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ESTABLISHING COLLABORATIVE NETWORKS FOR THE CONCEPTUALISATION OF PSS

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1. Introduction

Industrial companies in high-pay countries face increasing global competition as an effect of post-industrialisation [McAloone et al. 2011]. Companies are challenged by the transition from a product-oriented company to a combined product/service-oriented company. This transition brings with it new design objects, namely the product life cycle and the customer activity cycle. These also bring with them new challenges for understanding value creation, seen to involve a combination of product and service development. In this research discipline, value creation is considered to be the main customer satisfier in place of the traditional focus on product quality [Tan 2010]. Due to this transition customer relationships change and expand with time encompassing many new stakeholders when engaging in business creation. This means that the value creation process is not held by one company alone and as such is conducted at a system-solution level. PSS are mostly provided through relationships of different types, between stakeholders in the value system, though systematic approaches for screening the network and creating these relationships are sparse, especially when looking at the front end of the innovation process [McAloone et al. 2011]. Approaching this from the perspective of a single company, this paper poses and answer to the following question: How can normative tools be adopted or created to use across company borders for conceptualising collaborative PSS offerings?

From a research perspective the field of Product/Service-Systems (PSS) is still growing. Previous research has revealed that PSS can be more sustainable and valuable than conventional products [Mont 2004], furthermore, it has been identified that expanding PSS to include multiple stakeholders is an under-researched area. An approach to understand how value is distributed and created in collaborative PSS offerings will strengthen the ability to sustain and enhance the utility of offerings throughout the whole product/service life cycle [McAloone et al. 2011]. The underlying assumption of this research is that a representative model can be created and used as a boundary object between stakeholders to conceptualise and operationalise collaborative PSS.

In general there is an enlarged focus on information sharing when developing product/service-systems, caused by the nature of the prolonged focus on the product life cycle and the customer activity cycle. The “design object” is not just the physical product; it is the performance of the product throughout the whole life cycle. This means that the carriers of value in this system are not necessarily tangibles, but can be through intangibles such as knowledge, data and promotion etc. which create a complex shared “design object” for multiple stakeholders in the system. There is a need for investigation of how to enable multiple stakeholders to collaborate proactively around this new “design object” [McAloone et al. 2011]. By viewing the “total performance of the system” the authors believe that based on the different value propositions throughout the whole life cycle, a set of preferable relationships among the providing stakeholders must exist, which furthermore gives indications that

this perspective can bring value when conceptualising. When conceptualising PSS, four viewpoints must be considered: Product Life Phase system, Customer Activity Cycles, The Actor Network and the Value proposition. The research presented in this paper proposes and trials an approach focussing on the Actor Network viewpoint, which is further, elaborated, to reveal new strategies for the companies to build on when conceptualising.
The overarching hypothesis for this programme of research is that: *The competitiveness of a PSS offering will increase when the significant stakeholders within the value network or potential new value contributors are identified and involved in co-development of an offering.* This leads to the following research questions to be answered by this study:

1. How can an interlinked network of multiple stakeholders be visualised in one representation; by visualising the value system and different positions of each stakeholder herein?
2. To what degree or resolution should the visualisation be adjusted to suit the scope of the PSS boundaries?
3. How well does such a visualisation support the identification of collaboration opportunities and the conceptualisation of collaborative PSS offerings?

In the research presented in this paper, a literature study was conducted from other research areas such as business, marketing and management in order to find new ways of viewing the multi-stakeholder approach within PSS. The research was then focused on a number of case study interventions made within industry through the Innovation consortium PROTEUS (PROduct/service-system Tools for Ensuring User-oriented Services), of which the authors are active and leading members. The research objective of the consortium covers a whole industry branch represented by twelve companies, which gives a sound foundation for investigating collaborative-PSS development. Within this multiple case study, a single case of a large, multi-national company was chosen for an in-depth analysis and an approach of collaborative PSS conceptualisation was developed, trialled and evaluated.

2. Theoretical background

Existing literature points towards a need for a collaborative approach from multiple stakeholders within the value system, when developing and operating a PSS. The focus started by viewing the customer (e.g. the end user of the offering) as a receiver of the value, which is changing towards viewing a varied set of different stakeholders in the system "*...Customers and users represent valuable resources that can be actively employed in the development and delivery of PSS. However, methods and processes for how companies can effectively and efficiently manage the different roles and responsibilities when working together in broad actor networks are not well developed.... p. 247 Adrian Tan [Tan 2010]*. Furthermore, there is evidence to support that the Actor-network perspective must change focus from supply chain management, to a chain supplemented with a network of stakeholders. [Mont 2003]. The focus on network mapping has in PSS literature largely been staged through the framework proposed by Donaldson [Donaldson 2006] the *Customer Value Chain Analysis (CVCA)* methodology (although called a value chain it is created as a network). Furthermore, specific visualisation methods are developed within the PSS research area such as the *"Activity Modelling Cycle"* (AMC) by Matzen & McAloone [Matzen and McAloone 2007], "*System organisation map*", and "*map of interaction*" [Tan 2010]. However, none of these approaches enable the capture of the multiple views of the different stakeholders within the same representation.

2.1 Consolidation towards a multiple stakeholder approach

We see a consolidation within literature that viewing multiple stakeholders should be done from a network perspective and not as the classic value chain process presented by Porter, where the market is separated from the value creation process [McAloone et al. 2010]. Normann presents the Value star as the mental mindset of how to view the total value creation system of a modern business innovation process [Normann 2001], wherein all stakeholders should be seen as *organisers of value creation*. This approach allows for proactive integration of key stakeholders in the conceptualisation of PSS, and also continuous reconfiguration with respect to the actual need of the operation of the system. The value star, as seen by the authors, can be modelled to describe the mechanisms that allow reconfiguration. A similar understanding of the change from value chain to value system is found through Prahalad´s

notion of the experience environment, which is based on a non-linear and non-sequential process of stakeholders. Within the experience environment individual customers are supported by a network of companies and different communities to co-create value together; this network is dubbed the experience network. [Prahalad et al. 2003]. An in-depth study of past and current literature in connection to value done by Payne and Holt describes the recognition of *relationship value* as the most recent development, and point towards the customer-supplier relationship as being expanded within the new paradigm of relationship marketing [Payne et al. 2001].

2.2 Staging the network through visualisation

Donaldson´s framework can be used to identify all active stakeholders around the product or service aiding the understanding of the value flow. The methodology is a seven steps procedure, focusing on establishing the actor network map before analysing the value propositions contained within each actor relationship as well as the importance of these, the final outcome is information on which to base product development decisions. Tan [Tan 2010] reflects that the CVCA reveals the business model of a company, which is also commented by Donaldson as he suggests that further development could be created in the area of business model synthesis, together with application of the method within system design including service products. Allee [Allee 2010] has created a strong Value Network Analysis methodology (VNA), where these suggestions are taken into account, where also intangibles besides information are a part of the mapping in comparison to Donaldson´s framework. This could be – exchange of value where the benefit would be; customer loyalty, image enhancement, co-branding opportunities etc. This approach provides a sound language for the value networks and its behaviour, for usage in conceptualisation of PSS, as it is designed with a purpose to strengthen collaborative behaviour in the network and looks at multiple relationships herein. [Allee 2010]. The VNA focus on three elements constituting the map, (1) the nodes, (2) the transaction, and (3) the deliverables, and defines the network as: "*...a set of roles and interactions that generates a specific business, economic, or social good...*" [Allee 2010]. The first step within this methodology looks at *defining scope and boundaries*, which means that a purpose of the mapping must be decided, as well as the boundaries (what are we mapping) and then the level of detail (resolution of the map). Hereafter the three steps are quite similar to the approach of Donaldson. *Identify the participants of the network* (who are the stakeholders) together with their contributing role within that activity. Hereafter *the transactions are mapped,* which are a directional arrow, symbolising that something is moving from one stakeholder to another, the attributes of the link between the stakeholders are hereafter mapped, which are the deliverables. The last step is *sequencing* which implies that each activity is in an order in the network, in this way it is possible to validate the network [Allee 2010]. This approach brings us closer to normative methods that can be integrated when conceptualising PSS.

2.3 Conceptualisation based on a visualisation of stakeholders

Taking the network mapping a step closer to analysis and value relationship management, the combination and interrelation of the different PSS elements such as the Customer Activity Cycle and the Actor Network have inherent information for conceptualisation. The AMC is a conceptualisation tool for PSS development that combines these two views, through the modelling of service activities connected to a specific customer. This model supports the identification of beneficial partnering options within the supply network of the activities [Matzen et al. 2007]. For each activity the delivery network and their interrelations are mapped, visualising the different relationships opportunities, both vertical or horizontally. This model only contains the analysis for a single stakeholder in the system, namely the customer, and do therefore not incorporate multiple stakeholders needs within the system. It is the authors' belief that the VNA approach and multiple ACM (which could be expanded to incorporate stakeholders not necessarily customer) combined with the mental mindset of the Value-star holds an analysis platform wherein it is possible to define a set of structural roles in the network, which are affecting the behaviour of it. These structural roles are not the focus in literature when connected to visualisation techniques within PSS. Allee briefly describes a set of different roles as follows: *Central connectors* – are stakeholders that are connected through a lot of transactions, and can in this way be bottlenecks restricting value. *Boundary spanners* – are stakeholders that are the *link*

between two groups of different nature. *Information brokers* – are stakeholders that have a strong influence on exchange of intangibles, such as knowledge and information. [Allee et al. 2010].

2.4 Diagnosis of collaborative network

Defining the structural roles within VNA is aligned with the recent movement within value literature, as this is focused at the value relationships; managing the network as a whole and not as individual relationships [Payne et al. 2001] The network can be seen as a portfolio of all relationships, and the management of the network requires management of all synergies and co-ordination of all relationships [Möller et al. 2007], [Arlbjørn 2010], [Payne et al. 2001].Bringing this approach into the PSS conceptualisation activity, the management refers to *who* to co-develop with, and *who* to co-operate the system with, which in this context opens new innovation possibilities. This is by Normann recognised as *reconfiguring the business landscape*. Arlbjørn stress that the innovation possibilities within a company are depended on three conceptual elements and their interaction: (1) supply chain process, (2) supply chain technology and (3) supply chain network structure [Arlbjørn et al. 2010]. This defines the influencers on innovation possibilities, as the process (sequence) of activities, the technologies available within the network and the structure of the network, concluding that more research is needed within the way supply chain innovation evolves during the product life cycle The technologies for enabling multiple companies in collaboration are still sparse, which is a known barrier, but as the information technologies are rapidly evolving it holds an interesting development of new opportunities within network collaboration across company boundaries. [Arlbjørn et al 2010]. Balancing between different scales of network resolutions for conceptualisation opportunities, an overview of existing net terminology is needed (as these net holds a specific network structure). A framework of three different generic nets, are explained as: (1) internal nets (2) vertical nets (3) intermarket nets and (4) opportunity nets. [Möller et al. 2007], Internal nets are the intra-organisational networks (which are not of particular focus within this research). *Vertical nets* are an industry-specific net of suppliers around a specific business. *Intermarket nets* are defined by a set of unrelated industries representing an alliance. *Opportunity nets* are dynamic networks, which are only contemporary aligned to serve a certain goal. Specific nets are also *Quasi-integration networks* which is a horizontal network established alliance of complementary resources (e.g. airline alliance), *Supply oriented networks* which can be both vertical networks and solutions networks (which is a typical network when looking at PSS) these networks consist of producers of complementary products and services for a specific customer-focus. *Technology-oriented networks* can be R&D networks aiming at sharing risk and costs, or *standardization networks* focusing on being the dominant companies within a technology [Möller et al. 2007].

2.5 Literature summary

New theory movements as value-relationship management, network management, and value network analysis together with existing literature within PSS stresses that for being competitive a holistic view on the network must be created, and brought into the conceptualisation of PSS development. The network structure is important to navigate when designing the business strategy of a company, as all relationship together carry opportunities for new constellations of revenue, information, and resources (value-strings), needed for innovation and the possibility to sustain this. The visualisation of the network reveals new insight (as a tool for the PSS developer) and is seen through different approaches both within PSS and in management and business fields, a gap exist when the representation should take into account multiple views within the network. As mentioned above in describing the different generic nets, these contain different opportunities for re-configuration. Conceptualising new collaborative offerings as well as operating these by integrating multiple stakeholders, demands new tools and methods together with a typology of relationships and networks. A compilation of relationship, their opportunity and management mechanism is non-existing to transfer directly to the conceptualisation activity of PSS development.

3. Research methodology

In order to answer the research questions posed in the introduction, this research triangulates between

three pools of data and evidence:

1. The literature review presented in the previous section
2. Observations and experience within the PROTEUS innovation consortium consisting of 12 case companies striving to adapt the PSS approach
3. One in depth case study in which a new focus on a visualization approach is trialed. (*This will be referred to as "case company" in the empirical findings.*)

3.1 Research cases

The main case for this study is a large multi-national company developing propulsion systems for both marine and land-based systems. They were pioneers in moving from a product-oriented company to a service-oriented company in the 1980´ies, where they outsourced all production to licensees. Since this they have expanded their service business over the years, and today hold a large global network of service hubs (self-owned) of more than 150 different sites. This company was chosen due to its strong service orientation – the department of focal contact was the service department for a sub-group of the firm's products. This location used to contain the development unit (R&D) of the product but this unit was moved to a main development unit abroad, 18 months prior to the beginning of this study. This left the company with a need to refocus their business model – which they are currently in the process of doing. In addition to the above case, empirical insights gained from a period of 18 months within the above mentioned consortium, covering conduction of more than 30 interviews through at least two site visit at each company, and five workshops within a context of twelve maritime companies. The consortium's interests lie in understanding how to effectively and systematically integrate services into their product development and business creation process.

3.2 Data gathering

For the main case study, two primary data acquisition methods were used; semi-structured interviews and design-workshops. The data gathered comprised of audio recordings, video recordings, photos and field notes, involving several researchers. The interviewees were employees from the same site in the company (15 interviews of duration approximately 75 minutes each). The purpose of these interviews was to generate knowledge into different areas covering all areas of the PSS framework, the current held value proposition of the company, the different offerings of the company (in connection to the product life phase diagram) and the relations of the company to other stakeholders within the network, elaborating the company's presence towards the end customers activity cycle. The interviewee was asked to elaborate on questions covering their role within the company and department, their after-marked products/services, their relationships and participation in different networks. The interviews were audio recorded, field notes were taken and an extensive summary of each interview were created. The participants were from the following areas within the 'after-sales' department: Service project, After-sales R&D, Academy (training of internal and external technicians), Sales, Warranty, Marketing and Supply chain management (not within the after-sales department). The interviewees were managers from the respectively departments plus daily operational workers, such as e.g. service engineers and service technicians.

3.3 Data analysis

For the analysis of the empirical data, iterative exploration as method was used. Validating the data different graphical models (created in collaboration between researcher and company) were finally presented and validated with the participants. These models were primarily the ones of the PSS framework: Customer activity cycles, Product Life phase diagram, as the focus of the study were the *Actor network modeling* this was not introduced before the final workshop, to avoid creating any biases. We are re-visiting this element within the framework as we wish to create more normative methods.

3.4 Research workshop methodology

The purpose of the workshop was to focus on defining a set of collaboration opportunities for the company by using the value network mapping method together with a focus on their existing portfolio

of offerings. The workshop was designed mainly to test the systematic process for staging the currently held value network (described in section 2), and also to communicate the approach of PSS extensively to the company. The workshop was conducted with 12 participants which were roughly the same as those interviewed earlier in the study. During the workshop the researchers acted as both facilitators and observers, observing the nature of the different activities, live coding was done within one of the two groups aiding the analysis afterwards.
Firstly, the ideas and issues raised from the consortium and the previous interviews were presented to the participants. The participants were then broken into two groups and given three exercises.

1. To screen the offer portfolio (the value propositions) reflecting and adding elements followed by a presentation from each participant of current projects in the pipeline.
2. Both groups were presented to the stakeholder value network and were asked to identify the most important (highest influencing) stakeholders in the network in respect to their own company, and then identifying a set of important relations (transaction + deliverables).
3. Within the last exercise they were asked to suggest a new offering and identify the new relationships required to attain the offering.

4. Empirical insights

The empirical findings gathered from both the case study and the twelve companies cover a variety of interesting topics within PSS research. This section will limit the findings in connection to the questions raised in the introduction. Many interesting findings from the case study were related to the area of intra-organisational networks, directly related to re-organising internal structures when developing and operating PSS, however, this will not be included. Below the insights are clustered and compiled in a concise manner.

4.1 Participation in multiple and various networks

It was identified that the case company was part of many networks, with different types and levels of participation. Some network were of contemporary character – three of these focused on customer-oriented needs and possessed the character of an *Opportunity net* aligned to serve specific needs of the state and customer. All of these networks were focused on green development, none with service development integrated. *Technology-oriented networks* were also seen in different retrofit development projects, where a couple of companies were taking part in co-developing a new technology. *Vertical nets – supply-oriented networks*, were also seen within the case company and this network were oriented towards integrating both services and products on a large scale, this was a cluster of local maritime suppliers, the case company was acting here as a manager. Two large networks were identified as *Strategic alliances* as knowledge networks, within northern Denmark, and one between three Nordic Countries, in which the participating companies within PROTEUS were to a large extend represented. PROTEUS is in itself a *vertically managed network* through a consortium, led by both researchers and representatives from industry, together with a branch-organisation. Within this consortium a *sub-network* was created with all twelve members and two external companies focusing on proactive-service and co-development of these. Within PROTEUS a network was observed of three complementary suppliers, trying to create a holistic package of both products and services. “Life-saving-package”, this includes many interesting elements as both product-oriented and solution-oriented PSS.

4.2 Network strategies

Between the *strategic alliances* it was found that there was no structured alignment between the networks, they had overlapping goal-settings which were observed as having a negative effect on synergies in the industry. The case company did not have a strategy to follow and manage their different networks, participation in these were created ad-hoc, as the opportunities or needs arose. One network, the *supply-oriented network,* had an internal strategy as it was a long-term based relationship supported by the municipality. Managing these networks holistically was not observed in any of the companies.

4.3 Lacking systematic product development and overview of offer-portfolio

Several companies within PROTEUS are not using any product development models, nor have they any management of their offer portfolio. This is problematic in the way it causes unnecessary issues with development and marketing of their products/services. The case company had no total overview of their products and services, which had a major influence on their sales (e.g. new sales) could not include or create a service agreement. Within a sub-group of their products, which were located and managed at different site than the one visited, a customer-oriented model of their offerings, inspired by a "car-wash model", was used, enabling the customer in choosing and adding elements to a total system purchase (could be comparable with a service agreement). Interestingly this approach has inherent different relationship levels between supplier and customer. Within PROTEUS, the case company is in some aspects a best practice case, e.g. it has two departments focused on developing after-market products and services, but still no formal Product development process. The case company´s technical services, spare-part sales, and newly developed after-market products had increased turnover despite the crisis (decrease in ship-contracting world-wide) and despite a lack of formalised process.

4.4 Experience from the value network workshop

In the exercises from the workshop we focused, as mentioned in section 4, on main stakeholder within the network and a set of major relationships. The heart of the network was chosen to be their own department (the after-sales department) as this was the "*central connector*" to the customer in the after-market, and maintaining the relationship with the customer. The transactions identified were mostly connected to tangibles, the primary were; *spare-parts* from the licensees to their competitors, as e.g. piracy-companies, but also ship chandlers. The makers-list (list of preferred suppliers) were important deliverables between ship-yard and ship-owners, as this is the key entrance to the marked through new-builds. Through the exercise it was illustrated that they are still focusing heavily on their product-oriented part of their business and need further understanding of all the intangibles creating value within the network. This is despite that they are a strong service-oriented company. They were discussing a concept "Cloud ship" working as primary source of market/customer intelligence but also a shared platform between all the companies for co-development and co-operation through a strategic alliance. Furthermore, they were developing a new service package including a new relation and stakeholder not within the map. This service package was created with inspiration from the customer activity flow diagram, as this were divided into trajectories of different starting points, checking each starting point (emergency, five year check, inspection, ship-owner change) the last mentioned they had no service package for that, (one of their entrances for this would be through an auction house, providing a ship-survey "health-check") or offer the selling ship-owner, a check of the ship to better bargain on price. This new offering certainly was about a service-oriented offering (use-activity service).

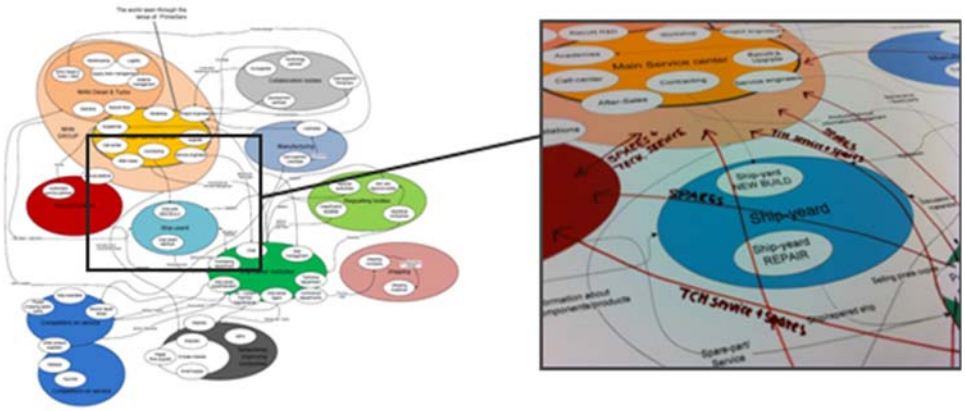

Figure 1. The value network analysis. Left the provided network for the participants, right picture is a snapshot after the workshop

4.5 Opportunities for collaboration

The workshop opened-up new ideas for collaboration, about ten different ideas, whereof they only doubted the potential of one of these. Through the exercise they were not directly asked to find collaboration opportunities, but asked to focus on relationship change, which resulted in creation of new offerings with new relations. Within the company they have a large unused set of co-suppliers of products which could be integrated into the service offering portfolio, through a new *vertical alliance* when presented; this idea was received positively, and with reflection on the ease of execution. All the companies within PROTEUS are willing to take a more user-oriented approach for developing new offerings, adjusting their value proposition. In PROTEUS all the companies see opportunities for collaboration and opportunities for creating e.g.: Shared service centres, Danish certification standard, joint training of external and internal technicians, and Co-handling of regulations. It was seen that back office activities are easier for the companies to imagine sharing, compared to the direct contact with the customer. Through the consortium classic constraints as type and size of the companies were inherent within the network, despite this all companies have willingness towards collaboration with other companies. Barriers exist with regard to how to execute these concepts of collaboration. This indicates that the problem of a leading stakeholder within a vertical network is indeed important, and underlined PROTEUS raison d'être.

5. Discussion and implication

Following the research questions this section will elaborate the findings and implication of the empirical insights.

RQ1: The visualisation of the network followed the NVA for the level of detail, wherein also the internal net structure of the company was mapped as a sub-network (intra-organisational network) which they have to a large extend related to when focusing on their direct link to other stakeholders. Their main customer, the ship-owner, was also mapped as a sub-network as the entrance to this varies a lot (technical department, purchase or third-party ship managers), this boosted a good discussion in the groups, visualising multiple companies within the same representation can in this ways be seen as possible. Creating the network with open-ended transaction for the participants to finish made them involved, and they were freely discussing the needs and relations to other stakeholders view points. Within this case study it is still unexplored if multiple companies can use the same representation for a boundary-object for conceptualisation, but for a focal company to conceptualise collaborative PSS offerings it work as an intensifier. Besides the main Actor Network model seen in Figure 1, another two models were used at the workshop for analysing the network, as seen in the two figures below. Figure 3 connecting the stakeholder network within the Activity modelling cycle and Figure 2 Illustrating the total flow-diagram of the user activities during the whole product life cycle, and the connected supplying stakeholders for each activity. These two models worked as reference posters, not as models for interaction.

Besides the above mentioned models, Figure 4 describes a total overview of the stakeholder network mapping, in connection to the different elements of the framework for PSS conceptualisation. This illustrates that the modelling can be considered and connected within each of the four PSS elements. The Value network in Figure 1 corresponds to number 4, and 2a and 2b illustrate the stakeholder network connected to 2a; the offer portfolio (which was also used within the workshop), and 2b; a strategy mapping of both portfolios of products/services and relationships; this was not tested. The third element in Figure 4 illustrates the product life phase diagram and the connected stakeholders within each phase; this approach is dubbed the product life gallery [McAloone 2010].

RQ2: The scope and boundaries of the network should be guiding the resolution of the network, and therefore no generic resolution can be defined. The resolution of the network also seemed to be dependent of the goal for the mapping, if it is due to defining business opportunities, optimising sales and marketing processes, delivery systems etc. for the PSS boundaries this is among other depending whether it is a product or solution-oriented PSS. For this particular purpose and setting with one company of 12 participants covering a broad view within the company, the detailing of the internal network structure aided the communication between the departments. The participants reacted to the extremely complex network, fearing that they would not be able to successfully understand and utilise

the network for the exercise; however after they had studied its content and had tried using the network they quickly became comfortable using it. They suggested different possibilities of integrating the value network within their company as a tool to align the understanding internally in the company of its position in the network and the stakeholders influencing their business.

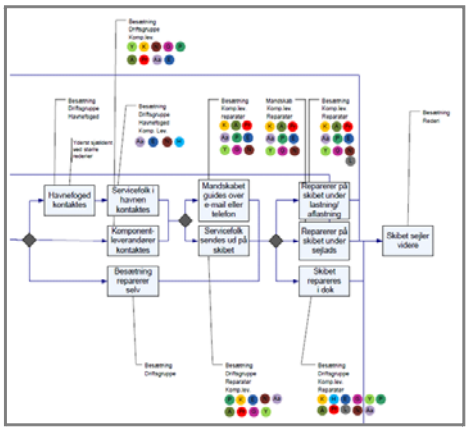

Figure 2. An example of the flow-model of total use-activities including all companies within PROTEUS 1b. in Figure 4

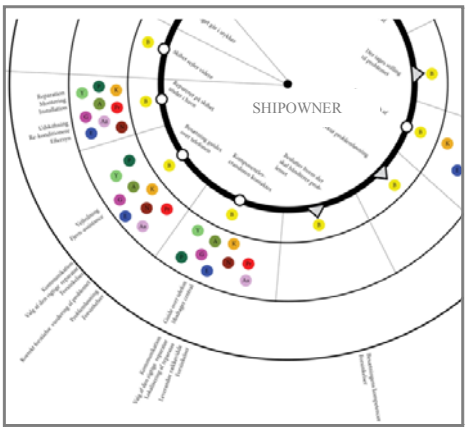

Figure 3. An example of an activity modeling cycle including all PROTEUS participants 1a. in Figure 4

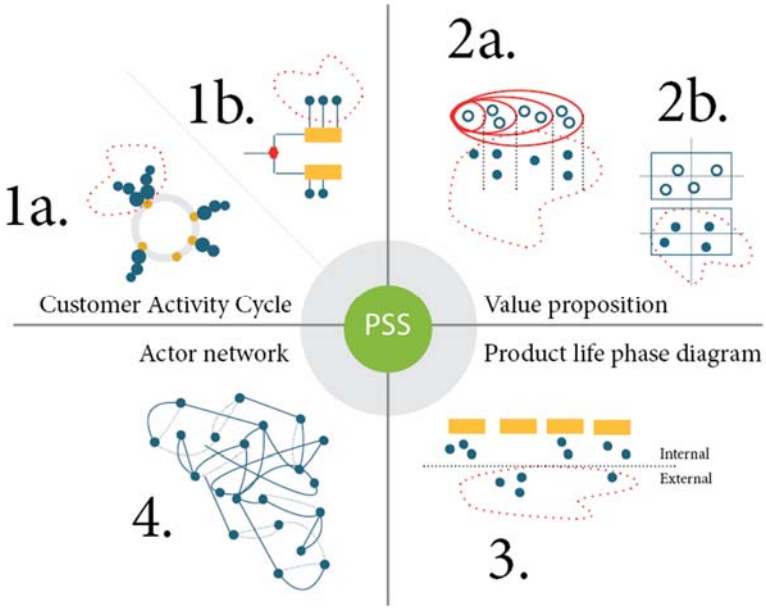

Figure 4. Illustration of the PSS conceptualisation framework, where different normative methods of integrating the actor network in each PSS element are illustrated

RQ3: The concepts created at the workshop had a nature of product-oriented PSS´s, only a few of which were collaborative PSS´s. The three different normative models presented at the workshop aided the conceptualisation in incorporating multiple stakeholders as discussing their relation and attributes triggered new ideas. Regarding the offer-portfolio which was created for the case company, it was found when plotting the different offerings the company had that these were greatly interlinked, indicating that it would be similar for each relationship needed/preferable for each offering. Through the workshop it was identified that the participants were inspired by this model and connected exercise and the terminology from this model was used for the subsequent exercises, furnishing them with a language to cover both product- and service-oriented offerings.

The PSS field is still in expansion, companies are still struggling with the transformation process towards a PSS-oriented business. The approach for carrying out multiple stakeholder development is

an extra layer to this transformation process, which makes the process (of developing PSS) more complex.

6. Conclusions

Through this paper a framework for staging the Actor-network to conceptualise collaborative PSS has been proposed and trialled. The staging was carried out on the basis of a Value Network Analysis and was combined with two other normative methods within the PSS research field, together with a new developed product/service portfolio, tested in a setting of a three step exercise workshop. The different visualisation models augmented the PSS solutions as these covered and utilised a broader aspect of the company´s relations in the network. This paper has presented a model with an overview of where and how to integrate the value network analysis into different areas of each of the four elements of the PSS conceptualisation framework. Future work within this research programme is planned to continue on the relationship and network typology, integrating these into new conceptualisation methods and trialling these in situations where multiple companies are present for conceptualisation.
There is a need for further research into this field, focusing on representation models, allowing a setting of multiple companies to conceptualise collaborative PSS offerings, furthermore research are needed in the field of network management to identify, which mechanism each network should be controlled by.

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