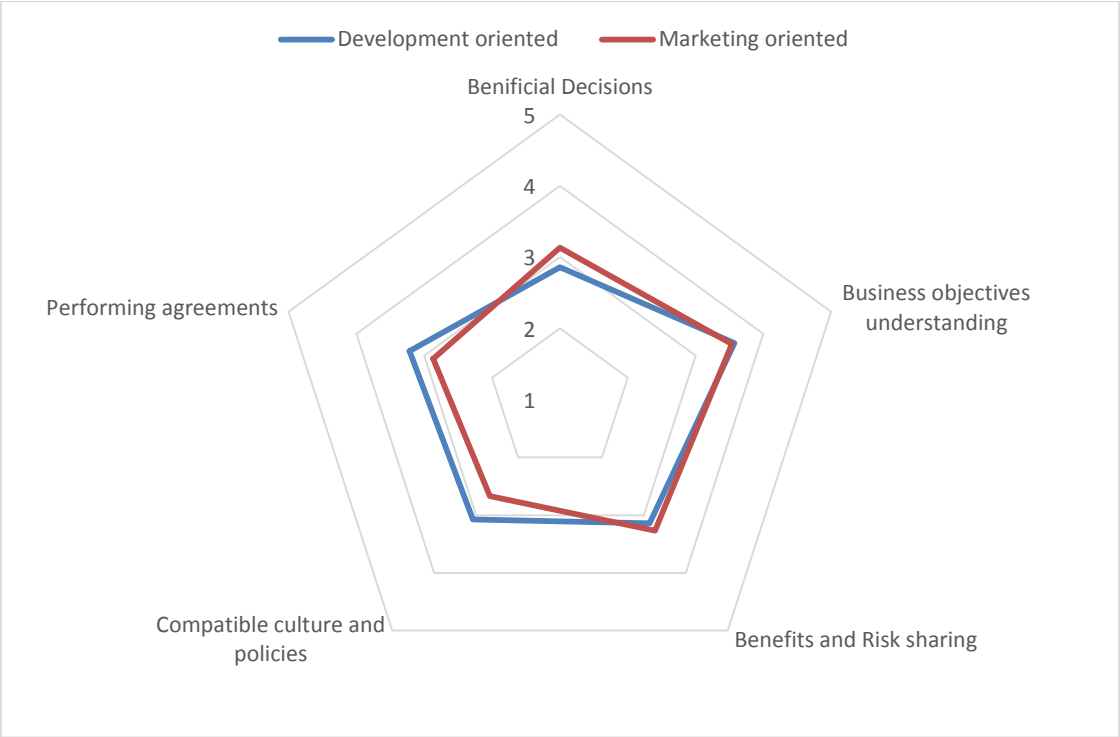

Figure 26 Questionnaire results collaboration successfulness

In the following chapter, the results gathered from the online questionnaire and the interviews will be compared in order to draw conclusions about knowledge management type in relation to business partner collaboration in a software ecosystem.

6 Findings and discussion

In this chapter, the results from the qualitative and quantitative research will be evaluated and combined in order to clarify the results of this research.

6.1 Respondents and business partnership types

While the aim of this research was to gather respondents from inside as well as outside the software ecosystem of GX Software, a large number of respondents was linked to this software ecosystem. This has an influence on the generalizability of this research. Generalizability can only be realized by deductive research and this research realizes the first deductive step. Further research needs to be conducted to increase the deductive results.

The interviews were held with representatives from various relationships of GX software from varying locations within its ecosystem. This revealed both the weaknesses and strengths of GX's ecosystem. The representatives which were interviewed also represented the two researched types of partner relationships (development-oriented and marketing-oriented), which makes it possible to compare the results with the responses from the quantitative research conducted. The interviews did not cover every layer or type of relation within the software ecosystem of GX Software, which also decreases the generalizability.

The responses to the online questionnaire, which was the research tool used for the quantitative part of this research, came from representatives who were evenly distributed between both marketing- and development-oriented partner collaborations. Although the number of valid responses is minimal, the even distribution of these collaboration types within the responses support the validity of the findings. The number of respondents whose answers could not be used (because they did not reach question 14) was a total of 56% of all respondents. This might be due to the English language, which made it difficult for the Dutch respondents, in combination with the technical definitions which the respondents needed to read and understand before being able to answer the questions. For future research, this should be taken into account when creating questionnaires.

6.2 Knowledge management influence

Most of the respondents of both the interviews (78%) and the online questionnaire (79%) agreed on the statement that knowledge management influences the business partner collaboration. This was also found to be the case in the expert interviews. This makes it plausible to conclude that knowledge management indeed has an influence on business partner collaboration, since such a majority of respondents indicate that it does.

6.3 Partner information sharing

The results of the interviews showed that a specific group of respondents from the implementation partner Incentro expected that the information which would help the partner would not be provided. This specific expectation was not found in the figures generated from the responses to the online questionnaire. There was an explicit difference in answers between respondents from marketing- and development-oriented collaborations, notable in the way that they expect to be kept up to date about events or changes which may affect the partner. The respondents from the marketing-oriented collaborations were much more convinced about this statement. The different relationship seems to be an influence on this factor. In a software ecosystem, it seems to be more expected and

important for the software vendors to inform its partners about events when the relationship is marketing-oriented.

6.4 Knowledge management types

The interviews with the partner managers indicated that in the development-oriented collaborations, the use of transactional and analytical knowledge management is less valuable than in marketing-oriented collaborations. This was supported by the findings from the qualitative interviews within the software ecosystem of GX Software. The responses to the online questionnaire about the ability to scan, acquire, assimilate and exploit knowledge from the knowledge management types also indicated that knowledge management systems of the developmental and innovation and creation type have more success in developmental collaborations. For the marketing-oriented collaborations, there were only minor differences in the results between the knowledge management types. This might indicate that in a marketing-oriented collaboration, all knowledge management types perform (almost) equally. This is supported by the interview results where all knowledge management types were used in the marketing-oriented collaborations.

6.5 Collaboration successfulness

During the interviews, the interviewees from Incentro indicated that information sharing between their organization and GX Software was based on a need to know basis. The information which might help the partner was not provided by default. The problem here lies with the potential of GX Software as a project organization. In that role, GX implements their own products for customers which, in that case, makes GX Software and Incentro competitors instead of partners. GX Software does not (always) provide the information required by Incentro because of this double relationship (business partners and competitors).

The collaboration with BlueConic was a special one as well, because employees of GX and BlueConic are former colleagues. This makes the comparison of collaboration successfulness between the interview data and the online questionnaire data irrelevant. The specific relationships for the interview respondents are too typical for the GX Software's ecosystem.

The collaboration successfulness results from the online questionnaires have a low Cronbach's alpha, which makes these answers less reliable. And although the answering of the questions was not very explicit, a few patterns were found in the successfulness of collaboration. The marketing-oriented collaborations made more beneficial decisions for the partner, while the development-oriented collaborations indicated a higher culture compatibility and performed better in the specified agreements.

6.6 Combining the results

Although it is not possible in this research to directly link the collaboration successfulness to the results, indications were found regarding the usage and successfulness of the knowledge management types within the two different types of business partner collaborations. The results are indicated in table 10 which shows the usefulness of the specific knowledge management type in a specific type of collaboration, as found in this research. The limitations of the usefulness of this framework are the same as the limitations of this research because of the small sample and large focus on a specific software ecosystem.

	Development Oriented					Marketing Oriented				
	PI	CSU	CSE	QU	QE	PI	CSU	CSE	QU	QE
Transactional	N	N	N	Y	N	N	Y	Y	Y	N
Analytical	N	Y	y	Y	N	N	Y	Y	Y	N
Asset Management	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Process	Y	Y	N	Y	N	Y	Y	Y	Y	N
Developmental	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Innovation & Creation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 10 Compared responses knowledge management and collaboration type

In table 10, the results of the partner interviews, the case study interviews and the questionnaire results are combined. The table represents the results from the partner interviews (PI) for the specified knowledge management type. When the partners indicated this type of knowledge management to be useful, it is indicated with a 'Y', otherwise an 'N'. The results from the case study interviews for the expected usefulness of the knowledge management types (CSU) and for the experienced usefulness (CSE) in the form of the ability to retrieve the appropriate knowledge from the system are also displayed. When the overall score was higher than 3, this is represented with a 'Y', otherwise with an 'N'. This same criteria is used to score the expected usefulness of the knowledge management systems from the questionnaires (QU) and the experienced usefulness (QE) in the form of the ability to retrieve the appropriate knowledge from the system.

These results from table 10 have been combined in table 11 in which the individual scores have been removed from the table. The combined and accumulated scores are represented in a color. The more green the color, the more positive the responses were. The more red a color is, the less positive the answers were. The number represents the total number of 'Y''s for that relation as described in table 10.

	Development Oriented	Marketing Oriented
Transactional	1	3
Analytical	3	3
Asset Management	4	5
Process	3	4
Developmental	5	5
Innovation & Creation	5	5

Table 11 Expected usefulness knowledge management type and collaboration type

Table 11 indicates that the Developmental and Innovation and Creation knowledge management types of business collaboration were expected to be the most useful. The results also indicate that the asset management knowledge management type is useful in both types of collaboration. Noteworthy is the transactional knowledge management type, which was within the context of a development-oriented collaboration only expected to be useful by the respondents of the questionnaire. All other results were negative. This indicates that the transactional knowledge management type is expected to be the least useful within a development-oriented partner collaboration. Within the marketing-oriented collaborations, the results for the transactional knowledge management type were diverse, being both positive and negative. This was similar for the results from both the analytical and process knowledge management types in both types of collaboration.

For table 11, the most important conclusion which can be drawn from the performed research is visualized. The conclusion and the limitations of this research with recommendations for future research will be discussed in the next chapter.

7 Conclusion and recommendations

7.1 Conclusion

7.1.1 The research

The goal of the research was to find the relationship between the knowledge management types and the business partner collaboration types. This could make it possible to find a selection method for organizations in order to help them choose the appropriate knowledge management type for their business partner collaboration. The following research question was thought up as a basis for this research:

What is the influence of knowledge management types on the relationship between business partner type and collaboration success in a software ecosystem environment?

The main question was divided into sub questions which helped to answer the main question. The following sub questions have been answered by literature research as described in chapter 2.

What types of business partners are there?
What is a software ecosystem environment?
What is the software ecosystem seen from a software vendor?
What types of business partners are specific for software ecosystems?
What types of knowledge management are used in business partner collaboration?
What are the criteria for collaboration success?
What are the difficulties in collaborating with business partners?
In what ways can the partner collaboration be influenced?

To find an answer to the main question, a framework was created showing the relationship between business partner type, knowledge management type and collaboration success, as shown in Figure 6. This was created and tested by performing explorative interviews with the former and current partner manager of GX Software and by executing script-guided interviews within the software ecosystem of GX. This illustrated information about the software ecosystem of GX Software, its role within the partnerships and the knowledge management types and systems used within these relations.

In order to validate these results, an online questionnaire was created which resulted in 33 valid answers from representatives of various software ecosystems. The results from this research have been described in this document and are summarized in the next chapter.

7.1.2 The results

The results varied between the interviews and the online questionnaires, but one main line has been discovered within the results. The results from this study show a pattern in which the marketing-oriented collaborations are less selective about which knowledge management type is successful for their collaboration than the development-oriented collaborations. In this type of collaboration, the best fitting knowledge management types seem to be the more tacit and human capital-focused knowledge management types from the framework of Binney (2001). Table 12 below shows the conclusion to the question of which knowledge management type seems to fit the best to the business partner collaboration type.

	Development Oriented	Marketing Oriented
Transactional		
Analytical		
Asset Management		
Process		
Developmental		
Innovation & Creation		

Table 12 Knowledge management type successfulness for collaboration type

In this study the greenest colored types were found to be the most successful and the red colored were found to be the least successful.

In this research, no real relation with collaboration successfulness could be investigated. In the interviews, all respondents were positive except for the interviewees from one organization. They all indicated that the problems with the collaboration's successfulness were caused by a mixed relationship between their organization and GX in the form of business partners when implementing GX's products, and as competitors when trying to win a new customer. In the online questionnaire, the Cronbach's alpha of the collaboration successfulness questions was low, which made investigating the set of questions in order to determine the successfulness of the collaboration in relation to other factors not valid. The answers to the collaboration questions were separately investigated. They showed that a compatible culture and conforming to agreements was better for development-oriented collaborations and making beneficial decisions scored better in marketing-oriented collaborations.

The next section will continue with the limitations of this research and the recommendations for future research.

7.2 Limitations & recommendations

The research performed was limited in both time and resources. This impacted the scope and the generalizability of the results found by this research. Below are the most important limitations found by the researcher and the recommendations for further research on this topic.

The most important limitations of this research are the number of respondents and their origin. A large number of the respondents to the online questionnaire were directly linked to GX Software. This is the same organization which was used for the case study. Only 18% of the respondents of the online questionnaire were not in a central organization of a software ecosystem. Alas, all of this reduces the generalizability of the results. To further investigate

this topic, more research should be performed with representatives from other software ecosystems and their partner organizations.

None of the interviewees who were involved in this research's case study were less than satisfied with their relationship with GX Software. To address the complete spectrum of business partners, future research should take partners and former partners into account in order to cover all possible opinions on the collaboration between the central software ecosystem organization and its partners.

Future research should be conducted in order to investigate whether the found relationships between specific knowledge management types and collaboration types as shown in Table 12 can be validated in other software ecosystems, or even in other contexts.

Indications were gathered from both the partner interviews and the case study interviews which point to the fact that knowledge management systems are more important in maintaining a business partnership and less important in setting up a business partner relationship. By conducting future research on this topic, this hypothesis can be either confirmed or denied.

8 Reflection

During the process of performing this thesis research, I learned a lot about knowledge management, business collaboration and the way my organization collaborates with its partners. At the same time, I also learned things about myself.

The process of planning and executing this thesis process has been a real struggle for me. At the start of the process, the deadlines were already very clear, but they were too far away to pressure me into me into making things happen sooner. The structured lessons and deadlines during the first one and a half years of the master study gave me a lot of guidance for my planning and it made it possible for me to finish all the tasks within the set deadline. During the thesis process, I realized that I need pressure and tight deadlines to push me into the next phase and to inform me about how much effort to put into it in order to finish things off. Besides missing the deadlines, my work and my wish to spend more time with my family made this process take longer than originally planned.

During this period I also realized that I am a person who prefers to work with others in order to test my theories and brainstorm in order to be able to form an idea while discussing a topic. I missed this a lot during this thesis process and was very happy and pleased every time my supervisor made time for me to discuss the progress which always gave me the little push I needed to continue working on the research.

Conclusion: It was worth the effort, but not really my cup of tea.

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APPENDIX A

Questionnaire

General

[Q1] Which country are you from:

[Q2] Which organization do you work for?

[Q3] What is your current position?

[Q4] What is your age:
[ ] 24 years and younger
[ ] 25-34 years old
[ ] 35-44 years old
[ ] 45-54 years old
[ ] 55-64 years old
[ ] 65 years or older

[Q5] How many years of experience do you have in collaborating with business partners?
[ ] None
[ ] < 2 years
[ ] 2 to 5 years
[ ] 5 to 10 years
[ ] > 10 years

[Q6] How many years of experience do you have in working with knowledge management and/or knowledge management tools?
[ ] None
[ ] < 2 years
[ ] 2 to 5 years
[ ] 5 to 10 years
[ ] > 10 years

[Q7] How many years have you experienced the effect that knowledge management (and/or knowledge management systems) have on the collaboration success with business partners?
[ ] None
[ ] < 2 years
[ ] 2 to 5 years
[ ] 5 to 10 years
[ ] > 10 years

[Q8] In the last two years what was your main role in the collaboration with business partners?

Software Ecosystem

Multiple definitions of a software ecosystem exist.

“A software ecosystem is an informal network of (legally independent) units that have a positive influence on the economic success of a software product and benefit from it"(Kittlaus & Clough, 2009)

“We define a software ecosystem (SECO) as a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts. Some examples of SECOs are the MySQL/PHP SECO, the Microsoft SECO, and the iPhone SECO. These examples can be used to establish typical characteristics of SECOs; SECOs can be contained in other SECOs, such as the Microsoft CRM SECO that is contained in the complete Microsoft SECO. Also, one might refer to the iPhone SECO with its AppStore as a closed SECO, whereas the MySQL/PHP SECO is open, since organizations have access to its source code and related knowledge bases.” (Jansen et al., 2009)

[Q09] Is your organization the central organization of a software ecosystem?
[ ] Yes
[ ] No

If [Q9] = Yes

[Q09a] Please name this software ecosystem.

[Q10a] Please select one partner relation from the software ecosystem of your organization which will be assessed in the following questions

[Q11a] Please describe the role of the specified partner in the software ecosystem

If [Q9] = No

[Q09b] Please name a Software Ecosystem your organization is part of.

[Q10b] Which organization is the central organization of the software ecosystem?

[Q11b] Please describe your organization's role in the software ecosystem

Business Partner type

Literature determines two very distinctive types of collaboration between businesses. These are development-oriented and marketing-oriented.

Development-oriented collaboration is defined below:

> Joint R&D; joint development of product interfaces or product compatibility; in-licensing of products or components from another business (Singh & Mitchell, 1996)

Marketing-oriented collaboration is defined as below:

> Joint marketing or distribution; marketing or distribution by one business of partners' products; software business resells systems for hardware business (may include information and resource sharing)(Singh & Mitchell, 1996)

[Q12] Please select the one description which fits your business partner relation the most:

[ ] Development oriented
[ ] Marketing oriented
[ ] Other

[Q13] Please specify to what degree you agree with the following statements

a. I experience the collaboration with the business partner as successful

[ ] Strongly disagree
[ ] Disagree
[ ] Neutral
[ ] Agree
[ ] Strongly agree

b. In my opinion knowledge management has an influence on the success of the collaboration

[ ] Strongly disagree
[ ] Disagree
[ ] Neutral
[ ] Agree
[ ] Strongly agree

Partner information sharing (Mohr & Spekman, 1994)
Partner information sharing is described by Mohr & Spekman (1994) is one of the key components which defines the communication behavior between partners.

[Q14] Please read the following statements and define the likelihood of these statements. All statements are referring to the relationship between SECO and Partner

a. We share proprietary information with our business partner
[ ] Very unlikely
[ ] Unlikely
[ ] Neutral
[ ] Likely
[ ] Very Likely

b. We inform our business partner in advance of changing needs
[ ] Very unlikely
[ ] Unlikely
[ ] Neutral
[ ] Likely
[ ] Very Likely

c. In our business partner relationship it is expected that any information which might help the other party will be provided
[ ] Very unlikely
[ ] Unlikely
[ ] Neutral
[ ] Likely
[ ] Very Likely

d. The business partners are expected to keep each other informed about events or changes that may affect the other party
[ ] Very unlikely
[ ] Unlikely
[ ] Neutral
[ ] Likely
[ ] Very Likely

Knowledge Management Type

Below are the six knowledge management types (Transactional, Analytical, Asset Management, Process, Developmental and Innovation and Creation) show in the knowledge management framework. It also indicates which types of knowledge management applications fit the specific types.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Knowledge Management Applications	▪ Case Based Reasoning (CBR) ▪ Help Desk Applications ▪ Customer Service Applications ▪ Order Entry Applications ▪ Service Agent Support Applications	▪ Data Warehousing ▪ Data Mining ▪ Business Intelligence ▪ Management Information Systems ▪ Decision Support Systems ▪ Customer Relationship Management (CRM) ▪ *Competitive Intelligence*	▪ Intellectual Property ▪ Document Management ▪ Knowledge Valuation ▪ Knowledge Repositories ▪ *Content Management*	▪ TQM ▪ Benchmarking ▪ Best practices ▪ Quality Management ▪ Business Process (Re)Engineering ▪ Process Improvement ▪ Process Automation ▪ Lessons Learned ▪ Methodology ▪ *SEI/CMM, ISO9XXX, Six Sigma*	▪ Skills Development ▪ Staff Competencies ▪ Learning ▪ Teaching ▪ Training	▪ Communities ▪ Collaboration ▪ Discussion Forums ▪ Networking ▪ Virtual Teams ▪ Research and Development ▪ *Multi-disciplined Teams*

[Q15] Please specify which types of knowledge management systems and types you use in your collaboration with your partners

[Q15a] Transactional

[ ] Yes

[ ] No

[Q15b] Analytical

[ ] Yes

[ ] No

[Q15c] Asset Management

[ ] Yes

[ ] No

[Q15d] Process

[ ] Yes

[ ] No

[Q15e] Developmental

[ ] Yes

[ ] No

[Q15f] Innovation and Creation

[ ] Yes

[ ] No

[Q16] Please specify the (expected) usefulness of the specified knowledge management type in the collaboration with your business partner

[Q16a] Transactional
[ ] Very useless
[ ] Useless
[ ] Neutral
[ ] Useful
[ ] Very useful
Please explain your answer?

[Q16b] Analytical
[ ] Very useless
[ ] Useless
[ ] Neutral
[ ] Useful
[ ] Very useful
Please explain your answer?

[Q16c] Asset Management
[ ] Very useless
[ ] Useless
[ ] Neutral
[ ] Useful
[ ] Very useful
Please explain your answer?

[Q16d] Process
[ ] Very useless
[ ] Useless
[ ] Neutral
[ ] Useful
[ ] Very useful
Please explain your answer?

[Q16e] Developmental
[ ] Very useless
[ ] Useless
[ ] Neutral
[ ] Useful
[ ] Very useful
Please explain your answer?

[Q16f] Innovation and Creation
[ ] Very useless
[ ] Useless
[ ] Neutral
[ ] Useful
[ ] Very useful
Please explain your answer?

In the next set of questions, please read Business partners as WE when you are not working at the central software ecosystem organization.

[Q17] Business partners have the ability to scan for the valuable knowledge within systems of the following knowledge management type provided by the central software ecosystem organization.(Lee, 2001)

[Q17a] Transactional
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q17b] Analytical
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q17c] Asset Management
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q17d] Process
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q17e] Developmental
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q17f] Innovation and Creation
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q18] Business partners have the ability to acquire the needed knowledge from the knowledge management systems provided by the central software ecosystem organization.(Lee, 2001)

[Q18a] Transactional
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q18b] Analytical
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q18c] Asset Management
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q18d] Process
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q18e] Developmental
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q18f] Innovation and Creation
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q19] Business partners have the ability to assimilate the found knowledge in their organizations gathered from these knowledge management types provided by the central software ecosystem organization (Lee, 2001)

[Q19a] Transactional
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q19b] Analytical
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q19c] Asset Management
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q19d] Process
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q19e] Developmental
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q19f] Innovation and Creation
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q20] Business partners have the ability to exploit the gathered knowledge for their organization, which is gathered from following knowledge management types provided by the central software ecosystem organization. (Lee, 2001)

[Q20a] Transactional
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q20b] Analytical
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q20c] Asset Management
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q20d] Process
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q20e] Developmental
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q20f] Innovation and Creation
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

Collaboration Successfulness (Lee, 2001)

[Q21] Please indicate to what level you agree with the following statements

[Q21a] We and our business partner make beneficial decisions under any circumstances
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q21b] We and our business partner understand each other's business objectives and process
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q21c] We and our business partner share the benefits and risks that can be occurred in the process of business
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q21d] We and our business partner have compatible culture and policies in the process of business
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

[Q21e] We and our business partner perform prespecified agreements and promises very well
[ ] Strongly disagree
[ ] Somewhat disagree
[ ] Neutral
[ ] Somewhat Agree
[ ] Strongly Agree

APPENDIX B

Online questionnaire fill-in duration

Response ID	Total time	Total time (corrected)	General Questions 1/2	General Questions 2/2	Software Ecosystem	Business Partner Type	Partner Information Sharing	Knowledge Management Type	Collaboration & Knowledge	Collaboration Successfulness
1	811,77	811,77	65,91	128,51	276	24,58	38	95,86	152,73	30,18
3	2826,69		44,11	1423,5	310,51	104,3	116,85	281,2	476,84	69,38
6	1059,07	1059,07	35,87	154,21	214,1	34,76	32,28	101,75	450,64	35,46
10	1127,09	1127,09	41,22	88,31	193,58	82,34	105,57	155,77	354,72	105,58
11	6322,62		27,46	81,29	5911,15	34,62	37,25	103,92	85,25	41,68
12	394,92	394,92	37,72	59,89	93,85	28,62	29,48	64,56	47,95	32,85
14	2906,93		29,17	383,61	154,69	32,3	43,23	139,82	2071,26	52,85
20	713,22	713,22	46,37	125,15	79,17	28,79	48,1	141,88	188,02	55,74
22	1262,99	1262,99	46,88	140,13	131,46	58,12	36,49	140,87	633,08	75,96
23	373,06		36,13	65,49	116,42	50,99	17,35	42,07	44,61	
35	867,46	867,46	122,81	74,28	168,73	98,53	30,22	169,63	175,67	27,59
26	1524,1		36,78	1186,01	51,47	17,36	38,62	78,08	73,46	42,32
34	846,86		39,2	503,42	86,66	65,42	33,02	55,15	63,99	
31	677,86	677,86	40,6	162,12	88,58	18,4	51,1	142,42	132,24	42,4
36	2646,38	2646,38	46,66	126,75	246,05	171,63	232,11	141,71	1615,43	66,04
40	12450,4		65,23	7242,48	87,74	51,16	33,2	4970,56		
38	620,6	620,6	45,56	85,97	199,38	45,05	31,51	64,38	105,81	42,94
41	748,01	748,01	40,69	156,09	177,35	25	60,19	94,96	146,73	47
48	1043,15	1043,15	45,54	56,29	65,78	46,6	31,22	628,13	113,02	56,57
51	2549,69		73,59	419,86	1036,55	121,78	100,32	294,29	337,11	166,19
57	881,45	881,45	26,18	141,13	214,88	55,29	114,83	185,59	105,89	37,66
55	602,15	602,15	28,54	96,31	155,97	36,06	65,09	115,14	56,94	48,1
56	660,08	660,08	34,38	120,44	146,72	43,08	64,53	60,95	143,55	46,43
58	3273,96		34,59	154,34	159,61	937,6	1579,09	70,45	260,76	77,52
60	404,25	404,25	29,75	103,96	46,04	24,52	23,65	51,65	90,27	34,41
73	758,47	758,47	49,94	82,94	174,31	119,8	77,7	116,25	96,83	40,7
76	775,56	775,56	48,65	80,92	122,87	33,11	39,21	115,38	267,19	68,23
77	616,08	616,08	28,23	107,63	113,01	51,21	50,17	157,69	44,91	63,23
78	721,5	721,5	21,49	18,71	217,73	27,38	68,99	119,73	204,13	43,34
87	359,34		61,94	113,84	129,82	53,74				
101	271,69		27,64	70,69	95,39	24,86	23,51	29,6		
97	2356,02	2356,02	144,37	447,72	412,67	224,26	611,62	118,98	255,7	140,7
102	16769,3		674,06	302,52	13779,1	21,01	217,84	276,29	1425,78	72,74
Avg. time (sec)	2128	940	66	440	771	85	128	291	341	59
Avg. time (min)	35,47	**15,67**	1,10	7,33	12,86	1,41	2,13	4,86	5,68	0,99

APPENDIX C

SPSS results Cronbach's Alpha calculation

Reliability

/VARIABLES=Q14A Q14B Q14C Q14D

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	32	97,0
	Excluded[a]	1	3,0
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,764	4

Reliability

/VARIABLES=Q15A Q16A Q17A Q18A Q19A Q20A

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,747	6

Reliability

```
RELIABILITY
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  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,743	6

Reliability

```
RELIABILITY
  /VARIABLES=Q15C Q16C Q17C Q18C Q19C Q20C
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,716	6

Reliability

```
RELIABILITY
  /VARIABLES=Q15D Q16D Q17D Q18D Q19D Q20D
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,662	6

Reliability

```
RELIABILITY
  /VARIABLES=Q15E Q16E Q17E Q18E Q19E Q20E
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,591	6

Reliability

```
RELIABILITY
  /VARIABLES=Q15F Q16F Q17F Q18F Q19F Q20F
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,737	6

Reliability

```
RELIABILITY
  /VARIABLES=Q21A Q21B Q21C Q21D Q21E
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA.
```

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,664	5

Reliability

RELIABILITY

/VARIABLES=Q16A Q17A Q18A Q19A Q20A

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,831	5

Reliability

RELIABILITY

/VARIABLES=Q16B Q17B Q18B Q19B Q20B

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,842	5

Reliability

/VARIABLES=Q16C Q17C Q18C Q19C Q20C

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,814	5

Reliability

/VARIABLES=Q16D Q17D Q18D Q19D Q20D

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,841	5

Reliability

RELIABILITY

/VARIABLES=Q16E Q17E Q18E Q19E Q20E

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,703	5

Reliability

RELIABILITY

/VARIABLES=Q16F Q17F Q18F Q19F Q20F

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA.

Case Processing Summary

		N	%
Cases	Valid	28	84,8
	Excluded[a]	5	15,2
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach’s Alpha	N of Items
,782	5