Factors for Successful Engineering and Exploitation of Services: *Four Explorative Case Studies on Servitization*

**Mireille Stout**

HU University of Applied Sciences, Nijenoord 1, 3552 AS, Netherlands

mireille.stout@hu.nl

**Johan Versendaal**

HU University of Applied Sciences, Nijenoord 1, 3552 AS Netherlands; Utrecht University, Princetonplein 5, 3584 CC Utrecht, Netherlands

johan.versendaal@hu.nl; johan.versendaal@uu.nl

**Justian Knobbout**

TenderCoach, Raamweg 22, 2596 HL Den Haag, Netherlands; HU University of Applied Sciences, Nijenoord 1, 3552 AS Netherlands

justian@tendercoach.nl; justian.knobbout@student.hu.nl

**Kristian Spek**

Xebia, Utrechtseweg 49, 1213 TL Hilversum, Netherlands; HU University of Applied Sciences, Nijenoord 1, 3552 AS Netherlands

kspek@xebia.com; kristian.spek@student.hu.nl

**Mark Tammer**

HU University of Applied Sciences, Nijenoord 1, 3552 AS, Netherlands

mark.tammer@hu.nl

**Martijn Zoet**

HU University of Applied Sciences, Nijenoord 1, 3552 AS, Netherlands

martijn.zoet@hu.nl

**Abstract**

Within a research group consisting of both students, lecturers and senior researchers in the field of Business Engineering, four explorative cases are analyzed to identify factors for successful servitization using a two dimensional framework. The first dimension represents the phase of servitization varying from: 1) vertically added service; 2) horizontally added service; 3) integrated product & service offering; 4) emphasis on service, with certain product; to 5) service replacing product. The second dimension, built on the enterprise architecture principles, corresponds with six different perspectives for service design: 1) a service's interaction aspects; 2) a service's organizational aspects; 3) coordination aspects; 4) functional aspects; 5) rules and constraints; 6) data and information aspects. Although the amount of cases and data is limited, the found factors can help (manufacturing) organizations exploring servitization or aiming to further develop existing services, specifically in the stage where setting market requirements needs to be aligned with overall business objectives.

1 Introduction

Vandermerwe and Rada (1988) identified and described the potential of creating new services and service engineering activities in contrast and in relation to more tangible product engineering. This by them coined servitization is driven by 1) customers requesting total solutions (not merely product-only), 2) increased competitiveness where services tend to have higher margins, and 3) contract manufacturing activities due to globalization. As an example of the first driver, a firm can choose to add after sales support to their existing product portfolio. Major companies with high installed product bases, like IBM, GE and Siemens, have successfully transformed their organizations by designing new services in anticipation of the second driver. Related to the third driver, e.g. in the electronics industry, organizations like Solectron and Flextronics have received contracts for manufacturing from high-tech OEMs, leaving room for the latter for service development.

Baines et al. (2009) provided a thorough literature review on servitization in the manufacturing industry. They concluded with eight findings of which one particularly justifies our research: »There is a paucity of previous work that provides guidance, tools or techniques, that can be used by companies to servitize« (p 562). Consequently, our research question is “what are important factors for service engineering, following principles of servitization?”

Oliva and Kallenberg (2003) identified a continuum for firms to move from tangible products to service offerings. Segers and Spaargaren (2011) have operationalized this continuum by breaking it down in five clearly identifiable phases (increasing as for the degree of servitization): 1) vertically added service; 2) horizontally added service; 3) integrated product & service offering; 4) emphasis on service, with certain product; and 5) service replacing product. During our analysis we will use these phases as a metrics to position the development of services.

The four servitization cases provide us with factors that were categorized using insight from the fields of enterprise architecture (Lankhorst et al., 2005; Zachman, 1996).

First the theoretical framework will give an outline of a set of service design aspects involved and the five already mentioned phases of servitization (Segers and Spaargaren). Next, four individual cases are summarized and for each the most prominent factors that have influenced the service development will be highlighted. Then, the outcome of the cases is characterized, taking into account the existing position of a firm in terms of the mentioned phases and design aspects. This characterization can be used to guideline companies embarking on (further) servitization. This paper is completed with a reflection on the educational process of the research workshops.

2 Theoretical framework

Many frameworks have been developed to identify the areas to take into account for operating a business. Examples are the European Foundation for Quality Management (EFQM) Excellence Model (www.efqm.org), McKinsey’s 7S-model (1980), and the Balanced Score Card (Kaplan and Norton, 1992). We choose to take an enterprise architecture perspective (e.g. Lankhorst et al., 2005; Zachman, 1996) as it includes all aspects of all former frameworks, but also addresses information (technology) as a separate component, which is in our opinion an often neglected component. In alignment with Novay’s Agile Service Development project (http://www.novay.nl/projecten/agile-service-development/7552) the following classification is identified: 1) a service's interaction aspects, 2) a service's organizational aspects, 3) coordination aspects, 4) functional aspects, 5) rules and constraints, and 6) data and information aspects.

The other dimension that we take into account is the phasing as provided by Segers and Spaargaren (2010), who have specifically elaborated on servitization and its possible positioning in the organization. Specifically they identify the following phases: 1) vertically added service; 2) horizontally added service; 3) integrated product & service offering; 4) emphasis on service, with certain product; and 5) service replacing product.

This results in the following outline of our framework, see table 1. Our operationalized framework will be a cross-table of these two dimensions, filled with data from our four cases.

**Table 1:** The two dimensions of our framework

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dimension 1 Phase:** | Vertically added service | Horizontally added service | Integrated product & service offering | Emphasis on service | Service replacing product |
| **Dimension 2 Perspective:** | Interaction aspects | Organizational aspects | Coordination aspects | Functional aspects | Rules and constraints | Information and technology |

As for the operationalization the cells in the cross-table will contain factors for successful engineering and exploitation of services. In order to consistently present the factors we will normalize the factors according to the following format:

<factori,j> = [“no condition:” | <conditions>:]<action>

A factor implies a certain action, provided 0 or more conditions. For instance, factor1,6 deals with a *vertically added service* within the perspective of *information and technology*: e.g. “frequent maintenance need: provide an IT-enabled automatic maintenance trigger for equipment”. If “no condition” holds, we will leave out the text “no condition:” to save space in the operationalized cross-table.

The format implies a certain *action* related to service engineering, ensuring an active attitude in tackling the associated factor when engineering or exploiting the service. Moreover we anticipate to describe the factors in terms that are case-independent.

3 Four explorative case studies

At the Bachelor program for Business Engineering (HU University of Applied Sciences Utrecht, Faculty of Natural Sciences and Technology), students conduct a final practical assignment resulting in a Bachelor thesis. In the Spring of 2011, four of these Business Engineering students formed a research group on the topic of Servitization, under the supervision of two lecturers and two researchers affiliated with the research chair Extended Enterprise Studies. During several workshops the students were instructed to identify success factors for their individual servitization projects. While writing their theses they also included those factors in their texts, within the context of their overall projects. Subsequently the lecturers analyzed their identified success factors and the texts of their theses, in order to list and classify the factors.

Following is a short description of the four explorative cases. Already the texts contain (implicit) factors for successful servitization: in that case the related (part of the) sentence is written in italics, with a lower-case character between brackets . Those italics parts (combined with the identified factors derived from the student workshops, and their theses texts) will subsequently be translated into explicit factors in the operationalized framework, using the proposed format, and with the former lower-case character replaced as a capital character.

*Case 1: Scrum service in non-IT environment*

In the first case a consultancy firm aims to translate a proven approach for software development environment into a product development environment (non IT environment). The associated service deals with the implementation of the Scrum method for product development, which provides an iterative and incremental framework, that enables development teams to work more effective and decline the throughput time of design processes. The engineering of the Scrum service for product development was an *iterative (a)* process and the *intermediate results were* *tested (b1)* in a real life consultancy project in which the *client organization* *aimed to improve* *its time to market (b2)*. To successful design this service for a new market, *all original IT terminology was replaced* *by generic terminology (c)*. An important conclusion was that the design process in a non-IT environment often deals with the creation or production of a physical prototype, which *enlarges the throughput time (d1)* of the design process. Also often design processes are audited and certified as a part of a quality management system. The case organization had to *incorporate production/design differences (d2)* in its new consultancy service, taking into account that IT and non IT environments deal with a variety of quality certifications. Summarizing, the consultancy firm adds a new service based on an existing service; we consider this positioned in the ‘horizontally added service’-phase: the new service is added to the existing service in a new domain.

*Case 2: Professionalizing the tender-coaching service*

The second case also involves a consultancy firm. The case organization supports organizations during the bid process and participation in European tenders. It wants to be a trendsetter in its market by offering support services for especially SMEs (small and medium sized enterprises), participating or willing to participate in European tenders.The case organization already offers tender-related services, however, their development has been ad-hoc so far. As a result, there are no quality criteria and process definitions for this consultancy service, making it hard to control the process and measure performance. One of the main services, the organizational scan, is improved and standardized by leveraging servitization characteristics. Major part of the analysis involved the *requirements (e1)* of the organizational scan for being a *client specific (e2)* service in the market, yet based on *standardized and efficient internal processes* *(f1).* Management decided to apply the *use of formats (f2)* in order to standardize the process and avoid an ad hoc service. These formats are used during the process, e.g. for structuring the interviews with clients, standardizing the production of reports and presentations, and regulating the interaction between the consultants. Consequently, the use of these formats resulted in *major changes in work processes and communication (f3).* The renewed and standardized service was used while performing the organizational scan during an external project. After the project was completed, an evaluation took place and some minor adjustments were made to fine tune the service. We consider this as positioned in the ‘vertically added service’-phase.

*Case 3: Cloud computing service for software*

The third case organization is the Distribution & Logistics unit of an international ICT service provider. One of the core activities of this unit is consult and implementation of ERP software systems for large transport and physical distribution organizations. Recent research programs indicated that SMEs do not use integrated Warehouse Management Systems (WMS) and Transport Managements Systems (TMS). Main reason is related to the high cost of investment for WMS and TMS software combined with cost of procurement and maintenance of hardware servers. The case organization wants to develop Software as a Service (SaaS): WMS and TMS software, in order to provide for a Warehouse and Transport Management service for SME’s in the transport sector. The Saas technology is *based on Cloud computing (g1)*, which makes it possible to offer and use software functionality without the investment for hardware servers and traditional software licenses. In the approach for this service development project first the *characteristics* *of Cloud computing* *were described (g2)* as an enabler of SaaS. Then the SMEs in the Dutch distribution market *demands were combined with the requirements and functionalities in the existing thick-client WMS software (h)* to fit this specific market. It was concluded that there was not enough demand for WMS software for SMEs. Consequently, the research continued with an analysis of the opportunities for the development of SaaS TMS software: entering a new market with a new service. This resulted in an advice on service development for SaaS TMS *taking into account the market and competitors, available technology and needs for collaboration (i)*, and finally Product/Service design functionality and support for SaaS TMS Service. We position this service in the ‘service replacing product’-phase.

*Case 4: Maintenance service support*

The fourth case study originates from the marine sector. A condition based maintenance service for vessels was developed in the case company. Although its clients share the ultimate maintenance goal: limitation of down time of assets, *thorough analysis of market requirements (j)*, resulted in the definition of three market segments. During the case study, the *existing maintenance services first were weighted on added value, experience, risk of imitation (by competitors) and turnover (k)*. This created the opportunity to, in fact, enlarge the market, *using existing services that were functionally combined into fit-to-market sets (l)* of condition based maintenance. To realize these three new mixes of condition based maintenance services, *interaction and communication between different internal departments must increase (m)*. If needed, *missing features will be provided for through collaboration with external partners (n)*. With this concept the case organization can provide for a condition based maintenance service and offer life cycle support for three different market segments, each with their own needs and specific drivers. We position this service in the ‘horizontally added service’-phase, not as a vertically added service, since external partners are involved in this service.

In all four case studies, the services developed aimed to offer a solution that would support objectives directly related to its customers primary process. In the first case the consult based on Scrum aims to decline the throughput time of its customers product development process. In the second case, the service on European tenders supports the client on successful tendering in order to feed the clients primary process with order confirmations. The Saas TMS service in the third case supports its customers primary transportation process. The latter case provides for a service that helps customers reduce down time of capital intensive assets that play a crucial role in the primary process. Each time, the relation between the service and the primary process of the customer, was created by a thorough analysis of market needs and service requirements.

4 Framework operationalization

In Table 2, see the translations of the previously identified factors in the format requested. Note that for spacing reasons we only include the factors identified in case descriptions above and leave out the additional factors that were separately identified reading through each of four student theses. Note also that the two phases (columns) that none of the explorative cases refer to are left out: there are only columns in the operationalized framework for ‘vertically added service’, ‘horizontally added service’ and ‘service replacing product’.

**Table 2:** The operationalized framework (the capital characters between brackets, in the cells, refer to the lower-case characters in the case descriptions)

|  |  |  |  |
| --- | --- | --- | --- |
| **perspective \ phase** | *Vertically added service* | *Horizontally added service* | *Service replacing product* |
| *Interaction aspects* | Elicitate requirements that are client-specific (E) | Engineer iteratively (A);Existing service, new market: replace existing terminology with more generic terminology (C);Varying client characteristics: segment market and services (J); Existing service, new market: classify existing services on added value, experience, risk and turnover (K); Existing service, new market: create new fit-to-market sets by combining existing services (L) |  |
| *Organization aspects* |  | Engineer iteratively (A);Client’s aim is improve time-to-market: test during engineering (B);Existing service, new market: identify and reconsider internal and interdepartmental collaboration (M)Extension of existing service: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (N) | New service, new market: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (I) |
| *Coordination aspects* | Service efficiency is important: use standardized formats (F) | Engineer iteratively (A);Existing service, new market: identify and reconsider internal and interdepartmental collaboration (M)Extension of existing service: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (N) | New service, new market: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (I) |
| *Functional aspects* | Elicitate requirements that are client-specific (E); Service efficiency is important: use standardized formats (F) | Existing service, new market: requirements also based on differences between old and new market (D); Varying client characteristics: segment market and services (J); Existing service, new market: classify existing services on added value, experience, risk and turnover (K); Existing service, new market: create new fit-to-market sets by combining existing services (L) | New technology used: describe characteristics, operational and technical elements (G); Existing functionality, new market: identify differences and similarities between new market demands and old functionalities (H) |
| *Rules and constraints* | Elicitate requirements that are client-specific (E); Service efficiency is important: use standardized formats (F);  | Engineer iteratively (A);Client’s aim is improve time-to-market: test during engineering (B);Existing service, new market: replace existing terminology with more generic terminology (C); Existing service, new market: requirements also based on differences between old and new market (D); Varying client characteristics: segment market and services (J); Existing service, new market: classify existing services on added value, experience, risk and turnover (K); Existing service, new market: create new fit-to-market sets by combining existing services (L); Existing service, new market: identify and reconsider internal and interdepartmental collaboration (M); Extension of existing service: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (N) | New technology used: describe characteristics, operational and technical elements (G); Existing functionality, new market: identify differences and similarities between new market demands and old functionalities (H); New service, new market: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (I) |
| *Information and technology* | Service efficiency is important: use standardized formats (F) | Extension of existing service: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (N) | New technology used: describe characteristics, operational and technical elements (G); New service, new market: identify need for partnership and collaboration based on external factors (market and competitors) and internal technological opportunities (I) |

1.5 Analysis of classification

Table 2 illustrates that every perspective (each row) contains important factors regarding service engineering. What is also to be noticed is that a certain factor is always related to multiple perspectives. It shows that the perspectives are related to each other, and can even be considered to be aligned. For example ‘Engineer iteratively’ is related to:

* ‘Interaction’-perspective: because engineering iteratively will involve stakeholders for defining a next cycle.
* ‘Organization’-perspective: for engineering iteratively one needs to e.g. involve different departments, while testing and defining a cycle.
* ‘Coordination’-perspective: because engineering iteratively will likely adjust different type of stakeholders, while testing and defining a cycle.
* ‘Rules and constraints’-perspective: as engineering iteratively prescribes a certain approach for service engineering.

On the other hand, ‘Engineer iteratively’ is not identified as related to the:

* ‘Functional’-perspective: engineering iteratively is more about the process of engineering than the identification of particular features.
* ‘Information and technology’-perspective: engineering iteratively does not necessarily contain (information) technology.

A special perspective is the ‘Rules and constraints’-perspective: all identified factors from the cases are plotted in this particular row. This is undoubtly because each factor itself is built as a rule with a ‘condition’ and an ‘action’. Even unconditionally defined factors (like ‘Engineer iteratively’) can be considered a rule/constraint for service engineering. Anyway, an important implication seems to be that the engineering of a service can be monitored by a rules management system.

6 Conclusions and further research

In our search for factors of successful service engineering we were able to classify the relevant factors in four cases according to a degree of ‘servitizations’ (see the columns in table 2) and different aspects (see the rows in table 2). Yet it is difficult to identify different conclusions per phase (column) provided the limited amount of cases and data. Because of the fact that each factor can be described and identified as a rule and/or constraint the management of factors can be performed by a rules management system.

(Manufacturing) organizations willing to embark on servitization may consult table 2 in order to organize for service engineering. Furthermore, organizations already in the process of new service engineering may use table 2 to audit their engineering project(s).

Final assignments of a Bachelor program can provide for a great amount of case material. Within Business Engineering the types of case organizations vary continuously and a wide range of business engineering principles is applied in different context. This makes it possible to research the practical use of models and frameworks. In this study the four explorative cases, gave the opportunity to look for factors that influence the success of service development in four different situations. All four cases, like many other practical assignments of our Business Engineering Bachelor Program, had a focus on the early stage of service engineering rather than the implementation. Consequently, most factors for successful servitization identified are strongly related to setting market requirements and their contribution to overall business objectives.

The limited number of cases implies that strong conclusions cannot be drawn. Future research should consider more cases, and also more phases (rows in table 2).

Creating a research group that brings together students, researchers and lecturers stimulates practice based engineering and research. For this research, the group was combined on a voluntary basis. Since student participation in the research group is not an obligated part of their graduation assignment, and consequently no extra European Credit Points are involved, students must be driven by internal motivators. This can have an impact on the commitment of student researchers, once their practical final assignment is finished and they have passed their exams. For future organization of these kind of research groups, further research on different ways of internal as well as external student motivation should be considered, in order to create a more structural and continuous input from explorative case studies in a long- term research program.

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