Product Service Systems in Production Companies
– a study of servitize.dk tendencies

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Introduction

In recent years there has been a growing interest in using a PSS approach when developing products and services to create a business model focused on selling functions, performance, or availability instead of physical products.

The definition of a PSS is an offering that combines products with services that will deliver value in use (Baines et al., 2007). A PSS offers the opportunity to decouple financial success from material consumption and thereby reduce the environmental impact of economic activity.

The goal of a PSS is to transform companies from being primarily product suppliers to selling more services linked to the products. This changes the business model to focus on the "sale of use" instead of the "sale of products". Depending on the type of PSS concept, this means that the customer pays for the usage of an asset instead of solely buying the product, which changes how risk, responsibilities, and cost are related to ownership (Baines et al., 2007).

In servitization, a PSS values how the assets are performing or how it is utilized, instead of focusing on ownership. Therefore, PSS will differentiate how products and services can bring value to the customer (Baines et al., 2007). To add future understanding of PSS, we need to investigate the three key aspects of a PSS:

Product: Seen as a tangible asset, which is manufactured, is physically represented and fulfils a user's need.
Service: An activity done to create value for others, e.g., maintenance/reparations.
System: a collection of elements including their relations. (Baines et al., 2007)

This whitepaper aims to investigate state-of-the-art within PSS, what different concepts exist when working with PSS, and how the industry is working with them and implementing them into their business. Through the whitepaper, we will answer the following questions:
•   What is PSS?
•   What different concepts exist?
•   How is the industry working with PSS concepts?
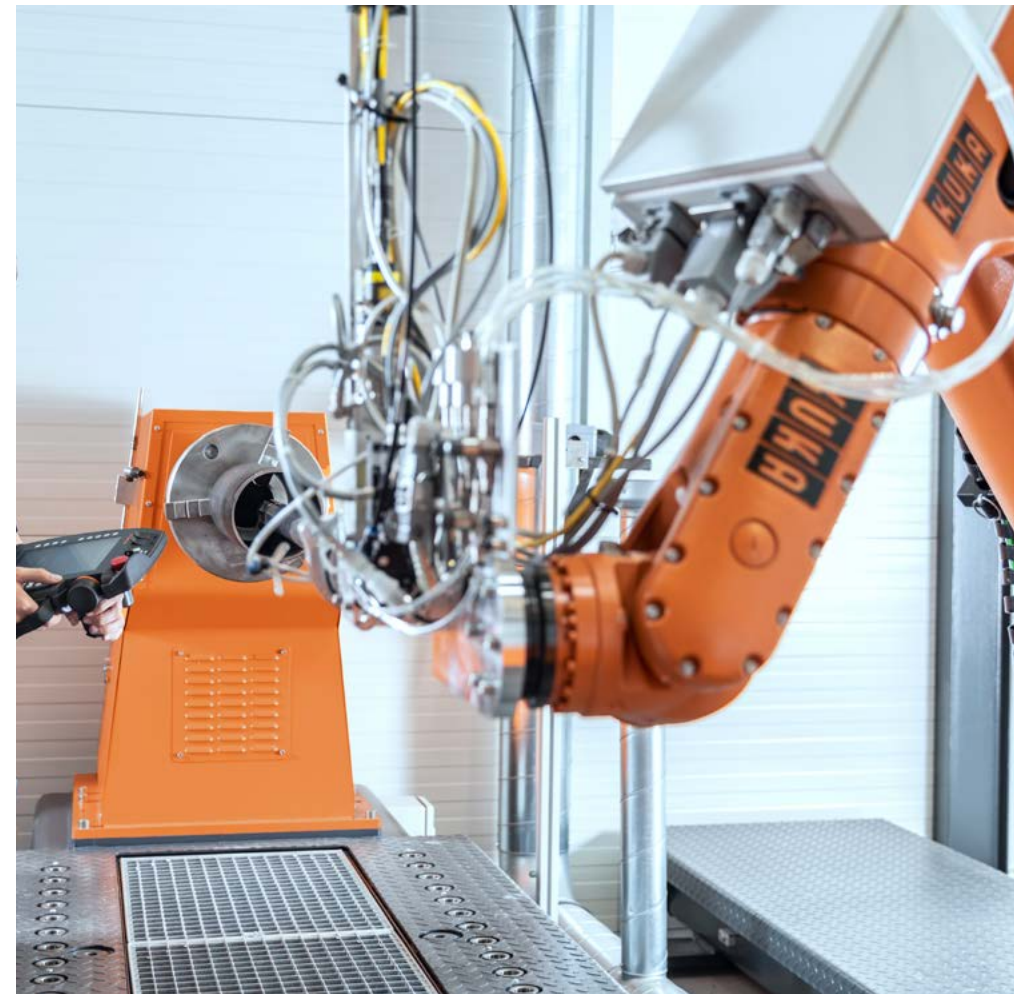
The three concepts of PSS

When talking about PSS there are mainly three different concepts of PSS: product-, use- and result-oriented PSS.

Product-oriented PSS is promoting and selling the product traditionally but includes additional services such as maintenance, repair, re-use, and recycling. Some offers even contain services that aim to help customers optimize the application of a product through training and consulting. The main motivation to implement product-oriented PSS is to minimize cost by optimizing the product lifespan and performance. This will ensure that companies can gain much more value from the same product. Furthermore, it considers the end-of-life of the product (recycle, reuse, easy repair) (Baines et al., 2007).

Use-oriented PSS is offering the usage and availability of products that are not owned by the customer, such as leasing or renting equipment. The main motivation to implement user-oriented PSS is to maximize the use of the product to meet the demands the customers are asking for. Furthermore, it ensures that the company will focus on increasing the lifespan of the product as well as the material it uses (Baines et al., 2007).

Result-oriented PSS is offering results or capabilities instead of a product. Examples could be information, selling the possibility to drive a car instead of a specific car. The main motivation to implement result-oriented PSS is that the company keeps ownership of the product since the customer only pays for the outcome or result (Baines et al., 2007).

Rolls-Royce's Result-oriented PSS

An example of how a result-orientated PSS can offer benefits in both business and the environment can be shown with the Rolls-Royce example. Rolls-Royce started offering Total-Care Packages to airlines. Rather than selling and transferring the ownership of gas turbine engines to the airlines, Rolls-Royce deliver "power-by-the-hour". While keeping ownership of the gas turbine technology, they can collect data on the performance and use of their product. With this data, Rolls-Royce enables the possibility to improve parameters to improve total product efficiency (engine efficiency, asset utilization, reduced total cost, and environmental impact). This has led their gas turbine technology to become world-leading while the spare and maintenance service they offer is exemplary (Baines et al., 2007).

Working with PSS

In this section, the paper will address some of the tools and services FORCE Technology is using to work with PSS development.

Business, Environment and Social Screening Tool

PSS has recently attracted new interest in both the literature and industry because of its potential in supporting sustainability. However, PSS is not by default more sustainable than traditional products. Therefore, PSS must be built from the beginning with sustainability in mind and have their sustainability potential assessed at an early conceptual design stage (Sarancic et al., 2022).

Due to the high relevance of assessing PSS from a sustainable point of view, BESST (Business, Environmental, and Social Screening Tool) was developed as a framework that supports the decision-making of PSS concepts with a focus on the triple bottom line, addressing three main challenges: economic, social, and environmental sustainability.

Economic sustainability is about increasing revenue size and stability from after-sales by the introduction of new services and by cutting the costs of internal development.

Social sustainability concerns providing customers with flexible and tailor-made solutions and creating value for its customers that is not solely dependent on the sales of equipment alone.

Environmental sustainability relates to Increased awareness and communication about environmental sustainability by offering a structured approach to include environmental dimensions in the development of product-service systems.

BESST is a tool that takes into consideration both the triple-bottom-line and key PSS elements across the whole product life cycle. The tool should be used in the early design phase when the company has already created concepts for different PSS.
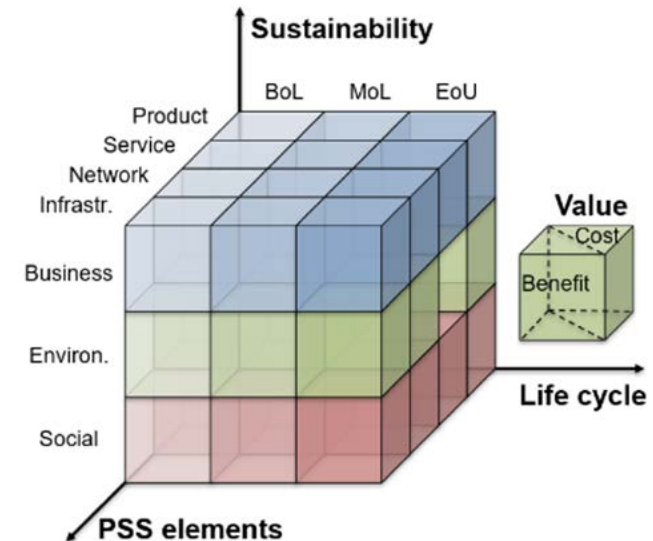
The BESST tool has proven to be able to address all three challenges and goals which are highlighted at the beginning of the project:

- The model will help facilitate workshops where companies can assess new potential services and change their revenue stream to have a higher potential in increasing aftersales (economic sustainability).
- The model will help provide flexible and tailor-made solutions for customers by bringing in the customers in the early design phase when designing new product-service systems (social sustainability).
- When implementing the model, companies will have a structured approach to include triple-bottom-line thinking in the early design phase of product-service systems (environmental sustainability).

Servitize.dk - Getting started with PSS

Servitize.dk is a project FORCE Technology is running in collaboration with several other partner RTOs and universities. The project's goal is to help Danish SMEs to engage more in product-service systems. When the project is over, the participating industrial companies should have raised their competitiveness, growth, and value creation among Danish industrial SMEs through an increased diffusion of product-service business concepts in companies.

Innovation consultants from FORCE Technology have through a four-year period, from 2019 to 2022, helped Danish production companies with more than 65 different Servitize.dk projects spanning several PSS concepts and combinations. Servitize.dk distinguish Product Service Systems into the following four categories related to products and processes:

Product-Life-Cycle Services (PLS)

Services that support the product throughout its life cycle, e.g. maintenance, inspection, reuse, etc. (key parameter: uptime)
Example: preventive maintenance, service contracts, and remote help with AR and HoloLens.

Asset Efficiency Services (AES)

Services that improve productivity, e.g. target management, documentation, customisation, online data collection, etc. (key parameter: ex. units produced)
Example: remote monitoring of aircraft engines, stoves, or predictive maintenance

Process Support Services (PSS)

Services that assist customers to improve their business processes, e.g. through a deeper understanding of processes related to customer's customers (key parameter: ex. lead time)
Example: reporting done for the customer, training of employees, or internal audits

Process Delegation Services (PDS)

Services performed on behalf of one's customers, (key parameters: customer satisfaction and customer profitability)
Example: farm management system, or car sharing.

	Service related to **PRODUCTS**	Service related to **CUSTOMER PROCESSES**
Supplier's promise to **PERFORM A DEED** (input-based)	**Product Life-Cycle Services** (PLS)	**Process Support Services** (PSS)
Supplier's promise to **ACHIEVE PERFORMANCE** (output-based)	**Asset Efficiency Services** (AES)	**Process Delegation Services** (PDS)

Ulaga & Reinartz, 2011

- Servitization holds many possibilities and dimensions for industrial companies. If you understand your customers' needs and gain insight into their challenges, there are many advantages to thinking of service and strategic service development as an integral part of the business.

- By offering services that reflect the customer's needs and that go all the way into their processes, you achieve greater customer loyalty and a stronger collaboration with your customers - both in the short and long term.

Together with the consultants, each conducted project was mapped under each category, showing the frequency and distribution of each Servitize.dk project during these four years. Furthermore, the consultants were interviewed to dive deeper into the reasoning behind the numbers and to gain general insights into their knowledge and experience with servitize.dk and their conducted projects.
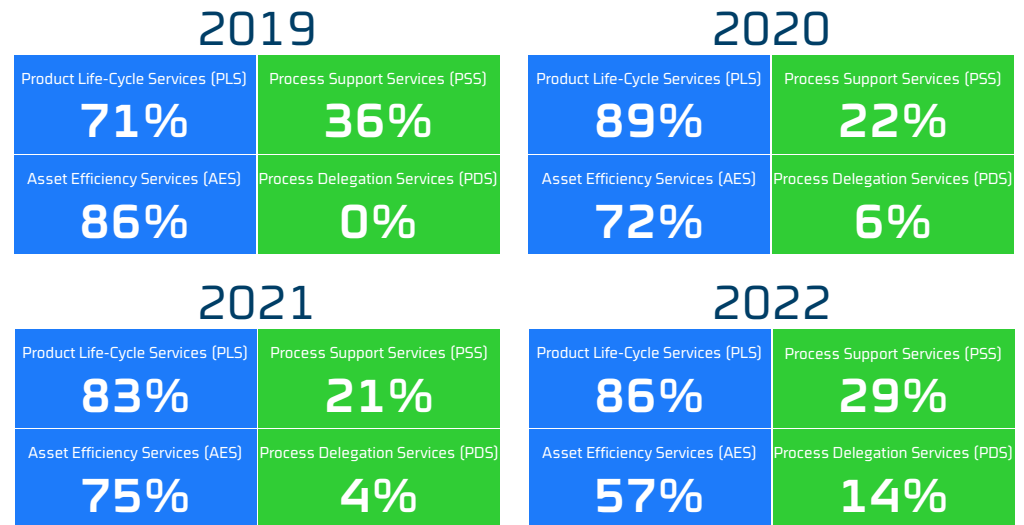
For companies to be able to apply for a Servtize.dk project, the company has to perform a maturity self-assessment to help the consultants get a better understanding of what concept of PSS would fit the companies' goals and ambitions.

The maturity model will help the company to choose what PSS concept is fitting for them and their situation. Most times, the companies have basic needs for incorporating PSS into their company and business structure. Therefore, most projects have their focus on Product-Life-Cycle-Services (PLS) and Asset Efficiency ncy Services (AES) as these PSS concepts lay the foundation for further more advanced PSS work, I.e., Process Support Services (PSS) and Process Delegation

Services (PDS). Projects can be placed across several of the four service types, and are not restricted to one concept only. The choice of concept combination is decided based on the project scope and in collaboration with the consultants.

As the figure shows, most projects fall into the product category covering concepts of Product Life-Cycle Services (PLS) and Asset Efficiency Services (AES). Throughout the years, the number of projects conducted under each of the four PSS categories is more or less stable, only varying a few percentages.

Diving into the reasoning behind the distribution of the numbers, and the clear indication that most servitize.dk projects are carried out under the Product Life-Cycle Services (PLS) and Asset Efficiency Services (AES) categories, is because the maturity in providing PSS has been lacking in many of the participating companies. Through interviews with the FORCE Technology innovation consultants, it was found that to implement the Process Support Services (PSS) or Process delegation Services (PDS), the companies would require more knowledge in implementing IoT and

2019

Product Life-Cycle Services (PLS)	Process Support Services (PSS)
71%	**36%**
Asset Efficiency Services (AES)	Process Delegation Services (PDS)
86%	**0%**

2020

Product Life-Cycle Services (PLS)	Process Support Services (PSS)
89%	**22%**
Asset Efficiency Services (AES)	Process Delegation Services (PDS)
72%	**6%**

2021

Product Life-Cycle Services (PLS)	Process Support Services (PSS)
83%	**21%**
Asset Efficiency Services (AES)	Process Delegation Services (PDS)
75%	**4%**

2022

Product Life-Cycle Services (PLS)	Process Support Services (PSS)
86%	**29%**
Asset Efficiency Services (AES)	Process Delegation Services (PDS)
57%	**14%**

The figure shows a representation of the distribution of FORCE Technology's Servitize.dk projects conducted in the respective four categories over the four-year project period.

servitization. Many of the participating companies were lacking this IoT and servitization aspect, which consequently resulted in a closer focus on the Product Life-Cycle Services (PLS) and Asset Efficiency Services (AES) since these PSS types help form the basis for working with IoT and servitization.

Within the year 2022, the projects within the Process Delegation Services (PDS) have more than doubled, thus showing a tendency

for more PSS-mature companies to participate in the project. This is likely because the maturity of the servitize.dk companies is increasing parallelly, since working with PSS as a strategic business improvement tool, and also IoT, is now more common and widespread than earlier. Therefore, the consultants can begin their work with the companies on a higher maturity level than previously, having more projects covering the Process Delegation Services (PDS) also.

Conclusion

The paper has been exploring what PSS is and what different concepts they contain. The paper found that PSS is a type of business model that provides for the coherent delivery of products and services. The paper has found that PSS contains three main concept types; product-, use-, and result-oriented PSS. In each of these concepts, there exist different variations depending on the nature of combining products with different services.

PSS has a high potential in bringing more sustainability into companies. The paper introduced the BESST which is used to help companies think sustainability into their PSS concepts from an early stage. The sustainability aspects are brought in by evaluating PSS concepts on the triple bottom line. This evaluation ensures that the PSS concepts are not only evaluated from a business perspective, but also from an economically-, socially-, and environmentally sustainable perspective.

To showcase how the industry is working with PSS concepts, the project Servitize. dk has been introduced, where FORCE Technology innovation consultants are working with PSS concepts through servitization. Servitize.dk has mainly been working with four different PSS concepts, where the main concepts being investigated have been Product Life-Cycle Services (PLS) and Asset Efficiency Services (AES). The reason for Product Life-Cycle Services (PLS) and Asset Efficiency Services (AES) to be the most common concepts to choose has been due to the participating companies' maturity regarding PSS. The two other concepts, Process Support Services (PSS) and process Delegation Services (PDS), have required a higher maturity and therefore are not that well represented in this project.

Interested in hearing more about the opportunities for PSS in your company?

Get in touch with us today

Put in your information and choose "IoT and Digital Technology" when submitting your inquiry.

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