Learning networks: a method for Integrated Product and Service Engineering – experience from the IPSE project

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Abstract

The aim with the Integrated Product and Service Engineering (IPSE) project is to develop a methodology for companies that want to make the journey of moving from selling products to also sell Integrated Product and Service Offerings. In order to achieve that major changes are needed in the companies. In this paper the learning network approach is described as well as the content of the workshop series that the companies participated in. The findings show that a learning network approach is beneficial methodology for achieving changes in the companies, since the participants learn from each other and from the researchers.

Keywords:

Product Service Systems (PSS), Integrated Product Service Offerings (IPSO)

1 INTRODUCTION

In recent years there has been a shift from a product focus into a growing focus on the early stages of product development and also service and business development [1, 2]. There is an understanding that in order to reach more far fetching benefits, business concepts needs to be affected and how companies develop customer offerings becomes central [3, 4]. This means that companies need to address how they develop their business models, their customer offerings and the products and services that fulfil customer offerings. To create value for the customer is more in focus [5]. To offer product and service offerings is not a new concept per se though it is a new concept for several manufacturing companies. Research show that the transition from being focused on selling products to becoming a more service oriented company is a process filled with possibilities and difficulties such as; organisational, financial and handling a new relationship to the customer [6].

The transition to product-service offerings places new and more demanding requirements on product and service development and production, along with new requirements for companies in the way they relate to and build up relationships with customers. Previous authors' research shows that existing product-service offerings are developed by the companies' marketing departments and based on existing products optimized for traditional sale [6, 7]. With product-service offerings, the skill to combine different types of products and services into a desired function becomes more crucial. In order to be able to deliver, companies need to continually develop their value chains and the competence of their personnel [3, 8]. It is important to organize the company and develop its logistics to be able to deliver a solution and create opportunities for take back of the products used in the offerings.

At the same time, modern product development involves increasingly more teamwork as well as incorporating more and more people. This development is caused, for example, by an increased technical complexity in products and an increased time pressure, as discussed in Wheelwright and Clark [9]. Wheelwright and Clark [9] and Cooper *et al.* [10] have emphasized an increased need and importance for multifunctional teams and similar types of interdisciplinary collaboration in order to minimize missed communication, provide a broader knowledge base and increase the cross-fertilization of ideas.

2 RESEARCH ON PSS AND IPSE

The research in Integrated Product and Service Engineering builds on research performed in different research disciplines such as; environmental research, product development, remanufacturing and business models for industrialized services. The research performed in the IPSE (Integrated Product and Service Engineering) research group is partly inspired from the PSS-concept as presented by e.g. Goedkoop *et al.* [11].

Furthermore, earlier research performed by the IPSE research group was partly driven by an interest in eco-design and the area was studied with an environmental filter for remanufacturing and product and service development, this is also one part of the research at present. The business models and the business strategies used in the companies are important to understand also when studying how the product development process is affected [12].

The current research is also influenced by the work in the Product/Service Engineering, where focus is on the receiver of the service and tools are developed that support the companies in describing and developing offerings to the customer. The word Engineering within the IPSE-project is a term for stating that a methodology that supports companies in developing Integrated Product and Service Offerings is developed.

3 THE IPSE PROJECT

Much research in this area, the PSS, has been more focused on theoretical issues and on making conceptual proposals for how PSS can and should work. Our research has instead been based on a close co-operation with companies that already have or are in the process of starting to sell integrated product service offerings (IPSO). The focus, e.g. in the *Integrated Product and Service Engineering (IPSE)* research project, is on developing a methodology for efficient development and production of integrated product and service offerings. A methodology developed in close co-operation with potential users and evaluated in real cases. The 2.5 year long project is founded by the Swedish Governmental Agency for Innovation Systems (VINNOVA).

The project is based on an indentified need for further research on how to develop integrated product and service offerings. The research group has also found that much research, and therefore also models and guidelines, were adjusted for large companies, though there is large potential for SMEs to gain from adjusting their business models. Furthermore, this and previous research have also shown that for small companies, product and service development is very tightly connected to business development. This means that the methodology also needs to address those issues.

The research in this project focus both on what to develop as in understanding the business models applied and how and what implications it leads to for the companies that move into selling integrated products and services, e.g. how to adjust different processes such as the product development process.

The aim of the IPSE-project is to develop a methodology that supports SMEs to develop integrated product and service offerings, i.e. a methodology for companies that wants to differentiate their product portfolio with different kinds of integrated product and service offerings suitable to their business.

The development of the methodology is made in co-operation with some twenty Swedish, small and medium sized manufacturing companies and two banks. The majority of the companies are members of two different networks and each network are related to a bank.

4 THE OBJECTIVE

In order to be able to develop an IPSE methodology that is useful for SMEs, it is essential and preferable to understand their current situation. This incorporates an understanding on how the potential users of the method are working today and what needs they have.

The objective with this paper is to analyse how SMEs can be supported, and what the requirements of a methodology for developing Integrated Products and Services are.

5 RESEARCH METHOD

The IPSE project started with a state-of-the-art analysis of the participating companies. This was made in order to get a deeper understanding about their current business models and product development and to investigate potential needs for methodological support. Qualitative research interviews [13] was used as the primary data collection method. The face-to-face interviews were recorded and performed with product and service developers as well as CEO. Customers were contacted via telephone interviews.

Based on the results from the state-of-the art analysis, the selected research approach has been to develop the methodology together with the participating companies in a series of workshops (further described in section 7). The research idea has been to create the networks as learning networks, meaning that the participating companies learn from and stimulate each other. At the workshops the researchers has participated by discussing different themes with the companies and guiding them in how they can develop integrated products and service offerings. The majority of the workshops have been recorded and all written material during the workshops such as whiteboards has been documented.

In order to be able to directly implement some of our findings from the series of workshops, we have divided all participating companies into three major groups. This has enabled for us to implement improvements to the methodology and then test the improvements with another group.

6 THE IMPORTANCE OF THE USABILITY OF METHODS

The general attitude, in both industry and academia alike, is that methods are important for improving product development performance [14]. However, the number of methods are broad, and are often met with the mixed attitudes of, for example, enthusiasm, curiosity and scepticism [15]. According to Ritzén [16], the usage of methods only becomes a regular activity if they support the users with their own work. Considering the above in combination with the low level of industry utilization of methods, a developer of methods should consider why methods have such limited use in industry. One possible explanation could be that the method does not fulfil the users' – e.g. managers' – requirements[1]. If so, the application of those requirements could be useful for further development of methods [14], e.g. the an IPSE methodology.

Lindahl [14] lists several context related aspects that influence the use of methods. For example organizational arrangements, social factors, physical settings and education levels. According to him, a method must more or less attract and fulfil requirements raised by different actors in order to be "actively used". He further states that, depending on the context, different actors' requirements are more or less important. The conclusion he makes is that it is more or less impossible to discuss requirements for a method unless considering the context in which the method will be utilized. Further, actors involved must gain something, for example a more time-efficient product development, from using the method unless it is likely that the utilization will stop or perhaps never even start.

According to Lindahl's [14] findings it exists four major requirements, of which three are interlinked. A method must exhibit the following:

- *be easy to adopt and implement* – whether a method fulfils the three following requirements is of lesser importance if it is due to a problem with adoption and

[1] Requirement is context defined as "a specific description of an attribute".

implementation and becomes seen as having a low degree of usability, and therefore is not utilized by the designers in their daily work. This requirement is the key for a method to become actively used.

- facilitate the user to fulfil specified requirements on the presumptive product and at the same time
- reduce the risk that important elements in the product development phase are forgotten.

Both of these two latter requirements relate to a method's degree of appropriateness. The second and the third requirements are related to the fourth requirement, which is considered by the author to be the most important, that the use of the method:

- *must reduce the total calendar time (from start to end) to solve the task.* If the method helps the user to fulfil specified requirements, it will also most likely help them to reduce the calendar time as well as the number of working hours needed to accomplish the product development. This is also something that enables the user to introduce changes in early phases of the development project when changes still are easy to make. Likewise, if the method reduces the risk that important moments in the product development are forgotten, it will most likely have a positive effect and reduce the calendar time and number of working hours needed.

Much would be gained if these four requirements were used as a first overall validation of the usefulness of methods.

The knowledge described above on how methods needed to be extended within the IPSE project, since it was a methodology that affects several actors in the companies and is also a methodology that supports a change process in the company when it comes to changing, business models and the product and service development, as well as the design of the products used.

7 LEARNING NETWORKS AS PART OF THE IPSE METHODOLOGY

7.1 Findings from the state-of-the art study of participating companies

From the state-of-the –art study it became clear that only a few companies had offers that were in line with a PSS offer. However, it was also clear that they had a potential to develop PSS offers and some of the companies were already performing activities in line with what is described in the PSS literature.

One important aspect that was noticed was that several of the interviewees lacked understanding the IPSE concept and the business logic. They also lacked insight into how they could gain from it, e.g. how they could do better business using a different business model and having a new perspective on their knowledge and products and how they could create more value for their customers.

The methodology was initially intended to primarily support the development process for the development of different offerings, and the products and services included in the offerings. The initial idea therefore mainly focused on the engineering aspects of the development of integrated product service offerings. During the analyses of the state-of-the-art it, however, became clear that the companies involved in the project, mainly SME´s, first needed a learning cycle for understanding the change of the business and understanding a new business logic.

The participating companies have their core competence in developing and marketing physical products. A shift into developing and delivering offerings is a major change of their business models and mindset. The considerations about this shift are often neglected when methodologies for PSS for manufacturing companies are developed.

In the participating companies few structured processes, such as stage-gate processes, were used. In small companies structured and formal processes are less used than in large companies that have a more complex organisation and more people to organise. In a small company the communication and organisation is easier. An example is that from the participating companies, the managing director is the one participating in the network and the workshops. This lack of experience of using methods also needs to be considered when developing the methodology.

7.2 A Learning Network approach

From previous research projects insights has been gained of the benefits with Learning Networks. Ritzén *et al.* [17] have described how a Learning Network approach can be used for achieving organisational change and for modelling development work. Their model is partly based on the model of "the cycle of experimental learning" by Kolb [18]. That model promotes that practitioners need to disconnect form an action experiencing loop and need support to learn from their experiences by discussing their practice in a more conceptual way and then act according to the new insights, figure 1.

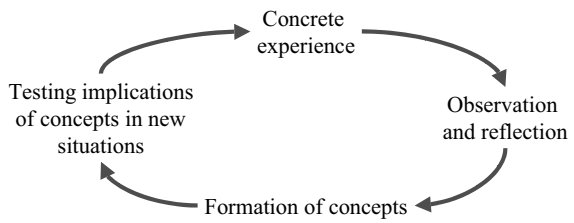

Figure 1. The cycle of experiential learning (from Kolb [18])

The basis of the learning network is that the companies bring in their own experiences and share their knowledge with each other and the researchers present their reflections and can give input from their knowledge. The researchers and the practitioners then both benefit from the network.

The goals for companies to participate in the Learning Networks are according to Ritzén *et al.* [17] to:

- gain theoretical insights and new knowledge
- share experiences
- have time and space for reflection
- gain motivation to overcome organizational barriers for change
- get support in process management

The workshop series described below are developed and organised as a learning network, see figure 2.

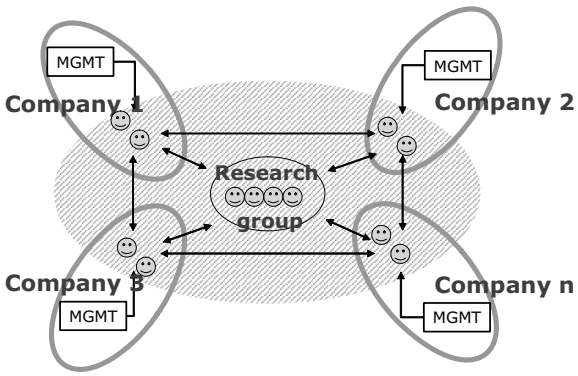

Figure 2. An illustration of a Learning Network [17].

7.3 The series of workshops

A workshop series was developed with focus both on understanding a new business model *and* how that affects product development, including the design of the products. At the same time the series of workshops it self forms a method. The first step of the workshop series was to inform and educate the participating companies of the new business logic and what the benefits for each of the companies could be. That understanding was crucial for the companies to understand and after that considerations for the physical products in the offering could be addressed. This is in line with Lindahl's [14] comment that the use of a method must be more or less useful for all users, i.e. the general manager need to be convinced that it is worth to let his company use this methodology. In SME companies, that in general have smaller economical resources, this is even more important.

When an understanding for the business models were developed the following workshops could focus more on specific aspects and on the design of the products used in the offerings from a lifecycle perspective.

7.4 Themes and a workshop series

A series of 5 workshops was developed. The development has been an interactive process and the content of the five steps have been developed and have been partly changed during the development in order to incorporate the input and conclusions from the workshops with the companies.

The five workshops topics are:

1. **Workshop 1: State-of-the-art – The current business model –** A state-of-the-art analysis is accomplished. Theoretical models as e.g. Oliva & Kallenberg [19] and .Brady *et al.* [20] are used to describe the companies current position regarding combined hardware-, software- and service offerings in order to be a base for the further business development. The environmental considerations taken today by the companies are also analysed from a lifecycle perspective.
2. **Workshop 2: Sale and customer requirements –** In this workshop customer' requirements are analysed and how those are satisfied, both in order to meet existing but also potential customers needs. This can be expressed in forms of value for the customer or user, and with advantage in the form of value chains. The aim is to identify current and potential customer values for existing as well as potential customers. The workshop ends with an analysis of the company's needs for development. Keywords in this part are SWOT, service mapping, triggers, business logic, customer communication and value arguments).
3. **Workshop 3: Planning a project for a new business logic and new a new offering –** This workshop is about planning and illustrate a new business logic and offering in terms of (1) customer requirements, and (2) project method. Customer requirements could be about how customer- and market requirements are collected. Project method is about how the company is planning its development project and if it exists any project methodology or IT supports that is suitable for Integrated Product Service Engineering.
4. **Workshop 4: Business offer development –** The focus is on organization and management of development projects and product development methods. (A special focus is on how to efficient and effectively plan the whole product's / offers' lifecycle in early phases of the development phase). This incorporate issues like trademarks and signal values coupled to the new type of offering, i.e. the integrated product service offering, e.g. by industry design and design of marketing communication material. Marketing communication comprise that *all staff* represents the company, and even partners and customers.

   In this step is also an analysis made of how the design of the product used can be improved in order to be adjusted to fit into a product and service offering. Aspects like easy to maintenance, take-back of products and environmental issues are addressed.
5. **Workshop 5: Follow-up and refine –** In this, the focus is on how to reach out with an IPSO business offer. E.g. how to in the right way influence channels and decision-takers within the target organisation, e.g. by communicating life cycle cost advantages so that the customer can understand (and can calculate and evaluate) the advantages. Furthermore, this workshop also covers how to make follow-up of calculations in order to support the providing company to in the best way use its resources.

8 ANALYSIS OF THE IPSE METHODOLOGY FORMAT

After the workshop 3 in the 1st company network a discussion took place regarding the companies' requirements on a methodology that would actually support them in their journey of changing their business model and also offering integrated products and services. The findings from that discussion, our continuous dialog with the companies and our experiences from the workshop series are described here.

One important aspect found was that the companies really appreciated the learning network approach. On of the aim with the IPSE project was from the beginning to develop an IT-tool support for the companies to use by themselves. However it has turned out to be a good strategy to put those plans aside and instead support the companies in a methodology that is of a learning network nature. The issue is complex and it is important to have a more initiated person that, from an outside perspective can, guide the company in a consultancy kind of role. This is especially important in the beginning when the concept is new for the participants.

One of the major benefits of a learning network is, according to the participants, that they get time for reflection and can learn from each other. Another crucial factor for the success of the methodology as a learning network was that the participants by themselves have recognised that *the process is the important thing*. The participants and we as researchers have experienced how their mindsets have changed since the project started and they have started to think in new ways. It has been clearly stated by the participating companies that they have experienced a transformation journey and to accomplish that a learning network is needed. That could not have been accomplished by giving each company a method to use separately. Through the workshop series they also have time to reflect between the meetings and the change process is allowed to take time.

Apart from the findings of the benefits of a learning network the findings of the methodology can be grouped into three categories; (1) the formation and organisation of the learning network, (2) the content and the themes of the workshops, (3) the methodology and documentation that the participants can keep and take with them to be used by the participants in their companies.

8.1 The formation and organisation of the learning networks

It is important to make a formation of companies in the network that really have the potential to learn from each other and also to have suitable actors from the companies. In the IPSE – networks are the managing directors participating and they are therefore on the same level in the companies and have authorities to perform changes in their companies. To have actors that have authorities to perform changes are important, but it was also found that the participants would have liked to be able to be more than one participator from each company. Ritzén *at al. [17]* also puts that forward. The companies have sometimes managed that but it has been difficult to achieve. In one of the networks the companies are part of the same group of companies and they then develop both their own company as well as the group of companies. To have more than one participator from each company also increases the possibility that someone from the company always will be able to participate in the network meetings.

It was also found that the participating companies could have had customers also participating.

The meetings should be held at “neutral ground”, meaning that it should preferably be held so that the participators have to leave their normal working environment. That makes it easier for them to focus and from being less disturbed. Several of the meetings have in the IPSE project been held at “natural ground”.

To have a moderator for the workshop series were seen as crucial. The moderator(s) are the ones organising the meetings and provide theoretical and methodological knowledge and support the companies.

8.2 The content and the themes of the workshops

When designing the workshops and themes for a learning network it is, according to the participants, important to remember that to change the business is something that takes time and shall take time. The pace and intensity of the gatherings needs to be adjusted to the changing pace of the companies.

One way is to have to put emphasis on understanding and changing the mindset of the participants in the beginning and then later on, when the participants have learned, focus on the changes that the participants can make in their company.

The themes and meetings must always connect to the previous workshop so that the deliverables and results from the previous workshop are useful and further elaborated in the next meeting. Then the participant can see the progress they are making.

The methodology need to support the understanding of the whole overall picture, i.e. how this new type of offerings relates and differs from traditional, mainly, product based offerings. The aspects that needs to be changed in the companies and the aspects that the companies should focus on needs to be pin pointed in the methodology. Such aspects can for example be; *business model, customer relationship, production aspects, environmental aspects, customer value, customer requirements and product development*.

8.3 The documentation and methodology to be used in the companies by participants

The methodology should support the work of breaking down complex issues into smaller less complex issues in order to make them easier to understand and solve.

To participate in the workshop series is found to be the most important factor but for some of the participants it would also have been useful to have guidelines formulated that they can use on their own. The participants ask for simple tools such as guidelines, checklists or questions that they need to address in the company. The method must support the work in identifying the most important aspects that need to be considered in their work.

The four major requirements stated by Lindahl [14] Is in line with this and has been a base for the further development of the IPSE methodology.

9 CONCLUSION

To develop a methodology that supports SMEs in making a shift into selling integrated products and services turned out to be something else than the researchers had initially expected. In the project it has been learned that to move into integrated products and services is a long journey for the companies and a major shift of mindset and business models. To change mindset for persons and a company is learning cycle and takes time. The methodology needs to be adjusted for that rather than primarily supporting designers and service developers in how to develop the products and services. So, before focusing on engineering aspects of integrated product service offerings, the management issues must be solved and clear, e.g. the management must understand the use and business logic of this type of offers and all people involved in the development of integrated product service offerings must understand the business logic and language.

To let the companies participate in learning network organized as a workshop series with themes has been found to be a suitable methodology. The companies bring their experiences and share knowledge with each other. The researcher’s role is to educate the participants in different subjects and to moderate the workshops. One important aspect of the workshops is that they really have been workshops and the participants have during the meetings had time to reflect how the input from the researchers relates to

their company and how it could be applicable. The methodology should be supported with checklists and guidelines that the participants can use on their own in their company.

The methodology still needs improvements such as securing that several participants from each company are participating and to finalize the guidelines and checklists for the companies to be used between and after the workshops in their own company.

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