INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED'09
24 - 27 AUGUST 2009, STANFORD UNIVERSITY, STANFORD, CA, USA

METHODOLOGY FOR SERVICE INNOVATION IN A MULTI-DISCIPLINARY CONTEXT

Lars Almefelt[1], Oskar Rexfelt[1], Daniel Zackrisson[2] and Teres Hallman[2]
(1) Chalmers University of Technology, Sweden (2) Volvo Technology, Sweden

ABSTRACT
Services' importance for the economy is increasing. However, services and their development remain under-researched in academia. This paper outlines the results of a project aiming to develop and apply methods for the early phases of service innovation. The project is a collaboration between an automotive manufacturer, a transportation firm, and a university. A research team selected and developed methods for problem analysis, development, and evaluation of services. In a series of workshops, actors from both firms set out on developing new services using the proposed methods. This paper describes these methods as well as demonstrates their application.

Keywords: Methodology, service development, customer involvement, teamwork

1 INTRODUCTION
While products continually are getting more and more technically advanced, we are also experiencing a servicification trend today [1] [2]. In 2003, over 70 % of both Sweden's and USA's gross domestic products consisted of services [3]. Furthermore, the service component of traditional, tangible products is also increasing, as well as the technological content of traditional services [2]. A wide range of researchers (e.g. [4] [5]) are identifying services as an important mean to enhance market orientation and increase firms' success in terms of profitability, competitiveness and customer loyalty. Still; services and their development remain under-researched [6] [7]. When 800 Swedish service firms were asked what domains should receive more academic attention, the three most frequent answers were: 1) Methods for service development, 2) Service quality, and 3) Customer relations [8]. In the same survey customers were pointed out as the most important source of ideas for new services.
This paper outlines the results of a project aiming to develop and apply methods for the early phases of service innovation. The project is a collaboration between a manufacturing firm in the automotive industry, a transportation firm, as well as a university, all in Sweden. The research team selected and developed methods and work practices for problem analysis, idea generation, development, and evaluation of services. The proposed approaches were applied in a service development experiment mainly based on workshops. In the experiment, a group of actors from both the manufacturing firm and the transportation firm set out on developing new services using the proposed approaches.

2 RESEARCH APPROACH
The research strategy behind the service innovation experiment builds on multidisciplinary research [9] and a case study approach [10]. Here, multidisciplinary research involves a problem-oriented approach bridging theory and practice, incorporating experiences and ideas from several disciplines, and aims to provide useful knowledge bound to a specific context. This line of reasoning can be related to action research, which means that practical problem solving, scientific research, and competence development is combined through a multidisciplinary collaboration [11]. In this experiment, action research provides the possibility to develop and evaluate methodology. A line of thought has been that the researchers provide the methodology framework while the representatives from industry provide expertise knowledge and engage in the actual service development.
The researchers were present through all phases of the service innovation experiment. In addition to providing methodology for service development, the researchers carefully documented the case supported by multiple information sources [10]. Continually, notes were made in a logbook, photographs were taken, and all productions resulted from the case study were taken care of.

In conceptualising the proposed methodology, influence was taken from product development and design, as well as from service development. This process was supported by a literature review. The actual methodology application was performed through a series of workshops involving all actors.
Adopting the research approach described above, the following types of results can be expected:

- A proposed *methodology* for service innovation.
- A demonstration of the proposed methodology *in use* through a workshop series.
- A nuanced description of *experiences* and formulation of *guidelines* on the topic.

The latter issue will just be briefly considered in this paper, but will be subject to a follow-up interview series and a peer review activity during 2009.

3 SERVICE DEVELOPMENT CHALLENGES

While services and their development today are acknowledged as important both in research and industry, there is seemingly a consensus that service development is not an easy task. Service firms generally do not have formal processes for developing services [1] [12], and the aforementioned study of 800 Swedish service firms show that 70 % of them have not got R&D departments [8]. This section will discuss three central service development challenges.

3.1 Services are difficult to describe and understand

There is no consensus on the characteristics of services [13]. However, there are special aspects of services that almost all researchers agree upon. One is their intangible nature [14] [15] [16] [17] [18]. This refers both to services' inability to be touched and the challenge they pose to be mentally grasped [15]. Services conceptually have complex constitutions, which may include goods, human-human and human-machine interactions, guarantees, subscriptions, etc. The constitutions of different service types also vary. A successful approach to develop certain types may be unsuccessful for other types [19].
Thus, this complex, relatively intangible, constitution of services, together with the large range of service types, makes services difficult to relate to during service development [1] [14] [16] [18]. It is important that everybody involved in service development have the same mental representation of the service, to ensure that it is similarly interpreted by all [20]. If this is achieved, the expectations of the customers will reflect what the service will deliver in practice. A challenge to marketers is that a successful use of tangible evidence often is required to explain new services [17]. This is also recognised in the service design area (e.g. [21] [22]). "The challenge is to find ways to create tangible manifestations and representations that communicate the value of the service", as put by [22].

3.2 Service value is difficult to predict

The outcome of services, i.e. their value to customers, is difficult to predict. One reason for this is the previously discussed difficulty to describe and understand services. If both developers and customers have fuzzy mental images of what is being developed, the outcome of the service will be difficult to accurately predict. Another reason is the heterogeneous nature of services. As services primarily are processes that are simultaneously produced and consumed, these processes vary as do their quality [14]. A third reason is that the value of services is heavily based on the customer's subjective experience [23]. It is next to impossible to accurately predict a subjective experience before actually experiencing it [22]. These difficulties point to two important prerequisites for service development:

1. Involve customers in the development process, as the service outcome heavily depends on them.
2. Conduct tests during the development process. These tests should have as high ecological validity (cf. [24]) as possible; otherwise the predictions of the service's customer value will be inaccurate.

3.3 Successfully involving customers in service development is difficult

There are seemingly three main advantages of customer involvement in service development:

1. Getting input from customers in the early phases of service design. What services do they need?
2. Getting creative input from customers during idea generation. Customer ideas for new services have been found more innovative than ideas generated by professional developers [25].
3. Getting input when new services are tested (see previous sub-section).

While customer involvement generally is viewed important, there are indications that it is often carried out ineffectively, or sometimes not at all. In a review of customer involvement research, [25] conclude: "Customer involvement especially devoted to service research is preached but not practiced". Some researchers believe that a reason for this inability to successfully involve customers

is the industry's tradition to rely on methods from marketing. [25] state in their aforementioned review that "Altogether, new service development relies on the difficult task of understanding and anticipating changing customer needs, with little help from traditional market research". Furthermore, [19] calls for a general implementation of methods untraditional in engineering, at least in regard services where the intangible components play a vital role.
Satisfaction of needs is, in principle, what services are about [26]. However, it appears that the complex nature of human needs make them difficult to access through question-based methods (e.g. focus groups and surveys). According to [27]: "Needs as such cannot be observed directly. Needs become visible in the activities and actions by which an individual seeks the satisfactions of needs. It is by identifying the problems that arise in the interaction between the human being (the user) and the object (the product/system) that a potential for improvement can be identified." Thus it is important to complement question-based methods with observations of users/customers in order to understand their everyday activities and needs [22] [26] [28], specifically if one wants to access the latent needs that customer will not express in surveys and interviews [29].

4 METHODOLOGICAL APPROACH FOR SERVICE INNOVATION

This section outlines the methodological principles and practical arrangements underlying the service innovation experiment, while reflecting the challenges described in Section 3.

4.1 Points of departure

The *points of departure* in this section are intended to support a consistent line of reasoning throughout the study, including the selection and application of methods. They are a synthesis of views found in literature and ambitions described in the introduction. Specifically, the following issues drive a main theme throughout the study:

A. Service is about *creation of value while referring to total effects on customer*. "Value" or "quality" of a service is a subjective experience – more than in the case of goods (cf. [22] [23]). There are also few standardised measures to denote value of a service (cf. [13]). In addition, the value of a service might be dependent on the interaction between parties involved. This also means that the experienced value of services is more contextual than the experience of goods.
B. The overall approach is *problem-oriented*, which means that the search for solutions is based on problems, needs, and potentials that have been identified in the customer's operations. Thus, the focus is set on finding best solutions in principle, rather than allowing that speculations or suppliers' existing solutions constrain the search for solutions.
C. Service concepts are studied through *co-innovation*, meaning that suppliers, customers, and other stakeholders meet together and engage in a common task. Thus, a joint work arena is provided for maximum utilisation of each participant's experience and expert knowledge. Specifically, the evaluation of effects and potential value is supported when representatives from customers are present – providing "first-hand experience". This is particularly relevant when it is difficult to formulate measurable evaluation criteria, as in the case of services (cf. [22]).
D. *Frequent iterations* between development and evaluation are particularly valuable in service development, since services are relatively difficult to understand and describe, and their effects are more difficult to predict. Thus, frequent iterations reduce the risk of misunderstandings within the development team while increasing the precision of the resulting service offer.
E. *Vivid embodiment* of services (cf. [21]) is inherently motivated since they are difficult to understand and describe. Value is related to the effects of the process rather than the process as such. This motivates imaginary modelling of the service in action and resulting customer experience. In opposition to hardware products, services are more difficult to represent using standardised drawings, CAD-models, or physical objects.
F. The *multitude of service types* is valuable to consider since it means many opportunities for innovation. Thus, methodology for service innovation should stimulate the consideration of many different service categories.
G. The *complexity of a service* is a challenge but also an opportunity. Many services are systems provided through a complex chain of activities, involving many parties. The value is a result of the overall process, and is potentially higher than the sum of the individual constituents' value. When it comes to services, soft domains such as the interaction between customer and supplier are more important than in the case of goods.

4.2 The innovation process

Basically, the proposed service innovation process is similar to a typical design process, thus proceeding from abstract to concrete and being driven by some kind of problem statement. As described by [30], five general steps of a design process can be distinguished: 1) *Understand*, 2) *Observe*, 3) *Visualise*, 4) *Evaluate* and *refine*, 5) *Implement*.

Thus, an important aspect of the design process as described is that it starts with *understanding and observation* rather than idea generation. This perspective is adopted in the service innovation process here (cf. point of departure "B" in 4.1). Accordingly, the process starts with a pre-study (corresponding to steps 1 and 2), followed by a workshop series (corresponding to steps 3 and 4) in which service solutions are generated and refined. The scope here, however, does not encompass implementation (step 5). Figure 1 (left) illustrates the overall innovation process, including a five-step flow divided into two work blocks: *pre-study* and *workshop series*. The pre-study was carried out by the researchers, while the four steps of the workshop series were carried out through *co-innovation* involving researchers, the manufacturing firm, and the transportation firm (cf. point of departure "C").

The pre-study was carried out on-site at the transportation company. The researchers followed along employees in their daily operations, asking questions but trying not to interfere with the normal routines. It should be emphasised that the full team was not engaged in the pre-study. In principle this means a loss of information. However, this was alleviated by the workshop *problem analysis*, in which all involved were provided the results of the pre-study, and were given the assignment to make their own problem analysis. This also means that the team members became both actors and informants (cf. [29]). As illustrated in Figure 1, the four main activities of the workshop series were carried out through six events. This was because the full manning was split into two teams during the *idea generation* and *development phases*. Thus, the possibility to apply and evaluate different methods was provided. During the final *evaluation*, the full manning was present to maximise experience available.

The pre-study was carried out during the summer 2008, and the workshop series was carried out during the period of October to December 2008. The duration of each workshop was three hours.

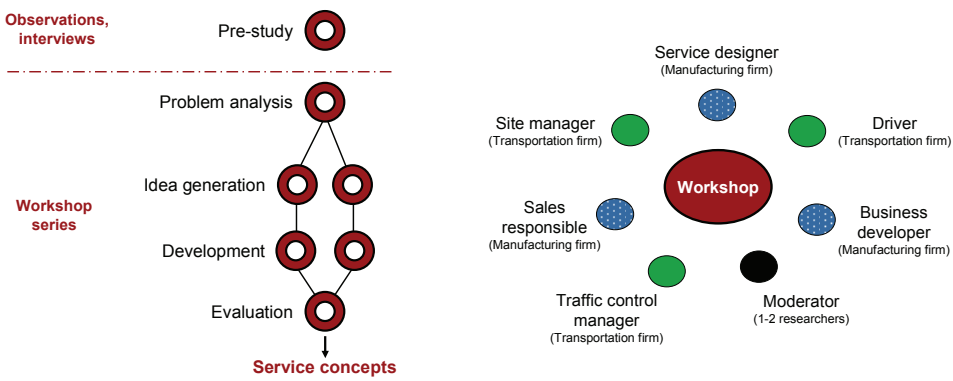

Figure 1. The overall service innovation process (left) and the set-up of each team (right)

4.3 The team set-up and roles during the workshop series

A central notion underlying the team set-up is cross-functional manning – thus involving different competences from both supplier and customer. This is to address point of departure "C" in 4.1, and in particular the line of thought that creativity is stimulated when parties from different contexts meet.

The full workshop manning consisted of twelve individuals from industry (six from the respective firm), plus two researchers. The twelve representatives from industry were split into two teams with a similar set-up of competences. Thus, each team included three members from the manufacturing firm and three from the transportation firm. The following competences were represented:

- One service designer, one business developer, and one sales responsible from the manufacturing firm.
- One site manager, one traffic control manager, and one driver from the transportation firm.

Right-hand side of Figure 1 illustrates the set-up of each team. As previously stated there were two such teams arranged, in the following denoted "team 1" and "team 2". The roles were as follows:

- The two researchers were responsible for providing and introducing the methodology and the included support methods. In addition, the researchers had the main role to act as moderators throughout the workshop series. They also had the responsibility to collect and organise the teams' output, as well as to continuously document the progress of the teamwork.
- The main task for the team members was to generate output on the current topic. A general notion is that the teams' output is valid, thus indicates the effectiveness of the methods in use.

4.4 Physical setting for the workshop series

With the main purpose of keeping focus on teamwork, the workshops were held on a special location, thus separated from the firms' ordinary environments. This means an environment with fewer disturbances which will enhance efficiency of the work. It is also a way of preventing that certain individuals come and go. What is even more interesting is that this makes provision for an open-minded team spirit. In leaving ordinary operations, it becomes easier to mentally leave the "self-evident" norms of the ordinary operations for the favour of a co-operative, innovative work (cf. [8]). This also addresses point of departure "C" in Sub-section 4.1.

4.5 Methods selected for the individual workshops

While referring to the six workshops included in the workshop series, this section will outline the methods that have been selected and developed for the individual sessions. In presenting the methods, their context of origin will be described, along with their justification in the context of the service innovation experiment. Some of the methods are well-known and are generally applicable, while others are bound to services specifically or even uniquely designed for this project. Generally, the methods are selected with the *belief* that they have the potential to be effective and efficient in use. Thus, each method should be seen as a proposition. Their effects in practice will be seen in Section 5.

Method for problem analysis

The aim of the first workshop – the problem analysis – was to convey the pre-study experiences to all workshop participants, as well as to let the participants analyse the customer's core activities and related problems, and to identify potential areas for improvement. This addresses point of departure "B" in 4.1. In turn, the purpose was to make the team members familiar with the problem situation. Another inherent purpose was to establish a co-operative team spirit (cf. point of departure "C").

A general notion underlying the problem analysis is that the customer's full operations should be considered, including a wide range of possible problem areas. Thus, a systems approach is adopted, which is a precondition to be able to assess total effects of service proposals that will emerge in the workshop series. This way of reasoning addresses both point of departure "A" and "G".

The method for the problem analysis workshop can be summarised by the following flow:

1. The researchers present the results from their pre-study at the customer (the transportation firm). The presentation is richly illustrated by the use of photographs, which is in line with the notion of vivid embodiment (point of departure "E"). Also, the researchers introduce seven identified *focus areas* (improvement areas), e.g. logistics, maintenance, security, and recruitment.
2. Each team is given a prepared A1-board to make its own problem analysis. The teams are asked to: "Shortly formulate the most important problems within respective focus area, however without stating any solutions". The A1-board has headlines matching the seven focus areas. The teams formulate their issues on Post-It labels and organise them under appropriate headlines.
3. The teams present their results to each other.
4. The researchers take care of the teams' results and synthesise into one, graphically stringent A1-poster. This poster serves a normative problem statement throughout the workshop series.

Method for idea generation in team 1

On the topic of idea generation, team 1 was given the task to:

- Generate service ideas based on the problem analysis.
- Select the two most promising ideas.

A general line of thought for team 1 was to keep focus on *different actors' perspectives*. This applies both to the idea generation workshop and to the subsequent development workshop. In order to match this line of thought, the 6-3-5 method (e.g. [31]) was selected for idea generation. The point in this context is that method 6-3-5 is carried out in a silent fashion, and all involved are given equal

opportunities to come with their ideas and to associate to all others ideas. In addition, method 6-3-5 was judged to appropriately address co-innovation, thus point of departure "C". In practice, the team members were given three prepared A4-sheets each and were asked to note down one service idea on each sheet, after which the sheets were shifted around the table for successive association.
In order to enhance problem-orientation, and thus address point of departure "B", the A1-poster with focus areas that resulted from the problem analysis workshop was present all through the workshop.
After the actual idea generation, the team members were asked to assess the ideas and select two for development in the next workshop. This was done according to an evaluation process focusing on the different actors' preferences, as follows:

1. Each team member denotes his/her favourite idea a green label. Remaining ideas are removed.
2. Each team member puts a yellow label on his/her second favourite among the remaining ideas and marks the idea that he/she has the least belief in with a red label.
3. The colour pattern is interpreted collectively and two ideas are selected.

Doing evaluation already in the idea generation phase emphasises the ambition to frequently iterate development and evaluation, as stated through point of departure "D".
Finally, the team was given the task to collectively create a *tagline* for each of the remaining two service ideas. In order to stimulate this, the researchers showed examples from real-life promotion.

Method for idea generation in team 2

Team 2 was essentially given the same idea generation task as team 1. However, while different actors' perspectives constituted a main theme for team 1, the methods for team 2 exploit *the multitude of service types* as well as *the complexity of a service*. Thus, points of departure "F" and "G" are addressed. Specifically, an A0-poster was designed in order to suggest different types of services.
Structured, speak-aloud brainstorming was deployed for the actual idea generation. Throughout the brainstorming session, the A0-poster illustrating the multitude of service types was present, and thus served as inspiration. As for team 1, the A1-poster with focus areas that resulted from the problem analysis was also present. The participants were asked to put down their ideas on post-it notes, which were then attached on an A1-board prepared with headlines corresponding to the focus areas.
Generally, the researchers moderated the brainstorming very actively, in opposition to the silent 6-3-5 method application in team 1. Being moderators, the researchers continuously encouraged the team members to come up with more ideas, and showed their appreciation for the ideas provided. Thus, a general ambition was to support creative, co-operative work (point of departure "C") by letting the team members freely associate to each others ideas while being provided external stimuli.
Subsequently, the idea flora was collectively evaluated while referring to the A1-poster with focus areas and listed problems. This was done according to the following process:

1. Each team member puts a green label on the idea with the best potential to solve listed problems. Remaining ideas are removed.
2. Each team member puts a yellow label on the second most promising idea, and a red label on the idea he/she has the least belief in.
3. The colour pattern is interpreted collectively and two ideas are selected.

Finally, the team was given the task to collectively create a *tagline* for each of the two service ideas.

Method for development in team 1

Here the assignment for team 1 was to further develop the two service ideas that resulted from the idea generation workshop. Still, a general line of thought for team 1 was to keep focus on *different actors' perspectives*. Another central notion was to stimulate a *continual, iterative process* for development and modelling of service concepts. The latter addresses point of departure "D", as defined in 4.1. To serve these purposes, a *modelling kit* was developed and brought about physically, see Figure 2. By the use of this kit, the team is expected to gradually mock up service concepts through an evolutionary process, while continually reflecting on potential effects at overall level (point of departure "A"). Specifically, the team is expected to actively consider interactions between different constituents of a service system. Concretely, the kit is designed as a parlour game, and includes different cards to support the visualisation (compare with point of departure "E") of the following components:

- Actors (the key parties/firms involved in the service process).
- Stakeholders (other than actors, but possibly affected by the service).
- Effects referring to operations, resources, or individuals.

- Actions (what actually happens).
- Information, goods, access, capital, and their flows (cards designed as arrows).
- Objects (possibly dealt with in the service process, e.g. a truck).
- Support technology (necessary to realise the service).

In use, the cards are organised on a playing court that is made of tricot plastic. It is possible to write and draw (and wipe off) on the cards as well as on the playing court by the use of ordinary whiteboard markers. Thus, the team members are provided the possibility to note down specific ideas and effects.
The thinking behind the kit and its intended use can be compared with the reasoning of [16]: The establishment of systems architecture and the consideration of interactions between components improve the efficiency of the development process, including the search for appropriate solutions. In addition, [16] emphasise the role of iterations, as is done here.

	Service concept X		
	Sub-solution alt. 1	Sub-solution alt. 2	Sub-solution alt. 3
Target customers			
Core services			
Support services			
Availability			
Owner/Provider			
Manning			
Financing			
Technology			
Promotion			

Figure 2. The service modelling kit (left), and the adapted morphological matrix (right)

Method for development in team 2

Team 2 used a more structured, step-by-step method for development of their selected two service ideas. As in their previous workshop, the methods selected address points of departure "F" and "G" – *the multitude of service types* and *the complexity of a service*. Specifically, it is considered that services often are provided through a combination of sub-solutions. "Value" is a result of the overall process, which is potentially higher than the sum of the individual constituents' value. The focus areas from the problem analysis serve as the norm for assessing overall value (cf. point of departure "A").
An adapted morphological matrix [32] was used as the basis for the concept development. The concept development was done in two main steps; first a "top-down" decomposition and listing of possible sub-solutions, and then a "bottom-up" synthesis. For practical use, A1-boards with morphological matrices, one for each service concept, were prepared by the researchers prior to the workshop. Right hand of Figure 2 illustrates the principle. These matrices included predefined service domains or service characteristics that the researchers had identified appropriate for the specific service idea at hand. The service ideas from the idea generation workshop were decomposed and organised in advance by the researchers. Then, each of the two service concepts was developed as follows:

1. The team makes a complementary idea generation in order to create a complete palette with alternative sub-solutions for every service domain (characteristic). The ideas are expressed on Post-It labels which are put directly on the morphological matrix.
2. The team collectively synthesises the service concept by selecting sub-solutions from all categories, while at the same time considering the focus areas. This process is stimulated by letting all team members put green labels on "necessary" solutions, and yellow on "optional" solutions. Specifically, the team is encouraged to put together sub-solutions that match particularly well, thus utilising synergies for the benefit of overall value (cf. [33]).

Method for evaluation, including visualisation of service concepts

A general ambition is that the evaluation methods shall provide support for assessment of customer value. In order to keep focus on co-innovation, the methods should also support the utilisation of collective experience in the team, and the consideration of individual team members' preferences.

A specific issue to consider is that the two teams applied different methods for their idea generation and concept development. Thus, the resulting four (two + two) service concepts were represented in different ways. However, a fair evaluation process presupposes a format that is common. In addition, while considering the notion of a *vivid embodiment of services* (point of departure "E"), we aim to:

- Represent services in a way that developers, managers, and customers understand.
- Represent services in a way that supports the imagination of the services in use.
- Represent services in a way that includes effects, mainly referring to customer experience.

Reflecting the ambitions above, a method for *visualisation* of service concepts was developed. In principle, this is done according to the following three-step process:

1. Extraction of the essence of each service proposal by the use of a predefined set-up of criteria. The practical work is supported by a matrix, as shown in Figure 3.
2. Formulation of a manuscript for a promotion leaflet for each service proposal.
3. Graphical designing of a fictitious promotion leaflet, thus representing each proposed service.

Four leaflets, each one describing a service proposal generated in the teams, were thus prepared for the *evaluation* workshop. The evaluation process includes three main activities: (1) A reflective analysis using an activity scheme [26]. In principle, total consequences of a service proposal are assessed while being stimulated by four general issues, see right hand of Figure 3. In practice, team 1 evaluates the two service concepts proposed by team 2, and vice versa. (2) A normative evaluation of the service proposals using a modified Pugh matrix [34]. For each criterion, every service concept is assigned a green label (positive effect), a red label (negative effect), or a yellow label (neutral). Today's situation serves as the reference. The researchers moderate a collective evaluation including both teams. (3) Every team member is asked to give his/her personal view of each service concept in a questionnaire including a five-step grading scale.

Name	Service concept 1	Service concept 2	Service concept 3	Service concept 4
Target customer				
Customer quotations				
Core sentence				
Tagline				
What creates value? What is performed?				
Representative illustrations				
Positive effects for the customer				
Financing				
Owner				

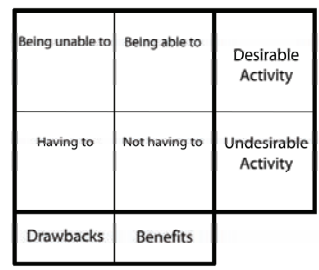

Figure 3. Matrix with criteria for organising the essence of service proposals (left), and activity scheme for assessing consequences of each service concept (right)

5 THE APPLICATION: FINDINGS AND DISCUSSION

In Section 4, a methodology for service innovation was described and justified, along with a set-up for its application. Next follow results of the proposition in action. The findings presented are based on analysis of the teams' productions, along with our own documentation of the case.

5.1 Findings from the pre-study

The pre-study resulted in rich data which was compiled in an 80-page document. Compared to the ideal view typically given in an official description of a company, the pre-study data holds a number of advantages. It includes problem descriptions observed in real life. Furthermore, it considers activities both at overall level and detailed level, including viewpoints of individuals. However, although extensive data was collected, saturation was not observed. This can be expected in studying a phenomenon as multi-faceted as the activities at a transportation firm, but still it is a limitation of the data. This was counteracted by interviewing actors at different hierarchical levels within the firm.

A major limitation of the pre-study was that the transportation company's customers were not included. It would have been valuable to assess their opinions in order to identify improvement areas.

The results of the pre-study consisted of text and photos mainly describing improvement areas in the transportation firm's operational environment. These were organised into seven focus areas.

5.2 Findings from the workshop series

Findings from the problem analysis workshop

A culture of collaboration and mutual learning was established during the first workshop. Ten of the twelve representatives from industry were present, and worked with problem analysis in their respective team. It was observed that the team members' work complemented the results of the pre-study: Supported by their experience and expertise, they were able to state frequency and importance of issues related to the focus areas. They also gave further examples and more nuanced descriptions. Another observation was that the teams added problem issues that had not been observed during the pre-study. However, issues brought to light this way are dependent on the individuals present. Specifically, problem issues for areas that are not covered by the team members present might be suppressed, resulting in a biased description of the situation.

Findings from the idea generation in team 1, using method 6-3-5

Four of the six team members were present in applying method 6-3-5. All participants – ranging from engineers to truck drivers – were equally able to express their ideas. In total 13 ideas were generated. Looking at the ideas, one can conclude that they are heterogeneous when it comes to their characteristic: Some are detail solutions while others are overall solutions, and the range includes daily routines, processes, services, technical components, and IT-systems. It seems like 6-3-5 results in a heterogeneous description of the idea flora. Moreover, the team members tended to provide new ideas for the problem area given by the first idea on the worksheet, rather than develop the original idea as such. Possibly, these phenomena could be alleviated by giving more instructions to the team members. However, the opportunity for this is limited, since 6-3-5 is intended to be applied in a silent fashion.

The assessment of the ideas, focused on voting, was carried out efficiently. However, the team had a tendency to keep most ideas rather than reducing the idea flora. They organised the idea flora in chunks of related ideas, which accentuated the heterogeneity of their descriptions. Nevertheless, the team was successful in naming their two resulting ideas ("Optiflow" and "The Service Service"), and in creating taglines ("More is less" and "Keeps you going"). These service ideas considered the coordination of transport needs and capacity, respectively IT-support for planning of vehicle service.

Findings from the idea generation in team 2, using brainstorming

All six team members were present in applying brainstorming according to the set-up described in 4.5. The pace was high throughout the session, and all team members were engaged in the work. However, some of them were particularly productive. 42 ideas were generated in the team, plus variants for some of them. In comparison to the idea generation in team 1, the ideas are more homogenous in their description, and generally they are more focused on services. Probably this is a result of the continual moderation by the researchers and the presence of the service poster. In addition, ideas were provided for all focus areas, which is natural when they are all visible on the A1-board. There was also a "general" headline on the board, thus taking care of ideas not directly related to the pre-defined focus areas. Actually, this headline was one of the most frequently used ones. Throughout the session, one of the team members had a tendency to start analysing the ideas. This was suppressed by the moderators, for the benefit idea generation.

In the subsequent evaluation activity, the idea flora was re-organised and some closely related ideas were put in chunks. The team named their two favourite ideas "Green Stop" and "Radio Convoy", and gave them taglines "The magnet of road service" and "Knowing the road" respectively. In principle, these service ideas consider a truck stop that provides education, respectively a radio station with a matching internet site for professional drivers.

Findings from the concept development in team 1, using modelling kit

Five of six team members of team 1 took part in the development workshop using the modelling kit. The kit appeared to be excellent in supporting discussion, in which all involved actively contributed and learned from each other. Without much need of moderation, the team members lively engaged in using the kit to describe the two service ideas from their previous workshop. In particular, the kit helped the group to concretise their heterogeneous chunks of ideas.

As intended, the kit supported an iterative modelling process in which total effects on customers were highlighted continually. Finally, each service idea had evolved into a system map where actors, actions, effects, etc. were represented by the cards included in the modelling kit.

Overall, the kit enabled the team to efficiently conceptualise the rather fuzzy service ideas from the previous workshop. On reflection however, the outcome of using the kit, i.e. the system maps, is seemingly not suitable to visualise a service concept to people who have not been part of the process.

Findings from the concept development in team 2, using morphology

Four of six team members engaged in concept development using the modified morphological matrix. First, the team adopted a top-down perspective on their two service ideas (one by one), and generated further ideas related to different service domains predefined by the researchers. Thus, ideas selected in their previous workshop were complemented with new ideas for new domains. The team members were very productive, although an active moderation was needed. Subsequently, the team adopted a bottom-up perspective and re-synthesised their two concepts, one by one. Also this activity was done without major problems. However, for one of the service concepts, the group initially had a tendency to include almost all sub-solutions available in the morphological matrix. Also, the team needed moderation since there was a tendency to extensively discuss details.

The method of actively selecting sub-solutions to an overall service concept appeared to drive decisions efficiently. Thus, the method rapidly resulted in relatively concrete descriptions of the service concepts. Specifically, the participants considered synergies between different sub-solutions (as is a major point in applying this method). For instance, when the team had to prioritise, they excluded sub-solutions that did not fully match the overall service concept.

Findings from the evaluation workshop

Both teams attended the evaluation workshop and ten of the twelve representatives were present.

Although the leaflets used (Figure 4) provided the essence of the different service concepts, it became clear that they could not communicate all details. This was brought to light during the evaluation process when some participants stated that details were missing from their ideas. A probable explanation is that the concepts were presented in a universal, compact format (see 4.5). Overall, though, it seemed like the leaflets served their purpose, specifically to enable all actors to envision a future with the services. This was further evidenced by comments in the personal questionnaires.

The activity schemes used for the reflective evaluation induced discussion, and helped the participants to evaluate both benefits and disadvantages. Their statements also included issues that had not been brought up during the earlier workshops, and the predefined categories in the activity scheme matched most statements. However, the categories focus on change only and thus do not address negative issues that remain unchanged when the service is consumed. Some participants reacted on this.

The normative evaluation process using the modified Pugh matrix was surprisingly efficient. Specifically, the group rapidly reached consensus when grading the different service concepts' effects related to the predefined criteria in the matrix. However, one team member had a tendency to defend the ideas of 'his' team, rather than joining an objective discussion. With only one exception, among 40 grades given in the Pugh matrix, the group's assessments were all positive or neutral.

The participants finally assigned their personal preferences regarding the four service concepts by completing questionnaires. The comments and grades indicate that main factors underlying their preferences are the services' potential profitability and their possibilities to be realised. Thus, the level of innovation did not seem to dominate in their assessment.

Universal format including:

- Name of the service, tag line, and graphical brand symbol
- Ingress introducing the service's effects
- Description of the service content below the headline: "What is service X?"
- Description of positive effects below the headline: "Our ambition"
- Invitation to purchase the service or apply for membership
- One or two representative illustrations or photographs
- Fictitious quotations and portraits of target customers
- Fictitious contact information.

Figure 4. Leaflets visualising the proposed service concepts

Findings related to the overall workshop process

All methods appeared to work in practice, thus produced expected results within the time scheduled. At the same time, it should be emphasised that the pace was high. In addition, the quality of the output, e.g. the level of innovation, has to be further analysed before stating final conclusions.

Sometimes the teams had difficulties to start working, but well in progress they often did not want to stop. Generally, intensive co-operative work characterised the sessions. The individual team members were highly dedicated, however with the exception of a single one who had a distanced attitude.

Reflecting on the output, one can conclude that the service solutions provided are holistic to their nature and address many of the focus areas. Probably this is due to the fact that they have continually been evaluated with reference to total effects. Possibly, there is a need for a complementary method that supports the consideration of detail solutions, even if they just solve a single problem.

6 CONCLUSION AND FUTURE WORK

Justified by challenges in service development, this paper has outlined a methodology proposition for service innovation. In principle, the methodology is similar to a typical design process, however adapted to address problem-orientation, co-innovation, and consideration of total effects on customer. An application of the methodology has been demonstrated through a workshop series involving cross-functional manning from two different industrial firms. During the workshop series, more than 50 service ideas were generated and evaluated, and four ideas were developed into service concepts. The workshop sessions were generally characterised by a positive team spirit and a high pace, and the team was successful in solving the different tasks on time. Currently, a follow-up study is in progress, while having the aim to describe specific effects of the methodology as well as opinions of individual team members. This research process is supported by in-depth interviews and peer reviews.

Acknowledgements

We would like to express our greatest thanks to all team members for making the workshops reality. Special thanks go to Lars Nordin and Linus Wiklander for their support with graphical design. Last but not least, the financial support from Vinnova, the Swedish Governmental Agency for Innovation Systems, is gratefully acknowledged.

REFERENCES

[1] Menor L., Tatikonda M., Sampson S. New service development: areas for exploitation and exploration. *Journal of Operations Management*, 2002, (20), 135–157.

[2] CTF (Centrum för tjänsteforskning). *Den nya tjänsteekonomin. Användardriven tjänsteutveckling,* 2004, Accessible at http://www.ctf.kau.se/KK-Profilen_sv.pdf.

[3] The World Bank. www.worldbank.org. Date of access: 2007-10-29.

[4] Vargo S.L. and Lusch R.F. Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, 2004, 68(1), 1-17.

[5] Grönroos C. *Service Management and Marketing - Customer Management in Service Competition*. 3rd edition, 2007 (John Wiley & Sons, London)

[6] Lovelock C. and Gummesson E. Whither Services Marketing? *In Search of a New Paradigm and Fresh Perspectives, Journal of Service Marketing*, 2004, 7(1), 20-41.

[7] Spat D. and Fähnrich K.P. *Advances in services innovations*, 2008 (Springer, New York).

[8] ALMEGA (The Swedish organisation of service companies). *Innovativa tjänsteföretag och forskarsamhället*, 2008.

[9] Svensson L., Brulin G., Ellström P.E., Widegren Ö. *Interaktiv forskning – för utveckling av teori och praktik*, 2002 (Arbetslivsinstitutet, Stockholm, Sweden).

[10] Yin R.K. *Case study research*, 1994 (Sage Publications, London).

[11] Ottosson S. Dynamic Product Development: Findings from Participating Action Research in a Fast New Product Development Process. *Journal of Engineering Design*, 1996, 7(2), 151-169.

[12] Edvardsson B., Gustafsson A., Johnson M.D., Sandén B. *New service development and innovation in the new economy*, 2000 (Studentlitteratur, Lund, Sweden).

[13] Chia M.C., Chin T.C., Chin H.H. A review of service quality in corporate and recreational sport/fitness programs. *The Sport Journal*, 2002, 5(3), 1-9.

[14] Alonso-Rasgado T., Thompson G., Dannemark O.J. *State of the Art in Service Design & Modelling*, 2004 (Vivace Project, Manchester, UK).

[15] Bateson J, Do we Need Service Marketing?, Marketing Consumer Services: New Insights, report 75-115, Marketing Science Institute, Boston, (1977).
[16] Bitran G. and Pedrosa L. A structured Product Development Perspective for Service Operations. *European Management Journal*, 1998, 16(2), 169-189.
[17] de Brentani U. New Industrial Service Development: Scenarios for Success and Failure. *Journal of Business Research*, 1995, 32, 93-103.
[18] Johne A. and Storey C. New Service Development: A Review of the Literature and Annotated Bibliography. *European Journal of Marketing*, 1998, 32(3/4),184-251.
[19] Bullinger H.J., Fähnrich K.P., Meiren T. Service Engineering –Methodical Development of New Service Products. *International Journal of Production Economics*, 2003, 85, 275–287.
[20] Clark G., Johnston R., Shulver M. Exploiting the Service Concept for Service Design and Development. In: Fitzsimmons J., Fitzsimmons M. (Eds.) *New Service Design*, 2000 (Sage,Thousand Oaks, CA).
[21] King O. Design strategy for service innovation. *Oral presentation at the conference "Målinriktad design av tjänster"*, Stockholm, Sweden, June 2008.
[22] Moritz S. *Service Design: Practical Access to an Evolving Field*, 2005 (Köln International School of Design).
[23] Parasuraman A., Zeithaml V.A., Berry L.L. A Conceptual Model of Service Quality and its Implications for Future Research. *Journal of Retailing*, 1985, 49, 41-50.
[24] Colman A.M. *A Dictionary of Psychology*, 2001 (Oxford University Press).
[25] Matthing J., Sandén B., Edvardsson B. New service development learning from and with customers. *International Journal of Service Industry Management*, 2004, 15(5), 479-98.
[26] Rexfelt O. *User-Centred Design and Technology-Mediated Services- Identifying and Addressing Challenges by Analysing Activities*, 2008 (Chalmers University of Technology, Sweden).
[27] Karlsson I.C.M. *User Requirements Elicitation: A Framework for the Study of the Relation between the User and the Artefact*, 1996 (Chalmers University of Technology, Sweden).
[28] Mager B. Designing excellent service performance. *Oral presentation at the conference "Målinriktad design av tjänster",* Stockholm, Sweden, June 2008.
[29] Kaulio M., Karlsson M.A., Rydebrink P., Klemets M. *PRE, Product Requirements Engineering*, 1996 (Chalmers University of Technology and IVF, Sweden).
[30] Kelley T. *The Art of Innovation*, 2001 (IDEO, New York).
[31] Pahl G. and Beitz W. *Engineering Design, a Systematic Approach, 2nd English Edition*, 1996 (Springer-Verlag, Berlin, Germany).
[32] Zwicky F. *Entdecken, Erfinden, Forschen im Morphologischen Weltbild*, 1971 (Droemer-Knaur, München, Germany)
[33] Almefelt L. Balancing Properties while Synthesising a Product Concept – A Method Highlighting Synergies. In *Proceedings of ICED'05*, Melbourne, 2005, Paper Number 300.46.
[34] Pugh S. *Total Design. Integrated Methods for Successful Product Engineering*, 1990 (Addison-Wesley Publishing Company, Wokingham, UK).

Contact: Lars Almefelt
Chalmers University of Technology
Product and Production Development
SE-41296, Gothenburg
Sweden
+46(0)31 7721374
lars.almefelt@chalmers.se
http://www.chalmers.se/ppd/EN/

Lars Almefelt and Oskar Rexfelt are researchers and lecturers at Chalmers University of Technology. They both hold PhD degrees in product development methodology. Daniel Zackrisson and Teres Hallman are development engineers at Volvo Technology Corporation. Currently they are engaged in strategies for service development for the Volvo Group.