Service Innovation Methodologies II

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How can new product development methodologies
be applied to service innovation and new service development?

Report no 2 from the TIPVIS-project

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Abstract

This report presents various methodologies used in new product development and product innovation and discusses the relevance of these methodologies for service development and service innovation. The service innovation relevance for all of the methodologies presented is evaluated along several service specific dimensions, like intangibility, inseparability, heterogeneity, perishability, information intensity, and co-creation. The methodologies discussed are mainly collected from the *Product Development and Management Association* (PDMA) glossary. The main conclusions of the report are that several methodologies have been identified that may be applied to service innovation with no or minor adjustments. However, it seems that most of the relevant methodologies are process oriented methodologies focusing the open front end of the innovation process. Fewer methodologies are found for the stimulation of innovation conditions for service innovation, for service innovation value assessment or outcome evaluation and for specific types of service innovations. This implies that service innovation methodologies must be developed and validated for the elements of service innovation not currently well supported by appropriate methodologies.

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1 Purpose of the report

To maintain competitive advantages, companies need to innovate and develop their products and services. Several normative methods have been proposed to help companies in their innovation and development of products. They include methods to reveal consumer needs, methods to organise a successful development process, methods to include suitable mix of expertise in the development project, methods to adapt to external conditions, etc. In a review of service innovation methodologies (Nysveen and Pedersen, 2007), it was found that that a search for "new service development methodology" revealed 0 (no) hits on Google while a search for "new product development methodology" revealed 965 hits. Also, Lusch, Vargo and O'Brien (2007, p. 5) argue that managers are aware of the importance of services for competitive advantage but that they "often fail to execute that knowledge…". The same authors also claim that academics understand that services are vital for competitive advantage, but that they do not have "sufficiently informed normative theory" to adequately analyze the link between services and companies' performance" (Lusch, Vargo and O'Brien, 2007, p. 5). This illustrates the lack of specific normative methodologies for service innovation. Motivated by the results of the Google search and the propositions by Lusch, Vargo and O'Brien (2007), Nysveen and Pedersen (2007) conducted a review of service innovation literature to search for innovation methodologies tailormade for service innovation. However, only a few normative methodologies for service development and –innovation were found. Among the methodologies revealed were a ten stage model for customer involvement in service innovation (Alam, 2002), an adaptation of the TRIZ methodology for new service design (Chai, Zhang, and Tan, 2005; Zhang, Chai and Tan, 2005), and a Resource-Process Framework for new service development (Froehle and Roth, 2006). However, no general empirical findings were identified on the results or effects of systematically applying these, or any other service-specific innovation methodologies, across service industries, -activities or -offerings.

Having in mind that services and products often differ along dimensions as intangibility, heterogeneity, simultaneity, perishability, and information intensity, the

lack of normative methods specifically designed for service innovation and service development may seem strange. Because of the differences between products and services, it is reasonable to believe that methods for product development should need to be revised or supplemented to be suitable as methods for service development and –innovation. One potential explanation for the lack of normative service development methodologies is the assumption that the differences between products and services are considered to be insignificant when it comes to development and innovation processes. This is however, inconsistent with the large number of studies systematically identifying differences in innovation conditions, -processes, -types and –results of service firms when compared to manufacturing or other product-oriented firms (e.g. DeJong et al., 2003, Nysveen and Pedersen, 2007; Tether, 2003).

The purpose of this report is to present various methodologies used in new product development and product innovation and to discuss the relevance of these methodologies for service development and service innovation. The service innovation relevance for all of the methodologies presented is evaluated along several service specific dimensions, like intangibility, inseparability, heterogeneity, perishability, information intensity, and co-creation. Also, the methodologies are considered in light of the confirmed differences between service innovation and product innovation identified in the innovation literature.

1.1 A framework for service innovation

According to DeJong et al (2003), the characteristics of service innovation may be described along four dimensions of particular significance. They are 1) the conditions for an effective service innovation process, 2) the service innovation process, 3) the types of service innovation, and 4) the service innovation outcomes. A more detailed overview of the content of the four main dimensions is summarized in Figure 1.

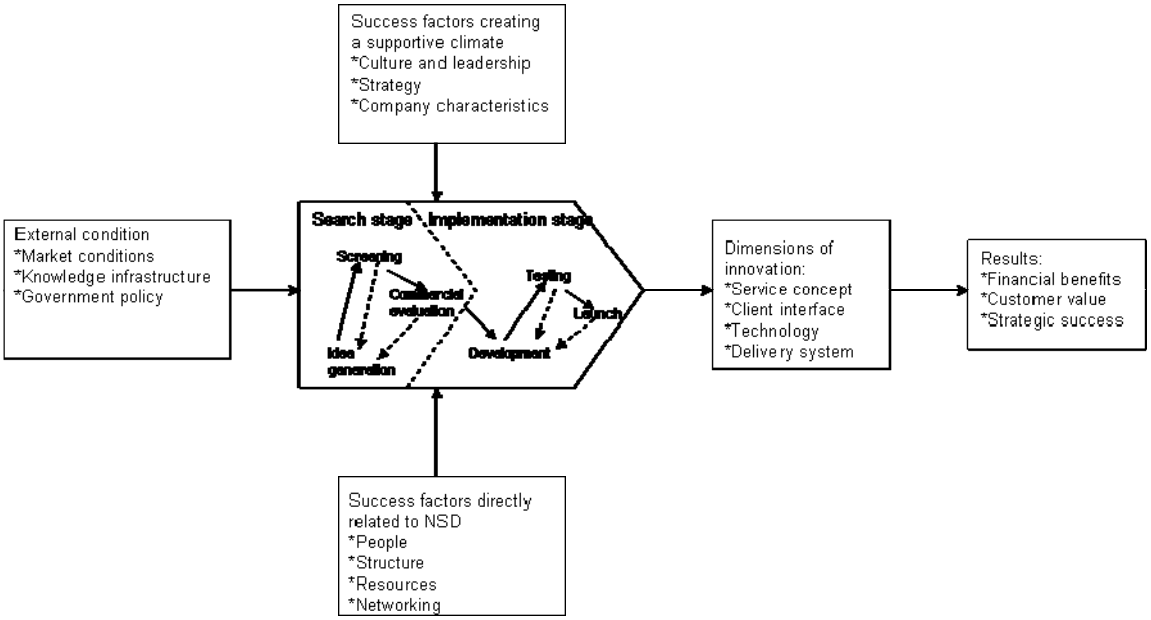

Figure 1: A framework for service innovation.

The conditions for an effective innovation process include success factors creating a supportive climate, various external conditions, and success factors directly related to new product and service development. As these factors are decisive for the success of innovation, valid and reliable normative methodologies to reveal and adapt these factors are of great importance for companies in their innovation. *The innovation process* can be organized in various ways, and normative methodologies can be of invaluable help for companies trying to organize and structure their service innovation process. It may also be difficult for companies to make decisions about what *types of innovation* to prioritize. Again, normative methodologies can help companies through a decision process regarding types of innovation to prioritize, and thus, increase the chance of a successful innovation process. Finally, normative methodologies are of great importance in the evaluation and measurement of *innovation outcomes* and success of innovation launched by a company. There are also *interactions* between the four dimensions that are of relevance to service innovations. For example, the service innovation process may have to be organized differently for one type of service innovation than for another. The availability of service innovation methodologies capturing these interactions are thus, also of great importance to company managers administering a portfolio of service innovation projects.

1.2 Outline of the report

In the next chapter we discuss the unique characteristics of services and various perspectives on services and service innovations identified from previously published literature (chapter 2). Chapter 3 gives a brief description of the methodological approach used in this article. We then present several normative methodologies used in product development and –innovation. The relevance of the methodologies for new service development and service innovation is then discussed in chapters 4 to 7. In chapter 4 the focus is on normative methodologies that can be used to reveal and stimulate *conditions for an effective innovation process.* In chapter 5, normative methodologies that may be used to organize and structure the *innovation process* are focused. Normative methodologies for choosing relevant *innovation types* will be discussed in chapter 6, whereas normative methodologies for measuring the *innovation outcome* and the success rate of innovations are the main topics discussed in chapter 7. Chapter 8 is devoted to a summary and discussion of the methodologies we find particularly interesting for service innovation, including the importance of interactions between the service innovation dimensions discussed in chapters 4-7. In chapter 8 we also conclude on the relevance of the methodologies discussed for service innovation.

2 Products and services

In this chapter we give a brief discussion of traditional and more novel perspectives on how services differ from products. Until the last few years, goods and products have been the dominating focus for studying transactions between producers/retailers and consumers. Typically, services have been treated as a value-added element of a product and not as the main element for firms' performance.

In this report, the relevance of the product innovation methodologies for service innovation and –development will be discussed along characteristics that are often proposed to differ between products and services. According to Vargo and Lusch (2004b), 13 differences between products and services were identified by Rathmell (1966) while the corresponding number were seven in a contribution by Lovelock (1991). However, the dominating paradigm focusing differences between services and products are the four differences pinpointed by Zeithaml, Parasuraman and Berry (1985); intangibility, heterogeneity, simultaneity, and perishability. *Intangibility* means that services cannot be seen or touched in the same way as products and should be evaluated as a performance rather than as an object. It also means that services often cannot be evaluated before purchase. Thus, services are often experiential goods that have to be experienced before they can be evaluated. *Heterogeneity* refers to the variability of services. While products appear identical each time a customer purchase the product, services typically differ at least somewhat in each purchase situation. *Simultaneity*, or *inseparability*, refers to the simultaneity of the service production and the service consumption. While products can be produced in advance and put on a shelf in a store, a service cannot be produced in advance, but only in cooperation with the consumer. *Perishability* means that services cannot be stored. A flight with 50 empty seats cannot store these empty seats and add them on the next flight. In addition to these four characteristics describing the differences between services and products, *information intensity* (Porter and Millar, 1985; Miles, 2004) is also often highlighted as an important service characteristic. Examples of information intensive services are lecturing and consulting services, but recent years, information intensive services has been growing due to digitalization and are found online, such as online

retail, online banking and online repository services (e.g. online search). Information intensity is in particular a characteristic of knowledge intensive services, but as seen from the examples above, not all information intensive services are knowledge intensive.

A somewhat alternative perspective on service is presented by Vargo and Lusch (2004). In their work, the service dominant (SD) perspective is proposed as an alternative to the traditional goods dominant (GD) perspective. An important difference between the two perspectives is that consumers are treated as an operand resource in the goods dominant perspective – meaning that consumers should be acted on by for example the 4 P's to gain competitive advantage. In the service dominant perspective, consumers are considered to be operant resources – meaning that consumers should be active co-creators. Co-creation is divided into 1) co-creation of service offerings, 2) co-creation of value propositions, 3) co-creation of conversation and dialogue, and 4) co-creation of value network and processes (Lusch, Vargo, and O'Brien, 2007). Consequently, the service dominant perspective highlights the importance of consumer involvement as an antecedent for companies' success.

In addition to consumer involvement, the perspective also underlines the importance of the knowledge and skills – competence – in an organization. Typically, competence becomes more and more specialized. An important competence is therefore also what Lusch, Vargo and O'Brien (2007) call collaborative competence. For most companies, it is difficult to have all of the relevant competence in-house. Collaboration with other actors in a company's network is therefore decisive for a company's success. Although the service dominant perspective discuses several other conditions than those briefly mentioned here, consumer involvement and collaborative competencies are two important elements of the theory. Both elements are considered important for a company's innovation and success.

The discussion of the relevance of the normative product development methodologies in this report will be related both to the traditional perspective comparing services and products along their five characteristics intangibility, heterogeneity, simultaneity/inseparability, perishability, and information intensity, and to the

somewhat more novel perspective focusing the importance of consumer involvement and collaborative competence as antecedents of successful innovation. In addition, the relevance discussions will reflect empirical findings of what characterizes service innovation as different from product and process innovations.

3 Methodology

For the sampling of normative methodologies for product development/-innovation, we used the "PDMA glossary for product development" (www.pdma.org, 2007). PDMA defines a lot of terms related to product development in this glossary, and all of the terms are not new product development/-innovation methodologies. Consequently, we have picked from the glossary the terms that we, based on the definitions given by PDMA, know to be normative methodologies for new product development or product innovation. Thus, the sampling from the glossary is made by our subjective evaluation of the definition presented by PDMA. Because the PDMA glossary has a long history, however, we are fairly certain that product innovation methodologies defined in their glossary have a history as a well established methodology that have been identified through PDMA's numerous studies of product innovation methodologies applied in (best) practice. Thus, they should potentially also be relevant when applied and adapted to new service development and service innovation initiatives.

Due to the requirements of methodologies being well established to be included in the PDMA glossary a number of more recent new product development and product innovation methodologies exist. Although these methodologies may be of relevance for this report, none of these additional methodologies were included in this discussion of relevance for service innovation. Thus, the review conducted in this report is not complete, in particular when it comes to more recent methodologies (e.g. Ulwick, 2005; Kim and Mauborgne, 2005; Christensen and Raynor, 2003; Chesbrough, 2003). However, we do claim that by building on the glossary of PDMA, we have included most of the relevant normative methodologies practiced in many companies' new product development and product innovation projects.

Some of the methodologies that will be described are rather narrow in their focus. Other methodologies embrace more or less the whole new product development process. Within these broad methodologies it is often relevant to include one or several of the narrow methodologies. However, when discussing the relevance of the product development methodologies for service innovation, we focus on the main

characteristics of the single methodology discussed. Including a discussion of the relevance of all possible methodologies that can be used within a broad methodology will be too complex, and is instead discussed as part of the discussion of the methodological importance of interactions between innovation conditions, processes, types and outcomes.

The presentation and discussion of the innovation methodologies are first organized by their focusing innovation conditions, -processes, -types or –outcomes. For each methodology, the methodology is presented along with some original references on its development and application. Most of this text is collected directly from the PDMA Glossary (www.pdma.org). The relevance and appropriateness of the methodology for adaptation to service innovation are then discussed in the light of the five service characteristics presented in chapters 1 and 2 and in the light of consistent findings from research on what characterizes and differentiates service innovations from other innovations.

4 Methodologies capturing and stimulating the conditions for innovation

Conditions for an effective innovation process include success factors creating a supportive climate (culture, leadership, strategy, and company characteristics), external conditions (market conditions, knowledge infrastructure, and government policy), and success factors directly related to new service development (such as people, structure, resources, and networking) (DeJong et al., 2003).

4.1 Affinity charting

The methodology can be described as a "bottom-up" technique for discovering connections between pieces of data. An individual or group starts with one piece of data (say, a customer need). They then look through the rest of the data they have (say, statements of other customer needs) to find other data (needs) similar to the first, and place it in the same group. As they come across pieces of data that differ from those in the first group, they create a new category. The end result is a set of groups where the data contained within a category is similar, and the groups all differ in some way. See also Qualitative Cluster Analysis (www.pdma.org, 2007).

The methodology can be used to systemize conditions for innovation. Clusters of relevant factors for creating a supportive climate, clusters of important external conditions, and cluster of success factors directly related to new service development can be revealed and categorized based on the methodology.

Because the methodology as it is described here focuses conditions for innovation, it should be possible to use the methodology for service innovation conditions in the same way as it is used for product innovation. However, because services are *intangible*, it may be difficult to communicate customer needs as precise as for product innovations (there is no tangible service prototype to show customers). One possible implication of this is that the clusters identified may not be as relevant as desired (because some of the characteristics of the service needs are ambiguously

understood). Also, because of the *heterogeneity* of services, the clusters revealed may be relevant for the new service in some situations, but not in other situations.

Despite these potential problems, the methodology seems relevant. It focuses on *customer involvement* in the innovation process adding further to its relevance for service innovation. The method may also be used at later stages of the service innovation process or to assess the value relationship between specific service innovation types.

4.2 Attribute Testing

Attribute testing is a quantitative market research technique in which respondents are asked to rate a detailed list of product or category attributes on one or more types of scales such as relative importance, current performance, current satisfaction with a particular product or service, for the purpose of ascertaining customer preferences for different attributes, to help guide the design and development process. Great care and rigor should be taken in the development of the list of attributes, and it must be neither too long for the respondent to answer comfortably or too short such that it lumps too many ideas together at too high a level (www.pdma.org, 2007).

As described above, the methodology is suitable to help guide and design the preparatory parts of the development process and is, therefore, discussed in this part of the report – conditions for innovation.

This methodology is based on an evaluation of consumers' experience of the existing service, and the evaluation is meant to be used as an input for improving the service. Because the methodology is based on experience with the service, the *intangibility* element should not reduce the validity of the methodology. The *simultaneity* element will also be part of the experience and will implicitly be part of the evaluative response from the consumers. Elements of service *heterogeneity* will be included in the feed-back from the consumers as long as the consumer response is based on a broad range of consumer interacting with a variety of the service personal of the company offering the service. The methodology *involves consumers*, and this is also a

characteristic making it relevant for service innovation. The methodology may also be applied in later stages of the service innovation process for example to assess the value of the attributes of service prototypes.

4.3 Customer site visits

This is a qualitative market research technique for uncovering customer needs. The method involves going to a customer's work site, watching as a person performs functions associated with the customer needs your firm wants to solve, and then debriefing that person about what they did, why they did those things, the problems encountered as they were trying to perform the function, and what worked well (www.pdma.org, 2007).

Customer site visits refer to both physical site visits and online site visits. Physical site visits may be used to inspire innovation processes in their early stage or as a part of more continuous stimulation of innovation conditions. Most service companies are also present online. Many customers therefore interact with service companies through their website, and feed-back from these customers is valuable as a source of innovation ideas (*consumer involvement*). This feed-back can include responses on the user interface and how the service is presented online. This kind of feed-back is concrete and is usually rather easy to communicate and to adapt. However, the feed-back from customers may also include ideas for how to improve person-to-person interaction mediated by the online environment. This will typically include feed-back on more *intangible* elements of the service, and the communication of such elements is typically more difficult than for tangible elements. Consequently, the possibilities for misunderstandings are relatively high. As a result of the *simultaneity* and *heterogeneity* of services, the feed-back on the person to person interaction can typically also vary a lot. Personalization is a possible solution to satisfy the preferences of all of the nuances in the feed-back. Also, the *information intensity* of services makes the communication and information exchange between the customer and the company a demanding process.

5 Methodologies applied to the innovation process

The innovation process includes activities from the generation of an innovative idea to the launch of the innovation. Literature on product development has presented several normative models for this process with various degrees in the level of process details. For service innovation, however, only a few process descriptions are proposed. Typically these process descriptions are based on descriptions of product innovation processes. It is often argued that the service innovation process is much more informal and more ad-hoc than product innovation. Because of this, service innovation processes is typically also described in less detail than product innovation processes. As can be seen from Figure 1, the six stage process typically used to describe a product innovation process is simplified into a two-stage process (search stage and implementation stage) for service innovation.

5.1 Alpha testing

This is a crucial "first look" at the initial design, usually done in-house. The results of the Alpha test either confirm that the product performs according to its specifications or uncovers areas where the product is deficient. The testing environment should try to simulate the conditions under which the product will actually be used as closely as possible. The Alpha test should not be performed by the same people who are doing the development work. Since this is the first "flight" for the new product, basic questions of fit and function should be evaluated. Any suggested modifications or revisions to the specifications should be solicited from all parties involved in the evaluation and considered for inclusion. Since the testing is done in-house, special care must be taken to remain as objective as possible (www.pdma.org, 2007). An article by Prasse (1991) illustrates how alpha testing can be used to achieve better software development.

This methodology can also be used to test ideas for service innovations. However, users of this methodology for service innovation have to be aware of the following. Ideas for service innovations are *intangible*. Physical prototypes will not be available,

and thus, testing the service innovation at this stage may be difficult. The testing will have to be based on ideas of the services innovation rather than a physical representation of the innovation. Furthermore, because of the *heterogeneity* of services, a test may show that this idea for a service works properly in one situation, but this may not generalize to other situations. Thus, the testing should be conducted in a simulation of a broad range of contexts to ensure that the idea for service innovation will work properly in most conditions. Also, because of the *inseparability* of services, the service innovation idea should be tested on many different employees in-house to prove its quality among a variety of potential future consumers. The in-house perspective of the methodology does not include neither *involvement of consumers* nor *collaborative competencies.*

5.2 Beta testing

The beta test is an external test of pre-production products. The purpose is to test the product for all functions in a breadth of field situations to find those system faults that are more likely to show in actual use than in the firm's more controlled in-house tests before sale to the general market (www.pdma.org, 2007). While alpha testing is based on a test and feed-back from the company's innovation personal, beta test is a test among potential consumers in various field situations. Beta testing is the last stage of testing, and normally can involve, for example for software, sending the product to *beta test sites* outside the company for real-world exposure or offering the product for a free trial download over the Internet.

At the time of beta tests, the innovation is not yet launched. This means that the beta test is a test of a "close to finished" version (prototype) of an innovation, and it is typically conducted at the end of the innovation process. Because of the *intangibility* of services, traditional prototypes do not exist for service innovations. Rather, a simulation of the service has to be conducted on a trial sample of potential consumers. It is important that the context factors are as identical as possible to the context factors as they will be after the service is launched. Furthermore, the service process must be planned in detail and tested on the sample. As far as these conditions are fulfilled, the beta test will shed light on uncertainty about issues regarding the co-production of the

service (*simultaneity*) and various consumer responses (*heterogeneity*) that can be expected when offering the service. *Consumer involvement* is essential for the methodology, a characteristic of the methodology making it relevant for service innovation. Consequently, a beta test has the potential to inform the service innovation team about the potential of the planned/developed service innovation. While the methodology is mainly related to the later stages of the innovation process, it may also be accompanied by systematic measurements of innovation outcomes and effects.

5.3 Brainstorming

Brainstorming is a group method of creative problem-solving frequently used in product concept generation. There are many modifications in format, each variation with its own name. The basis of all of these methods uses a group of people to creatively generate a list of ideas related to a particular topic. As many ideas as possible are listed before any critical evaluation is performed. (See Chapters 16 and 17 in *The PDMA HandBook 2nd Edition*.) (www.pdma.org, 2007). Some of the main mechanisms used in brainstorming are to rule out criticism, to accept freewheeling, to combine ideas suggested, and to go for quantity before the critical evaluation is started (Richards, 1999). However, according to Furnham (2000), research clearly shows that individuals working alone create more and better ideas than brainstorming groups. As a result of this, more and more researchers have started to study critical characteristics of successful brainstorming groups (Bolin and Neuman, 2006).

In an idea generation process, the principles of brainstorming should be rather easily transferable from product innovation to service innovation. One potential difficulty is the *intangibility* and *information intensity* elements of services that may make the communication of the ideas more difficult for services. Because the idea for a service innovation cannot easily be sketched on a blackboard or otherwise precisely communicated, the potential for misunderstanding and equivocation is higher than for product innovation. Beside this potential problem, the methodology should have value for idea generation in service innovation. The methodology will be of particular interest if potential *consumers are involved* in the brainstorming process.

Furthermore, brainstorming among other actors in the company's network may reveal *collaborative competencies* of great value for the idea generation. Group involvement in idea creation also has the advantage that potential *network effects* of the service, something that is typical of many online services may more easily be revealed.

5.4 Breadboard

Breadboard is a proof-of-concept modelling technique that represents how a product will work, but not how a product will look (www.pdma.org, 2007). The following definition of breadboard is available at Wikipedia (Accessed 23.04.07) and suggests a more narrow application of the concept ; "A breadboard is a reusable solderless device used to build a (generally temporary) prototype of an electronic circuit and for experimenting with circuit designs. This is in contrast to stripboard (veroboard) and similar prototyping printed circuit boards, which are used to build more permanent prototypes or one-offs, and cannot easily be reused. A typical breadboard will have strips of interconnected electrical terminals, known as bus strips, down one or both sides—either as part of the main unit or as separate blocks clipped on—to carry the power rails".

The breadboard methodology is very specifically related to the development of tangible prototypes, in particular of electronic circuits. Although the basic principles of the methodology may be used for innovation of *intangible* services, this is not typical or common method for service innovation. A search at www.google.com on breadboard in combination with service innovation (breadboard AND "service innovation") revealed 14 hits, demonstrating the limited relevance of this methodology for service innovation.

5.5 Capacity planning

This methodology is a forward-looking activity that monitors the skill sets and effective resource capacity of the organization. For product development, the objective is to manage the flow of projects through development such that none of the functions (skill sets) creates a bottleneck to timely completion (www.pdma.org, 2007). More specific, Wikipedia present the following discussion of capacity

planning; "*Capacity planning is the process of adjusting the capacity of an organization to do work in response to changing or predicted demands. In the context of capacity planning, capacity means the maximum amount of work that an organization is capable of completing in a given period of time. In a simple model, it might be calculated as (number of machines and/or workers) x (number of shifts) x (utilization) x (efficiency). The demand for work an organization experiences will vary under many circumstances. Notable events that might cause the demand for work to vary greatly include starting a new organization, extending the operations of an existing business, considering additions or modifications to product lines, and introducing new techniques, equipment and materials. Discrepancy between capacity of an organization and the demands of its customers results in an inefficiency, either in under-utilized resources or unfulfilled customers. The goal of capacity planning is therefore to minimize this discrepancy*." (www.wikipedia.org, accessed 23.04.07).

From the description of capacity planning, the major relevance of this methodology is as a tool to adjust the capacity of the organization when considering modifications to product lines. As such, it mainly applies to product innovation types. When modifying services, there will typically also be a need to adjust the capacity of the organization. Some of the employees are typically removed from their ordinary position to a position in the development team. Consequently, their ordinary position will have to be replaced by other employees. Also, new capacity will often be needed in the service development team, as for example various types of expertise and competence in project management. Although service innovations often require other types of skills, competence and resources than product innovations, the capacity planning should be possible to do along the same principles for service development projects as for product development projects. Some potential problems may be related to the complexity of service due to *intangibility* and *information intensity*, making the capacity and resource planning relatively difficult. Furthermore, eventual inclusion of *consumers' involvement* and collaborative competencies increases the uncertainty of what may happen during the innovation process. However, capacity planning as a methodology should be rather transferable from product development projects to service development projects.

5.6 Cognitive modelling

Cognitive modelling is a method for producing a computational model for how individuals solve problems and perform tasks, which is based on psychological principles. The modelling process outlines the steps a person goes through in solving a particular problem or completing a task, which allows one to predict the time it will take or the types of errors an individual may make. Cognitive models are frequently used to determine ways to improve a user interface to minimize interaction errors or time by anticipating user behaviour (www.pdma.org, 2007). In cognitive psychology, a model is a simplified representation of reality. The essential quality of such a model is to help deciding the appropriate actions, i.e. the actions ensuring that a given goal is reached (www.wikipedia.org, accessed 23.04.07)

The methodology seems to be relevant for two purposes. First, cognitive modelling of various problem solving processes in the innovation development process can help product development managers to understand more clearly how to plan the time and resources necessary for example in the various steps of the innovation development process. Second, cognitive modelling may also be used to map the consumers' anticipated responses and/or behaviour. Consequently, the methodology may help the development team to designing an innovation that fits potential consumers' preferences better. This, second use of the concept applies to the stimulation of innovation conditions as well as to guide the innovation process.

Because of the *intangibility* element of service innovations, the cognitive responses of members of the development team may be a bit more difficult to simulate than for members of teams developing a tangible innovation. Also, the *simultaneity* dimension of services increases the *heterogeneity* of services. Therefore, it may also be more difficult to model all of the potential cognitive responses and behaviours of consumers in advance. This is particularly true due to the social element in the simultaneous production and consumption of a service. An opposite perspective may also be suggested. Cognitive modelling, representing the average consumer response/behaviour when using a service, may increase the success rate of a service development group developing standardized user interfaces, for example for automated teller machines (ATM) or Internet banking. Mapping cognitive models of

customers means that *customers are involved* in the development of service; an advantage when applied to service innovation. Overall, we conclude that cognitive modelling is an interesting methodology for service innovation, although the accuracy of the cognitive models developed may be a bit lower than for product development, because of the intangibility and the heterogeneity of services.

5.7 Concept generation

Concept generation is defined by PDMA as the processes by which new concepts, or product ideas, are generated. Concept generation is sometimes also called idea generation or ideation (www.pdma.org, 2007). According to Ulrich and Eppinger (2004, p. 98) a concept is "an approximate description of the technology, working principles, and form of the product". Furthermore, they describe a concept as a sketch or a rough model describing how the product will satisfy the customer. The concept generation is divided into five steps by Ulrich and Eppinger (2004); 1)clarify the problem, 2)search externally, 3)search internally, 4)explore systematically, and 5)reflect on the results and the process (purpose: learning).

In product development, the concept is typically sketches and brief descriptions of functionality and form. Functionality of services can also be sketched in the way that the development team makes simplified descriptions of for example how a service process should or may be designed. The main issue of concept generation is the process for generating the concept. The process for product concepts presented by Ulrich and Eppinger (2004) can also be used for developing service concepts. When working on a service innovation, the development team has to clarify the problem, they have to search both internally and externally for relevant information, and this information must be explored systematically to add value to the project. Throughout this process, the *intangibility*, *heterogeneity* and *information intensity* of services may make it more difficult to be concrete about the clarification of the problem. Intangibility and information intensity may also make it more difficult for the development team to be specific about the information needed when searching internally and externally. Consequently, the information search may be more like a trial and error process relative to concept development for products. However, the

external focus on information search makes both *consumer involvement* and inclusion of *collaborative competencies* possible advantages in using the methodology.

5.8 Concept optimization

Concept optimization is a research approach that evaluates how specific product benefits or features contribute to a concept's overall appeal to consumers. Results are used to select from the options investigated to construct the most appealing concept from the consumer's perspective (www.pdma.org, 2007). Various methodologies can be used for the purpose of revealing the optimal concept. An example of a methodology that can be used for concept optimization is conjoint analysis (Sorenson and Bogue, 2005). For a more thorough discussion of relevance, we refer to chapter 5.13.

5.9 Concept Screening

Concept screening is the evaluation of potential new product concepts during the discovery phase of a product development project. Potential concepts are evaluated for their fit with business strategy, technical feasibility, manufacturability, and potential for financial success (www.pdma.org, 2007). Ulrich and Eppinger (2004) define concept screening as part of the concept selection step. Typically, the concepts developed are evaluated (or screened) along several selection criteria (concept screening matrix), and the two or three concepts with the highest aggregate score will be candidates for further development.

Concept screening implies an evaluation of the existing concepts. It is a necessary methodology to reduce the number of concept alternatives in the further development process. Such a reduction is just as important in service development as for product development. The concept screening matrix uses a quantitative approach to evaluate the various selection criteria for each of the concepts. What may be a problem is that the *intangibility*, *inseparability* and *heterogeneity* of services make it more difficult to unambiguously quantify the achievement of the selection criteria for each of the concepts. The *intangibility* and *information intensity* dimensions also amplify this potential problem because it is more difficult to communicate clearly the

characteristics of each of the intangible concepts along all of the selection criteria than it is for tangible product concept characteristics. Thus, concept screening may take more qualitative forms for service innovations and rely more on perceptions than on measurements.

5.10 Concept statement

Concept statement is a verbal or pictorial statement of a concept that is prepared for presentation to consumers to get their reaction prior to development (www.pdma.org, 2007). The concept statement is a particular version of the concept idea. Concept statements can range from factual descriptions to more persuasive descriptions (Lees and Wright, 2004). A typical situation in product development is that the development team has many ideas for innovation based on the initial idea generation results. Because of limitations in resources, it will not be possible to start the development of all of these ideas. It is therefore important to evaluate a concept statement for each of the concept ideas. Based on these concept statements, a rough selection of the concept candidates with highest commercial potential may be selected. The concept statements selected will then be developed further.

The number of ideas in the initial stage of the innovation process is probably high both for product innovations and for service innovations. The relevance of concept statements as the basis for a rough initial selection of potential concept candidates should therefore be just as high for service innovation concepts as for product innovation concepts. *Intangibility* and *information intensity* of services may make it more difficult to develop clear and unambiguous descriptions of the initial service ideas (service concept statements). Consequently, the selection of the concept candidates based on concept statements for service concepts may be more uncertain and risky than for selection of product concepts based on more concrete and tangible attribute concept statements.

5.11 Concept study activity

Concept study activity is the set of product development tasks in which a concept is given enough examination to determine if there are substantial unknowns about the

market, technology or production process (www.pdma.org, 2007). The term has not been found to be used by other than PDMA.

The methodology is used to ensure that market, technology or production processes is satisfactory. Technology is used in many services. Market conditions are just as relevant for *intangible* services as for tangible products, and the production process for services may include both back-office processes and the service delivery process. Concept study activities should therefore be considered just as relevant for service innovation as for product innovation. However, the term concept study activity is very general, and more specific methodologies must be chosen for concept study activities of market, technology, and production process conditions. In particular, methodologies focusing *consumer involvement* is vital for the understanding of market conditions, and *collaborative competencies* are important for understanding technology and production processes.

5.12 Concurrent engineering

Concurrent engineering (CE) is when product design and manufacturing process development occur concurrently in an integrated fashion, using a cross-functional team, rather than sequentially by separate functions. CE is intended to cause the development team to consider all elements of the product life cycle from conception through disposal, including quality, cost, and maintenance, from the project's outset. Concurrent engineering is also called simultaneous engineering (www.pdma.org, 2007). Principles of concurrent engineering are common goals, teamwork, visibility of activities in the process, mutual considerations, and collaboration to solve eventual conflicts (Hauptman and Karim, 1999). Information technology systems are often used to support concurrent engineering (Sapuan, Osman, and Nukman, 2006)

The methodology concerns coordination of parallel activities. By doing activities in parallel rather than sequentially, usage of time and costs can be reduced. Parallel activities are just as relevant for service innovation as for product innovation. The importance of coordination between activities conducted by various groups in service innovation project is therefore important. Because clear and precise communication of

intangible and *information intensive* services are more difficult than to communicate than tangible attributes of a product, the risk of miscommunication is higher in service innovation than in product innovation. This problem is relevant both for the coordination of activities within and between groups. Consequently, a clear understanding of common goals may be more difficult, teamwork may be more demanding, mutual considerations may be more difficult to understand, etc. Although concurrent engineering seems to be more difficult in service innovation than in product innovation, the methodology is very important also for service innovation. The integrated and collaborative approach of the methodology takes advantage of both *consumer involvement* and *collaborative competencies*, increasing the chance that the service innovation will be a success. Various information system tools for project organization may contribute to more efficient concurrent engineering. In addition to being a methodology supporting the innovation process, the methodology may be applied as a process innovation itself.

5.13 Conjoint analysis

Conjoint analysis is a market research technique in which respondents are systematically presented with a rotating set of product descriptions, each of which contains a rotating set of attributes and levels of those attributes. By asking respondents to choose their preferred product and/or to indicate their degree of preference from within each set of options, conjoint analysis can determine the relative contribution to overall preference of each variable and each level. The two key advantages of conjoint analysis over other methods of determining importance are: 1) the variables and levels can be either continuous (e.g. weight) or discreet (e.g. color), and 2) it is just about the only valid market research method for evaluating the role of price, i.e. how much someone would pay for a given feature (www.pdma.org, 2007). Relevant articles are Ding (2007) and Radlow, Hu, and Ho (2004).

Conjoint analysis is, as many other methodologies in the development process, based on descriptions of potential products (or concepts). As we have commented on earlier, description of *intangible* and *information intensive* attributes are vaguer and less precise than descriptions of tangible attributes. Thus, the evaluation of the rotating set

of product descriptions will be less reliable for services than for products. *Heterogeneity* and *inseparability* also makes it more difficult to give precise and unequivocal descriptions of the service attributes because the perception of the attributes or characteristics of the intangible characteristics will vary across situations and across consumers. This also makes the results from conjoint analyses of service innovations less reliable than for product innovations. The methodology will be more relevant for evaluation of existing services that consumers have a real experience with, rather than for new services where consumers have to base their evaluation on descriptions rather than experiences with the services. If the methodology is used with potential or actual consumers as respondents, this kind of *consumer involvement* must be considered as an advantage of the methodology when it comes to relevance for service innovation. The indirect comparison of attributes conducted during conjoint analysis also makes it more appropriate in service innovation than other attribute assessment techniques which require tangible and additive attribute values.

5.14 Contextual Inquiry

Contextual inquiry is a structured qualitative market research method that uses a combination of techniques from anthropology and journalism. Contextual inquiry is a customer needs discovery process that observes and interviews users of products in their actual environment (www.pdma.org, 2007). Contextual inquiry is categorized as an ethnographic methodology (Smart, Whiting and DeTienne, 2001). It can be defined more precisely as “a field data-gathering technique that studies a few carefully selected individuals in depth to arrive at a fuller understanding of the work practice across all customers (Beyer and Holtzblatt, 1998, as referred in Smart, Whiting and DeTienne, 2001). An important issue when using contextual inquiry is to gather data and observations in the respondent’s own environment. Smart, Whiting and DeTienne (2001) highlight the importance of access to different kinds of respondents to ensure a heterogeneous sample.

The context inquiry method seems to have a few qualities making it well suited for service innovation. First, the contextual focus of the methodology makes the respondents use the service in a, for them, typical usage situation (*customer*

involvement). In this perspective, the reliability of the methodology is relatively good. The *simultaneity* of services is also observed in the right context. This makes it easier for researchers to reveal "true" information about how the prosumtion of the service really works. Second, the importance of the *heterogeneity* of respondents (Smart, Whiting and DeTienne, 2001) focused in the methodology also increases the chance of discovering the variety of service interaction among consumers. Finally, because the methodology is based on observing real usage of real services, the understanding of *intangible* characteristics of the service is also relatively good when compared to methodologies based on simulation of services or descriptions of services. Due to the grounding of contextual inquiry in the user's context it is most appropriate when applied to incremental innovation types. The methodology is also general and may be applied to uncover and stimulate innovation conditions.

5.15 Continuous Learning Activity/Learning organization

The methodology includes a set of activities involving an objective examination of how a product development project is progressing or how it was carried out to permit process changes to simplify its remaining steps or improve the product being developed or its schedule. The methodology is also denoted as "Learning organization" (www.pdma.org, 2007). A learning organization can be defined as "skilled at creating, acquiring and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights" (Garvin, 1993, p. 80, as referred in Kontoghiorges, Awbrey and Feurig, 2005). According to Kontoghiorges, Awbrey and Feurig (2005), characteristics of a learning organization are 1)open communication, 2)risk taking, 3)support and recognition for learning, 4)resources to perform the job, 5)teams, 6)rewards for learning, 7)training and learning environment, and 8)knowledge management. Instruments have been developed to identify learning organization. However, these instruments are not yet validated satisfactory (Kontoghiorges, Awbrey and Feurig, 2005).

For service innovation projects, it is of vital importance to examine the development of the project relative to the schedule. It is also, of course, just as important for service innovation projects, as for product innovation projects, to learn and adapt throughout

the project. One potential problem with this methodology used on service innovation projects is the *intangibility* dimension. It may be more difficult to know the development of the project as long as you do not have a physical documentation of the development. For example, for product development projects it is easy to say that we have finished the prototype stage of the project when the physical prototype is readily developed. This may not be that easy for service innovation projects because a physical prototype will not be developed. However, the focus on open communication and learning in the methodology means that the methodology will take advantage of *consumer involvement* and dialogue and interaction with other actors in the company's network for the purpose of learning (*collaborative competencies*). This will strengthen the potential of the methodology as a tool for service innovation.

5.16 Convergent thinking

Convergent thinking is a technique generally performed late in the initial phase of idea generation to help funnel the high volume of ideas created through divergent thinking into a small group or single idea on which more effort and analysis will be focused (www.pdma.org, 2007). While convergent thinking typically proceeds towards a single answer, divergent thinking moves in many directions without boundaries. That is also why divergent thinking is often referred to as "Thinking outside the box" (Thompson, 2003, p. 99). In contrast to what most people believe, creativity is more divergent when a number of individuals' works individually compared to when they work in groups (Thompson, 2003).

After an initial stage of "Out of the box" thinking, it is necessary to focus the ideas a bit before the project can proceed – to agree on which ideas to develop further. The number of ideas developed in the initial part of a project should be independent of whether it is ideas about product innovations or service innovations. Consequently, the need for convergent thinking is just as relevant for service innovations as for product innovations. The *intangibility* and *information intensive* dimensions may complicate the process of convergent thinking because it can be more difficult to establish a common understanding of all of the initial ideas for intangible and information intensive services than it is for tangible and less information intensive

product ideas (which can be sketched and illustrated more concretely). Consequently, there is a higher risk that the conclusions of the convergent thinking in service innovation may not be as convergent as expected. This is typically discovered later in the process when the service ideas are developed in more detail and the understanding of the service ideas becomes clearer.

5.17 Critical path scheduling

Critical path scheduling is a project management technique frequently incorporated into various software programs, which puts all important steps of a given new product project into a sequential network based on task interdependencies (www.pdma.org, 2007). A critical path schedule typically describes all of the activities to be conducted in an innovation project. The duration of each of the activities is linked to each of the activities. The critical path reflects the longest chain of dependent events, and thus, the minimum possible time for completion of the activities (Ulrich and Eppinger, 2004).

Critical path scheduling is just as important as a methodology for organizing service innovation projects as it is for product innovation projects. However, the *intangibility* and *information intensity* of service innovations can make it more difficult to make correct estimations on time scheduling. And because of the communication difficulties typically related to intangibility (relative to tangibility), it can also be more difficult to explain the development tasks that have to be conducted on each of the stages of the critical path schedule. Consequently, the time estimations for each stage may be less accurate for critical path scheduling in service innovation projects relative to product innovation projects.

5.18 Decision screens

Decision screens are sets of criteria that are applied as checklists or screens at new product decision points. The criteria may vary by stage in the process (www.pdma.org, 2007). A decision screen is typically a drawing or a virtual illustration of the innovation at a stage in the development process. An example of a decision screen can be seen in Andreoni and Petrie (2003).

Because of the *intangibility* of services, it is very difficult to use this methodology in service innovation projects. Services cannot be drawn or illustrated the same way as tangible products. It may be possible to draw and/or illustrate some sketches of an innovative service process, but overall, decision screens cannot easily be used in service innovation projects.

5.19 Design to cost

Design to cost is a development methodology that treats costs as an independent design parameter, rather than an outcome. Cost objectives are established based on customer affordability and competitive constraints (www.pdma.org, 2007). Up to 70 percent of the product cost is typically committed early in the product development process (Pham and Ji, 1999, as referred in Sheha and Abdalla, 2002). Quite a few models are developed to estimate the cost of producing products (Sheha and Abdalla, 2002).

When developing new services, it is important to understand the unit cost of producing the service. Unit cost measurement may, on the other hand, be less precise and also less relevant due to high proportions of fixed costs related to service offerings. Even more important is thus, the focus on the cost elements during development to minimize the cost of the service production, and through this, the creation of competitive advantage. *Heterogeneity* of services means that the service will vary across customers, and thus, the cost of delivering the service will also vary across customers. Furthermore, cost estimation of *intangible* and *information intensive* dimensions is often more difficult than the estimation of costs for standardized tangible and less information intensive products. Therefore, the cost estimation of various concept ideas in service design will be less precise than for product development processes.

5.20 Empathic design

Empathic design is a 5-step method for uncovering customer needs and sparking ideas for new concepts. The method involves going to a customer's work site, watching

when he or she performs functions associated with the customer needs your firm wants to solve, and then debriefing the customer about what they did, why they did those things, the problems they encountered as they were trying to perform the function, and what worked well. By spending time with customers, the team develops empathy for the problems customers encounter trying to perform their daily tasks (www.pdma.org, 2007). The five stages are 1)Observation, 2)Capturing data, 3)Reflection and analysis. 4)Brainstorming for solution, and 5)Developing prototypes for possible solutions (Burns, Barret and Evans, 1999).

Service companies also seek to solve customers' problems. The methodology is therefore relevant also for service companies. The methodological approach is rather qualitative, and observation of how a service is produced is potentially a useful approach for revealing ideas for service improvements. Observation of the user (*consumer involvement*) gives the researcher an opportunity to understand the interaction and co-production between the consumer and the service company (*simultaneity*). Observing the delivery of a service to several customers also gives the researcher an opportunity to understand the *heterogeneity* of the service, which is helpful for understanding as many potential improvements as possible. *Intangibility* and *information intensity* of the services may make it difficult to capture the relevant data and to make complete use of the data in reflection and analysis.

5.21 Ethnography

Ethnography is a descriptive, qualitative market research methodology for studying the customer in relation to his or her environment. Researchers spend time in the field observing customers and their environment to acquire a deep understanding of the lifestyles or cultures as a basis for better understanding their needs and problems (www.pdma.org, 2007). Ethnographic studies are suitable to "uncover tacit knowledge, referring to the largely unarticulated, contextual understandings that are manifested in routines, nods, silences, humour, postures, and gestures as well as statements about belief and values" (Arnould and Price, 2006). Consequently, ethnographic studies may be used to stimulate innovation conditions and as a methodology in service innovation processes.

Because of the focus on the consumers in relation to their environment (*consumer involvement*), ethnographic studies should be very suitable as a methodology for understanding consumers' needs, and thus, creating ideas for service innovations. The focus on consumers in relation to the environment means focus on understanding the co-production (or *simultaneity*) of services. As such, the methodology is probably among the most interesting and effective in understanding this interaction between consumers and the service company. Because researchers spend time in the field observing consumers, this also increases the chance of understanding various types of consumers (*heterogeneity*) and their needs and preferences. The methodology's focus on uncovering tacit knowledge and symbolism of silence, postures and gestures also means that the methodology is relatively suitable for revealing *intangible* elements of services.

5.22 Excursion

Excursion is an idea generation technique to force discontinuities into the idea set. Excursions consist of three generic steps: 1. Step away from the task; 2. Generate disconnected or irrelevant material; 3. Force a connection back to the task (www.pdma.org, 2007). "*This technique encourages people to move away from the problem and use random links and random connections to stimulate ideas. This disrupts typical, systemized assumptions and associations that emerge when "thinking in the problem", thus encouraging new possibilities to emerge*" (Weaver, 1995, as referred in Kenny, 2005, p. 27).

The methodology seems to be well suited for service innovation. Innovation and creativity may be stimulated by getting some distance to the innovation task. By pushing irrelevant stimuli to the forefront of the group members' minds and make them fit the irrelevant material to the original innovative task after a while, this may stimulate generation of new and radical innovations. The methodology should be valid also for service innovation. Although services are different from products, the service specific dimensions discussed in this report should put no restrictions on the relevance of the methodology for generating service innovation ideas.

5.23 Feasibility determination

Feasibility determination is the set of product development tasks in which major unknowns (technical or market) are examined to produce knowledge about how to resolve or overcome them or to clarify the nature of any limitations. The methodology is also sometimes called exploratory investigation (www.pdma.org, 2007).

The description of this methodology is rather brief, and other descriptions of the methodology are difficult to find (the methodology is not even described on Wikipedia). Based on the brief description, the methodology seems meaningful to employ for service innovation. Technical unknowns can be related to information systems supporting the service or to technology-based self-services. Market unknowns are just as relevant for service innovations as it is for product innovations. However, due to the *simultaneity* and *heterogeneity* of services the unknowns are more difficult to reveal for services than for products. Unknowns about a user interface for technology-based self- services or general unknowns about a market can typically not be summarized in one clear answer, because the best answer depends on the individual consumer's preferences.

5.24 Focus groups

"Focus groups" is a qualitative market research technique where 8 to 12 market participants are gathered in one room for a discussion under the leadership of a trained moderator. Discussion focuses on a consumer problem, product, or potential solution to a problem. The results of these discussions cannot be generalized to the general market (www.pdma.org, 2007).

Focus groups can be a useful methodology to reveal information about problems and potential solutions for customers. However, because of the service characteristics, focus group interviews may not be as effective for service innovation as for product innovations. While prototypes can be brought to the focus group to stimulate the discussion, this is not possible for *intangible* services. Services cannot be stored (*perishability*) and brought to focus group sessions. Because focus group interviews

typically are not conducted in a real service context, it is also quite challenging for the moderator to communicate the service precisely and to communicate the *heterogeneity* of the service and all of the elements related to the co-production (*simultaneity*) of the service. The participants in the focus group may therefore discuss and answer questions based on ambiguous understandings of the service or service concept. Respondents taking part in the focus group should be recruited among existing- or potential customers (*customer involvement*) to reveal as relevant feed-back as possible.

5.25 Gantt chart

A Gantt chart is a horizontal bar chart used in project scheduling and management that shows the start date, end date and duration of tasks within the project (www.pdma.org, 2007). Gantt charts only implicitly reflect the dependencies among the project tasks (Ulrich and Eppinger, 2004).

A service development project does of course need to be managed just like a product innovation project. It is important to know the various tasks that have to be conducted during the project, when they will start, and the duration of them. However, *intangibility* of services can make it more difficult to be aware of all of the potential hindrances and outcomes throughout the process. Communication of intangible dimensions is also more difficult than communication of tangible dimensions, making misunderstandings and less predictability more likely in the service innovation process. Furthermore, *information intensity* of services is typically also a dimension making it more difficult to plan the duration of the various tasks in detail. Although the methodology seems useful, project managers can probably not expect the same level of precision in a Gantt chart for service innovation projects as for product innovation projects.

5.26 Hunting for hunting grounds

This is a structured methodology for completing the Fuzzy Front End of new product development (www.pdma.org, 2007). It is a methodology for finding new markets (the hunting grounds) and new products when a company's existing markets are

mature. In a brief review of "*The pdma toolbook for new product development*", Belliveau, Griffin and Somermeyer (2003) describe the methodology as difficult to follow, complex, and that the terms used are not illustrated. The methodology is not extensively used, and no scientific article using the methodology has been revealed.

It is difficult to judge the relevance of the methodology when the methodology is not very clearly described. However, in general, *intangibility* and *heterogeneity* are both service dimensions making it relatively difficult to define market needs and to define a service that fits the market needs satisfactory.

5.27 Individual depth interviews

Individual depth interview is a qualitative market research technique in which a skilled moderator conducts an open-ended, in-depth, guided conversation with an individual respondent (as opposed to in a (focus) group format). Such an interview can be used to better understand the respondent's thought processes, motivations, current behaviours, preferences, opinions, and desires (www.pdma.org, 2007).

Individual depth interviews can be useful in understanding consumers' preferences and behaviours, and thus, give valuable input to service innovation (*consumer involvement*). However, the *intangibility* of services makes it more difficult for the consumer (or the respondent) to communicate the preferred service attributes precisely in an interview context. Furthermore, the variety of preferences is not easily revealed in a few interviews. The methodology is therefore not very useful for understanding the *heterogeneity* of preferences present at the marketplace. Consumers' actual behaviour is easier to reveal when the consumers are actually using the service or a service innovation prototype. However, because of the *intangibility* and the *perishability*, such prototypes cannot be easily produced and brought to an interview situation for trial. In this sense, individual depth interviews are more useful for product innovations than for service innovations (because tangible product prototypes can be brought to the interview session for trial).

5.28 Information acceleration

Information acceleration is a concept testing method employing virtual reality. A virtual buying environment is created that simulates the information available (product, societal, political, and technological) in a real purchase situation at some time several years or more into the future (www.pdma.org, 2007). Information acceleration is kind of a virtual showroom for testing new products (Urban et al., 1997). Such showrooms are useful in testing product prototypes before they are actually launched in the market.

In virtual environments, the innovation concept can be tested among potential consumers (*consumer involvement*). The concept can also be manipulated and responses on various versions of the concepts can be compared to find the version evaluated most positively among the respondents. The virtual environment used in information acceleration creates excellent opportunities for testing service ideas or service concepts. Although services are *intangible* and cannot be touched (or stored – *perishability*), they can be illustrated in virtual environments. If a hotel is working on improving their service process when their guests are checking out of the hotel, they can virtually create/illustrate various approaches of the service and test which of the approaches consumers prefer most. By making the virtual environment interactive, it will also be possible to study elements of the *simultaneity* dimension of the service. This will also make it possible for the hotel to reveal some of the *heterogeneity* related to the service and to design the process so that it can handle this heterogeneity. The methodology is of course most relevant for interactive services where various versions of an interface can be tested on real or potential consumers. The methodology may be applied in service innovation projects or as a means to continuously stimulate innovations (improve innovation conditions).

5.29 Integrated product development

Integrated product development (IPD) is a philosophy that systematically employs an integrated team effort from multiple functional disciplines to develop effectively and efficiently new products that satisfy customer needs (www.pdma.org, 2007). The perspective "*creates overlap and interaction between activities in the new product*

development process" (Gerwin and Barrowman, 2002, p. 938) and the need for coordination between various actors is significant. Furthermore, Gerwin and Barowman (2002, p. 939) define IPD as "*a managerial approach for improving new product development performance (e.g., development time), which occurs in part through the overlap (partially or completely parallel execution) and the interaction (exchange of information) of certain activities in the NPD process*".

All development projects with more than one person involved are in some way integrated and have to be coordinated. In this perspective, integrated development is equally relevant and important for service innovation as for product innovation. One might argue that the complexity of services (*intangibility* is difficult to communicate, *heterogeneity* and *simultaneity* creates ambiguity, *information intensity* makes complete communication difficult) makes integrated development very difficult, and thus, should be avoided. An alternative perspective, and the perspective we defend here, is that because of the intangibility, the information intensity, and the complexity created by the heterogeneity of services, integrated development is particularly important for service innovation. The service idea has to be discussed and defined very clearly and thoroughly among all of the involved actors so that the common understanding of the service idea is as good as possible. This has to be done continuously throughout the development process. The integrating element in the methodology also indicates openness for feed-back and input from other actors in the company's network, underlining the importance of *collaborative competencies*. Consequently, we argue that this methodology is even more relevant for service innovation than for product innovation.

5.30 Morphologic analysis

Morphologic analysis is a matrix tool that breaks a product down by needs met and technology components, allowing for targeted analysis and idea creation (www.pdma.org, 2007). Basically, the methodology is about identifying a set of important factors of the innovation and to try out all possible combinations of these factors. The main advantage of the methodology lies in the structuring and

investigation of all possible relationships in a multi-dimensional problem complex (Ritchey, 1998).

The well structured investigation of various combinations of factors must be considered as an interesting approach also for service innovation. However, while the number of combinations along the chosen factors is finite for products, this may not be the case for services. Because the *simultaneity* of services stimulate *heterogeneity*, the number of, and combinations of, relevant factors must be considered practically infinite. All customers vary to some extent along relevant factors of the service, and as long as customers take part in the production of services, it is not possible to scrutinize all possible combinations of relevant factors. To make the methodology useful, the customer relevant factors included in the analysis have to be categorized into some main categories based on, for example, empirical observations of what are the main categories of consumer behaviour along a consumer factor when interacting with the service.

5.31 Network diagram

Network diagram is a graphical diagram with boxes connected by lines that show the sequence of development activities and the interrelationship of each task with another. These diagrams are often used in conjunction with a Gantt Chart (www.pdma.org, 2007). According to Ulrich and Eppinger (2004), the common ways to organize tasks are as sequential tasks, parallel tasks and/or coupled tasks (where the coupled tasks depend on each others). The methodology is used and illustrated by e.g. Tillquist, King, and Woo (2002).

Network diagram is used as a methodology for managing the innovation process. Management of innovation processes is important for the innovation to be effective and efficient. Thus, the relevance of network diagram is in principle equally great for service development as it is for product development. It may, however, be somewhat more difficult to divide the service innovation into clear and well defined activities and tasks. Both *intangibility* and *information intensity* are elements that can make such divisions into well defined and delimited tasks and activities more difficult for

services than for products. In particular for coupled tasks, it may be some challenges related to communication and coordination of the coupled tasks because of the *intangibility* and *information intensity*.

5.32 Nominal group process

This is a brainstorming process in which members of a group first write their ideas out individually, and then participate in group discussion about each idea (www.pdma.org, 2007). More specific, the methodology is designed to stimulate each member of a team to contribute with ideas to the development process. The methodology can be divided into six stages. 1) A question is presented and each of the team members silently generates his/hers ideas. 2) The team members share their ideas. 3) The team members discuss the ideas. This allows members to get clarifications of the ideas and supplementary information about the ideas. 4) Each of the team members silently makes a preliminary ranking of the ideas. 5) The team members display their rankings and explain his/her opinion. 6) Each member of the team silently makes a final voting (Moon, 1999).

Idea generation is the seed for every innovation. The nominal group methodology is an idea generation methodology, and it is rather simple to carry out. Because idea generation is important for all kinds of innovation, and because the methodology is rather simple to use, nominal group process should be considered a relevant methodology for service innovation. However, *intangibility* makes it more difficult to clarify the individual ideas presented. *Information intensity* of services also complicates the clarification of service innovation ideas. Using the nominal group process methodology, one should in particular pay attention to the stages where clarification and supplementary information is highlighted (stage 3 and 5).

5.33 Participatory design

Participatory design is a democratic approach to design that does not simply make potential users the subjects of user testing, but empowers them to be a part of the design and decision-making process (www.pdma.org, 2007). The methodology focuses collaboration between the intended users and the developers throughout the

development process. The philosophy of participatory design is 1) to improve potential customers' quality of life (rather than demonstrate the capability of the innovation or innovation team), 2) to be cooperative with customers rather than patriarchal, and 3) value interactivity and feed-back with/from consumers. Furthermore, the importance of gaining knowledge of the usage context, and incorporate elements to adapt to this context, is highlighted in the methodology (Ellis and Kurniawan, 2000).

Participatory design focuses on the understanding and involvement of potential consumers in the development process. In general, this is a recommendable approach to develop customer oriented innovations, and the approach should be valid for both service innovation and product innovation. Actually, because of the *simultaneity* (and the co-production of services), the involvement and understanding of potential consumers preferences and behaviour (*consumer involvement*) may be particularly important for service innovation. Also, the focus on consumer- and contextual understanding highlighted in the methodology may also increase the understanding of the *heterogeneity* of the service. Consequently, the service can be designed to handle this heterogeneity. Continuous feed-back and cooperation with potential consumers throughout the development process also reduces the chance of misunderstandings related to the difficulties of communication of *intangible* elements of services. Also, the complexity of services in general related to *information intensity* will probably be easier to overcome through continuous discussions with potential consumers – increasing the likelihood that consumers' feed-back is based on a solid understanding of the service idea.

5.34 Perceptual mapping

Perceptual mapping is a quantitative market research tool used to understand how customers think of current and future products. Perceptual maps are visual representations of the positions that products hold in consumers' minds (www.pdma.org, 2007). The mapping is typically visualized along two and two dimensions along x- and y axes in a diagram (Hair et al, 1998). Perceptual mapping is about consumers' perception of the innovation and/or attitudes towards the

innovation. Through such visualization, it is possible to see how consumers evaluate the existing product and for example a prototype of the innovated product along several dimensions.

It is important to get an impression of how an innovation is perceived relative to the existing product. Or, how an innovation is perceived relatively to products it is assumed to compete against at the marketplace. This is interesting information both when conducting service- and product innovation. Although services differ from products in several ways, consumers have perceptions and attitudes towards both products and services. Thus, the methodology is relevant both as a tool for evaluating service innovations and product innovations. However, while prototypes of product innovations easily can be mapped against an existing product, this is typically a bit more difficult to do for service innovations because of the importance of the realism of contextual factors in the co-production of the services (*simultaneity* and *heterogeneity*). Thus, to make a realistic comparison (mapping) of existing services and service innovations it is important that the mapping of both is based on service trials in a real world (like) context.

5.35 Phase review process

A Phase review process is a staged product development process in which first one function completes a set of tasks, then passes the information they generated sequentially to another function which in turn completes the next set of tasks and then passes everything along to the next function. Multifunctional teamwork is largely absent in these types of product development processes, which may also be called baton-passing processes. Most firms have moved from these processes to Stage-Gate™ processes using multifunctional teams (www.pdma.org, 2007).

Because of the absence of multifunctional teamwork in this methodology, the relevance of the methodology is generally limited. As noted by PDMA, most companies have moved away from this methodology and are instead choosing methodologies with a multifunctional approach. We therefore conclude that the relevance of Phase review process for service innovation is limited.

5.36 Pipeline management

Pipeline management is a process that integrates product strategy, project management, and functional management to continually optimize the cross-project management of all development-related activities (www.pdma.org, 2007). According to Subramanian, Pekny and Reklaitis (2000, p. 1005), the main focus of pipeline management is to clarify "what is the best set of projects to pursue, and further, what is the best way to assign resources to activities in the chosen projects, such that the chosen measure of performance is maximized". The optimization of the project portfolio depends on uncertainty related to task duration, resource requirements and task success.

Integrated management is useful for optimizing the project development portfolio. Given a service company working on several service innovations, such a holistic/integrated perspective on the innovation activities is positive and welcome and increases the chance that the innovation projects with the highest potential are fulfilled. The potential problem with pipeline management is that it becomes extremely complicated. The reason for this is that *intangibility* makes it difficult to communicate and understand the service ideas during the innovation period, in particular for managers who are not deeply involved in the service innovation projects. *Simultaneity*, *heterogeneity* and *information intensity* increase this complexity even more. Although the purpose of the methodology is positive, there is a chance that truely integrated pipeline management takes a lot of resources and becomes too complicated to make sense. However, what should be stressed, is the importance of evaluating all of the service innovation projects regularly in relation to the organization's mission and goals.

5.37 Project decision making and reviews

This is a series of Go/No-Go decisions about the viability of a project that ensure the completion of the project provides a product that meets the marketing and financial objectives of the company. This includes a systematic review of the viability of a project as it moves through the various phase stage gates in the development process.

These periodic checks validate that the project is still close enough to the original plan to deliver against the business case (www.pdma.org, 2007).

It is important that innovation projects are kept on track of the original mission, goal, and business case of the company. Thus, the innovation process should be matched against the original business case regularly. This is of course just as important for service innovations as it is for product innovations, and the approach is therefore also valid for service innovation projects. One may argue that the *intangibility* and *information intensity* of services makes it a bit more complex and difficult to say for sure whether the innovation project matches the original business case. Furthermore, the *simultaneity* and *heterogeneity* of services also means that it is a bit more difficult to say whether the service innovation will match the original business idea, because it depends on how consumers behave in the co-production of the service.

5.38 Rapid prototyping

Rapid prototyping is any of a variety of processes that avoid tooling time in producing prototypes or prototype parts and therefore allow (generally non-functioning) prototypes to be produced within hours or days rather than weeks. These prototypes are frequently used to test quickly the product's technical feasibility or consumer interest (www.pdma.org, 2007).

Rapid prototyping is particularly important in industries characterized by frequent changes in fashions, trends and technological opportunities. These are typically industries as clothing/apparel, software industries, electronic equipment, such as cameras, mp3 players, mobile phones, etc. To be a market leader in these industries, frequent redevelopment of the products and the introduction of new design are decisive for the company's competitive position. Service trends generally do not change as often as the trends in industries just mentioned. Thus, rapid prototyping is not as decisive for service innovation as it is for product innovation. An exception, however, is found in many online services such as website designs and online social network services. Prototyping is, in general, more difficult for services because of the *intangibility* and the *perishability* of services. Prototypes of services cannot be

produced and brought to focus interviews for evaluation as easily as products can. Services can, however, be designed and illustrated virtually, and variants of the virtually illustrated service can be designed to show some of the potential *heterogeneity* of the service innovation. However, prototyping is primary a methodology for product innovation, and rapid prototyping is particularly important for products in market characterized by frequent changes in trends, fashion and technological opportunities.

5.39 Relay-race process

This is a staged product development process in which first one function completes a set of tasks, then passes the information they generates sequentially to another function, which in turn completes the next set of tasks and then passes everything along to the next function. Multifunctional teamwork is largely absent in these types of product development processes, which may also be called phase review or baton-passing processes (www.pdma.org, 2007).

Relay-race process is not a very prevailing methodology, and scientific articles using or discussing the methodology is almost absent. The methodology is also purely sequential, while most modern innovation methodologies are based on parallel and/or coupled tasks (see e.g. Ulrich and Eppinger, 2004). Furthermore, multifunctional teams are described as being absent in the methodology. The limited usage of the methodology, its sequential focus, and its preference for mono-functional teams excludes the methodology as a relevant and modern methodology both for product- and service innovation projects.

5.40 Roadmapping and technology roadmapping

Roadmapping is a graphical multi-step process to forecast future market and/or technology changes, and then plan the products to address these changes (www.pdma.org, 2007). The methodology is basically based on three questions; 1) Where are we now, 2) Where do we want to go, and 3) How can we get there. The "how can we get there" question is the most comprehensive of these questions. Considerations about resources, technology, products, markets and research, and

development related to each of the three questions are also made (Phaal, Farrukh, and Probert, 2007). The specifications in the "how can we get there" stage of the methodology can be very detailed (see e.g. Wikipedia). The roadmapping methodology is often used in technology intensive sectors, and we often see the denotation "technology roadmapping" used in the literature.

Understanding how to meet future market needs and preferences are critical for all kinds of companies. This kind of knowledge is also a vital starting point for both product and service innovations. Thus, roadmapping seems to be a relevant approach for marking out the path for how a service company successfully can meet the future. However, roadmapping is often described as how to identify and specify technological drivers and alternatives. Exploring this issue would require that one specify the tasks in a service process and how the various tasks relate to each other. This may be a fruitful approach, but it will be somewhat less precise than when used on technology. The explanation for this proposition is that *intangibility* makes services and parts of services less clearly defined than technology and that the *information intensity* makes the relation between the parts of a service relatively more complex. It is therefore not as easy to relate the various parts of a process to each others as it is for tangible technology. The service, and its parts, also depends on how consumers behave when using the service (*simultaneity* and *heterogeneity*). Another issue is that research suggests service innovation to be less driven by technology than process and product innovations (Tether, 2003), but recent findings suggest that many service innovations are based on applied technology, Information and communication technology (ICT) in particular. Thus, technology roadmapping may be a relevant methodology in the preparation of service innovation processes.

5.41 "Rugby" process

"Rugby" process is a product development process in which stages are partially or heavily overlapped rather than sequential with crisp demarcations between one stage and its successor (www.pdma.org, 2007). Thus, "rugby process" is an innovation process methodology based on parallel and coupled activities in the development

process rather than sequential activities. Searching for “rugby process” in scientific literature shows that the denotation is hardly used.

The use of parallel and coupled activities makes most innovation process more efficient. Consequently, innovation projects both for products and services should try to organize the innovation process into parallel and coupled activities. The *intangibility* and *information intensity* of services makes them more difficult to communicate between teams working with different activities on an innovation project. Thus, if service innovation activities are parallel or coupled, communication and coordination between the teams working on the different activities are relatively more important for service innovation than for product innovation. The positive side of this methodology for service innovation is the coupled tasks, meaning that the conditions for *collaborative competencies* are good. Because of this relevance, the lack of descriptions of and normative literature on the methodology are, consequently, disappointing.

5.42 Scenario analysis

Scenario analysis is a tool for envisioning alternate futures so that a strategy can be formulated to respond to future opportunities and challenges (www.pdma.org, 2007). According to Wikipedia, scenario analysis is a process of analyzing possible future events by considering alternative possible outcomes (scenarios). The analysis is designed to allow improved decision-making by allowing more complete consideration of outcomes and their implications. Examples of usage of scenario analysis can be found in Pollack-Johnson and Liberatore (2005) and Schoemaker (1995).

Scenario analysis may be used in the initial stage of the innovation process or as part of the continuous analytical work to improve firm and industry level innovation conditions. The approach of scenario analysis is to clarify (as far as possible) future changes, and to adapt products and services to fit with the future changes, whether these changes are technological or market related. As such, the methodology is interesting both for service- and product innovation. Potential changes in preferences

for services can be mapped and predicted both for services and products. For example, it is possible to find out whether consumers want more self-service technology-based services in the future or whether they will prefer traditional face to face service delivery. However, one might argue that the uncertainty of such predictions is higher for services than for products because of the *intangibility, simultaneity, heterogeneity, and information intensity* – and the complexity related to theses dimensions. This, however, does not reduce the relevance of the methodology, just the challenges when applying it.

5.43 Screening

Screening is the process of evaluating and selecting new ideas or concepts to put into the project portfolio. Most firms now use a formal screening process with evaluation criteria that span customer, strategy, market, profitability and feasibility dimensions (www.pdma.org, 2007). Typically, the criteria are evaluated for each of the potential ideas or concepts in a selection matrix, and the candidates with the highest score are further developed in the innovation process (Ulrich and Eppinger, 2004).

It is necessary to screen out some of the initial ideas and concepts in both service- and product innovation processes because it is often not possible to develop all of the ideas and concepts that are generated early in the innovation process. Both the *intangibility* and the *information intensity* make it relatively difficult to perform such a screening because it is difficult to describe services precisely. Thus, the screening evaluation is conducted based on ideas and/or concepts that may not be very well understood. Furthermore, it is difficult to understand how a service will work on this stage of the process, because the service is not yet tested on consumers. This means that the implications of the *simultaneity* element, and the corresponding *heterogeneity* of the service, are not very well understood. Although the methodology seems necessary and useful, users of the methodology should be aware of these uncertainties related to the usage of the methodology for service innovation.

5.44 Stage Gate process

This methodology is a widely employed product development process that divides the effort into distinct time-sequenced stages separated by management decision gates. Multifunctional teams must successfully complete a prescribed set of related cross-functional tasks in each stage prior to obtaining management approval to proceed to the next stage of product development. The framework of the Stage-Gate™ process includes work-flow and decision-flow paths and defines the supporting systems and practices necessary to ensure the process is ongoing smooth operation (www.pdma.org, 2007). Cross and Sivaloganathan (2005) describe the stage gate process as linear and that the model is based on the presumption that requirements for the stages can be defined in advance. They perceive the methodology as rigid and claim that it is not very suitable for incorporating changing customer requirements during the development process.

Although the stage gate process can be conducted with some kind of iterative activities, more flexible development processes will often be desirable. It is an advantage to be able to reiterate sub-processes and make changes and adaptations based on the learning from stages later in the development process. Because of the *simultaneity*, service innovations will typically be evaluated most realisticly late in the development process when real consumers are testing the service innovation in a context as real as possible. Thus, it is important that knowledge from tests conducted late in the development process can be implemented in the service innovation, although the development team has to go a few steps back in the process to implement these changes. *Information intensity* and *intangibility* may also make it difficult to make everything correct, without misunderstandings, the first time tasks are conducted in each of the stages. Possibilities for reiterating earlier sub-processes, therefore, seem to be important for service innovation. And, the stage gate process is not very iterative, making the relevance of the methodology somewhat limited for service innovation.

5.45 System hierarchy diagram

The system hierarchy diagram is used to represent product architectures. This diagram illustrates how the product is broken into its chunks (www.pdma.org, 2007). Physical elements are the parts and components and subassemblies that make the product work. These physical elements are organized into chunks (physical building blocks of physical elements). The architecture is how the physical elements and chunks are combined and how they interact (Ulrich and Eppinger, 2004).

It is difficult to build a corresponding hierarchical system diagram for services. The methodology will not easily be effectively used for service innovation. As part of a componentization oriented innovation type, the methodology may, however, be of value.

5.46 Technology Stage Gate

This methodology is a process for managing the technology development efforts when there is high uncertainty and risk. The process brings a structured methodology for managing new technology development without thwarting the creativity needed in this early stage of product development. It is specifically intended to manage high-risk technology development projects when there is uncertainty and risk that the technology discovery may never occur and therefore the ultimate desired product characteristics might never be achieved (www.pdma.org, 2007).

Technology Stage Gate methodology (Eldred and Shapiro,1996) was originally proposed as an alternative to the traditional stage gate process model methodology discussed in chapter 5.44. It focuses more on the fuzzy front end of the innovation process and tries to better structure the stages of this initial phase of the innovation process. One way to do this is to make the activities at one stage “opaque” to the members of the innovation process working at an earlier stage. As such, it introduces more sequencing and less reiteration than traditional stage gate processes. Given this, our discussion of the limitations of stage gate process methodologies in chapter 5.44 applies to this methodology as well.

5.47 Thought organizer

These are tools that help categorize information associated with ideas such that the ideas can be placed into groups that can be more easily compared or evaluated (www.pdma.org, 2007). According to Fuhs (1986, p. 258), thought organizers are tools that "allows users to focus their thinking on more concepts, to examine more alternatives and to create more idea relationships". Thought organizers are also often called Brainstorming tools (Fuhs, 1986).

Generation of good and creative ideas for innovation is a precondition for innovation. Tools supporting idea generation is therefore in general a positive contribution to idea generation. The methodology may be specifically relevant for service innovation. This is because of the *information intensity* of services and the *intangibility*, making ideas of service innovation complex and difficult to communicate. Tool helping to organize the thoughts behind service innovation ideas therefore sounds like a useful and positive approach to service innovation (Please also see discussion for Brainstorming in chapter 5.3).

5.48 TRIZ

TRIZ is the acronym for the Theory of Inventive Problem Solving, which is a Russian, systematic method of solving problems and creating multiple-alternative solutions. It is based on an analysis and codification of technology solutions from millions of patents. The method enhances creativity by getting individuals to think beyond their own experience and to reach across disciplines to solve problems using solutions from other areas of science (www.pdma.org, 2007). The methodology is based on 40 inventive principles and four separation principles (Chai, Zhang and Tan, 2005).

The TRIZ methodology is a methodology supporting a more formalized and structured approach to innovation. It gives very detailed guidelines for the process of innovation, in particular the idea generation part. Such a formalized and comprehensive methodological approach may be useful for service innovation, in particular because of the complexity of services. Both potential problems related to

information intensity and *intangibility* may be reduced through a thorough and well organized service innovation process. It is one of the few original product innovation methodologies that have been explicitly discussed in the innovation literature for its appropriateness to service innovation (Chai, Zhang and Tan, 2005). While the results of this discussion illustrates that the methodology has a great potential for supporting service innovation processes, it is indeed comprehensive, and is probably most useful for larger service development projects. The methodology may also be applied as a general framework for stimulating innovation conditions and parts of the methodology focuses particular innovation types.

6 Methodologies applied to specific types of innovations

The different types of innovation include service concept, client interface, technology, and delivery system innovations (confer Figure 1). Service concept innovations "relates to the content and characteristics of the new or renewed service" (DeJong et al, 2003, p. 19). Client interface innovations relate to how the service can be used (DeJong et al, 2003). The innovation type is particularly relevant when trying to improve the ease of use of services. Technology facilitates more and more services and is an important part of many service innovations (DeJong et al, 2003). Finally, service delivery system innovations "refer to the internal organizational arrangement that have to be managed to allow service workers to perform their job properly, and to develop and offer innovative services" (DeJong et al, 2003, p. 20).

6.1 Analytical Hierarchy Process (AHP)

This is a decision-making tool for complex, multi-criteria problems where both qualitative and quantitative aspects of a problem need to be incorporated. AHP clusters decision elements according to their common characteristics into a hierarchical structure similar to a family tree or affinity chart. The AHP process was designed by T.L. Saaty (www.pdma.org, 2007). Typically, pairwise comparisons are conducted to make decisions about the relative importance (and thus the priority) of alternatives in a multi-criteria decision–making problem (Chow and Luk, 2005). Examples of how the methodology have been used is for the selection of suppliers in the automobile industry (Gnanasekaran, Velappan, and Manimaran, 2006), evaluation of service level of restaurants (Chow and Luk, 2005), and for evaluation of potential vendors (Bau and Sharma, 2005).

According to Chow and Luk (2005), AHP can be used to find out how the firm perform in terms of service quality (in relation to its competitors), which service initiatives that will enhance service competitiveness, which service areas that require immediate improvement, how the firm's service improvement should be prioritized, and what opportunities exist for service improvement in relation to the competition. The methodology can be used to prioritize the importance of various external factors

an innovation process should adjust to, what kind of competence to prioritize in the innovation process, and, as discussed by Chow and Luk (2005), what type of innovation that should be prioritized. Although the methodology is versatile, we find it most relevant for decisions about innovation types.

The usage of the AHP to consider the competitive positioning of restaurants (Chow and Luk, 2005) indicates that the AHP is relevant for services. The criteria for choosing between various candidates for service innovation types should be possible to develop more or less in the same manner as for product innovation. However, in the process of evaluating various service innovation candidates against the criteria, the *intangibility* and *information intensity* of the service innovations may create problems. Because of intangibility and information intensity, it may be difficult to conclude for sure about how the various service innovation candidates satisfy the various criteria (it is easier to conclude about tangible prototypes than vague intangible ideas). Also, because of the *inseparability* and *heterogeneity* of services, the service innovations that are revealed to fit the criteria best, may not work for all types of consumers when launched in a market. Thus, sensitivity to consumers' behaviour may be included as criteria for selection of service innovation candidates in a service innovation process.

6.2 Anticipatory Failure Determination (AFD)

AFD is a failure analysis method. In this process, developers start from a particular failure of interest as the intended consequence and try to devise ways to assure that the failure always happens reliably. Then the developers use that information to develop ways to better identify steps to avoid the failure (www.pdma.org, 2007). AFD is an efficient and effective methodology for analyzing, predicting, and eliminating failures in systems, products, and processes (http://www.ideationtriz.com, 2007). Thus, it is applied to process innovations. Although we have included this methodology in the section on particular innovation types, the methodology can also be used for other purposes (eliminating failures in products) than process improvements in service innovation.

Given that the purpose of this methodology mainly is on improving processes, the transferability from product innovation processes to service innovation processes is relevant. The *intangibility* and *information intensity* of services may, however, complicate the usage of the methodology for improving service innovation processes. A condition for an effective and efficient service innovation process is a common understanding of the service innovation. Because of the intangibility and information intensity of services, it may be more difficult for the people involved to have a common platform of understanding of the service innovation. It may therefore also be more difficult to agree on what are the main failures in the innovation process compared to a product innovation process.

The methodology is also relevant for analyzing, predicting, and eliminating failures in products. The *heterogeneity* and *inseparability* of services may make it difficult to agree on critical failures in the service, because the service may be suitable given one usage scenario but not for a different usage scenario. In such a case, development of various versions or personalization of the services may solve some of these problems.

6.3 Failure Mode Effects Analysis (FMEA)

FMEA is a technique used at the development stage to determine the different ways in which a product may fail, and evaluating the consequences of each type of failure (www.pdma.org, 2007). An FMEA includes three stages; 1) identify potential and previously unknown failure modes and all corresponding failure mode causes and effects, 2) rank causes of failure according to likelihood (probability of occurrence and of nondetection) and impact (severity of the effects of the resulting failure mode), and 3) provide for problem follow-up and identify corrective action to be taken (Layzell and Ledbetter, 1998).

The methodology focuses particular innovation types related to the quality or lack of failure in products, processes and services. The *heterogeneity* of services may make it more difficult to identify failure modes. It all depends on the individual consumer being served and the service employee co-producing the service (*simultaneity*). While it is often easy to identify a service failure, causes of a service failure are difficult to

foresee because they will also depend on how the customer and the service employee handle the situation together. Furthermore, a successful corrective action also depends on needs and preferences of the consumer. Consequently, identify, rank, and list potential corrective actions to how a service may fail is difficult because of the heterogeneity of services.

6.4 Kaizen

Kaizen is a Japanese term describing a process or philosophy of continuous, incremental improvement (www.pdma.org, 2007). Two perspectives are highlighted in the literature. They are Kaizen costing and Kaizen event. Kaizen costing is "*a method for ensuring that a product meets or exceeds customer requirements for quality, functionality, and prices to sustain product competitiveness* " (Modarress, Ansari, and Lockwood, 2005). Kaizen events are "*well-structured, multi-day problem solving sessions involving a cross-functional team, who is empowered to use experimentation as they see fit to derive a solution"* (Montabon, 2005). The purpose of a Kaizen event are often to "*reduce costs, reduce inventory levels, or to reduce throughput time*" (Bradley and Willett, 2004, p.). A Kaizen event in product development will be a well-structured problem solving session involving cross-functional teams to increase the efficiency and the effectiveness of a product development process.

A typical Kaizen event lasts for about three days. It includes a brief kick off and a short period of Kaizen training. Then the current process in focus is mapped and benchmarked. Then brainstorming is often used to develop new ideas for the process. Implementation plans are then drawn up, and any last experiments are conducted. The team finally presents its suggestion for solution to top management (Montabon, 2005).

The Kaizen methodology is a systematic method to look for potential improvements in effectiveness and efficiency. As such the methodology is just as relevant for service innovation as for product innovation, but it focuses mainly on process improvements, and as such, it is designed for a specific type of service innovation. Using the Kaizen

methodology on service innovation probably adds some extra complexity into the methodology. This is because of the *intangibility* dimension of service which makes it more difficult to communicate the problem in the team. Furthermore, the *simultaneity* and *heterogeneity* makes it more difficult for the team to come up with unambiguous solution. Finally, the *information intensity* of many services also makes it extra challenging for the team to bring up solutions making the service innovation process more efficient and effective. Usage of cross functional teams in the methodology means that the methodology takes advantage of *collaborative competencies*, which is considered important for successful service innovation.

6.5 Modular architecture

This is a product architecture methodology in which each functional element maps into its own physical chunk. Different chunks perform different functions, the interactions between the chunks are minimal, and they are generally well-defined (www.pdma.org, 2007). The methodology is about how physical parts of a product are linked together. Advantages of modular architecture are the possibility to switch each of the parts in the product when all of the parts are modular. The contrast to modular architecture is integrated architecture.

This methodology has its main focus on fit and modularity between tangible/physical parts of a product and must be considered as marginal relevant for service innovation. Still, its principles have been given considerable attention within so called service oriented architectures. Here, the principles of componentization and modularization from the product innovation literature are applied to information intensive services. The type of services where this methodology is applied, however, is of the tangible, information intensive type that is represented with well-defined interfaces in information system. For this type of service innovation it is highly relevant and applicable.

6.6 Process mapping

The act of identifying and defining all of the steps, participants, inputs, outputs, and decisions associated with completing any particular process (www.pdma.org, 2007).

Process mapping is typically conducted as a three step process (Soliman, 1998, p. 811). 1) Identification of products and services and their related processes, 2) Data gathering and preparation, and 3) Transforming the data into visual representation in order to identify bottlenecks, wasted activities, delays and duplication of efforts. According to Aguiar and Weston (1993, as referred in Soliman, 1998, p. 811) "*process mapping can improve the customer focus of the process, assist in eliminating the non-value added activities and reduce the process complexity"*.

Process mapping may be applied to improve the service innovation process itself, but mainly it is a methodology for process innovation. Services are often processes with interaction between a service employee and a customer or interaction between a self-service technology-based services and a customer. No matter how the service is delivered, it is always a process where the *simultaneity* is in focus – meaning that the interaction between the company offering the service and the customer co-produce the service. Understanding this process, and the interaction within the process, is a decisive factor for the success of service companies. A methodology that makes it possible to identify bottlenecks, wasted activities, delays and duplication of efforts in a service delivery process is therefore most useful for process innovations in service activities.

6.7 Quality function deployment (QFD)

Quality function deployment is a structured method employing matrix analysis for linking what the market requires to how it will be accomplished in the development effort. This method is most frequently used during the stage of development when a multifunctional team agrees on how customer needs relate to product specifications and the features that deliver those needs. By explicitly linking these aspects of product design, QFD minimizes the possibility of omitting important design characteristics or interactions across design characteristics. QFD is also an important mechanism in promoting multifunctional teamwork. Developed and introduced by Japanese auto manufacturers, QFD is widely used in the automotive industry (www.pdma.org, 2007). House of quality, The matrix of matrices, and The four phases of matrices are probably the three mostly use QFD systems (Lager, 2005).

While QFD may be seen as a framework for innovation projects in general, its original aim is quality improvements. As quality improvement is a specific innovation type, the methodology is discussed here, but the methodology may also be applied as an innovation process framework or as a framework for improving innovation conditions in general. The QFD methodology has a consumer perspective and its main purpose is to match the customers demands (what) with product properties (how) (Lager, 2005). This is an interesting approach both for service- and product innovation projects. However, the methodology is typically based on transforming customer needs into engineering dimensions, developing measurable product properties, technical benchmarking of engineering dimensions, etc. Thus, the methodology is adapted to traditional, tangible dimensions. To make the methodology relevant for *intangible* services and the uncertainty of the dimensions related to *simultaneity, heterogeneity* and *information intensity*, the methodology will probably have to be significantly adapted. Through such adaptations, it may also loose some of its strength; systematic and precise measures and matching of customers needs and product properties.

6.8 Six Sigma

Six Sigma is a level of process performance that produces only 3.4 defects for every one million operations (www.pdma.org, 2007). At its core, Six Sigma revolves around a few key concepts. 1) Critical to Quality: Attributes most important to the customer, 2) Defect: Failing to deliver what the customer wants, 3) Process Capability: What your process can deliver, 4) Variation: What the customer sees and feels, 5) Stable Operations: Ensuring consistent, predictable processes to improve what the customer sees and feels, and 6) Design for Six Sigma: Designing to meet customer needs and process capability

Six Sigma includes two key methodologies: DMAIC and DMADV. DMAIC is used to improve an existing business process. DMADV is used to create new product designs or process designs in such a way that it results in a more predictable, mature and defect free performance. Thus, both methodologies are oriented towards specific

innovation types. Still, Six Sigma methodology is comprehensive and may be applied as a framework for guiding both innovation condition improvements and innovation processes.

DMAIC

The basic methodology consists of the following five steps: *Define* the process improvement goals that are consistent with customer demands and enterprise strategy. *Measure* the current process and collect relevant data for future comparison. *Analyze* to verify relationship and causality of factors. Determine what the relationship is, and attempt to ensure that all factors have been considered. *Improve* or optimize the process based upon the analysis using techniques like Design of Experiments. *Control* to ensure that any variances are corrected before they result in defects. Set up pilot runs to establish process capability, transition to production and thereafter continuously measure the process and institute control mechanisms.

DMADV

Basic methodology consists of the following five steps: *Define* the goals of the design activity that are consistent with customer demands and enterprise strategy. *Measure* and identify CTQs (critical to qualities), product capabilities, production process capability, and risk assessments. *Analyze* to develop and design alternatives, create high-level design and evaluate design capability to select the best design. *Design* details, optimize the design, and plan for design verification. This phase may require simulations. *Verify* the design, set up pilot runs, implement production process and handover to process owners.

Six Sigma is a well structured and thorough methodology with a market oriented perspective. It is about finding out about consumers preferences (*consumer involvement*), adapt to consumer preferences, and control and verify that consumers' preferences are continually met. This is at the core of how every company should have its focus – both companies offering services and companies offering products. The general comments about difficulties of revealing preferences about *intangible* and *information intense* services are of course valid also when using Six Sigma methodology, particularly due to the quantitative focus of the methodology.

Measuring intangible capabilities of a service is often more difficult than to measure tangible capabilities of a product. The control element of six sigma focuses on variance reduction based on measured attributes of the production process and offering. This is of course more difficult for services where *simultaneity* and *heterogeneity* are typical characteristics. Rather, control should focus on principles for handling variance, and how to develop strategies for dealing with heterogeneity.

7 Methodologies applied to obtain or measure specific innovation outcomes and effects

Innovation outcome refers to financial benefits (revenue, profit, etc), customer value (satisfaction, loyalty, brand value, etc), and strategic success (market share, positioning, etc.) of innovations. While many of the methodologies discussed in chapter 5 include specific recommendations for measuring outcomes or effects, or focus the use of a process methodology to obtain specific outcomes or effects, the methods discussed here mainly focuses measurement issues related to these outcomes and effects.

7.1 Balanced scorecard

A comprehensive performance measurement technique that balances four performance dimensions: 1) Customer perceptions of how we are performing, 2) Internal perceptions of how we are doing at what we must excel at, 3) Innovation and learning performance, and 4) Financial performance (www.pdma.org, 2007). Depending on the business, the performance dimensions can be adapted to be more relevant. Stewart and Mohamed (2001) used operational perspective, benefit perspective, user-oriented perspective, strategic competitiveness perspective and technology/system perspective to evaluate the performance of an IT/IS system in construction. The methodology is based on a systematic procedure weighting the importance of each of the performance dimensions and linking performance measures to each of the performance dimensions.

The methodology is very adaptable, and performance dimensions can be chosen to fit the individual company. Davis (1996) and Kim, Suh, and Hwang (2003) are examples of articles focusing performance dimensions such as value enhancement, satisfaction, service improvements, and process quality. Kim, Suh, and Hwand (2003) explicitly argue for the relevance of measuring *intangible* attributes of benefits revealed by a CRM system by the use of the balanced scorecard methodology.

The methodology is used to map the situation and success of existing activities and products/services or a company, and feed-back from customers are essential here (*customer involvement*). The results are typically used as input for changes and innovations. Customers' perception of how we are performing includes an evaluation of the *intangible, inseparable, heterogeneous,* and *information intensive* characteristics of the service. The internal perception should also be transferable from a "product company" to a "service company". The innovation and learning performance may be more difficult to evaluate in a service company than in a product company. Innovations are typically more incremental in service companies, and the *intangible* dimensions of services also make service innovations more difficult to observe. Finally, it can also be more difficult to link service innovations directly to financial performance because of the *intangible* and incremental character of service innovations. Often, non-financial measures such as brand perception, consumer satisfaction and brand loyalty are used to measure service innovation outcomes. It is assumed that an increase in these non-financial measures will influence financial measures positively.

7.2 Benchmarking

Benchmarking is a process of collecting process performance data, generally in a confidential, blinded fashion, from a number of organizations to allow them to assess their performance individually and as a whole (www.pdma.org, 2007). Benchmarking is defined by the American Productivity and Quality Centre (1993) as "a systematic and continuous measurement process; a process of continuously measuring and comparing an organization's business process against business process leaders anywhere in the world to gain information which will help the organization take action to improve its performance" (Simpson and Kondouli, 2000, p. 623). Benchmarking can be divided into three types; internal benchmarking, competitive benchmarking, and generic benchmarking (Yasin and Zimmerer, 1995). Internal benchmarking is a natural starting point for the company when trying to understand the company's products, services and processes. Competitive benchmarking is when a company's products, services and processes is benchmarked, or compared to, competitors' products, services and processes. Finally, generic benchmarking is when

a company's products, services and processes are benchmarked against companies assumed to have the best practices on for example accounting and marketing. Generic benchmarking is often conducted against companies from unrelated industries (Yasin and Zimmerer, 1995).

Benchmarking is relevant for all of the four parts of the service innovation framework presented in section 1. Outcomes can be benchmarked, the quality of the development process can be benchmarked, the quality of various inputs (conditions for innovation) to innovation can be benchmarked, and a company can also benchmark the quality of the four innovation elements.

First, *intangibility* and *heterogeneity* makes it difficult to identify clearly the benchmarking dimensions of services to which we want to compare our own new service. This means that benchmarking of services often can be based on imprecise and vague information/conceptualization of the dimensions that the service is benchmarked along. *Intangibility* of new services also makes it difficult to benchmark them along typical measures used to measure the success of new products. "*Such traditional quantitative guideposts as profitability and unit sales often present only part of the success equation for new services. Many other factors such as cross-sales, customer loyalty and perceived quality also factor into the success formula*." (Edgett and Snow, 1996, p. 6). "*The intangibility of services complicates the evaluation process. For example: there are difficulties in accurately determining costs and/or profit for individual service offerings, it is difficult to ascertain the impact of a poor quality product offering, the ability of the new services to cross-sell into new or existing services must be taken into account, there is a need to measure the contribution the new service makes toward relationship building with customers, and lack of profit in the early part of the selling cycle does not necessarily mean failure of a service*." (Edgett and Snow, 1996, p. 7). This means that benchmarking measures have to be adapted to service characteristics to ensure a reliable and useful benchmarking of service innovations. That said, the development of such measures has not gone unattended in the service literature (e.g. Parasuraman, Zeithaml and Berry, 1985). Service *heterogeneity* and *simultaneity* also call for measures able to reveal the variance of the new service performance and whether the company's new

service vary more in performance than competitors performances. If so, the benchmarking of the service delivery process may increase the company's understanding of how the service delivery process can be adjusted to more satisfactory meet quality standards.

7.3 Best practice

"Best practice" is a term for methods, tools or techniques that are associated with improved performance. In new product development, one tool or technique alone do not assure success; however a combining a number of them are associated with higher probabilities of achieving success. Best practices are, however, somewhat context specific. Thus, sometimes the term "effective practice" is used (www.pdma.org, 2007). There is no universally accepted definition of "Best practise", but the term includes usage of methods and tools making it possible to compare the company's activity with what is believed to be the best practice in the industry. The methodology "Best practice" is based on Benchmarking methodology (Levenburg and Klein, 2006).

Because the methodology is based on Benchmarking methodologies, we refer to chapter 7.2 for the discussion of its relevance to service innovations.

7.4 Concept testing

This is the process by which a concept statement is presented to consumers for their reactions. These reactions can either be used to permit the developer to estimate the sales value of the concept or to make changes to the concept to enhance its potential sales value (www.pdma.org, 2007). According to Dahan and Mendelson (2001, p. 103), concept testing can be thought of as "a search for the "best" design, positioning, pricing, and manufacturing of a new product". The big issue is often to balance the concept test costs against the potential profits of concept testing (Dahan and Mendelson, 2001). Quantitative methodologies for balancing costs and potential profits related to concept testing and methodologies for estimating consumers' behavioural intention towards concepts are proposed by Dahan and Mendelson (2001) and Jagpal, Jedidi, and Jamil (2007).

Intangibility of services makes them more difficult to evaluate before purchase than tangible services. Concept testing lets consumers understand the service concept based on a concept statement. Although this gives the consumers a fair chance to understand and evaluate the service, the intangibility and the *information intensity* of the service will make it somewhat more difficult for consumers to give a trustworthy and unequivocal evaluation of the service concept relatively to concept statements for products. *Heterogeneity* also makes it difficult to give an unequivocal and clear feed-back on a service concept, because the service will vary depending on the persons delivering and receiving the service (*simultaneity*). Thus, the reliability of results from tests of service concepts will be lower than for product concept tests. That aside, testing the concept of a service on real consumers (*consumer involvement*) is probably the best way to get an understanding of elements related to simultaneity and heterogeneity of the service. Based on the feed-back from consumers, the service should be adapted to handle the heterogeneity it will meet in the market. Consequently, the methodology may be applied to late innovation process stages or to innovation outcome assessments.

7.5 Dashboard

Dashboard is typically a coloured graphical presentation of a project's status or a portfolio's status by project resembling a vehicle's dashboard. Typically, red is used to flag urgent problems, yellow to flag impending problems, and green to signal on projects on track (www.pdma.org, 2007). According to Gitlow (2005), Dashboard methodology is typically anchored in a company's mission statement. This mission statement is typically specified into business objectives and strategic objectives. The status of the main objectives is typically measured by key indicators (and the flag system described by PDMA is typically used at the indicator level). Finally, tasks and projects are implemented to fill the gap between the ideal and the real value of the key indicators. While the methodology may be applied at the project level, most typically dashboards are used for more operational surveillance of indicators chosen through a balanced scorecard process.

The need to anchor service innovations to a company's mission statement and objectives are equally relevant for service- and product organizations. Possible problems with the dashboard methodology are related to the measurement of key indicators of the status of objectives. Because of the *intangibility* elements, the indicators of the fulfilment of project objectives are typically more diffuse than if the measurement could be based on tangible and concrete elements. The level of *information intensity* in services also typically makes the measurement of key indicators more extensive and complex.

7.6 Gap analysis

A gap analysis focuses on the difference between projected outcomes and desired outcomes. In product development, the gap is frequently measured as the difference between expected and desired revenues or profits from currently planned new products if the corporation is to meet its objectives (www.pdma.org, 2007). Gap analysis is a business resource assessment tool enabling a company to compare its actual performance with its potential performance. If a company or organization is under-utilizing resources, it currently owns or is forgoing investment in capital or technology then it may be producing or performing at a level below its potential. The goal of the gap analysis is to identify the gap between the optimized allocation and integration of the inputs and the current level of allocation. This helps provide the company with insight into areas that have room for improvement (www.wikipedia.com, accessed 09.05.07).

Because of service characteristics as *intangibility* and *heterogeneity* it is often difficult to make a link between service innovations and changes in profit and revenue. Often more qualitative outcome measures as perceived quality, customer satisfaction, brand perception, etc is focused instead. However, gap analysis can be a suitable methodology to reveal the gap between expected levels in outcomes as satisfaction, quality and loyalty and actual level of these variables. If the gaps revealed indicate an actual level lower than expected/desired level (negative gap), the result should be used as input for further service innovations. What may be more difficult for service innovation than for product innovation is to reveal the causes behind negative gaps.

This is in particular due to the intangibility and the heterogeneity characteristics of services.

7.7 Sensitivity analysis

Sensitivity analysis is a calculation of the impact that an uncertainty might have on the new product business case. It is conducted by setting upper and lower ranges on the assumptions involved and calculating the expected outcomes (www.pdma.org, 2007). The methodology typically has a quantitative approach.

Sensitivity analysis is about the effect uncertainty of various elements of the innovation. Knowledge about such effects is of course interesting both for service- and product innovation project. The dimensions used in this report to describe the differences between services and products (*intangibility, information intensity, simultaneity*, and *heterogeneity*) are all describing services as more complex and more characterized by uncertainty. This can be interpreted two ways. The first interpretation is that because of this large uncertainty, sensitivity analysis should be used heavily in service innovation projects to learn how it will impact the business case. A second interpretation is that the uncertainty is so large that doing sensitivity analysis is waste of time – because it is not possible to build on a realistic base of uncertainty factors and/or estimates. Often, decision makers do not have enough information about the end-users' needs to state their preferences. Preferences are therefore uncertain, and will often have to be estimated to some extent (Maddulapalli, Azarm, and Boyars, 2007). Thus, sensitivity analysis may be applied at various stages of the innovation process as well as to assess the uncertainty of innovation outcomes and effects.

7.8 Value analysis

Value analysis is a technique for analyzing systems and designs. Its purpose is to help develop a design that satisfies users by providing the needed user requirements in sufficient quality at an optimum (minimum) cost (www.pdma.org, 2007). According to Miles (1989, as referred in Ho, Cheng and Fong, 2000, p. 180), value analysis (or value engineering) is "a complete system for identifying and dealing with the factors

that cause uncontributing cost or effort in product, process or services. This system uses all existing technologies, knowledge and skills to efficiently identify costs or efforts that do not contribute to the customer's needs and wants". Basically, the methodology 1) select the object to be examined, 2) identify costs related to all functions involved, 3) eliminate unnecessary functions and/or search cheaper ways to perform the same function, and finally 4) implement the improved design (Ho, Cheng, and Fong, 2000).

The main purpose of the methodology is to provide maximum customer value to minimum costs. This should be the mantra of all innovation projects, both product innovation- and service innovation projects. Although quality and costs of services typically are more difficult to standardize (because of the *simultaneity* and *heterogeneity* dimensions), reviewing services with the purpose of improving customer value and cutting costs seems like a fruitful starting point for service innovation. While the methodology represents a framework for both service innovation processes and specific types of innovations, it focuses the importance of the assessment of innovation outcomes and effects as the basis for its normative recommendations.

8 Discussion and conclusions

In this chapter we summarize the service innovation relevance of the methodologies reviewed in this report and present some recommendation for the usage of some of the methodologies in service innovation. In addition, a few other methodologies not listed by PDMA is briefly reviewed and evaluated for its relevance for service innovation.

8.1 Summary of findings

Based on the review of product development methodologies listed by PDMA, a discussion of the relevance for service innovation and –development has been conducted in the preceding chapters. Another measure, besides our subjective evaluation of the relevance based on service specific elements, is the amount of methodology usage. If a methodology is not used for service innovation, this can be interpreted as an indication saying that the methodology is probably not very useful for this purpose. In table 8.1 a summary of 1) the usage of the methodologies discussed in general, 2) the usage of the methodologies discussed in relation to service innovation, 3) the relevance of the methodologies based on our subjective evaluation of the methodologies, and 4) a conclusion on the relevance of the methodologies for service innovation is presented.

Methodology	**Name of methodology**	**Name of methodology & ”service innovation”**	**Relevance (subjective evaluation)**	**Conclusion**
Conditions for innovation				
Affinity charting	9	2	M	Not relevant
Attribute testing	153	0	M	Not relevant
Customer site visits	48	0	M	Not relevant
Innovation process				
Alpha testing	573.000	186	L	Not relevant
Beta testing	5.360	11	M	Relevant
Brainstorming	69.600	131	H	Relevant
Breadboard	13.100	2	L	Not relevant
Capacity planning	13.900	31	M	Relevant

Cognitive modeling	6.620	140	M	Relevant
Concept generation	2.190	18	M	Relevant
Concept optimization	237	1	L	Not relevant
Concept screening	282	2	L	Not relevant
Concept statement	537	3	M	Not relevant
Concept study activity	1	0	M	Not relevant
Concurrent engineering	27.300	74	M	Relevant
Conjoint analysis	8.920	40	L	(Not relevant)
Contextual inquiry	1.650	3	H	Relevant
Continuous learning activity	14	0	M	Not relevant
Convergent thinking	1.900	6	M	Not relevant
Critical path sceduling	0	0	M	Not relevant
Decision screens	58	0	L	Not relevant
Design to cost	2.070	4	M	Not relevant
Empathic design	337	16	M	Relevant
Ethnography	175.000	59	H	Relevant
Excursion	115.000	20	M	Relevant
Feasibility determination	290	0	M	Not relevant
Focus groups	75.500	230	M	Relevant
Gantt chart	6.300	8	M	Not relevant
Hunting for hunting grounds	6	1	L	Not relevant
Individual depth interviews	93	0	M	Relevant*
Information acceleration	306	6	M	Relevant*
Integrated product development	2.670	16	M/H	Relevant
Morphologic analysis	5.800	0	M/L	Not relevant
Network diagram	5.970	8	M	Not relevant
Nominal group process	694	0	H	Relevant
Participatory design	8.260	23	H	Relevant
Perceptual mapping	1.050	4	M	Not relevant
Phase review process	142	1	L	Not relevant
Pipeline management	675	4	M	Not relevant
Project decision making and reviews	0	0	M/L	Not relevant
Rapid prototyping	45.800	45	L	Not relevant
Relay-race process	2	0	L	Not relevant

Roadmapping/Technology roadmapping	2.110	17	M/L	Not relevant
Rugby process	1	0	M	Not relevant
Scenario analysis	11.800	33	M	Relevant
Screening	2.680.000	409	M	Relevant
Stage gate process	551	23	M/L	Not relevant
System hierarchy diagram	9	0	L	Not relevant
Technology stage gate	23	0	M/L	Not relevant
Thought organizer	14	0	H	Relevant*
TRIZ	6.330	23	M	Relevant
Types of innovation				
Analytical hierarchy process	4.240	11	M	Relevant
Anticipatory failure determination	73	1	L	Not relevant
Failure Mode Effects Analysis	483	0	L	Not relevant
Kaizen	8.260	50	M	Relevant
Modular architecture	15.000	15	L	Not relevant
Process mapping	4.500	31	M	Relevant
Quality function deployment	9.260	56	M	Relevant
Six sigma	22.600	66	M	Relevant
Innovation outcomes and effects				
Balanced scorecard	20.100	128	M	Relevant
Benchmarking	214.000	570	M	Relevant
Best practice	246.000	589	M	Relevant
Concept testing	2.310	31	M	Relevant
Dashboard	45.900	20	M	Relevant
Gap analysis	13.500	39	M	Relevant
Sensitivity analysis	342.000	58	M	Relevant
Value analysis	22.300	45	M	Relevant

Table 8.1: Summary of the discussion (*).

(*) The following should be noted to explain the contents of table 8.1:

1. Name of methodology: Number of hits on name of the methodology in Google scholar.
2. Name of methodology & “service innovation”: Number of hits on name of the methodology in combination with “service innovation” in Google scholar.
3. Relevance (subjective evaluation): L=Low/M=Medium/H=High: Used as an indication of relevance based on the discussion in the preceding chapters.
4. Conclusion: The conclusion is based on the following rules: A methodology is concluded to be relevant if it is used in combination with “service innovation” more

than 10 times if the subjective evaluation considers the methodology to be medium or highly relevant. If the methodology is used less than 10 times in combination with "service innovation" it has to be evaluated as highly relevant in our subjective evaluation to be concluded as a relevant methodology. Methodologies subjectively evaluated as low in relevance are concluded as not relevant. Exception from these rules are explained below the table.

Some of the methodologies are marked with an asterix in the "Conclusion" column indicating that our assessments require further explanations. These explanations are found in Appendix A.

In this report we have categorized the methodologies within four categories; conditions for service innovation, the innovation process, types of innovations, and innovation outcomes. From table 8.1 we see that only three of the methodologies are related to *conditions for innovation*. What is even more challenging for service innovation is that none of the three methodologies are considered particularly relevant and suitable for service innovation. To create a supportive climate for service innovation there is a huge need for more suitable and effective methodologies. Consequently, to understand the importance of various external conditions for service innovation research and methodology development in this area is required.

Most of the methodologies reviewed are suitable for supporting the *innovation process*, and many of the methodologies are also considered to be relevant for supporting service innovation processes. We can therefore conclude that it is possible to take advantage of some of the methodologies from product innovation literature to support effective and efficient service innovation processes. Although the methodologies may have to be adapted somewhat, product innovation seems to be a useful starting point to search for relevant methodologies for service innovation process support.

Eight methodologies reviewed were considered to be mostly related to supporting specific *types of innovation*, and five of them were considered relevant for service innovation. We conclude that methodologies used for product innovation can be relevant for supporting specific service innovations types, but there is still a need to develop a broader range of suitable methodologies for this purpose, in particular, for

the support of the innovation types unique to service innovations (e.g. service interface innovations and structural service innovations).

Finally, eight methodologies were identified for the purpose of measuring *innovation outcomes and effects*. All of these methodologies are considered relevant for measuring service innovation outcomes and effects. Although the number of methodologies should preferably be larger in order to satisfy diverse measurement requirements across various service companies, methodologies from product innovation do seem to be a useful place to start when searching for and adapting such methodologies.

8.2 Discussion

The sampling of normative methodologies for product innovation reviewed in this report is picked from the PDMA glossary for product development (www.pdma.org, 2007). First, the methodologies are picked based on our (the authors) subjective evaluation of the words listed in the PDMA glossary. Consequently, we may have omitted relevant methodologies. Second, methodologies have to be well established to be included in the PDMA list. Consequently, newer methodologies for product innovation may not be included in the list. Although we are quite sure to have included the most influential established product innovation methodologies in our review, we present a few more methodologies below to increase the chance of also including newer relevant methodologies.

In a study of the European innovation methodology landscape, Diedrichs, Engel and Wagner (2006) present a list of innovation management tools and methodologies. The authors present methodologies related to 1) innovation strategy, 2) innovation organization and culture, 3) innovation life cycle management, 4) idea generation, 5) launch and continuous improvements, and what they call 6) innovation enablers. Several of the methodologies for *innovation strategy* discussed by Diedrichs et al (2006) are also mentioned in the PDMA list (scenario, roadmapping, SWOT). In addition, methodologies related to trend scouting/-extrapolation, analyses of internal and external factors in general (including analyses of customers' needs and

competitors' moves) are mentioned. Also, innovation strategy development is included in their list, describing seven stages a company should follow when developing an innovation strategy (evaluation of the business situation, identification of strategic key questions, definition of strategic choices, formulation of the strategy, identification of key indicators, creation of a strategy implementation roadmap, and a follow-up after 12 – 18 months). Methodologies related to trend scouting/extrapolation, competitive analyses, and customer needs assessment are important methodological supplements to the PDMA methodologies discussed in this report related to conditions for innovation (please see Figure 1). Only three methodologies were discussed in this section, and none of them were considered relevant for service innovation. Consequently, we review some of these methodologies presented by Diedrichs et al (2006) below in chapter 8.3.

Within *innovation organization and culture,* Diedrichs et al (2006) also mention a few methodologies relevant for studying conditions for innovations (please see Figure 1). The methodologies are Bright-side concept, checklist to identify cultural barriers, the MEK-LOEP tool to analyze if goals and objectives are mutually understood, checklist to analyze barriers of information flow, SYMPLE, and GERAM. The GERAM methodology is particularly suited for engineering, and is therefore excluded from further discussion in this report. Although checklists may not be considered as methodologies, they are of great importance. Cultural elements may stimulate or hinder innovation, and companies should be aware of these potential possibilities/hindrances in their innovation activities. Thus, understanding its own organizations culture and needs for complementary organizational cultures may be a key to successful innovation for companies. A checklist on cultural barriers may be helpful for this purpose. Furthermore, we have discussed several potential problems related to communication of intangible and information intensive service elements in this report. A checklist to analyze barriers of information flow therefore sounds like a very good idea to ensure as smooth as possible communication and information flow in innovation activities in general, and in intangible and information intensive service innovation in particular.

Innovation life cycle management relates to the innovation process category in this report (please see Figure 1). The Stage Gate methodology (also discussed by PDMA), the KIEL model, and general restructuring of the innovation process to reduce time to profit and time to market are listed. The purpose of the methodologies is to ensure that the innovation process moves forward as effective and efficient as possible.

Idea generation is at the heart of innovation. Idea generation is typically considered as the first stage in an innovation process, and methodologies for idea generation is therefore related to the innovation process category in this report (please see Figure 1). Most of the methodologies mentioned by Diedrichs et al (2006) are also discussed in the PDMA list, but Diedrichs et al (2006) mention a few creativity techniques, pointing to more formalization of the development of innovative ideas. However, some of the techniques are only listed by Diedrichs et al (2006) with no further comments. When searching for information about the methodologies at www.wikipedia.com and on www.google.com, information about the methodologies is brief, unclear, and ambiguous. Based on this, we consider the methodologies to have limited interest for the review in this report.

The last stage of an innovation process is typically described as the launch stage. One of the categories of innovation mentioned by Diedrichs et al (2006) is *launch and continuous improvement*. This category of methodologies is naturally related to the innovation process category in Figure 1. Methodologies mentioned by Diedrichs et al (2006) are marketing analysis, systematic activity planning, reporting tools, test groups, checklist for selecting launch partners, quality tools, EFQM, and benchmarking. Marketing analysis (analysis of target population, competition and needs for marketing the product/service) are a very generic denotation, and several of the methodologies described by PDMA are relevant for this purpose. Activity planning, reporting tools, and quality tools are also more generic denotations where several methodologies and tools are available. Benchmarking is also included in the PDMA list. Because the PDMA list includes many methodologies for the innovation process, none of the methodologies mentioned by Diedrichs et al (2006) belonging to the category “launch and continuous improvement” are discussed any further in this report.

The last category highlighted by Diedrichs et al (2006) is methodologies related to what they call *innovation enablers*. These are typically methodologies related to innovation conditions in Figure 1 in this report, and thus valuable supplements to the scarce number of methodologies listed by PDMA relevant for innovation conditions. Typically, technology is included in several of the methodologies as a factor stimulating innovation. More concrete methodologies listed are Output driven learning and Project definition workshop in addition to some software tools for project management and -planning.

From this brief comparison of the PDMA-list of methodologies and the methodologies of the IMPROVE-project (Diedrichs et al., 2006) it seems that the PDMA-list covers most of the innovation methodologies practices at the firm and innovation unit levels. Some of the methodologies identified by Diedrichs et al. (2006) supplement the PDMA-list, but many of the unique methodologies mentioned are branded versions of more generally practices methodologies that are covered in the PDMA-list. Still, further analysis of some of the methodologies identified in the IMPROVE-project could be valuable for service innovation methodology adaptation. Thus some of these methodologies are further discussed in section 8.3.

8.3 Supplementary methodologies

Based on the list presented by Diedrichs et al (2006), we present a few more methodologies below. The methodologies are chosen because they are valuable supplement to the PDMA list on topics not covered very well by the PDMA list (typically within the category “Conditions for innovation”). In addition, a criterion for presentation is that a description of the methodology is available in one or more articles in Google Scholar.

8.3.1 Trend scouting/-extrapolation

24 hits were found on Google Scholar for trend scouting. Trend scouting is about revealing future trends for a market or a product/service. This can be done by analysing historical development of the task investigated and extrapolate this

development for the future (Otto and Wood, 2001). Extrapolation can be adapted to changes in preconditions for the future development if such changes are assumed to be relevant. Other approaches to the methodology are to identify experts in the area to be studied and to interview these experts about their expectations for the future development on the topic. Based on such interviews, lead users and/or lead products/services can be identified and further investigations can be conducted related to these users/products/services (von Hippel and Katz, 2004).

The methodology is applicable for service innovation. Trends based on history can be extrapolated also for services, but the exactness may not be as high for services as for products because of the information intensity and intangibility of services. The approach based on expert interviews is also applicable. As discussed in the main part of this report, qualitative methodologies as for example interviews are considered to be rather suitable for service innovation. Consequently, we consider trend scouting/-extrapolation to be a relevant methodology for service innovation.

8.3.2 Competitive analyses

Competitive Analysis is an often used methodology, and 9.630 hits were found on Google Scholar. The term Competitive Analysis is also used in marketing to describe the process a company or individual uses to assess competition. The following is a representative sample of the types of questions that should be answered in order to effectively analyze the competition: Who are your competitors? What does customer need? Are the preferences you are competing to met? What are the similarities and differences between their products/services and yours? What are the strengths and weaknesses of each of their products and services? How do their prices compare to yours? How are they doing overall? How do you plan to compete? Offer better quality services? Lower prices? More support? Easier access to services? How are you uniquely suited to compete with them?" (Wikipedia, accessed June 27, 2007).

The questions raised in Competitive Analysis can be answered by the usage of various methodologies reviewed from the PDMA list, and the questions raised does not particularly address issues of relevance to innovation. Thus, more specific methodologies have to be chosen based on their suitability for illuminating the

questions raised. We refer to the discussion in chapter 5 – 7 of the applicability of PDMA methodologies for service innovation

8.3.3 Customer Needs Assessment

Although 118 hits were revealed in Google Scholar for "customer needs assessment", a thorough review and description of the methodology is not easy to find. However, the methodology is about revealing the main needs of consumers with the purpose of satisfying these needs. Needs can be revealed through methodologies such as focus groups, individual interviews, brainstorming, etc. (please see general discussion in this report of the PDMA methodologies). Gap analyses can be conducted to visualize the gap between customers' needs and whether the needs are satisfied today (alternatively; how well the needs are satisfied today).

8.3.4 Output driven learning

Four hits were revealed for output driven learning in Google Scholar. The methodology "includes training as one of its main delivery mechanisms" (Landale, 2003). An important part of the methodology is to define relevant and clear measurement criteria to ensure benefits for the company. It is also underlined by Landale (2003) that the goals of different employees differ and that the learning measures have to be adapted to the different employees to reflect the individual goals.

Learning activities are just as important for services as for products, and learning can be a main antecedent of service innovation. Because of the service specific characteristics, measures of output driven learning may be more qualitative for service oriented innovation than for product innovation. However, the main elements of the output driven learning (benefits for the company and adaptation of learning measures) are also relevant when applied as a methodology for service innovation. It can also be mentioned that an expert group on innovation in services (Diedrichs et al., 2006) highlight educational needs and training as one of the most important stimulating factor for future service innovation.

8.3.5 Project definition workshop

"Project definition workshop" revealed 17 hits in Google Scholar. The methodology is developed by IBM. The purpose of the methodology is to optimize the service oriented architecture (SOA) for a company. The methodology is typically based on a five days session where IBMs SOA experiences are applied to the company's business. From an IBM whitepaper (2006), the following description is cited: "*IBM Project Definition Workshop experts review objectives and benefits of an SOA approach – and the IBM SOA reference architecture – as it relates to your business and IT challenges. The SOA readiness assessment analyzes your organization's business process, architecture and methodology to determine what your next SOA steps should be. From this information, IBM develops an SOA architecture road map, asset-reuse strategy, project plan, and SOA process and governance models – along with the underlying technology – that works best for your business. And perhaps most important, IBM provides recommendations about how you can put your project plan into production, so you can begin to reap the benefits of SOA right away*".

The description of the methodology is rather shallow, but the main focus of the methodology is on improving service elements of the business. As such, the methodology must be considered relevant for service innovation. Based on the description, the methodology seems to be rather comprehensive – including redesign of business processes and service architectures. The description also gives and impression that the methodology is particularly relevant for services with a high level of IT intensity.

8.4 Recent methodologies

As a final part of the discussion of innovation methodologies, we discuss a few methodologies published the last few years that we consider to have considerable potential for being useful in service innovation.

8.4.1 Open innovation

The traditional perspective on innovation has been the fulfilment of all of the stages in an innovation process within the same company or through controlled and long term

relational arrangements. Characteristics of such a closed innovation model are integration of resources and competence related to the innovation, and control throughout the whole innovation process. In an open innovation perspective, this idea is turned somewhat upside-down. Chesbrough (2003) divide the innovation process into funding (often associated with an initial stage), generating (which includes concept generation, testing, prototyping, etc), and commercializing (which corresponding to the launch stage of a traditional innovation process), and his major idea is that these three parts of an innovation do not need to be conducted within the same company (closed innovation model) or within long term relational partner companies only. The open innovation model is based on the idea of disintegration. "….no longer should a company lock up its IP, but instead find ways to profit from others` use of that technology trough licensing agreements, joint ventures and other agreements" (Chesbrough, 2003, p. 37). Thus, innovative ideas discarded internally in a company may have a profit potential in an *innovation market*. Rather than discard the innovation, it is better to make profit on a licensing agreement with some other company taking advantage of the innovation.

Chesbrough (2003) divide potential actors in an open innovation model into three main categories. Two types of actors are typical for *innovation funding*. They are 1) innovation investors (venture capital, private investors, etc.) and 2) benefactors (typically national research funding). *Innovation generators* are divided into 1) explorers (discovery research), 2) merchants (innovation with specific commercial goals), 3) architects (typically actors working in areas that are complex and fast-moving, disfavouring the "do it yourself" approach), and 4) missionaries (contributions to innovation to serve a good cause – community based idea exchange). Finally, the two main actors in *innovation commercialization* are 1) innovation marketers (idea/innovation marketing) and 2) one-stop centers (selling others ideas and innovations to customers - B2C and/or B2B).

There are few reasons to believe that open innovation as an innovation system should be less relevant to service innovation than to product innovation. Intangibility, however, may make the use of open innovation market mechanisms more difficult, but despite these difficulties, perishability may make the use of such mechanisms

more relevant. Also, increasing componentization of services and developments of service oriented architectures may increase the relevance of applying the principles of open innovation suggested by Chesbrough (2003).

8.4.2 Blue ocean strategy

The blue ocean strategy is about making the existing competition "irrelevant by creating a new market space where there are no competitors" (Kim and Mauborgne, 2005, p. 106). The Blue ocean strategy contrasts the Red ocean strategy where "bloody" competition is fought in existing markets. Blue ocean strategy is about "thinking outside the box". Two main tools are used in the Blue ocean methodology to stimulate "out of the box" innovations. The first tool is "The strategy canvas". This is a diagnostic tool helping companies to understand the competition in the market as it is right now and what customers receive from competitive offerings (Kim and Mauborgne, 2005). Based on the diagnosis revealed from "The strategy canvas", "The four action framework" should be used to mark out a new value curve. "The four action framework" includes Eliminate, Reduce, Create, and Raise. Eliminate means that factors currently taken for granted in the industry should be evaluated with the purpose of elimination. Often, factors included in a company's value curve is outdated and really do not add value to consumers anymore, and thus, should be eliminated. The next stage is Reduce. This is about deciding which of the existing factors offered that should be reduced to a standard well below the current industry standard (because the factors are assumed to be of marginal importance). Create means that the company has to create new factors that the industry has never offered before. Finally, Raise is to prioritize which of the factors that should be raised to a level well above the industry standard. Typically, these factors should include factors identified in the Create stage. By following this procedure, a company will be offering new and unique values. Consequently, the company do not need to fight with several other competitors all playing a "me too" strategy at an existing marketplace, but will rather find itself at a new marketplace offering new and unique values to consumers.

While blue ocean strategy sets out a fairly broad set of principles for innovation, it also provides two methodological tools. The tools are also fairly broad, particularly in the public documentation of the blue ocean strategy methodologies. Thus, the tools

are likely to be practiced by applying a set of more specific tools and methodologies. Still, the principles applied in blue ocean strategy methodologies are as relevant to service innovation as to product innovation. For example, the factors included in the four action framework may well be qualitative factors suggesting paths of improvement in current service offerings as well as identifying currently un- and underserved service opportunities

8.4.3 Ulwick

The main proposition in the Ulwick (2002) methodology is not to listen to customers' suggestions for innovation solutions but to their preferences for what an innovation can do for them. Consequently, how you listen to "the voice of the customer" does matter. Ulwick (2002) presents a five step procedure to ensure that customers' preferences for desired outcomes are revealed. The first step is about planning outcome-based customer interviews. It is important to identify and support the job the customer is trying to get done (for example prevent skin from drying) and to choose respondents from the groups of customers that are able to express their desired outcomes of these jobs. Second, the desired outcomes have to be captured throughout the interviews. A moderator should take part in the interviews and sort out outcomes from solutions. It is also suggested that the moderator translates discussions in the interviews to outcomes and asks the respondents if his/her understanding of the outcome is correctly perceived. Preferably, an outcome should be divided into 1) direction, 2) unit of measure, and 3) outcome desired – for example "Minimize (direction) the time it takes (unit of measure) to prepare the skin for hair removal (outcome desired)" (Ulwick, 2005). It is also important to learn about constraints in using the products so that the product innovation can be adapted to such constraints (for example the product must not require the use of mirror). The third step is about organizing the outcomes revealed throughout the interviews. A categorization that matches the stages in the process the innovation is supposed to support is recommended. Step four is about rating the outcomes revealed for importance and satisfaction. A quantitative survey is conducted focusing customers' evaluation of the importance and their satisfaction with the outcomes revealed from the interviews. Relevant jobs, outcomes and constraints revealed in the interviews should be included in the survey. Opportunity calculation is conducted based on the survey. In the fifth

and final step, the outcomes with the highest scores are identified Characteristics of the outcomes with the highest score are high importance and low satisfaction. Outcomes with the highest scores are underserved in the market and represent opportunities for improvements. By focusing over and underserved opportunities for different customers the Ulwick methodology is somewhat similar to the four actions framework tool of the blue ocean strategy methodology.

The Ulwick methodology is described in rather practical and specific terms and may easily be applied and/or adapted to service innovations. An advantage of the methodology is that even if the service offering in itself may be intangible and difficult to describe, the focus on the outcomes of the service offering when seen from the customers' perspective makes it easy to apply also for intangible service offerings. On the other hand, the methodology only indirectly supports service opportunity identification but provides tools for assessing the value of service innovation opportunities once these are identified. Consequently, the methodology seems relevant to both product and service innovation.

8.4.4 The innovation value chain

The innovation value chain model is divided into idea generation, idea conversion and idea diffusion. But the methodology views the innovation process as an end-to-end process rather than focusing on one part at a time. "Managers need to stop putting all their effort into improving their core innovation capabilities and focus instead on strengthening their weak links. Indeed, our research suggests that a company's capacity to innovate is only as good as the weakest link in its innovation value chain" (Hansen and Birkinshaw, 2007, p. 125). It is, therefore, decisive to identify the weakest link in the value chain. *Idea generation* depends on idea generation within single units and departments, idea generation across units and departments, and idea generation with other companies. The authors suggest that companies should build external networks and internal cross-unit networks as strategies to succeed in this part of the innovation development. *Conversion* includes a successful screening and funding part and a successful development part. Multi-channel funding and safe havens are suggested as strategies to ensure the strength of the conversion stage. *Diffusion* is about dissemination of the innovation. An idea evangelist is discussed as

one potential remedy to ensure that the innovation engagement is high in all parts of the organization and that none of the departments slow down the diffusion process. An interesting tools presented in the Hansen and Birkonshaw (2007) article is a questionnaire making it possible to identify which of the links in a company's innovation value chain that are the weakest. Based on such an analysis, strategies can be implemented to strengthen this link and, through this, the innovation value chain as a whole. The innovation value chain model is however, a rather broad set of principles suggesting the innovation process may easily be broken down into a value chain model. As discussed above, service innovation processes may not as easily as product innovation processes be broken down in this way, and consequently, the relevance of this model as a general methodology may be somewhat less for service innovations than for product innovations.

8.5 Conclusions and implications

Conclusions in two areas may be made from the findings of this report. These include conclusions on the list of methodologies covered by the PDMA glossary and conclusions more specific to service innovation methodologies in general.

First, two findings have been made on the methodologies covered by the PDMA glossary. The list is skewed in the direction of methodologies relevant to service innovation processes, in particular, methodologies supporting the open front end of innovation processes are particularly well covered. This is not only a characteristic of the methodologies of the PDMA glossary but rather a characteristic of the distribution of innovation methodologies in general. The other finding is that there are innovation methodologies that are not covered by the PDMA glossary. For example, recent methodologies of innovation support and stimulation applied outside classical product development contexts are not covered by the glossary. Still, the methodologies covered by the PDMA glossary include most of the well-established and practically applied methodologies of product innovation.

Three implications are suggested from these conclusions. The first is a need to supplement the methodologies listed in the PDMA glossary with more recent

methodologies and methodologies supporting innovation conditions, specific innovation types and innovation outcome measurement. This may be done by open ended research capturing methodologies described in innovation literature as well as in industry practice. Current research under the PDMA umbrella mainly focuses describing which of currently known methodologies are applied and how these are being applied (e.g. Kahn, Barczak and Moss, 2006). The other implication is that research should be extended to capture methodologies described in the literature and applied in industry practice on *service* innovation and cover these methodologies in the PDMA glossary. An implication of a more practical kind is that it might be an idea for PDMA to initiate some of this research as part of the establishment of an equivalent to PDMA for service innovation or as part of the establishment of a service innovation special interest group under the PDMA umbrella.

Second, three conclusions more specific to service innovation methodologies may be made. While the distribution of methodologies listed by the PDMA glossary are somewhat skewed, several methodologies have been identified that may be applied to service innovation with no or minor adjustments. Due to the characteristics of services, the distribution of these methodologies is even more skewed than the original PDMA glossary. In particular, it seems that most of the relevant methodologies are process oriented methodologies focusing the open front end of the innovation process. This is partly due to this part of the innovation process mainly being conceptual both for service and product innovation processes. Finally, as a consequence, fewer methodologies are found for the stimulation of innovation conditions for service innovation, for service innovation value assessment or outcome evaluation and for specific types of service innovations among the methodologies listed in the PDMA glossary.

Referring to a previous report on service innovation methodologies, we found relatively few empirical studies reporting the application and results of applying normative methodologies of the type listed in the PDMA glossary to service innovations (Nysveen and Pedersen, 2007). Thus, our suggestion here that many of the methodologies listed in the PDMA glossary may be applied to service innovations requires empirical validation. An implication is that the appropriate methodologies

identified in this report most be adapted and applied to service innovations within a validation end evaluation framework. This would enable research on service innovation methodologies to evolve from being descriptive to being more explanatory and prescriptive.

Another implication is that for the elements of service innovation not currently well supported by appropriate methodologies, service innovation methodologies must be developed and validated. A considerable knowledge base has been developed recent years from descriptive research on service innovation conditions, processes and outcomes (see e.g. De Jong et al, 2003; Tether, 2003), suggesting that a “design science” activity of methodology development is required rather than more descriptive research. Still, it is likely that appropriate normative methodologies will vary considerably across different service innovation types and service industries. Thus, no generally applicable service innovation methodology can be expected to be identified, but a toolbox of relevant service innovation methodologies and a framework for which tools to apply when and where is more likely to be optimal.

While a “design science” approach to service innovation methodologies is appropriate, it should be supplemented by continued research on service innovation best practices. This will, however, require a more open approach to capturing methodologies than that applied in traditional best practice studies or innovation surveys where best practice is defined as how known methodologies are applied. Best practice studies in service innovation methodology should instead focus both on discovering methodologies as well as how these are practiced.

Appendix A. Explanations of selected assessments

Some of the methodologies of table 8.1 are marked with an asterix in the "Conclusion" column indicating that our assessments require further explanations. We have the following comments on these methodologies.

Individual depth interviews: Although we do not find any articles combining the term "individual dept interviews" with "service innovation", we do consider this methodology to have relevance for service innovation. If we use the search term "depth interview" in Google scholar, 169.000 hits are revealed. If we combine the term "depth interview" with "service innovation", 580 hits are found. We also subjectively evaluate the methodology to have relevance. Thus, we conclude that the methodology is relevant for service innovation.

Information acceleration: Although this methodology is not used extensively for service innovation, we consider the methodology to be interesting because of its focus on virtual reality. More and more services are offered in virtual environments, and this is one of few methodologies taking tests of virtual services seriously. We therefore conclude that the methodology is interesting for service innovation – and in particular for virtual services.

Thought organizer: Thought organizer is also denoted as a Brainstorming tool in the literature. Although the name Thought organizer is rarely used in the literature, we do find the methodology to be of relevance because of its Brainstorming approach (please also see review of Brainstorming as a methodology).

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