

MASTER

Knowledge integration

creating a more customer centric innovation trajectory in a b2b setting

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Veldhoven, January 2013

**Knowledge integration:
Creating a more customer centric
innovation trajectory in a b2b
setting**

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in partial fulfilment of the requirements for the degree of

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Abstract

As in most business to business settings, different departments experience different customer encounter, meaning that they possess different customer knowledge. Currently, the gathering of customer requirements is in many organizations solely conducted by the (product-)marketing department. This paper examines whether knowledge of other departments should also gain more attention in this gathering of customer knowledge. In order to research this, the value of the knowledge is of importance, as well as its integration.

In-depth interviews are used to gain qualitative information about the value and integration of knowledge. For each department, at least two interviews are conducted. In order to determine whether knowledge is valuable and/or integrated, objective raters were used. These raters were supposed to rank different quotes of the interviews. The rankings provided the data to compare the different departments' knowledge value and integration.

The findings showed that knowledge of the first line service employees and the direct sales employees is very good. However, its integration was not that high. So, in the discussion is elaborated how the knowledge of the first line service employees and the direct sales employees can be integrated in a higher extend in the innovation process.

Acknowledgements

The first phases of new product development processes are extremely important for its outcome. This first phase is not an easy phase because all options are open and decisions have to be made. The same holds for writing a master thesis. It is difficult to immediately define the correct research question. However, carrying through these difficult moments is paying off. The result is a master thesis of which I am proud.

At first, I would like to express my gratitude towards my supervisors of the TU/E. Jeroen Schepers, as my first supervisor from the TU/e, made me enthusiastic about frontline employees and the knowledge they bring to the organization. I've enjoyed every single meeting with him and appreciate his supportive feedback. Fred Langerak, as my second supervisor of the TU/E, also provided detailed feedback. Especially during the project definition, he provided me with a critical mindset.

Second, I would like to thank my first supervisor of Assembléon, Mark Maas. He provided me with lots of experience from his own field. His expertise in requirements engineering definitely helped to gain a good feeling of the practical side of requirements engineering.

Additionally, I would like to thank Jeroen de Groot, my second supervisor of Assembléon. I am very grateful for the opportunities and the support he gave me during my project. As well as the rest of Assembléon's employees who took time to help me with this project.

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Hein Jochems

Veldhoven, January 2012

1. Management summary

In a business to business environment, all departments experience different customer encounters. So, the knowledge of a customer is spread over an organization, different departments all possessing different knowledge.

Considering Assembléon's innovation process, it is noticeable that the (product-)marketing department is the only department which actively searching for customer knowledge. However, other departments are also experiencing customer encounters, they are passively gathering customer knowledge. However, when taking into account the concept development phase, the other departments are hardly providing input. The development of the User Requirement Specification (URS) is a formal responsibility of the (product-)marketing department. Meetings with other disciplines sporadically occur. In order to determine whether it would be beneficial to formally integrate the knowledge of other departments, it is of importance whether their knowledge has value for Assembléon. Additionally, it must be checked to what amount the knowledge currently is integrated.

In order to rank the different departments on these two dimensions (knowledge value and knowledge integration), in-depth interviews were conducted. Ten departments/groups were identified that experience customer encounters. For each of these ten departments/groups, at least two employees were interviewed. The interview questions were based on models and scales from scientific literature related with knowledge value and knowledge integration.

The answers of the in-depth interviews were compared for each department in order to find the most balancing quotes. These quotes were presented in a ranking task which was conducted by 8 persons. Each rater ranked the ten departments on a continuous scale for the different dimensions.

After combining these data, the overall findings of my research became clear. The departments could be checked on their value of knowledge and their knowledge integration. A discrepancy was found by the direct sales and the first line service department. Both departments possess very valuable knowledge, however they scored very low on the knowledge integration dimension.

Another department that could positively influence the concept development phase is the RAP group. They possess some valuable knowledge however this is not congruent with its knowledge integration.

Other departments were found to have a knowledge integration level that was congruent with their value of knowledge.

Different recommendations can be given, based on the findings. First of all, it is advisable to formalize processes. Formal processes will enhance learning effects and is found to be positive related with project performance.

With respect to the departments, it is recommended to engage the first line service and direct sales department in the development of the URS. Both these departments seemed to have valuable knowledge. In order to gather this information in the concept development phase of a project, the process must be slightly changed.

Instead of reviewing an already filled URS, it is more beneficial to let the first line service and direct sales department fill an URS themselves (separately). Note that it is important that the voice of the subordinates is embedded in this URS (These people experience the most customer contact). Therefore, these URS should be filled by a manager in cooperation of a subordinate (the current process is that managers only review the URS). In order to make sure that the voice of these subordinates is embedded in the final URS, these subordinates become a gatekeeper in this process. Before the URS can be send towards the R&D department, the subordinates must approve.

Further, to make sure that the front line service employees and the direct sales employees engage in passive knowledge gathering during customer encounters, some other recommendations were given. These employees should be trained to gather knowledge (training), they should be rewarded to gather knowledge (reward system), and they should be given time to gather knowledge (time scheduled).

2. Problem description

2.1 Short introduction on Assembléon

This document describes the research project that I conducted in order to graduate for my master study. My project is conducted at Assembléon, an organization that develops and sells pick-and-place machines. Assembléon's machines are mainly used in the surface mount technology (SMT) industry. Pick-and-place machines are machines that can pick electrical components (such as SMD components, connectors or chips) with high precision and places them with high speed on the desired place on the printed circuit board (PCB). Besides this main business, Assembléon's products can also be used to place small parts (e.g. plastic or metal pieces) on dedicated places.

Assembléon offers a range of machines with which they can offer added value towards their customers. These machines differ among others in accuracy, speed, flexibility and costs. The sold machines are always dedicated equipped for certain customers.

Assembléon's headquarter is located in Veldhoven, where the development and the assembly of the machines is done. Sales & service branches are located in Europe, Asia and North-America. Assembléon employs around 500 people worldwide. 300 of them are located in the Netherlands.

2.2 Problem description

This paragraph gives some background information on the way of working of Assembléon and the main problem to investigate. The project assignment is derived from this problem as are the research questions and sub-research questions.

2.2.1 Importance of customer knowledge

Many academic studies are conducted about customer knowledge. Customer knowledge is widely accepted as: "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information" (Davenport & Prusak, 1988, pp. 5).

Many scientific studies found and support that customer knowledge is very important in innovation processes and organizations. Innovation is accepted in scientific literature as: "the application of ideas that are new to the firm, whether the new ideas are embodied in products, processes, services, or in work organization, management or marketing systems" (Gibbons et al., 1994). Assembléon's innovation process will be reviewed with respect to the customer knowledge that is integrated.

A process which uses customer knowledge is more likely to succeed than a process that does not (e.g.: Cooper & Kleinschmidt, 1995; Nonaka & Takeuchi, 1995). Scientific literature also state that customer knowledge is very organization specific. It depends on the industry, the context and the product how effective customer knowledge is (Dougherty & Hardy, 1996; Dougherty & Heller, 1994). So, customer knowledge is very important to use in innovation process. However, its effectiveness is case specific.

2.2.2 Different departments, different knowledge

Assembléon operates in a business to business (b2b) setting, which has consequences for the employee-customer interface. In a b2b environment (in general) the employee-customer interface is present at different organization levels. For example, Assembléon's sales employees have contact with plant managers, maintenance employees have contact with line manager, and call center employees have contact with machine operators. This stresses that the employee-customer interface is not that straight informed in Assembléon's case. It is a complex structure in which different relations exists with the customer's organization. The relations with the customer are not always designed the same way. It depends on several parameters, e.g.: the size of the potential business with the customer, the difficulty and amount of the 'specials'¹ and the size of the customer's organization. It is possible to present the relations for a 'normal' situation. Different departments of Assembléon are related with the different customer levels (in a normal situation).

To understand these relations, we first define the organizational levels at the customer. Organizations are designed differently. The organizational size of the customer defines the number of organizational levels. The most obvious organizational levels are described:

- Machine operators represent the lowest organizational level of the customers. The machine operators use the machine on a day-to-day base and have a small technical background.
- Maintenance engineers are the next level (only in the situation in which the customer has own maintenance engineers). Maintenance engineers are supposed to repair and conducted maintenance on Assembléon equipment.
- Line managers supervise the operators and maintenance engineers. The line managers are responsible for the whole machine line. These employees plan the production runs at the customer site and are responsible for the production figures.
- Different management levels are located above the line managers. For organizations with many employees there is usual a middle management level between line managers and higher management levels.

Based on these different levels at the customer's organization it is possible to identify the interface between Assembléon and its customers. Some departments (in a normal situation) only have contact with a certain group in the organization. It was noticeable, that the service department mainly has contact with the lower levels within the customer's organization. However, other departments are supposed to only have contact with the higher levels of the customers, for example the direct sales department. Therefore, it can be concluded that different department have different knowledge about the customer. Lower organizational levels concentrate on the 'using of the machines', where as higher levels concentrate on the 'customer preferences' (e.g.: Chesbrough, 2003; Ernst, Hoyer & Rübsaamen, 2010). In Figure 1, an example of the customer interface is graphically shown.

¹ A 'special' refers to a part of the machine that should especially be designed for a certain (or only a couple) of customers.

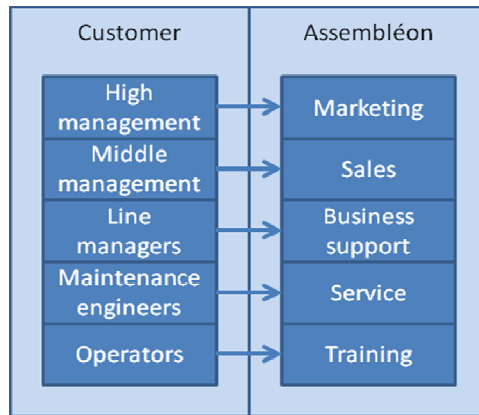


Figure 1 Assembléon’s departments have contact with different departments of the customer’s organization. (note: the shown connections are a rough estimation. The real situation is more complex).

2.2.3 Integration of different knowledge

Different academic papers stresses that the integration of different customer knowledge in the innovation process has a strong positive effect on project performance. Where knowledge integration refers to: “knowledge integration is an ongoing collective process of constructing, articulating and redefining shared beliefs through the social interaction of organizational members” (Huang, 2000, pp. 15).

Many papers found this positive relation between knowledge integration and innovation project success. Where project success refers to: the value for the customer, sales figures, profit margins, return on investments, etc. (e.g.: Takeuchi, 1995; Hong et al., 2004; Yang, 2005).

In Assembléon’s situation, the marketing department is responsible for the defining of the customer requirements. This department is actively searching to translate customer knowledge into customer requirements. Sales and service departments are also gathering customer knowledge. However, this knowledge is not automatically translated in customer requirements. Belkahla & Triki (2011) are referring to ‘active gathering’ and ‘passive gathering’. Passive knowledge gathering does not focus on gathering customer requirements. The knowledge gathered within this ‘passive gathering’ can be of great help for the development of a new machine (Ernst, Hoyer & Rübsaamen, 2010). In Figure 2, the active and passive gathering is related with several departments of Assembléon.

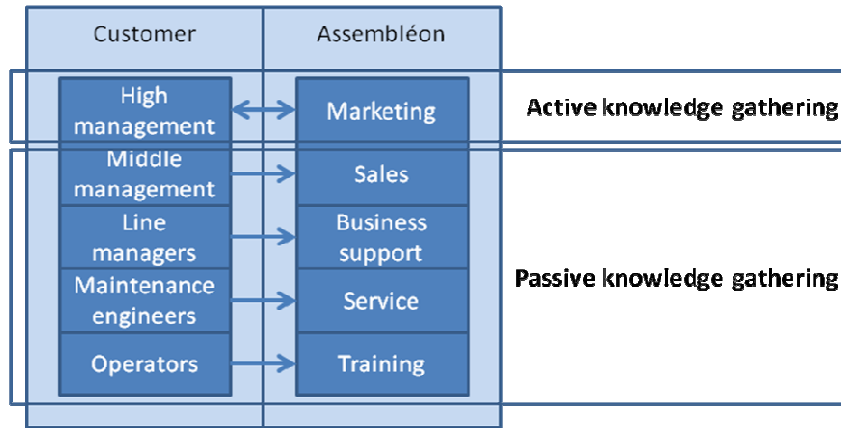


Figure 2 Several (not all!) departments of Assembléon related with active or passive knowledge gathering.

2.2.4 Assembléon's innovation process

It is already mentioned that customer knowledge has a positive influence on the innovation process. In order to properly review the innovation process, 'standard' innovation process steps are used. These 'standard' innovation steps are widely accepted and used in academic papers (e.g.: Ernst et al., 2010; Nepal, Monplaisir & Singh, 2005). The innovation process can be separated into the (1) concept development, the (2) product development and the (3) implementation phase. This is graphically shown in Figure 3.

Many methods exist that could be used to translate customer knowledge into product specifications. For example, quality function deployment, interviews, and group tasks analysis (e.g.: Chan & Wu, 2002; Courage & Baxter, 2005). These methods can be used by organizations in order to find customer requirements. These methods can only be used effectively when customer knowledge is implemented. Assembléon does not use all its customer knowledge in the first phase of the innovation process. This is shown by the dotted line in Figure 3.

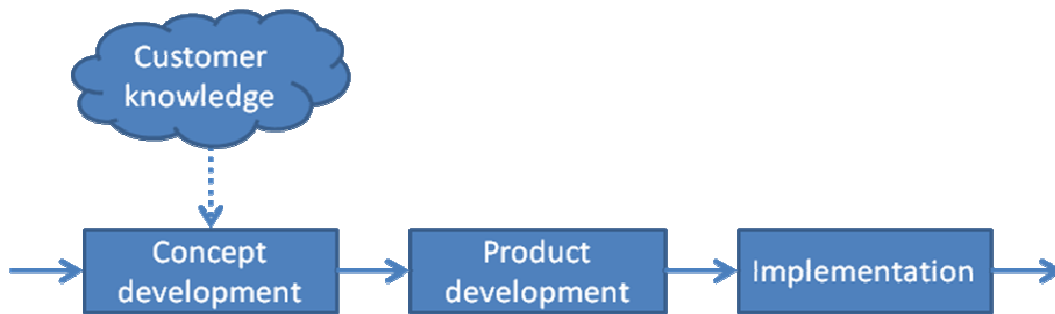


Figure 3 Innovation process which consists of the three main phases. The dotted line represents the input of customer knowledge that is not completely conducted in Assembléon's process.

2.2.5 Concept development phase

This paragraph only considers the first phase of the innovation process. This first part is only used to gather and define the customer requirements. Assembléon is making a User Requirement

Specification (URS²) in order to list customer requirements. The method how Assembléon is generating the URS is not in line with recommendations in the literature (using as much valuable customer knowledge as possible).

The development of the URS is a responsibility of the product managers (marketing) of Assembléon. Therefore, the product manager is the person who lists all the customer requirements. The input of other departments is not (formally) used for the URS. When a product manager is not sure about certain customer requirements, ad hoc meetings with internal dedicated experts (or customers) are possible. However, in that case a certain (employee of a) department reviews only its ‘own area’ of customer requirements (i.e. service employees are only expected to review customer requirements related with service aspects). Figure 4 shows Assembléon’s current situation. The dotted lines represent the input lines into the development of the URS. These lines are currently not (or partly not) present in Assembléon’s process.

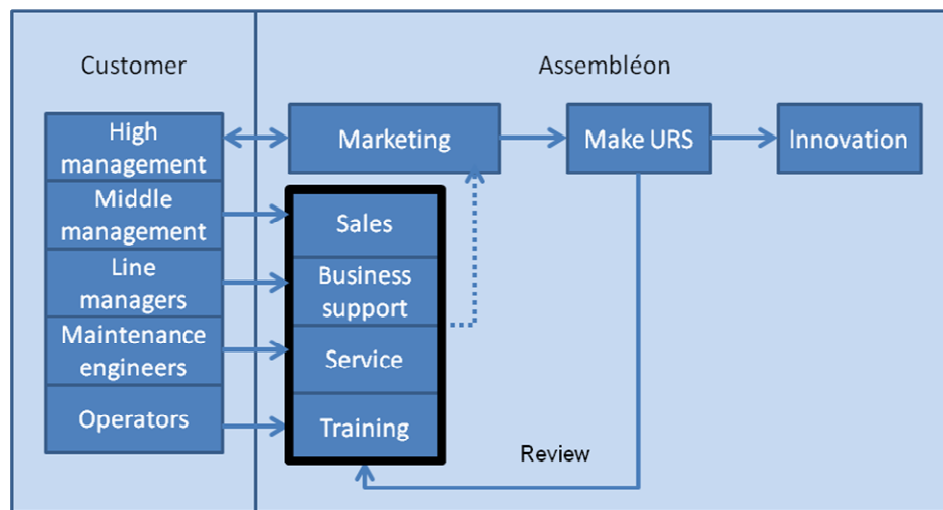


Figure 4 Overview of innovation process with the dotted input lines that will be researched in my project.

The lack of formal implementation results in the fact that not all customer knowledge, possessed by Assembléon, is used for the identification of customer requirements. Assembléon is an informal organization which possibly led to the fact that information is shared via informal ways. However, literature stresses that it is beneficial to use formal and bureaucratic organizational structures in innovation processes (Olson, Walker & Ruckert, 1995; Froehle, et al., 2000).

2.2.6 Value of customer knowledge

As mentioned before, knowledge integration has a positive effect on the innovation project performance. However, the integration of knowledge has not only positive effects. Knowledge integration from different departments in the concept development phase should increase the time that is necessary to create the URS. The involvement of more departments requires more communication between departments, which will cost time.

On the contrary, in scientific literature is found that more knowledge integration should decrease the development time in innovation projects (Cankurtaran et al., 2010; Mitchell, 2006).

² URS: user requirements specification. This document entails a list of the customer requirements.

However, mixed results are found with respect to the engagement of different departments in innovation projects. Some papers state that multidisciplinary teams have a negative influence on the development time (Langerak & Hultink, 2008). Other papers claim a positive relation between multidisciplinary teams and development time (Henke et al., 1993; Wheelwright & Clark, 1992). It is obvious that literature is not consistent about the engagement of different departments in innovation projects.

It is likely that a certain trade-off exists in the integration of knowledge. The integration of customer knowledge should be dependent on the value of the knowledge. Too much knowledge integration would (possibly) result in a lower development speed, while too less knowledge integration would result in worse products. In order to identify whether knowledge should be integrated, its value should be considered. Table 1 shows the relations between knowledge integration and project performance, this stresses the importance of the knowledge value.

		Project performance	
		Product fit customer requirements	Development speed
Integrate knowledge	Valuable	+	+/-
	Not valuable	0	-

Table 1 Relations of knowledge integration and value with project performance.

The integration of knowledge should be dependent on the value of knowledge. In other words, it has to be taken into account whether knowledge is new to the organization and whether it is usable in the concept development phase.

2.3 Problem statement

Based on the fact that the different departments, all possessing different knowledge, are not formally involved leads to the following problem statement:

The customer knowledge, possessed by Assembléon, is not completely used in order to find/create all customer requirements.

My project gives insight in this problem and makes sure (via the recommendations) that as much as possible customer knowledge would be integrated in the making of the URS.

2.4 Project assignment

This problem statement led to the following project assignment that is handled in my master thesis:

Design/improve Assembléon's innovation process in such a way that more customer knowledge is used in formatting the user requirements specification.

2.5 Main research question

Based on this problem statement and project assignment, a main research question was derived:

How can the customer knowledge, possessed by different departments, be integrated in Assembléon's innovation process?

2.6 Sub-research questions

Because the broad nature of this research question, it is advantageous to divide it in two sub-research questions. These questions were created based on the findings in the literature with respect to the innovation process that Assembléon used. For all departments of Assembléon's which have direct contact with the customer, it is interesting to measure the integration and value of the knowledge. The two relevant sub-research question:

What is the current knowledge integration of Assembléon's departments in its innovation process?

What is the value of the knowledge that currently is possessed by Assembléon's departments?

3. Literature review

In order to answer the research questions, scientific literature will be consulted to gain information about the subject area. First, literature with respect to different sorts of customer knowledge will be consulted. Additionally, the integration of customer knowledge in innovation processes will be discussed. Assembléon's situation will be compared with the literature findings.

3.1 Customer knowledge

First, it is important to discuss what customer knowledge exactly is. In the previous section, the definition of customer knowledge is provided (Davenport & Prusak, 1988). This definition refers to knowledge as experiences, values, contextual information, and expert insight. In the problem statement is stressed that different departments possess different knowledge (e.g.: Chesbrough, 2003; Ernst, Hoyer & Rübsaamen, 2010). Both the definition of customer knowledge and the fact that departments possess different knowledge (as explained in the problem statement) supports that customer knowledge could be divided into different aspects.

A quick literature scan showed that several (customer) knowledge models exist. Comparing these different models, shows that the differences are due to the fact that some of the models are build upon an in-depth view towards the customer knowledge (based on the content of customer knowledge), while other models are focusing on the more general aspects of customer knowledge (more emphasis on the characteristics of knowledge itself). The most important customer knowledge models are considered in this literature review (however, none of these models is dominant in the knowledge management literature).

The goal of analyzing these customer knowledge models is to find a valid distinction in customer knowledge. Also is checked which models have overlapping characteristics with each other. Models with more common characteristics will lead to possible combinations between different

models. To take different knowledge models into account, my research will become more generalizable.

3.1.1 Content of the knowledge

The literature provides models that were specially aimed to describe (aspects of) customer knowledge. Two models were found that were focusing on the content of the customer knowledge: the model of Zanjani et al. (2008) and the model of Peppers & Rogers (2004).

The model of Zanjani et al. (2008) focuses on the content of the customer knowledge. Their model divides customer knowledge mainly in three different aspects, namely: knowledge for the customer (in order to match the customer to the right product/service), knowledge from the customer (how he/she is using your products) or knowledge about the customer (understanding his/her requirements). The aspects about knowledge for the customer is not relevant in my project.

For each of the three different aspects Zanjani et. al. (2008) created (sub-)sub-aspects. Discussing all these lower level aspects is out of the scope of my thesis. Therefore, in Figure 5 the customer knowledge model of Zanjani et al. (2008) is shown.

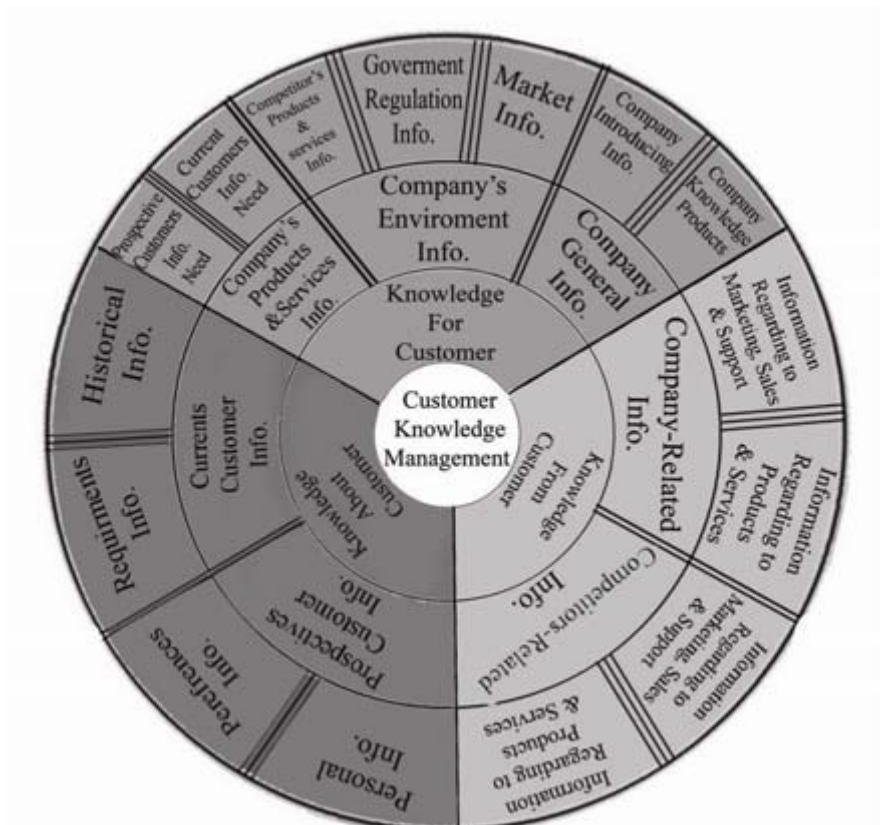


Figure 5 Zanjani et. al. (2008) customer knowledge management model.

A second model with respect to the content of customer knowledge is the model of Peppers & Rogers (2004). This model describes the different sorts of customer knowledge that can be

obtained from customers. The first identified aspect is demographic knowledge. Demographic knowledge contains personal data (gender, age, income) or descriptive data (turnover, size, industry). The second aspect of Peppers & Rogers (2004) model is attitudinal knowledge. Attitudinal knowledge refers to knowledge that is related with attitudes and opinions (customer satisfaction, customer requirements, brand preferences, quality). The third, last, aspect is the behavioral knowledge. Behavioral knowledge refers to knowledge about the behavior of customers (how does a customer work with the organization's equipment).

When comparing both models, some similarities are found. It is interesting to check to what amount the models overlap. It is obvious that the demographic knowledge is in line with the sub-sub-category 'personal info'. Both these categories hold information about descriptive of the customer.

Attitudinal knowledge is in line with both the 'preferences info' and the 'requirements info'. Together, preferences and requirements info form a framework of what customers require and what their attitude is towards product concepts.

The behavioral knowledge is in line with the 'info regarding to products and services'. This sub-sub-category represents information how a customer is using the organization's equipment.

As noticeable, the aspects that were defined by Peppers & Rogers (2004) could easily be linked towards dedicated sub-sub-categories. This stresses that the model of Zanjani et al. (2008) is much broader and entails more variant aspects of knowledge. The category 'knowledge for the customer' of Zanjani et al.'s (2008) model was not supported by any of the three aspects of Peppers & Rogers (2004).

3.1.2 Descriptives of the knowledge

Next to the models which are describing the content of customer knowledge, other customer knowledge models could be found in the literature. These models are not content specific, but describing more general aspects customer knowledge.

The first discussed model was developed by Luca & Atuahene-Gima (2007). Their model describes four different aspects that are used to describe knowledge.

- Breadth of knowledge: Breadth of knowledge is described by Luca & Atuahene-Gima (2007) as the understanding of a wide range of customers.
- Depth of knowledge: Depth of knowledge is described as the complexity and sophistication of the customer knowledge.
- Knowledge's tacitness: Tacitness of knowledge refers to knowledge that is difficult to communicate towards others employees. It is hard to transfer this knowledge between two persons.
- Knowledge specificity: Knowledge specificity refers to knowledge that is very useful in certain context and in other context it is worthless.

Gebert et al. (2002) also developed a model which is describing customer knowledge. They developed their model based on a literature review. Their model determines the relevance of knowledge in a business setting. They propose three factors that are relevant in this determination.

- Business significance: This means that knowledge should impact the costs or revenues of an organization.
- Measurable and manageable: This means that the knowledge should be usable.
- Little overlap as possible: This means that knowledge should/could be combined to create a consistent network of knowledge.

Again, both models are compared with each other. The model of Luca & Atuahene-Gima (2007) is used to describe knowledge overall. The model of Gebert et al. (2002) only focuses on the factors that determine whether knowledge is relevant. Still, some similarities between both models are found. The different aspects can be combined into three different aspects, see Table 2.

Aspect	Gebert et al. (2002)	Luca & Atuahene-Gima (2007)
1	Measurable and manageable	Knowledge tacitness
2	Little overlap as possible	Breadth of knowledge
		Knowledge specificity
3	Business significance	Depth of knowledge

Table 2 Three aspects to identify the value of knowledge based on Gebert et al. (2002) and Luca & Atuahene-Gima (2007).

The ‘measurable and manageable’ aspect is in line with the ‘knowledge tacitness’ aspect. Tacit knowledge is more difficult to measure and manage because it is harder to communicate tacit knowledge.

Also, a fit is found between the aspects ‘breadth of knowledge’ and ‘little overlap as possible’. The broader the knowledge, the more chance to find an overlap in knowledge. Additionally, knowledge specificity is relevant for the overlap of knowledge. Knowledge that is very specific is not likely to overlap other knowledge.

Last, a small fit between ‘business significance’ and ‘depth of knowledge’ can be found. It is likely that more sophisticated and complex knowledge will affect an organizations costs or revenues. Simple knowledge will have less business significance.

The difference between the two models is the focus. The model of Gebert et al. (2002) only focuses on the relevance of knowledge. The model of Luca & Atuahene-Gima (2007) refers to knowledge in general. However, despite this difference many common aspects are defined. This supports that it is valid to divide knowledge in these three aspects (business significance, measurable & manageable, and little overlap).

3.2 Knowledge integration

The second part of the literature review will focus on the integration of knowledge. In the problem statement, knowledge integration is defined as an ongoing collective process of social interactions (Huang, 2000).

First, some results of knowledge integration are discussed, followed by some aspects related with knowledge integration.

3.2.1 Project performance

Many papers searched for the relation between the customer knowledge integration in innovation processes and the innovation project performance. All retrieved studies found that the more customer knowledge is present in the innovation process, the better the innovation project performance. Where innovation project performance refers to: the value for the customer, sales figures, profit margins, return on investment, etc. (e.g.: Takeuchi, 1995; Prahalad & Hamel, 1990; Hong et al., 2004; Yang, 2005; Kotonya & Sommerville, 1998). This stresses that customer knowledge is beneficial for the innovation project performance.

The reason why knowledge integration will lead to a better project performance is not extensively elaborated in the literature. Many papers solely state that knowledge integration is positive related with project performance. However, Tiwana (2004) identified a possible reason for this relation. Knowledge integration will lead to less defects in the products (during the development phase and also after product launch) (Tiwana, 2004; Kessler & Chakrabarti, 1996). This will decrease costs because a lesser amount of rework and repair activities has to be conducted. Knowledge integration will also lead to an increase in development efficiency (Tiwana, 2004). An efficient process will lead to a process which will experience no waste of resources. This makes sure that a project will be conducted within budget, which will increase the project’s performance.

To integrate customer knowledge, it should be used in the innovation process. Possible methods of integrating knowledge are via interdepartmental meetings, workshops, intranet, seminars, creating cross-functional teams, etc. (e.g.: Belkahl & Triki, 2011; Kim & Lee, 2006).

3.2.1.1 A negative side of knowledge integration?

There is also a (possible) negative effect of integrating knowledge which is mentioned in the problem description. Some papers found that functional diversity will lead to an increase in the development time, while other researchers found the opposite. A longer development time is not desirable because an earlier entry on the market increases the chance of success (Griffin, 1993).

Table 3 shows the different findings that could be found in the literature about the integration of knowledge and departments.

Independent	Development time	Source
Cross-functional teams	Decreases	Clark & Fujimoto, 1991; Henke et al., 1993; Wheelwright & Clark, 1992
Knowledge integration	Decreases	Cankurtaran, Langerak & Griffin, 2010; Mitchell, 2006
Stimulating inter-functional cooperation	Increases	Langerak & Hultink, 2008
Multidisciplinary team	Increases	Cankurtaran, Langerak & Griffin, 2010

Table 3 Short overview of results retrieved from scientific studies, related with functional diversity and development time.

Knowledge integration is mainly found to be negative related with development time. However, multidisciplinary teams and stimulating inter-functional cooperation are found to have a negative relation with development speed.

Langerak & Hultink (2008) argued that their contradicting findings are due to different processes and different situations in organizations. This is in line with the statement of Tidd, Bessant & Pavitt (2005) and Loewe (2006) who stated that each organization should use an innovation process that is purely designed for its own organizational context and situation.

3.2.2 Aspects of knowledge integration

Knowledge integration has a very broad definition, it refers to social interactions. Different papers define different aspects that are relevant when considering the internal knowledge integration. There is no general model (or scale) that represents knowledge integration on a departmental level.

The most relevant aspect that was found in the literature is knowledge sharing behavior. This aspect represents the willingness and ability of employees to share knowledge (Yi, 2009). A high amount of sharing behavior will direct relate with a high level of knowledge integration. However, the concept “knowledge sharing behavior” is based on an individual level while my research has a departmental scope. Different departmental aspects influence the knowledge sharing behavior of employees.

Organizational structure is found to be a relevant construct for employees to engage in knowledge sharing behavior. For example, centralization is found to have a negative influence on the knowledge sharing behavior of employees (Tsai, 2002). On a lower level, the use of more formal meetings (instead of sporadic meetings) and the use of a reward system (rewarding knowledge sharing behavior) are directly related with more knowledge sharing in an organization (McCann III & Buckner, 2004).

Further, the level of trust within an organization (Kim & Lee, 2006) and the shared knowledge of the customer among employees³ (Hong et al., 2004) are found to positively influence knowledge sharing behavior.

To conclude, there is no widely accepted model which describes knowledge integration. However, some higher level aspects were found to directly influence the knowledge sharing behavior of employees.

4 Research design

In this section the project plan is elaborated (e.g. what data is gathered, in what sequence). As noticed in the literature review, the innovation process of an organization should be tailored to its environment. Each organization should have an own design, based on aspects like: the scale, the type and the industry of the organization (Tidd, Bessant & Pavitt, 2005). Hence, it was not possible to provide an answer to the research question solely based on literature findings. None of the papers exactly fitted the environmental parameters of Assembléon. Additionally, Loewe (2006) stated that no organization should blindly copy best practices in their innovation process. The solution to this argument was to conduct an own study on Assembléon's customer knowledge and innovation process.

In order to answer the research questions, it is necessary to collect information about the two main dimensions: (1) the value of the customer knowledge and (2) the knowledge integration. In order to find this information, different activities have to be conducted. A graphical representation of this process is shown in Figure 6.

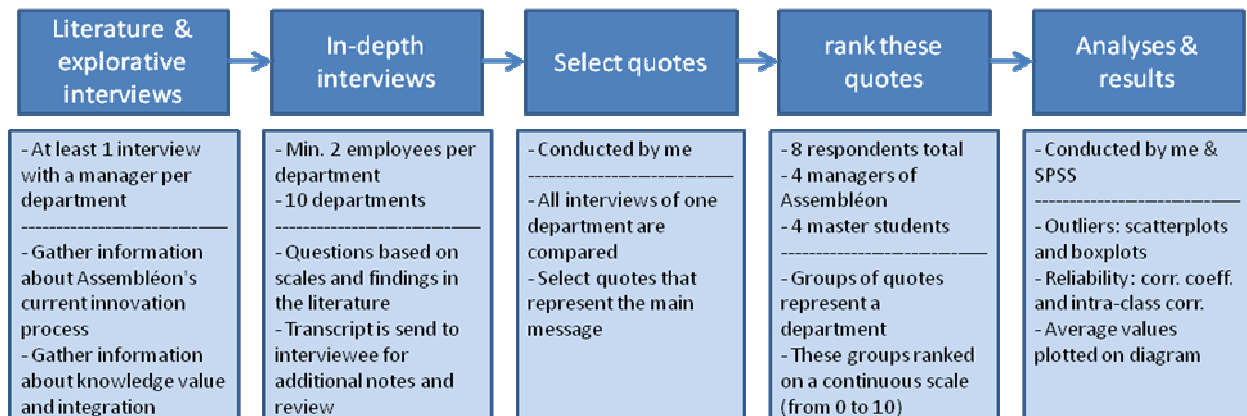


Figure 6 The methodology used in this research to gather information about (1) knowledge value and (2) knowledge integration.

As shown in Figure 6, my research starts with explorative interviews, followed by in-depth interviews. The quotes from the answers on these in-depth interviews were used to rank the

³ Shared knowledge of the customer is found to be positive related with knowledge sharing behavior because it is easier to share knowledge with employees which has a shared vision towards the customer (Hong et al., 2004)

different departments on the two dimensions. Thereafter, the results were analyzed by the usage of SPSS. The different steps will separately be elaborated and discussed in upcoming paragraphs.

As shown in the literature review, the two dimensions exist of different aspects. However, the available scales did not exactly match these aspects. In the ranking task the aspects were once more named differently. In order to provide some clarity, Figure 7 shows the process with the names of the used aspects/scales.

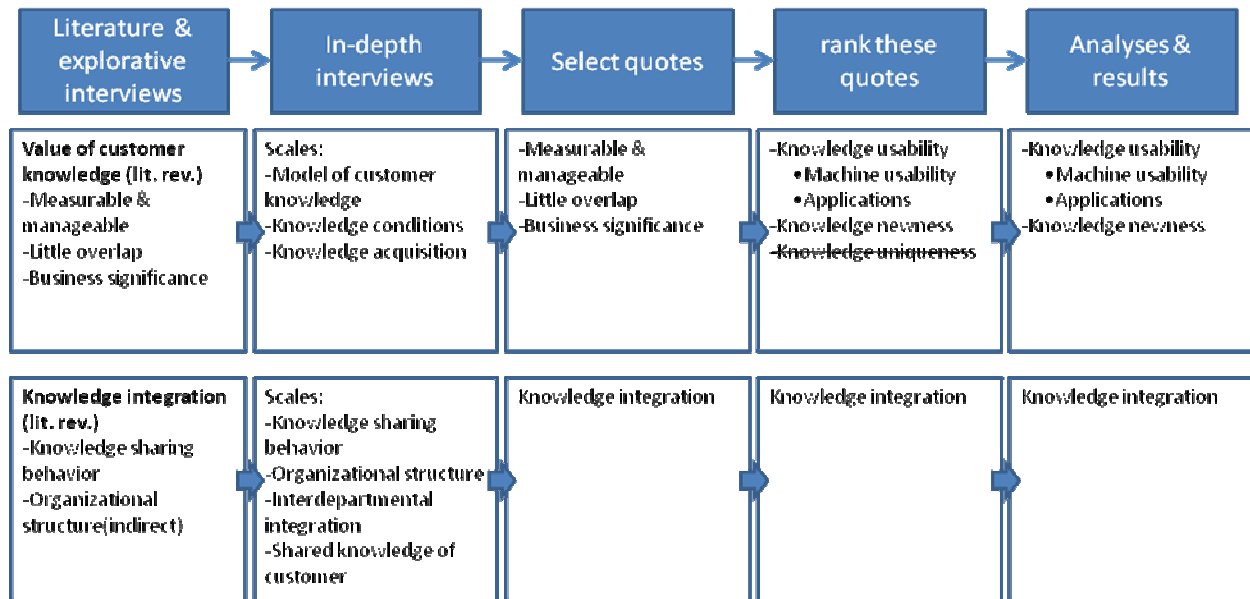


Figure 7 The processes represent the (1) value of knowledge dimension and (2) the knowledge integration dimension (the aspects retrieved from the literature review, the scales that were used, aspects used in the ranking task, and the aspects how they are presented in the analysis).

4.1 Explorative interviews

First, the explorative interviews were conducted with different managers of Assembléon. These interviews helped to identify relevant factors to consider in my thesis (based on discrepancies between Assembléon's processes and findings in the literature. Additionally, these interviews helped to identify Assembléon's innovation process in more detail. The interviews were conducted with managers of the different departments. R&D- and product managers provided a more general insight in the knowledge flows. Managers of other departments (sales, customer service, etc.) provided a more detailed view about the knowledge flows from their department towards the innovation process. Overall, the employees that were interviewed are:

- 2 R&D managers,
- 1 sales manager,
- 1 customer service manager,
- 1 quality manager,

- 1 sales/business support manager, and
- 1 product managers (marketing).

Based on these explorative interviews, the innovation process and its knowledge flows were identified (mainly based on the questions about the integration dimension of the different departments). It provided an overview about the way Assembléon currently designed its innovation process and where possible discrepancies occurred between Assembléon’s innovation process and scientific literature.

4.2 In-depth interviews

In order to measure the value of the knowledge and to measure the knowledge integration, in-depth interviews were conducted. For both the value and the integration of knowledge the used scales are discussed. Additionally, the respondents were discussed.

4.2.1 Value of customer knowledge

As shown in the literature review, Luca & Atuahene-Gima (2007) en Gebert et al. (2002) categorized the knowledge of an employee into three different aspects (measurability & manageability, overlap, business significance). These three aspects were used as a guide to find relevant question for the in-depth interviews.

The questions that were asked were mainly based on findings in the literature. Luca & Atuahene-Gima (2007) did not provide a scale in order to determine the value of knowledge. They only developed a customer knowledge model. Therefore, two scales will be used that are highly related with the model of Luca & Atuahene-Gima (2007). The model of Zanjani et al. (2008) and Gebert et al. (2002) were both argued to posses many common characteristics with the model of Luca & Atuahene-Gima (2007). Therefore, the scale of Zanjani et al. (2008) and the scale of Gebert et al. (2002) are used to determine the value of knowledge. The scales are presented in the Table 4.

Based on:	Interview guide
Model of customer knowledge management (Zanjani et al., 2008)	Do employees of your department actively gather knowledge about its current customers?
	Do employees of your department currently posses knowledge about its current customer?
	Do employees of your department actively gather knowledge about its prospective customers?
	Do employees of your department currently possess knowledge about its prospective customers?

Different knowledge conditions (Gebert et al., 2002)	Is the customer knowledge, gathered and possessed by your department, of business significance; does it impact the costs or the revenues?
	Is the customer knowledge, gathered and possessed by your department, measurable and manageable?
	Is the customer knowledge, gathered and possessed by your department, overlapping knowledge of other departments?

Table 4 The scales of Zanjani et al. (2008) and Gebert et al. (2002) measuring aspects related with the value of knowledge.

Besides these two scales, some questions were asked which were not based on a scientific model. For example, questions which relates to the newness of knowledge, first one to perceive certain information and, the amount of the possessed knowledge.

Additionally, the knowledge acquisition of employees was also discussed at the in-depth interviews. These questions were based on the knowledge acquisition and customer orientation of employees as described in different papers (Darroch, 2003; Thomas, Soutar & Ryan, 2001). These constructs are not directly related to the value of the customer knowledge, however they could be of importance by defining the amount of knowledge that is possessed by a department. See Table 5 for the scale of Darroch (2003) that was used in the interviews.

Based on:	Interview guide
Knowledge acquisition (Darroch, 2003)	How are employees of your department encouraged to attend seminars and conferences? (Galvin, 1996)
	Are employees of your department being encouraged to think about Assembléon's business? How? (Nonaka & Takeuchi, 1995)
	To what amount are employees of your department sensitive towards information about changes in the market place?
	To what amount are real market needs used, and not internal politics, to drive innovation? (Kohli & Jaworski, 1990)
	How quick is your department to detect changes in customers' preferences? (Kohli & Jaworski, 1990)
	How often do employees of your department meet with customers to find out what products/services they will need in the future? (Kohli & Jaworski, 1990)

Table 5 The scale of Darroch (2003) measuring aspects related with the value of knowledge.

Appendix B provides more details about the used scales with respect to the determination of the knowledge value.

4.2.2 Knowledge integration

As shown in the literature review, the integration of knowledge depends on several aspects. The most important aspects that are discussed in the interviews, are the aspects which directly refer to knowledge integration. These aspects were found in different academic papers. The aspects that are discussed in the interviews are: knowledge sharing behavior (Yi, 2009), organizational structure (McCann III & Buckner, 2004; Kim & Lee, 2006), shared Knowledge of customer (Hong et al., 2004) and, interdepartmental integration (Kahn, 2001).

In the literature is shown that these aspects are related with knowledge integration. Therefore, the scales which are presented to measure these aspects used in the interviews, see Table 6.

Based on:	Interview guide:
Organizational structure (Kim & Lee, 2006)	Are subordinates supposed to get a lot of formal approvals in their decision making?
	Is it discouraged when a subordinate makes his/her own decisions?
Interdepartmental integration (Kahn, 2001)	How is customer knowledge shared between your department and other departments with respect to the innovation process? (via formal meetings, memorandums, circulated reports, circulated forms?)
	How and where is your knowledge about the customer implemented in the innovation process?
Knowledge sharing behavior (Yi, 2009)	How do employees of your department (or you) contribute written ideas and thoughts via online databases?
	How do employees of your department (or you) share documentation from personal files related to the innovation process?
	How do employees of your department (or you) express their customer knowledge in organizational meetings? Participate in brainstorming sessions? Problem-solving suggestion?
	How do your employees share work-related failures in the innovation process in order to avoid repeating these?

	Considering the knowledge that is shared between employees of your department (or you), can this knowledge be classified as knowledge about the customer? Knowledge to update customer information? Knowledge to avoid risks and trouble (e.g.: problem reports)?
	Do employees of your department share info via communities (informal groups that voluntary share common practice)?
	How are employees of your department stimulated to share knowledge with other employees? Are they performing these tasks voluntary? (Kim & Lee, 2006)
	How are employees of your department involved in teams or groups that share knowledge? (Kim & Lee, 2006)
	Have your employees (or you) freely access towards the documents, which contain knowledge, possessed by others? (Kim & Lee, 2006)
Shared knowledge of customer (Hong et al., 2004)	Considering knowledge of other departments, which departments got knowledge that is retrieved by your department (or by you)? (and is thus passed through via your department)

Table 6 The questions that were asked during the interviews with respect to knowledge integration.

Appendix C provides more details about the used scales with respect to the integration of knowledge.

4.2.3 Respondents in-depth interview

In order to come up with usable results in my study, in-depth interviews were used. As stated before, the value of the customer knowledge and the knowledge integration will be analyzed on departmental level.

Assembléon has a couple of departments, which are divided into certain teams. Due to the different work activities within a department, it was necessary to use these different teams in order to create a valid outcome. In that case a department is not considered as a whole, but divided into the different teams for the analyses. This division into teams was necessary because when the departments were considered as a whole, it became more likely that no valid result would be found. In that case, scores of different team will neutralize each other. It is possible that in the same department multiple teams are present; one team has a high value of customer knowledge while the other team has no customer knowledge at all. In such case, both teams would neutralize each other's knowledge, resulting in a neutral score.

Therefore, it is obvious to divide the departments into different teams, based on the activities that employees conduct. (See Table 7, note: some departments were not separated into ‘teams’ because its employees are all performing about the same tasks.)

With respect to reliability, it was necessary to interview multiple persons of each team (function group). For most teams, two persons were interviewed. However, in some cases it was not possible to interview two persons. For example, only one employee is responsible for the training of customers in Europe, therefore it was not possible to validate his interview answers with a colleague’s answers. In order to still ensure validity, his manager was interviewed.

The division of the departments and an overview of the respondents of the in-depth interviews are shown in Table 7.

Department	Team	Managers	Subordinates
STAR ⁴			2
Marketing	Product management	1	1
Sales	Direct sales	1	1
Business support			2
Service	Call center	1	1
	Training	1	1
	Second line service	1	1
	First line service	1	1
Research & development	RAP ⁵		2
	Sustaining		2

Table 7 The division of the different departments in sub-groups and the number of respondents per department.

4.2.4 Respondent validation

In order to improve the validity and rigourness of this study, the quotes that I chose to represent the value or integration of knowledge were reviewed by the respondent. After an in-depth interview was conducted, the transcript was send to the respondent. The respondent then got the

⁴ STAR: System Testing and Release. This departments tests developed machine functions. When approved, this departments decides to actually start selling the function.

⁵ RAP: Requirements, Applications, Processes. Team that handles special requests about machine functionalities. This group actually develops these requests.

possibility to modify their answers in order to improve the reliability of their quotes. This increased the validity of the provided quotes.

4.3 Analysis

The goal of the gathered data is to create a link between the level of knowledge integration and whether this knowledge is valuable. Based on this information each department could be plotted in a graph. This graph should show the knowledge value and integration of a certain department. This plotting was based on the results of the in-depth interviews. However, the in-depth interviews provided qualitative data that should be analyzed. The graph is shown in the result section.

4.3.1 Qualitative data analysis

In the literature, different qualitative data analysis methods are proposed (e.g. Lacey & Luff, 2001): content analysis, thematic analysis and theoretical analysis. Theoretical analysis is based on the recognition of theoretical concepts in the results of the interviews. Theoretical analysis was not applicable because my research is based on a theory which is already proven (more customer knowledge will improve the customer centeredness of innovations). Thematic analysis was also not applicable because it is a descriptive way to handle qualitative data.

The method that I used was a content analysis. A content analysis ensured that qualitative data was categorized quantitatively (which was necessary in my analysis). Based on the interviews different levels of the value and integration of customer knowledge could be created. In order to ensure that my study is rigorous, it was necessary to objectively analyze the interview results. Therefore, quotes of several answers were chosen to represent the main argument of the respondent (with respect to (1) knowledge integration and (2) the value of that knowledge). These quotes represent the value or integration of the knowledge of a certain department.

After the determination of these quotes, it was necessary to create an order in these quotes (with respect to the other departments). Therefore, the packages of quotes were presented independently (not related towards the quotes about knowledge integration). All packages of quotes with respect to the value of knowledge were presented towards eight persons. These persons ranked the different packages of quotes with respect to the value of knowledge. This method made sure that the interviews were analyzed objectively. Thereafter, the same method was used for the quotes for the knowledge integration. See appendix D, for the order tasks that the respondents conducted.

4.3.2 Analysis value of knowledge

Assessing the value of customer knowledge was based on a certain framework. As mentioned above, scales were used that best fit the three aspects which represent knowledge value (measurable & manageable, little overlap and, business significance). So, the quotes from the interviews were fitted into these three aspects. However, in the question where the eight persons should rank the interview quotes, more familiar concepts were used.

The definitions used by Gebert et al. (2002) were too broad and left too much room for haziness. Therefore, these three aspects were named different terms in the ranking task, see Table 8. This ensured that the participants of the ranking tasks correctly understood the exercise.

Aspect	Gebert et al. (2002)	Ranking task
1	Measurable & manageable	Knowledge usability about application requirements
		Knowledge usability about machine usability
2	Little overlap	Knowledge uniqueness
3	Business significance	Knowledge newness

Table 8 Three aspects that represent value of knowledge are transformed into four aspects which were used in the ranking task.

The aspect measurable and manageable is clearer as: “usability of the knowledge”. However, during the interviews it became clear that there is a clear separation in knowledge usability: (1) knowledge usability about application requirements and (2) about machine usability. So, in the selection of the quotes an extra separation is made whether the quotes are describing knowledge about applications (functions of the machine) or whether they are describing usability requirements.

4.3.3 Analysis knowledge integration

With respect to the knowledge integration dimension, only one construct was used (just ‘knowledge integration’). Further, the same method was used in order to rank the different departments on the integration of their knowledge (eight persons were supposed to rank different packages of quotes from the interview).

4.3.4 Ranking task

In order to rank the different departments, a balanced group of persons was used to conduct the ranking exercise. The eight persons that were asked to rank the different departments existed of four employees of Assembléon and of four master students which are studying innovation management. A balanced group of persons was chosen because a certain risk exists. The results of the employees of Assembléon have the risk that they are prejudiced towards Assembléon’s situation. The results of the master students have the risk that they are not aware of the context and are not able to provide a valid ranking.

The ranking was conducted on a ‘line’ per exercise, see Figure 8. This made sure that the different departments (numbers) could be placed everywhere on this line, a continuous ranking.

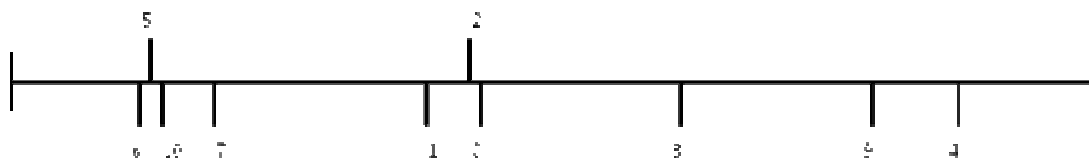


Figure 8 An example of a filled ranking exercise. The numbers represents departments.

Before the eight persons were allowed to rank the different departments on the four different aspects, a small pilot test was used to review the quotes and the test the exercises. Two persons were used for this pilot. Based on this pilot test the quotes of some respondents were removed in order to make sure that the ranking task was as clear as possible to conduct. Additionally, some critic was provided on the exercise in which the respondents were supposed to rank the quotes on the uniqueness dimension. This provided clues that the quotes, which are describing whether a department has unique knowledge, were not suitable for the ranking tasks. For example, participants could not distinguish whether it is more unique when knowledge has an overlap with the sales department than with the STAR department. (The quotes do not distinguish the sort and amount of overlap between the departments.)

Additionally, uniqueness of knowledge is somewhat related with newness. In a normal situation new knowledge (new to the organization) is not possessed by anyone else within Assembléon. In this situation, it is likely that new knowledge is also unique knowledge (not possessed by other departments). However, when this 'new knowledge' is gathered via multiple departments simultaneously (or closely in time after each other), this new information is not unique (e.g. this could occur when there are multiple disciplines gathering knowledge in the same customer encounter). Based on these arguments and the feedback on the pilot test, the 'uniqueness of knowledge' dimension was not used in the ranking task.

After the ranking task was performed, it was possible to identify whether Assembléon has, better, newer, more usable, customer knowledge than currently is located in the innovation process.

5 Results

In this section the results of the ranking task and interviews will be discussed. As stated in the method section, for each department several quotes were chosen in order to represent a certain department. After the election of these quotes, eight respondents were supposed to rank the different departments. First, the results of the in-depth interviews are discussed. Second, the descriptives and reliability of the ranking task will be discussed. Thereafter, the results of this task will be presented.

5.1 Quotes of in-depth interviews

The quotes which best suited the measured dimensions, were represented towards the eight persons. In some cases the respondent of the in-depth interviews gave answers that perfectly fitted the question. Some of the respondents gave answers that were hard to use in the ranking exercise (answers with poor quality which required multiple questions to cover one topic). These differences in answers occur due to educational differences and different work experience. For example, product managers are in general higher educated than call center employees. The difference in quality of the answers is immediately notable (the asked question was whether there is an overlap in knowledge with other departments):

- Product management: "There is always an overlap. A part of the knowledge comes from the region (business support, sales). These people know the

customers, they are often present at the meetings we have with the customers. Product marketing analysis their requirements and try to create general market requirements. That is specific knowledge located within product marketing, the translation of market requirements towards a specific URS for a product.”

- Call center: “Yes, overlap with the sales department.”

Therefore, in some interviews more questions need to be asked in order to get the same amount of information.

For each department (except training), at least two employees were interviewed, therefore quotes could be compared. When things are mentioned by all two employees, it is quite sure that a certain quote represents the real situation. However, in some situation, the two respondents of the in-depth interviews were not on the same line about certain topics. In many cases, no match was found between the answers of the supervisors compared with its subordinates. For example within the direct-sales department: (towards the question how direct sales provides input in the innovation process)

- Supervisor: “via regular meeting, where we continuous stimulate knowledge sharing.”
- Subordinate said: “now and then we have meetings, sometimes I joined these. However, this is not a regular process. Certainly not.”

This discrepancy between supervisors and subordinates is also present in other departments. It is likely that this discrepancy occurs due to dishonest reactions of the managers. In these interviews the managers are talking about their own performance (with respect to retracting knowledge form their subordinates). Schaufeli & Enzmann (1998) found in their study that introspection is a subjective method to measure performance because work is an important part of someone’s life. When someone admits that he is performing poor, it would damage his/her self-esteem. Therefore, employees are willing to believe that they perform well (Baumeister, 1993). This theory could explain the discrepancy in the answers. The subordinates had no worries to honestly complain about the knowledge sharing within Assembléon. Therefore, the answers of the subordinates were chosen to have a higher reliability than the answers of the supervisors. Additionally, in some cases a third person was consulted.

5.2 Descriptives of the ranking task

This paragraph will discuss the descriptive of the ranking tasks and checks whether the results of these tasks are reliable and could be used whether the eight respondents agree with each other).

As discussed above, the ranking task was conducted by eight different persons. Four of them are employed by Assembléon and experienced with its innovation process. The other four are students of industrial engineering at the University of Eindhoven.

In Table 9, the descriptive information about the eight respondents is shown.

Respondent	Gender	age	experience
1	male	45	15
2	male	56	11
3	male	50	2
4	male	39	17
5	male	23	none
6	male	23	none
7	male	23	none
8	male	23	none

Table 9 Descriptive information about the eight respondents of the ranking task.

As noticeable, the group of four students is extremely homogeneous. All four students were male, 23 years old and had no experience with Assembléon whatsoever. The managers of Assembléon showed a little more diversity in age and work experience.

5.3 Outliers of the ranking task

After the eight participants ranked the different departments, the results of the ranking tasks were checked for outliers. This was conducted via examining boxplots and scatterplots.

The check for univariate outliers was conducted via boxplots. One boxplot per department for each category ((1) knowledge integration, (2) newness of knowledge, (3) usability about usability aspects and, (4) usability about applications) was reviewed. This resulted in 31 boxplots⁶ that were checked. The results showed 4 extreme outliers and 6 normal outliers.

The check for bivariate outliers was conducted via scatterplots. In the scatterplots, for every department each three categories were checked against knowledge integration. This resulted in the identification of several outliers. For example, the knowledge newness of the STAR department, see Figure 9.

⁶ 31 boxplots; not 32 boxplots because the sales departments is not ranked on the ‘usability of knowledge with respect to machine usability’.

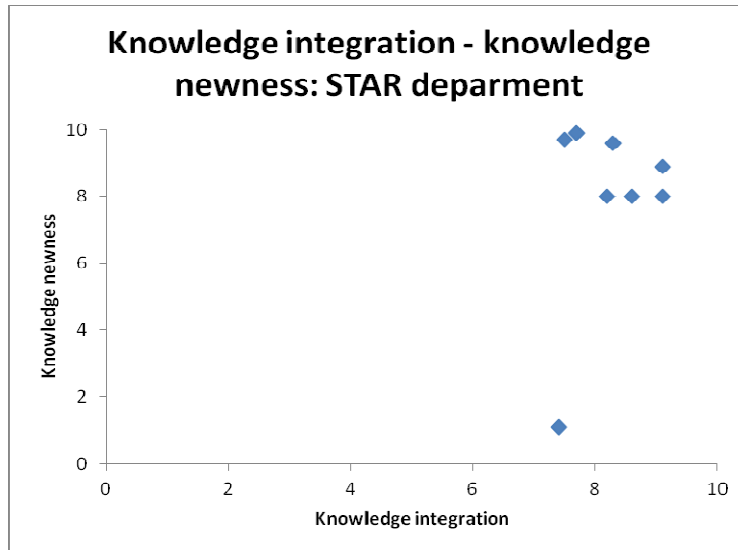


Figure 9 Result of checking for bivariate outliers for the STAR department in the knowledge newness category.

When taking into account Figure 9, it is noticeable that there is one outlier. It shows that the outlier is only based on a weird value for the knowledge newness dimension. The value of the knowledge newness, which created the outlier, should be removed from the dataset.

The results of the examination of the scatterplots were compared with the results of the boxplots. This resulted in the deletion of 10 values which are identified as outliers.

5.4 Reliability of the ranking task

In order to determine whether the provided data of the ranking tests could be used, it is important to determine its reliability. It is important to check whether the eight persons that should rank the departments agree with each other. Different measures exist to measure the so-called inter-rater reliability, the level of agreement between the raters.

First, the different raters could be compared via pairwise correlation coefficients. Spearman's (1904) method is used because the ranking task was based on a continuous ranking. The correlation coefficient of Spearman (1904) only takes into account the relative position of the departments. For example, when a rater provided values for department 1 and 2 which are respectively 1 and 2, a perfect correlation is found with a rater which provided the scores 3 and 4 respectively (when the rank number remains the same). In our case, it is not a problem that only relative positions are considered because averages are used in the further analysis.

The correlation coefficients are calculated via SPSS. The calculation that is conducted by SPSS is:

$$\rho = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}}$$

Where ρ refers to the correlation coefficient and x_i and y_i refers to values which represent the position of a certain department on the ranking line. x and y refer to the two respondents of the ranking task that are compared.

This method compares the answers between two different respondents of the ranking task. The analysis between two respondents is conducted based on all the answer they provided. The coefficient of Spearman (1904) represents the level of agreement between sets of respondents. (1 represents the maximum level of agreement). The correlation matrix is shown in Table 10.

Participant number:	1	2	3	4	5	6	7
2	.759**						
3	.818**	.748**					
4	.677**	.513**	.496**				
5	.851**	.573**	.633**	.774**			
6	.777**	.532**	.667**	.603**	.715**		
7	.878**	.369*	.495**	.672**	.771**	.632**	
8	.696**	.307	.395*	.680**	.674**	.624**	.734**

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed)

Table 10 Correlation matrix between the eight participants of the ranking task based on Spearman's (1904) method.

As noticeable in Table 10, all relations were found to be significant (except one) and are positive related. The average level of agreement over the eight respondents is found to be 0.645, a score which is relatively good. The average level of agreement of the four managers of Assembléon is found to be 0.669. The four students provided a level of agreement of 0.692. As noticeable, both groups (managers and students) internally have a slightly higher level of agreement than the overall level of agreement. However, this difference is very small and it could not be concluded that the students group and managers group should be separated during the further analysis of the data. The eight respondents of the ranking task are considered as one group of respondents.

Additionally, the intra-class correlation coefficient is also calculated. It also represents the inter-rater reliability of the ranking task (Everitt, 1996; Schrouf & Fleiss, 1979). The two way mixed model based on consistency is used to determine the value of the interclass correlation

coefficient. The retrieved value is 0.941 for all the eight respondents. The group that only consists of managers and students scored respectively 0.888 and 0.887. All three scores are very high and represent a good inter-rater reliability. Again, the level of agreement is lower within the subgroups, this ensures that the further analysis should be conducted based on all eight participants. There is a good level of agreement between them.

5.5 Results of the ranking task

After the checks for outliers and reliability, the data was cleaned and approved for the analysis. The averages of the values of the ranking tasks were used to analyse the departments. It is also interesting to check the standard deviation for the different departments. A large standard deviation is the result of a huge spread in the values, provided by the eight respondents. In Table 11, the minimum value, maximum value, mean and standard deviation is provided.

Department per category	Minimum	Maximum	Mean	Standard deviation
Knowledge integration:				
STAR	7,4	9,1	8,24	0,67
Product management	7,4	9,0	8,00	0,53
RAP	1,7	8,4	5,88	2,35
Direct sales	1,4	2,4	2,03	0,42
Business support	0,9	5,1	2,90	1,76
Call center	0,5	3,1	1,61	0,90
Training	3,4	5,7	4,99	0,85
Second line service	3,1	6,9	5,34	1,50
First line service	1,3	3,1	2,14	0,81
Sustaining	0,7	7,9	4,08	2,35
Knowledge newness:				
STAR	8,0	9,9	8,87	0,87
Product management	8,8	10,3	9,59	0,54
RAP	4,6	9,9	7,34	2,03
Direct sales	4,8	9,4	7,30	1,94
Business support	2,1	7,2	4,03	2,19
Call center	0,4	6,6	2,71	1,96
Training	1,2	6,2	3,28	1,56
Second line service	0,8	7,3	3,91	2,19
First line service	3,1	10,0	6,38	2,43
Sustaining	0,7	4,7	2,46	1,66
Knowledge usability about machine usability:				
STAR	6,9	9,0	7,94	0,85
Product management	1,7	8,5	4,73	2,38
RAP	4,0	9,7	6,63	2,35
Business support	1,0	6,4	2,60	1,96

Call center	2,6	9,4	5,63	2,62
Training	7,4	8,2	7,80	0,34
Second line service	3,8	8,9	6,59	1,85
First line service	6,2	9,4	7,91	1,31
Sustaining	1,4	8,7	4,40	2,63
Knowledge usability about applications:				
STAR	6,7	9,7	8,16	1,20
Product management	8,4	9,9	9,02	0,59
RAP	6,2	9,7	7,87	1,31
Direct sales	2,9	6,9	4,94	1,82
Business support	2,4	9,2	6,21	2,55
Call center	0,3	2,6	1,60	0,84
Training	1,5	7,6	4,70	2,42
Second line service	1,8	5,0	3,51	1,13
First line service	4,2	9,1	6,73	1,93
Sustaining	0,6	6,0	4,03	1,90

Table 11 Minimum, maximum, mean and standard deviation of the provided values at the ranking task.

The most interesting part of Table 11, are the standard deviations. It is noticeable that these values are widely ranged. Some departments have a low standard deviation, which means that the eight respondents were very like-minded. However, some departments have a higher standard deviation. The maximum standard deviation is 2.62. This is high for a continuous scale which ranges from 0 till 10. Despite, a high standard deviation, it indicates where a certain department should be positioned.

The results of the ranking task were combined and an overall ranking of the departments could be created. The results can graphically be shown in three different figures (knowledge integration against (1) knowledge newness, (2) knowledge usability with respect to machine usability and (3) knowledge usability with respect to applications).

5.5.1 Knowledge newness

First, the knowledge integration is related with the newness of knowledge. The average values of the eight respondents were used to create Figure 10.

Schulz (2001) stated that new knowledge should be integrated in order to determine whether this knowledge is useful, regardless whether it is extremely or slightly new for the organization. This stresses that a department which possesses knowledge that is slightly new, should integrate this knowledge to a high extend in order to determine whether it is useful. Based on this argument it can be concluded that the ideal line (with respect to knowledge newness) is an exponential line. (In other words, the knowledge integration must have a higher level than the knowledge newness.)

Figure 10 shows the ideal line and the results of the ranking task.

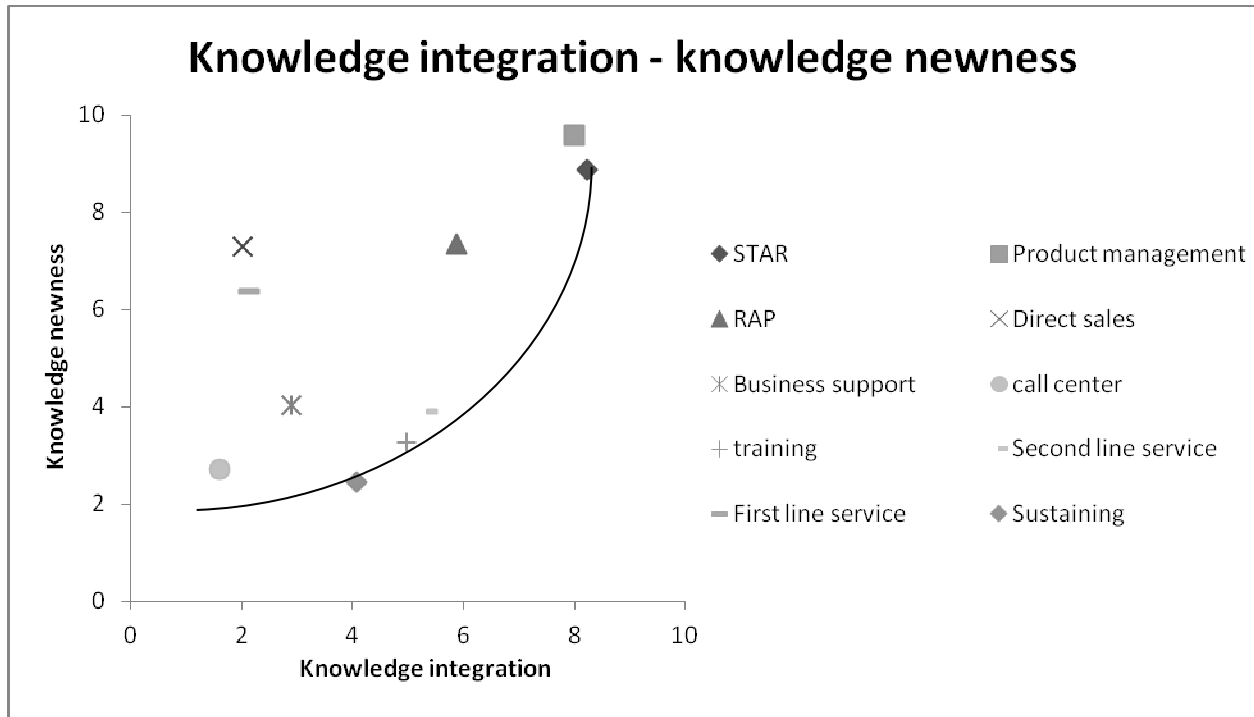


Figure 10 Knowledge newness visualized against knowledge integration. The black line represents the ideal line of integration with respect to knowledge newness.

As noticeable, not all departments are located on this ideal line. The direct sales, first line service, RAP and business support are all three located on the left of this line. This suggests that these departments possess new knowledge but that their knowledge is not enough integrated in the innovation process.

None of the departments are located on the right of the ideal line. This would have meant that a department experienced too much integration with respect to its knowledge value.

5.5.2 Knowledge usability (machine usability)

The second figure that was created, was based on the usability of the knowledge with respect to machine usability. The results are graphically shown in Figure 11.

With respect to usability of knowledge, literature does not directly provide information about the ‘ideal line’ of integration. Schulz (2001) states that the more usable the knowledge is, the more important it is for an organization. This stresses that the ideal line, with respect to knowledge usability, is a linear line. Knowledge that is partly usable, should be partly integrated. This holds for both the usability of knowledge with respect to machine usability, as well as for applications. Figure 11 shows the ideal line and the results of the ranking task.

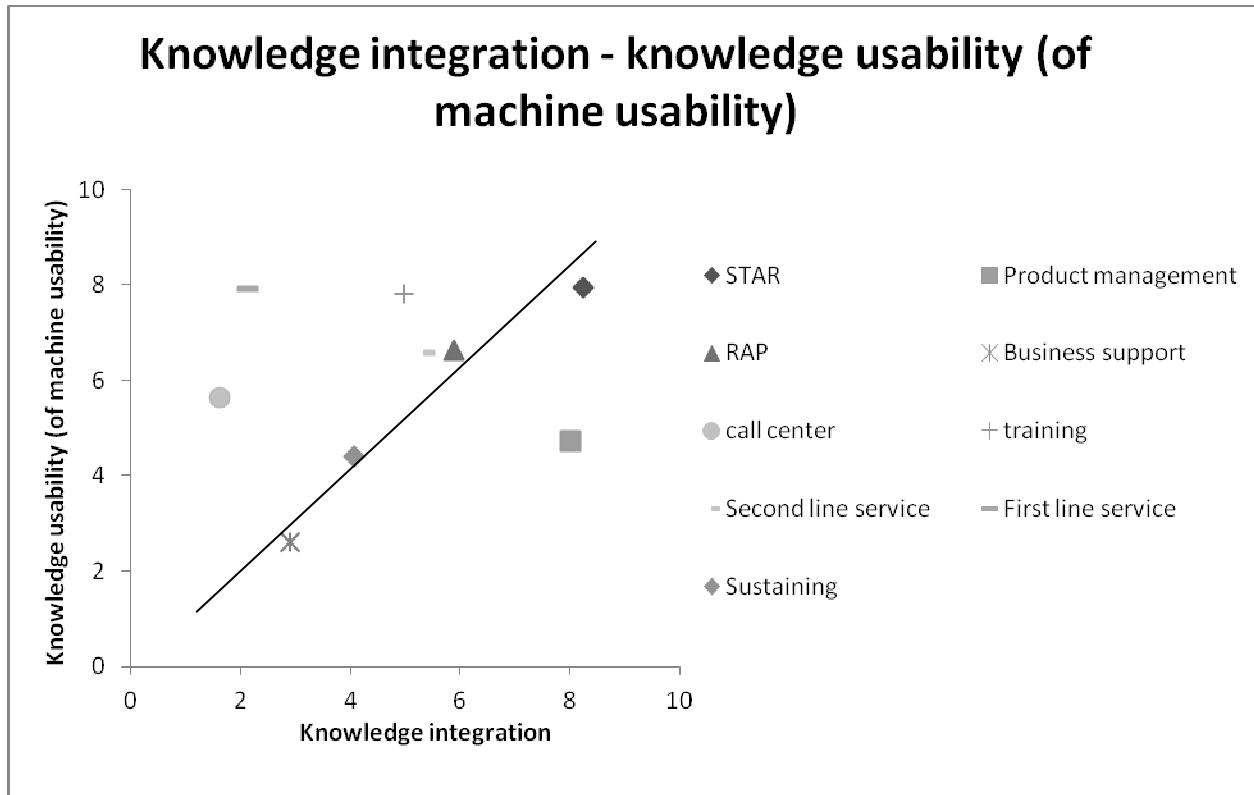


Figure 11 Knowledge usability (with respect to machine usability) visualized against knowledge integration. The black line represents the ideal line of integration with respect to knowledge usability.

Not all departments are located on the ideal line. Three departments are identified that are obviously not located on the ideal line. The knowledge of the first line service, training and, call center department are all three insufficiently integrated in the innovation process. These departments are located on the left side of the ideal line.

Further, the product managers department is located on the right side of the ideal line. This means that their knowledge is too much integrated in the innovation process with respect to the machine usability.

5.5.3 Knowledge usability (application)

The third figure that was created, was based on the usability of the knowledge with respect to applications. The results are graphically shown in Figure 12.

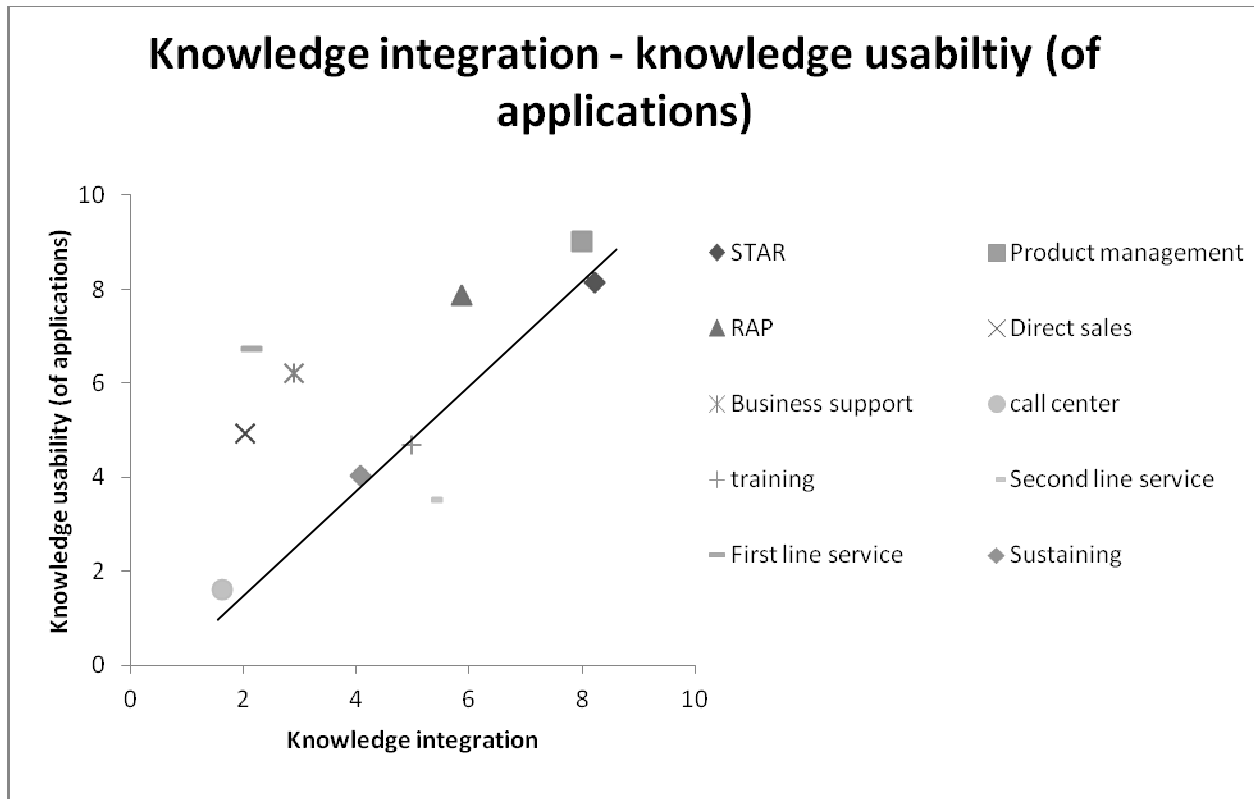


Figure 12 Knowledge usability (with respect to machine usability) visualized against knowledge integration. The black line represents the ideal line of integration with respect to knowledge usability.

In Figure 12, it is noticeable that three departments are not positioned on the ideal line. The second line service, business support and, direct sales department are located left of the ideal line of involvement. These departments possess usable knowledge about applications, but their integration is not sufficient.

The other departments are located around the ideal line. Their knowledge integration is sufficient to the value of their knowledge (at least for the usability of the knowledge with respect to applications). It is a doubt whether the RAP department is located correctly. Maybe the knowledge of the RAP group should be integrated a little more.

6 Discussion

Based on the results of my project, it is possible to answer the research questions. In this section the different sub-research questions will be answered for the departments, recommendations will be provided and, limitations of my project will be discussed.

6.1 Sub-research questions

First, the sub-research questions will be discussed for the departments that do not show congruency between the knowledge value and knowledge integration. The two sub-research questions:

What is the current knowledge integration of Assembléon's departments in its innovation process?

What is the value of the knowledge that currently is possessed by Assembléon's departments?

Two separate aspects are required: the knowledge integration and value of knowledge. Both dimensions were measured in the interviews. However, as mentioned in the methodology section, some departments are not considered as one due to variation in work activities. Therefore, this research question is reviewed for each subgroup. Only the interesting subgroups that did not show full congruency between the knowledge value and knowledge integration are discussed.

6.1.1 Call center

The results showed that Assembléon's call center has a lot of contact with customers. Their contact is mainly based on short contacts and questions with the customers. The call center's activities are in general based on the redirection of customers towards certain departments and 'easy' questions about the machines. The call center employees gain information about the different problems that occur on the machines when they are redirecting customers.

The knowledge integration of the call center department in the innovation process is very limited. The call center is the departments with the least input in the innovation process. The value of the knowledge of the call center can be separated into the three different aspects (newness, usability about machine usability, usability about applications). The knowledge that is possessed by the call center department is not very new. With respect to the application knowledge, the call center does not possess usable information. However, with respect to the machine usability, the call center does possess somewhat useable information. However, combining these three aspects let us conclude that this useable information is not new to the organization. Therefore, the knowledge integration is congruent with the value of knowledge.

6.1.2 Training

The training department of Assembléon consists of only one employee (at least for Europe). The activities of this department are the providing of training (internal and external) and the training development.

The current knowledge integration of the training department in the innovation process is medium. The training department can provide input sporadically. The knowledge of the training department is not very new. The knowledge usability is medium for information about applications and somewhat higher for the information about machine usability.

Overall, the value of the knowledge of the training department is congruent with its integration. The usability of the information is medium-high, while the newness of this knowledge is very

low. This averages out to a medium value of knowledge (congruent with a medium level of integration).

6.1.3 First line service

The first line employees of Assembléon, are employees who are directly involved with the customer. These employees are at customer sites, solving problems that customers experience with their Assembléon equipment. The first line employees experience very intense customer contact.

The integration of the first line employees in Assembléon's innovation process is very low. The knowledge newness is medium-high. The knowledge usability with respect to machine usability is high, as well for the knowledge usability about applications. This finding is supported in scientific literature (Schneider & Bowen, 1984).

It is noticeable that the value of the knowledge that is possessed by the first line service employees is not in line with its integration. It is obvious that the value of the knowledge is high (the knowledge is usable and new to the organization). The knowledge integration of the first line service employees is low. It would be beneficial to better integrate the knowledge of the first line service employees. It is very likely that this will enhance the innovation project performance. This finding is supported in the literature by Moosa & Panurach (2008), who also stated that the frontline employees should be involved in the innovation process.

6.1.4 Direct sales

The direct sales employees experience many customer encounters. Their goal is to sell Assembléon equipment, wherefore they are gathering a lot of information about application requirements.

My research showed that the knowledge integration of the direct sales department is low. The newness of the knowledge is high. The knowledge usability with respect to applications is medium. Combining those two results, the value of the direct sales department is new and usable. This is not congruent with its low knowledge integration of the direct sales departments. The knowledge of the direct sales department should be integrated on a higher extend.

This finding is congruent with findings in the literature. Ernst et al. (2010) found that, in the concept stage of an innovation project, it is beneficial to actively stimulate communication between the sales department and other departments.

6.1.5 RAP group

The RAP group develops dedicated hardware and software for customer specific requirements. Most of their projects are unique and not requested by other customers. Based on the results it can be concluded that the RAP group possess some valuable knowledge. Their knowledge is quite new. Combined with a high level of usable knowledge about applications, it is noticeable that the RAP group should experience high knowledge integration. Currently, the RAP group's knowledge is medium integrated in the innovation process. In the future, this should be increased.

6.1.6 Other departments

The knowledge value of the other departments is all congruent with their knowledge integration. The knowledge value is determined by combing the different aspects (knowledge newness, knowledge usability about machine usability, and knowledge usability about applications). Therefore, it is not recommended to increase the knowledge integration of another department. So, only the knowledge of the first line service, sales and RAP employees should be integrated in a higher extend.

6.2 Recommendations

6.2.1 Process improvements

Based on the results of this project, different recommendations can be given towards Assembléon. First, the current concept development process of Assembléon is provided, see Figure 13. This process is executed by the product marketing employees of Assembléon.

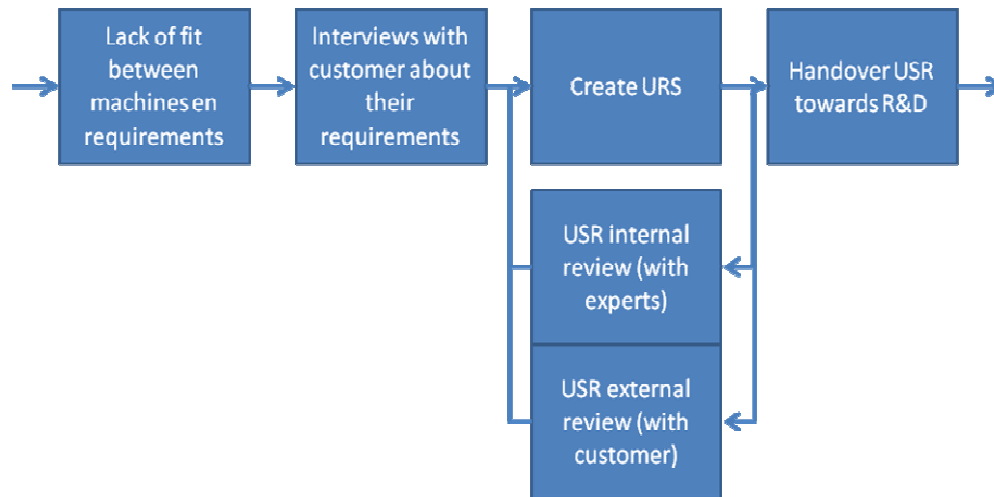


Figure 13 Current concept development process of Assembléon (creating the URS). This is not a formal process in Assembléon’s organization.

This process is executed by the product managers of Assembléon. When the product managers are not sure about certain specifications, an internal review is conducted with a manager of another department (or an external review with the customer is conducted).

In upcoming paragraphs the recommendations will be discussed that will change the current concept development process of Assembléon.

6.2.1.1 Formalize processes

Literature states that it is beneficial to use formal innovation processes. The risk of informal processes is that knowledge is not properly communicated through the organization. ‘Knowledge providers’ and ‘knowledge takers’ will find it more difficult to find each other.

Especially for small innovative projects, a more bureaucratic process is beneficial (Olsen, Walker & Ruekert, 1995). In Assembléon’s case, the development of an application can be considered as a small innovative project. Froehle et. al. (2000) argues that a more formalization

in innovation process will increase project performance due to an increase in advantageous learning effects.

6.2.1.2 Integrate knowledge of first line service and direct sales

Based on the ranking task, it can be concluded that the knowledge of the first line service employees and direct sales employees should be used more extensive. The current integration is not congruent with the knowledge that is possessed by these departments. This finding suits the current ideas in the literature. The knowledge of the customer, possessed by a frontline (service or sales) employee, is excellent. These employees have a good feeling about the customer needs that are not satisfied yet, they are the first entities in the organization that receive these innovation opportunities (De Brentani, 2001). This is in line with the findings of my research. The first line service and direct sales department where both ranked as departments which possess knowledge that is new for the organization.

As mentioned before, the usage of customer information within the innovation trajectory is widely praised in the academic literature (e.g.: Jong & Vermeulen, 2003; Belkahla & Triki, 2011). Frontline employees can, especially, help by the determination of the level of service customization and user-friendliness that is required by customers (Martin & Home, 1995). This finding in the literature supports my finding that the first line service employees of Assembléon have a high amount of usable knowledge about machine usability.

Both my research and literature stress that the knowledge of the first line service and direct sales department should be integrated to a higher extend.

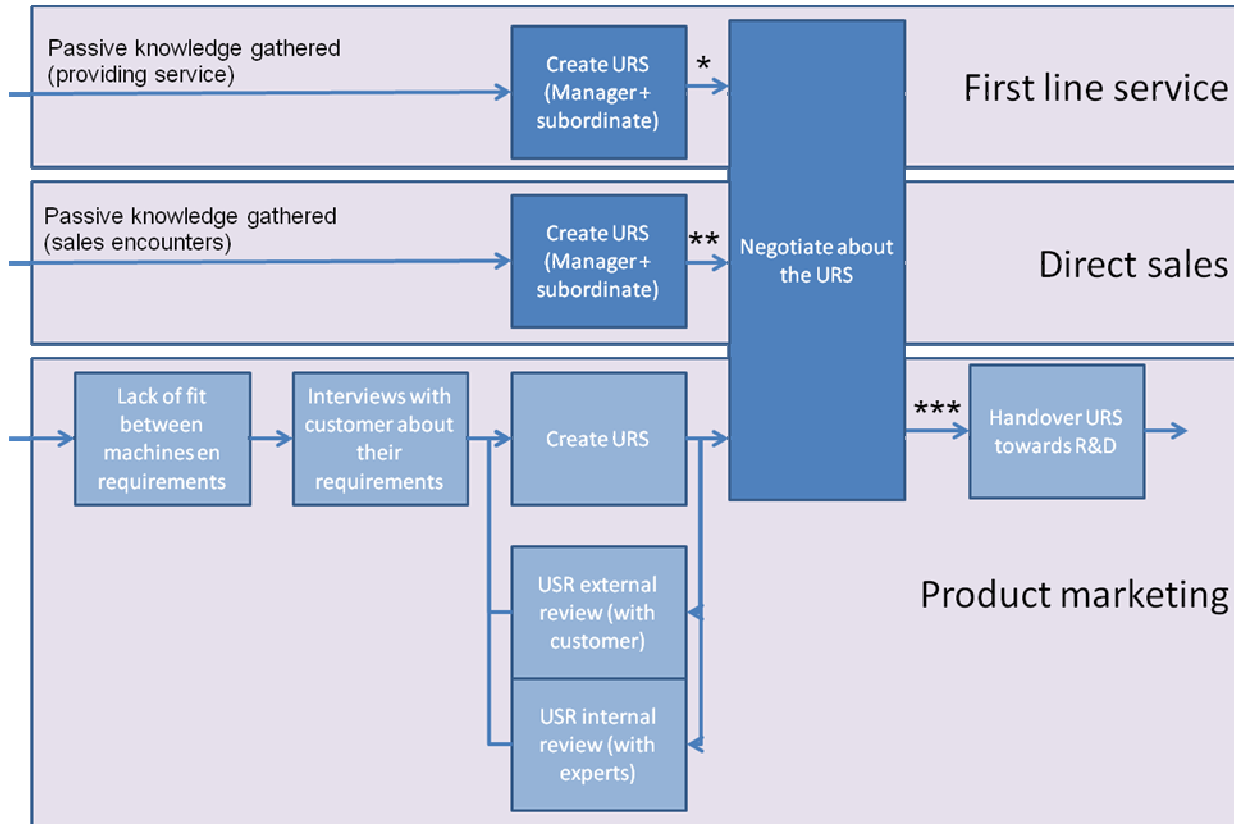
6.2.1.3 Improving the current process

Several practical implications will improve the concept development process. The different improvements are:

- The URS must not be reviewed but **filled in** by managers of other departments. Currently, the URS is only reviewed by other employees, this will increase the chance of group thinking and not stimulate creativity. When an empty URS is send to other employees, they are necessary to think about their own experiences and knowledge. After the certain employees filled the URS, the different parties can negotiate about the requirements in the URS.
- The URS should be send towards **subordinates** (the real front line employees), not to managers or experts. In the current situation, the URS is send towards the managers of a certain department. Some managers do not discuss the URS with their subordinates, they only use their own knowledge and ideas. It is likely that subordinates do not feel engaged in the concept development phase.
- **Formal gatekeepers** should be used before the concept development phase is ended. Especially, sales and first line service employees should approve the URS before the actual development will start. The other formal gatekeepers should be product managers, STAR employees and (optional) employees of the RAP group.

- Employees should be empowered and involved in the **decision making** during the development of the URS. Again, the sales and first line service employees should be involved in the decision making of the team that develops the URS.

Combining these different improvements into the current concept development process will result in a process that is shown in Figure 14. The original process, which was used by the product marketing group, is still maintained (shown as the light blue boxes). The first line service and direct sales department are both ought to develop a URS. This URS must be based on the knowledge they possess (no extra customer encounters are necessary).



* 1 First line service subordinate is the formal gatekeeper.

** 1 Direct sales subordinate is the formal gatekeeper.

*** 1 First line service subordinate, 1 direct sales subordinate, 1 member of the RAP group and 1 member of the STAR team are the formal gate keepers.

Figure 14 The improved process which ensures more knowledge integration of the first line service and the direct sales department.

As noticeable, some subordinates are chosen to be the gatekeepers. It is important that these gatekeepers are engaged with the gathering of customer knowledge and that they are employees who experience customer knowledge.

The negotiations about the URS are conducted with a manager and a subordinate of the first line service, a manager and a subordinate of the direct sales departments, and (a) product marketer(s).

6.2.1.4 Find suitable employees

As noticeable, the new process design uses several subordinates as a source of information and as gatekeepers. In order to make sure that suitable persons are involved with these activities, Assembléon should engage first line service and direct sales employees that are engaged and willing to share their knowledge. Assembléon should internally search for the most suitable employees with respect to knowledge sharing behavior.

Literature provides several individual aspects that significant relate with customer orientation (gathering customer knowledge). Organizational commitment, job satisfaction, job involvement (Dursun & Kilic (2011), employee creativity (Sousa & Coelho, 2011) and, self-esteem (Korschun & Bhattacharya, 2008) are all positive related with customer orientation. Job involvement refers to the amount an employee identifies his/herself psychologically with his/her work (Darden et al., 1993).

Based on these aspects, the most suitable person could be chosen per departments to take part in the development of the URS.

6.2.2 Knowledge gathering recommendations

Further, different recommendations could be provided in order to stimulate the knowledge gathering at customer encounters (passive).

Fernandez & Pitts (2011) identified factors that encourage frontline employees to engage in innovative behavior. They found four factors that were of importance for employees to engage in bottom-up innovation⁷. The four relevant factors were: (1) the expectancy of rewards based on the innovation, (2) employee training and development, (3) employee empowerment and involvement in decision-making at the innovation process, and (4) a high-exchange relationship with supervisors. (Note that these last two factors are present in the new process design.)

Williams & Attaway (1996) found a positive relation between the organizational culture and the customer oriented behavior of its employees. Organizational culture refers to the amount of supportive aspects that are embedded in the organization (e.g. empowerment, interrelationships, socialization, commitment, pride, goal congruence, etc.) (Wallach, 1983).

When an organization is providing support towards frontline employees to gather customer knowledge, the frontline employee will gain a better idea about what needs are important for customers (Wang, Lui & Wang, 2011).

Based on these different studies it is obvious that the organizational culture is an important factor in order to engage employees in customer oriented behavior. Assembléon should provide enough support for its first line service and direct sales employees to engage in customer oriented behavior. Different practical implementations could ensure this:

⁷ Bottom-up innovation refers to innovations which are steered from the experiences of frontline employees. These innovations are based on the customer requirements that are identified by frontline employees during sales and/or service encounters (Mechinda & Patterson, 2011). These innovations are really starting from the 'bottom' of the organization.

- A **reward system** should be used to engage front line employees in the search for customer requirements. When an employee finds customer requirements, he/she could present these towards product marketing. If this idea or requirement is developed and found to be relevant, the front line employee should receive a bonus/award/recognition.
- Front line employees should be **given time** to gather customer requirements. Make knowledge gathering a formal duty of some engaged front line employees, this will make sure that time is especially available for knowledge gathering. This will put less pressure on front line employees to meet performance targets.
- The employees with customer contact should be **trained** to gather customer requirements. Employees should be familiar with methods how they could retract information within their customer encounters (oral or via surveys).

6.2.2.1 A trade off

Based on the paragraphs above, it is noticeable that frontline employees/Assembléon should make a trade-off. The gathering of customer knowledge is time consuming. When it is desirable to gather knowledge, in depth, knowledge about the customer it is necessary (e.g.: based on an observation or conversation). This will be more time-consuming than just performing the sales/service duties. The trade-off that should be made is whether the employee should work as efficient as possible or should focus on retracting as much information as possible. Assembléon should be very clear to its employees whether they should focus on working as efficient as possible or whether it is also valued when information is retracted.

6.3 Limitations

No research is without limitations, mine is no exception. Several limitations can be identified with respect to my research. The first aspect is the fact that in-depth interviews were conducted by me. These interviews were structured, however there is still an interpersonal effect which influences the interviewee.

The second aspect is the analyses of the qualitative interviews. The quotes of the qualitative interviews were combined and grouper per subject. Per subject the best describing quotes was chosen to be part of the ranking task. The election was only conducted by me, which gave my research subjectivity. It would be beneficial to use multiple persons in order to choose these quotes, however it is extremely time consuming.

Further, my research lacks generalizability. Literature states that each innovation process should be designed in its own specific context (Tidd, Bessant & Pavitt, 2005; Loewe, 2006). The results of my study are very case-specific. The results could not be copied into other organizations with other innovation processes.

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Appendix A

This list was used during the exploration phase in order to find discrepancies between the literature and the innovation process of Assembléon. The goal was to identify a relevant area in order to improve the customer centeredness of Assembléon. Behind the method is mentioned whether a certain method is used or not in Assembléon's innovation process.

Additionally, this list was used as a guide for the interviews at the different employees in order to validate the direction of my thesis.

Implementing the voice of the customer:

- Implemented customer interaction in every stage of the NPD process: no, mainly during the idea generation and implementation phase, during the design phase customer contact is lacking (e.g.: Griffin & Hauser, 1993)
- Beta testing: yes (e.g.: Dolan & Matthews, 1993)
- House of quality (QFD): yes (e.g.: Temponi, Yen & Tiao, 1999)
- Concept tests: yes (e.g.: Duke, 1994)
- Focus groups: no, hardly applicable in this type of industry (e.g.: Kitzinger, 1994)
- Consumption analysis: yes (e.g.: Philips, 1983)
- Ethnography (description of customer behavior): no, only gathering data from a machine in order to analyze usage (e.g.: Arnould & Wallendorf, 1994)
- Translation from customer language to engineering language: yes (e.g.: Jiao & Chen, 2006)
- Lead users (leading edge & high benefits in their needs): yes, however not formally mentioned in BCP (workshops, screening, etc) (e.g.: Hippel, 1986)
- Interviews with customers: yes (e.g.: Gerwin, 1993)
- Interdisciplinary team: partly yes, the marketing and R&D department are collaborating (e.g.: Farrell, Schmitt & Heinemann, 2001)
- Scanning literature & internet databases: yes (e.g.: O'Leary, Rao & Perry, 2004)
- User communities: no, customers are not willing to share their knowledge towards other customers (e.g.: Jeppesen & Frederiksen, 2006)

Role of marketing in the innovation project:

- Trade union: yes (e.g.: Schnabel & Wagner, 2007)
- Trade fairs: yes (e.g.: Seringhaus & Rosson, 1994)
- Customers: yes (e.g.: Ulwick, 2002)
- Competition: yes (e.g.: Zanjani et al., 2008)
- Suppliers: partly yes, implemented via the feedback on the URS of the R&D department (e.g.: Clark, 1989)
- Industry journals: yes (e.g.: O’Leary, Rao & Perry, 2004)
- R&D & marketing cooperation in the NPD process: yes, this relation is part of the so called ‘triangle’ between marketing, R&D and the project leader (e.g.: Ernst et al., 2010)
- Cross functional teams: partly yes, collaboration between R&D and marketing (e.g.: Henke, Krachenberg & Lyons, 1993)

Project management tools: (project management, document management, etc.)

- Face to face meetings: yes (e.g.: Vessey & Sravanapudi, 1995)
- Tele-conferencing: yes (e.g.: Alshawi & Ingirige, 2003)
- Dedicated project intranet: yes (e.g.: Eppler, 2001)
- Team co-location: no (e.g.: Bulte & Moenaert, 1998)
- Team-building exercises: no, however culture within team does not require this (e.g.: Francis & Young, 1979)

Appendix B

This appendix shows the questions that are asked during the in-depth interviews about the value of customer knowledge. In the first and second column is shown which literature is used in order to determine these questions.

First, the knowledge acquisition aspect will be elaborated. The paper about knowledge acquisition of Darroch (2003) was used in order to develop relevant interview questions. Darroch (2003) developed a scale to measure the knowledge acquisition. Therefore, the paper of Darroch

(2003) was helped to identify relevant questions for my interview. Several items from the developed scale were used to create semi-structured interview questions.

In order to retrieve qualitative information about the type of knowledge, two constructs were used as a subject for the development of the semi-structured interview questions. First, the conceptual model of customer knowledge, based on Zanjani et al. (2008), is used. Based on their conceptual model several questions are created in order to make it possible to identify the type of knowledge. Second, the knowledge conditions, defined by Gebert et al. (2002), are used. They defined three different aspects which are determining the relevance of knowledge.

After these two customer knowledge aspects were measured, the qualitative information about the integration dimension could be gathered via interviews. The integration dimensions was, as mentioned above, divided in two different constructs.

Dimension:	Aspects:	Interview guide:
Knowledge acquisition	Knowledge acquisition (Darroch, 2003)	How are employees of your department encouraged to attend seminars and conferences? (Galvin, 1996)
		Are employees of your department being encouraged to think about Assembléon's business? How? (Nonaka & Takeuchi, 1995)
		To what amount are employees of your department sensitive towards information about changes in the market place?
		To what amount are real market needs used, and not internal politics, to drive innovation? (Kohli & Jaworski, 1990)
		How quick is your department to detect changes in customers' preferences? (Kohli & Jaworski, 1990)
		How often do employees of your department meet with customers to find out what products/services they will need in the future? (Kohli & Jaworski, 1990)
Type of knowledge	Model of customer knowledge management (Zanjani et al., 2008)	Do employees of your department actively gather knowledge about its current customers?

		Do employees of your department currently possess knowledge about its current customer?
		Do employees of your department actively gather knowledge about its prospective customers?
		Do employees of your department currently possess knowledge about its prospective customers?
	Different knowledge conditions (Gebert et al., 2002)	Is the customer knowledge, gathered and possessed by your department, of business significance; does it impact the costs or the revenues? (Gebert et al., 2002)
		Is the customer knowledge, gathered and possessed by your department, measurable and manageable? (Gebert et al., 2002)
		Is the customer knowledge, gathered and possessed by your department, overlapping knowledge of other departments? (Gebert et al., 2002)

Appendix C

This appendix shows the questions that are asked during the in-depth interviews about the integration of customer knowledge. In the first and second column is shown which literature is used in order to determine these questions.

First, the organizational design aspect is elaborated. The interview questions about the organizational design are based on two constructs. The first construct refers to the organizational structure of Assembléon. The interview questions about this first construct were based on Kim & Lee (2006). They identified several structural aspects that were discussed in some interview questions. The second construct focuses on the connectedness of different departments (Kahn, 2001)

The second construct of the integration dimensions is the 'systems for knowledge capturing' aspect. Based on the explorative interviews, it is found that the systems for knowledge capturing are different documents (e.g.: the URS, the SPS) and the IT-system (which contains a database with 'change requests'. The sharing/integration of customer knowledge will be conducted via these systems. Therefore, it is necessary to ask respondents about their interaction with these systems (Kim & Lee, 2006). The ease of use of such system is important in order to make sure that employees are using it to share their knowledge (Davis, 1989).

The third and final constructs of the integration dimension is the organizational culture. The interview questions about the organizational culture are based on different aspects. Knowledge sharing behavior (Yi, 2009) and the shared knowledge of the customer (Hong et al., 2004) are considered.

Beneath, the interview questions with respect to the integration of knowledge are presented:

Dimension:	Aspects:	Interview guide:
Organizational design	Organizational structure (Kim & Lee, 2006)	Are subordinates supposed to get a lot of formal approvals in their decision making?
		Is it discouraged when a subordinate makes his/her own decisions?
	Interdepartmental integration (Kahn, 2001)	How is customer knowledge shared between your department and other departments with respect to the innovation process? (via formal meetings, memorandums, circulated reports, circulated forms?)
		How and where is your knowledge about the customer implemented in the innovation process?
Systems for knowledge capturing	IT system (Kim & Lee, 2006)	Is your department actively using internet and email in order to communicate with other departments? (e.g. the PIB database)
		Can everybody in your department easily use the information systems?
		How often and how are subordinates (or you) in the opportunity to add customer knowledge into the innovation process via documents?
Organizational culture	Knowledge sharing behavior (Yi, 2009)	How do employees of your department (or you) contribute written ideas and thoughts via online databases?
		How do employees of your department (or you) share documentation from personal files related to the innovation process?
		How do employees of your department (or you) express their customer knowledge in

		organizational meetings? Participate in brainstorming sessions? Problem-solving suggestion?
		How do your employees share work-related failures in the innovation process in order to avoid repeating these?
		Considering the knowledge that is shared between employees of your department (or you), can this knowledge be classified as knowledge about the customer? Knowledge to update customer information? Knowledge to avoid risks and trouble (e.g.: problem reports)?
		Do employees of your department share info via communities (informal groups that voluntary share common practice)?
		How are employees of your department stimulated to share knowledge with other employees? Are they performing these tasks voluntary? (Kim & Lee, 2006)
		How are employees of your department involved in teams or groups that share knowledge? (Kim & Lee, 2006)
		Have your employees (or you) freely access towards the documents, which contain knowledge, possessed by others? (Kim & Lee, 2006)
	Shared knowledge of customer (Hong et al., 2004)	Considering knowledge of other departments, which departments got knowledge that is retrieved by your department (or by you)? (and is thus passed through via your department)

Appendix D

This appendix shows the four ranking tasks (with the quotes of the different departments). These tasks were conducted by 8 persons, 4 of them were employed by Assembléon as managers and 4 where co students.

Rangschik opdracht

Kennis integratie en de waarde van de kennis

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Business support: (ook wel sales support) afdeling die sales ondersteund, bijvoorbeeld door het maken van quotes en machine configuraties.

Change request: Een interne aanvraag om een verandering door te voeren in een machine (gebaseerd op klantvoorkeuren of een gevonden probleem).

Demografische klantkennis: Dit is kennis die beschrijft hoe de organisatie van de klant eruit ziet (omvang organisatie, managementlagen, wie is wie, etc.).

Design specificatie: wordt opgesteld nadat de URS is opgesteld, dit document geeft aan hoe de klanteisen vertaald worden in de machine (het design).

Driehoek: Groep die beslist over de prioriteitsetting van de innovatie projecten, bestaande uit een product manager, een projectleider en een architect (maakt de vertaalslag van klantvoorkeuren naar technische oplossingen).

FPR: Field Problem Report. Dit is een verslag van een probleem/fout in de machine die gevonden is die al 'in het veld' (bij een klant) staat.

iFlex: de recentste machine die is ontwikkeld door Assembleon.

Klant trainingen: trainingen die worden gegeven aan operators, line managers en maintenance engineers zodat zij leren hoe men een machine dient te gebruiken.

Lijn managers: Zijn werknemers bij de klant die verantwoordelijk zijn voor een gehele productielijn.

RAP groep: applicatie groep. Groep die speciale aanvragen omtrent functies van de machines ontwikkeld.

Roll out klanten/versie: wanneer de machine 'af' is wordt deze uitgerold in de markt door deze eerst bij een aantal 'roll out klanten' neergezet zodat zij deze een tijd kunnen testen. Op die manier wordt de eerste klantfeedback vergaard.

STAR: System Testing and Release. Deze afdeling test nieuw ontwikkelde onderdelen van een machine en geeft deze daarna ook vrij voor verkoop.

URS: user requirements specification. Dit document omvat een lijst met klanteisen.

Age:...

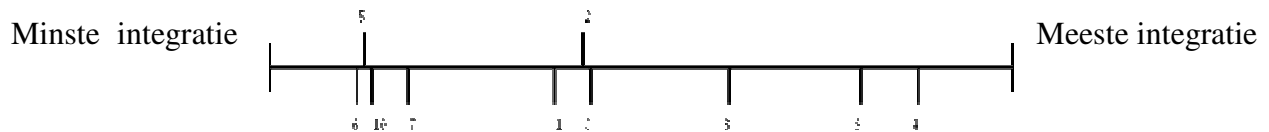
Years of experience:...

Opdracht: integratie van kennis

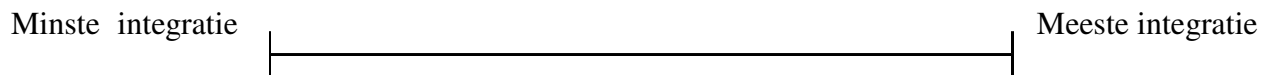
Verderop krijgt u een aantal quotes te lezen. Deze quotes zijn afkomstig uit interviews en geven iets aan over de kennis van een afdeling. U dient deze quotes te rangschikken op een volgorde waarbij u het gevoel heeft dat deze quotes gerangschikt staan van **MINSTE KENNIS INTEGRATIE** naar **MEESTE KENNIS INTEGRATIE** in de **SPECIFICATIE FASE**. U dient de cijfers die gekoppeld zijn aan de verschillende quotes in de tabel in te vullen.

Hieronder ziet u verschillende quotes staan die een afdeling beschrijven, u dient deze op een bepaalde dimensie (lijn) in te delen (zie voorbeeld). Wanneer u getallen die u al heeft ingevuld wilt veranderen dan kunt u deze doorstrepen en ergens anders plaatsen.

Een voorbeeld waarbij de lijn al ingevuld is met de verschillende afdelingsnummers:



Invullijn:



1. STAR (System Testing and Release)

- “Onze kennis wordt gebruikt tijdens de specificatie fase voor nieuwe functies of defects.”
- “Geen structurele invloed op de URS.”
- “Input gegeven in het integratieplan en de uitvoering.”
- “In de design fase worden de testers er al bij betrokken.”

2. Product management

- “Visit reports en marktanalyses worden gedeeld. Bij innovatie landt het ook via de URS, soms via change requests. Elke 3 weken een sprint kick-off (prioriteitsetting).”
- “Dagelijks interacties met innovatie. Individuele gesprekken en meetings met de driehoek.”
- “De stap van de URS naar de design specificatie wordt hooguit een keer gereviewd door mij.”

3. RAP (Applicatie groep)

- “Direct geven we heel weinig input. Meer indirect, je probeert innovatie handvaten te geven.”
- “Eerst veel input in proces van de iFlex. Daarna alleen reviews (wegens tijd en geld).”
- “Ik probeer rond de iFlex, (1 keer in de 2 a 3 maanden) met de managers van ontwikkeling een soort feedback sessie te houden.”

4. Direct sales

- Input innovatie proces: “Eén keer per kwartaal (formeel), verder informeel.”
- “Onze input is geen regulair proces, absoluut niet. Het druppelt niet goed door.”
- Input in proces: “Niet zo veel. Wel wat ideeën gespuid (wat klant verwacht en wat trend is).”

5. Business support

- “Geen input in innovatie proces. Er vindt niet op een reguliere manier terugkoppeling plaats. Wij houden marketing op de hoogte van behoeften. Verder gaat alle kennis via sales.”
- “Over input in de URS weet ik zelf niets af.”
- “Input aan het einde van het proces (additionele dingentjes die nog bij het concept komen).”

6. Call center

- “voor innovatie heel weinig input. M.b.t. de URS is geen input vanuit ons meegenomen.”
- “1 à 2 keer per week wordt er informatie (m.b.t. roll out klanten) teruggevoerd aan eerste en tweede lijns engineers. Ook kennis naar sales en de applicatiegroep. Verder niets structureels.”

7. Training

- “Tijdens de concept- en BETA-versie, wordt er vaak gevraagd of ik input geef aan marketing.”
- “URS: daar ben ik nooit bij betrokken.”
- “Geen directe link naar innovatie. Ik deel informatie naar de regio’s en de service engineers.”

8. Tweede lijns service employees

- “1 à 2 keer per week wordt er informatie over de klant teruggevoerd (roll out klanten).”
- “Sales heeft een deel van z’n kennis te danken aan ons.”
- “redelijk geplande input in innovatie proces, vooral op technisch vlak. Onze input is enigszins meegenomen in URS (bepaalde individuen).”

9. Eerste lijns service employees

- “We kunnen bevindingen niet indienen, alleen zeggen tegen mensen (informeel).”
- “Er zijn engineers in het veld die iFlex aan het uitrollen zijn, terugkoppeling daarvan gaat richting STAR, niet direct aan innovatie.”

10. Sustaining (derde lijns service employees)

- “Ontwikkeling werkt meer vanuit de ‘sales visie’ en minder vanuit onze visie.”
- “Er wordt weinig informatie uit ons gehaald om de requirements voor ons gebied te vinden (opstellen URS). De input voor de iFlex was te weinig naar mijn zin.”
- “In de vertaling van de URS naar een design specificatie spelen we gedeeltelijk een rol.”

Opdracht: nieuwheid

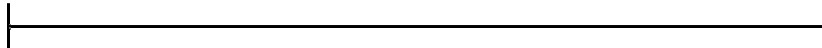
Verderop krijgt u wederom een aantal quotes te lezen. U dient deze quotes te rangschikken op een volgorde waarbij u het gevoel heeft dat deze quotes gerangschikt staan van **BESTAANDE INFORMATIE** naar **NIEUWE INFORMATIE** voor de **SPECIFICATIE FASE**. U dient de cijfers die gekoppeld zijn aan de verschillende quotes in te vullen op de lijn.

Ps. 'Nieuwe informatie' refereert naar 'nieuwe informatie voor de organisatie'. (Wanneer een afdeling dus als eerste informatie van de klant ontvangt, heeft deze dus veel nieuwe informatie.)

Invultabel:

Bestaande info

Nieuwe info



1. STAR (System Testing and Release)

- "We gaan zo vaak mogelijk naar klanten."
- "Het detecteren van klantvoorkeuren zitten we heel dicht bovenop."
- "Bij ons komt het (klantaanvragen en -feedback) vaak als eerste binnen."

2. Product management

- "Wekelijks opzoek gaan naar toekomstige klanteisen."
- "Als het verassende informatie is komt het heel snel terug naar ons."
- "We hebben ook contact met 'klanten' die nog geen klant van zijn."

3. RAP

- "We merken veranderingen in voorkeuren vrij snel."
- "Tijdens klantcontact kom je snel in discussie waar hij mee bezig is en wat hij zelf als toekomst ziet."
- "Met het vinden van nieuwe requirements ben ik niet bezig."

4. Direct sales

- "Wij zijn gevoelig voor veranderingen van de markt, er is een hoop discussie met de klant over wat hij wil."
- "Employees komen vaak bij de klant om te checken hoe het gaat en wat de veranderingen zijn."

5. Business support

- "Bij wat grotere klanten heb ik weleens direct contact, verder heb ik te veel een deskfunctie."
- "Als de sales employees het los laten, nemen wij het over."
- "Het detecteren van klantvoorkeuren is niet echt aan mij."

6. Call center

- "Nieuwe klanteisen komen ooit wel eens bij ons binnen maar dat soort dingen komen meer binnen bij mensen die ter plaatse zijn, bijvoorbeeld sales of eerste lijns engineers."

7. Training

- “Door het verzorgen van klantentraining veel klantcontact.”
- “Het detecteren van klantvoorkeuren ligt niet binnen mijn scope.”
- “Contact met redelijk bekende klanten, met nieuwe klanten heb ik geen bemoeienis.”

8. Tweede lijns service employees

- “Wij krijgen signalen (van de markt) minder snel door”
- “Veranderingen in klantvoorkeuren pakken we wel op.”
- “Geen kennis van mogelijk toekomstige klanten, ik focus op huidige klanten.”

9. Eerste lijns service employees

- “Signalen van de markt krijgen we op zich wel snel door. Dagelijks ventileren klanten heel veel informatie.”
- “Ik zou heel veel input kunnen geven wat een klant vind en wat voor wensen hij heeft.”
- “Wanneer klanteisen veranderen beginnen zij meteen met vragen stellen.”

10. Sustaining (derde lijns service employees)

- “We zien de eisen aan de huidige productie. De toekomstige voorkeuren zijn niet zichtbaar.”
- “Wanneer een klant een speciale applicatie wil, dan gaat het via RAP of via ontwikkeling.”

Opdracht: bruikbaarheid van informatie omtrent gebruiksvriendelijkheid van de machine

Verderop krijgt u wederom een aantal quotes te lezen. U dient deze quotes te rangschikken op een volgorde waarbij u het gevoel heeft dat deze quotes gerangschikt staan van **ONBRUIKBARE INFORMATIE** naar **BRUIKBARE INFORMATIE** met betrekking tot het definiëren van **GEBRUIKSVRIENDELIJKHEID** van de machine wederom in de **SPECIFICATIE FASE**.

U dient de cijfers die gekoppeld zijn aan de verschillende quotes in te vullen op de lijn.

Invultabel:

Onbruikbare info |-----| Bruikbare info

1. STAR (System Testing and Release)

- “Wij hebben informatie over hoe een klant met een machine omgaat.”
- “Onze belangrijkste focus ligt bij de huidige producten, wat we bij de klanten neerzetten.
- “Bij klanten gaan we kijken of het product goed aankomt. Wekelijks heb ik contact met onze rollout klanten.”

2. Product management

- “Eerste lijns engineers hebben betere feedback over de actuele situatie dan wij.”
- “De dagelijkse interacties met klanten zijn belangrijk, daaruit weerspiegelt de klanttevredenheid.” (over applicaties en het gebruik, echter komt de feedback betreffende het gebruik niet direct vanuit een operator).

3. RAP (applicatie groep)

- “Enerzijds, kennis vanuit de gebruiker.”
- “We hebben best wel wat kennis over de klant (hoe hij de software gebruikt).”
- “Op verschillende niveaus omdat wij op verschillende niveaus de vragen binnen krijgen. Soms is het puur technisch en soms een applicatie aanvraag.”

4. Direct sales

- *Deze afdeling hoeft niet ingedeeld te worden bij deze opdracht.*

5. Business support

- “Voornamelijk kennis over het hele proces. Wij brengen klantwensen in kaart.”
- “Klant contact naar mijn zin nog te minimaal is, we hebben veel deskfunctie.”
- “We hebben te maken met de klanten die andere machines hebben.” (Dus weinig input over gebruiksvriendelijkheid van huidige machines)

6. Call center

- “kennis over de problemen die een klant ervaart.”
- “Call center heeft goed zicht op de gedragingen qua bestellen van onderdelen. Het administratief stuk.”
- “In principe is het kennis over de klant. Over problemen die een klant ervaart.”

7. Training

- “Operator geeft informatie over klantgedragingen. Een lijnmanager over het voorbereiden van een productierun, hoe deze afloopt en afsteltijd. Het hele proces rondom het bedienen.”
- “Door werkzaamheden heb ik veel klantcontact.”
- “Ik heb inzicht in de gebruiksvriendelijkheid en de help informatie.”

8. Tweede lijns service employees

- “Wij merken hoe de klant omgaat met de spullen.”
- “Ik let wel op input van huidige klanten. Als je daar bent merk je wat niet lekker loopt (bijvoorbeeld een foutmelding waar de klant geen wijs uit kan halen).”
- “Ik ben veel minder vaak bij een klant dan eerste lijns service medewerkers.”

9. Eerste lijns service employees

- “Ik krijg kennis over problemen terwijl ik ook veel potentie zie, dingen die we moeten veranderen in de machine.”
- “Ik bekijk dingen vanuit de werkvloer en dat doet hier verder niemand.”
- “Ik zou heel veel input kunnen geven wat een klant vind en wenst (wilt) van een machine.”

10. Sustaining

- “Je merkt dat klanten machines op hun eigen manier gebruiken. De problemen van een klant zijn vaak een specifiek gevolg van wat die klant gedaan heeft.”
- “Bij een klant gaat het eigenlijk alleen maar om het probleem dat er speelt.”

- “Veel technische kennis, weinig klantkennis. Tenzij het over het ‘handelen’ van de klant is.”

Opdracht: bruikbaarheid van informatie omtrent applicaties (functies) op de machine

Verderop krijgt u wederom een aantal quotes te lezen. U dient deze quotes te rangschikken op een volgorde waarbij u het gevoel heeft dat deze quotes gerangschikt staan van **ONBRUIKBARE INFORMATIE** naar **BRUIKBARE INFORMATIE** met betrekking tot het vinden van de **APPLICATIES/functionaliteiten** van de machine in de **SPECIFICATIE FASE**.

U dient de cijfers die gekoppeld zijn aan de verschillende quotes in te vullen op de lijn.

Invultabel:

Onbruikbare info Bruikbare info

1. STAR (System Testing and Release)

- “Ik wordt vaak gevraagd om te beoordelen of de klant iets heeft aan nieuwe functionaliteit.”
- “Het detecteren van klantvoorkeuren, daar zitten we heel dicht bovenop.”
- “Onze belangrijkste focus ligt natuurlijk op de huidige producten. Er wordt natuurlijk heel veel gepraat met de klant. Nieuwe applicaties en nieuwe ontwikkelingen komen dan snel ter sprake.”

2. Product management

- “Vanuit mijn rol moet ik weten wat het idee van de klant is over hoe ze onze producten gaan en willen gebruiken in de toekomst.”
- “Het vinden en verwoorden van de markt requirements naar een specifieke URS is onze taak.”
- “We reizen bewust naar klanten om informatie te vergaren.”

3. RAP (applicatie groep)

- “Soms is het gewoon een applicatie aanvraag, over wat een klant wil.”
- “Wij raken altijd op een of andere manier wel iets van die klantvragen.”
- “Ik schrijf applicatie notes zodat er extra informatie gedeeld wordt.”

4. Direct sales

- “Er is een hoop discussie met de klant over wat hij wil.”
- “Met name klantvoorkeuren worden vergaard.”
- “Wij vergaren informatie over bepaalde marktsegmenten (bv. bepaalde markten willen meer betalen dan andere).”

5. Business support

- “Wij brengen klantwensen in kaart, na een aantal interviews weten we waar hij naar opzoek is.”

- “Het enige dat ik weleens merk is dat je nog weleens aanvragen krijgt, of dat nou via een klant is of via een agent. Soms merk je dan dat klanten speciale opties op hun machine willen.”
- “We hebben te maken met klanten die nog geen Assembléon machines hebben.”

6. Call center

- “Over applicaties kunnen wij weinig vertellen.”
- “Een klant zal dan in eerste instantie met de vraag bij ons komen. Maar omdat wij er technische weinig op kunnen zeggen gaat dit toch weer door de organisatie. Wij vangen dus wel wat op, van ‘oh ze zijn daar mee bezig’.”

7. Training

- “Klantinformatie gebaseerd op technische kennis. Ik weet waarom een klant iets vraagt, ik ken zijn processen, ik weet wat de klant wil en of een bepaald software pakket dat mogelijk maakt.”
- “Het detecteren van voorkeuren ligt niet binnen mijn scope.”

8. Tweede lijns service employees

- “Veranderingen in klantvoorkeuren pakken we wel op maar is niet mijn focus.”
- “Er wordt enigszins gepraat over hetgeen er in de toekomst nodig is (m.b.t. service).”
- “Ik ben veel minder vaak bij een klant dan eerste lijns service medewerkers.”

9. Eerste lijns service employees

- “Veranderde klanteisen merk ik meteen. Die beginnen meteen met vragen stellen hoe iets moet.”
- “Ik zou Assembléon heel veel input kunnen geven wat een klant voor wensen heeft van een machine.”

10. Sustaining

- “Speciale applicaties gaan ofwel via de project groep of via ontwikkeling. Wij zijn daar zijdelings bij betrokken. Klantvoorkeuren detecteren hoort niet in onze groep.”
- “Bij een klant gaat het eigenlijk alleen maar om het probleem dat er speelt.”