CHAIN REACTIONS

INNOVATION BRIEF 1

PRODUCT SERVICE SYSTEMS

Version 1
08 2019

ABOUT INNOVATION BRIEFS

CHAIN REACTIONS addresses the challenge for industrial regions to increase regional capacity to absorb new knowledge and turn it into competitiveness edge and business value. There is a strong need to help SMEs to overcome capacity shortages for innovation and integration into transnational value chains.

The project aims at empowering regional ecosystems with the knowledge and tools to help businesses overcome those barriers and generate sustained growth through value chain innovation.

CHAIN REACTIONS focuses thereby on modern approaches considering value chains and their complex developments rather than linear technology transfer approaches. The framework of value chain innovation builds on Porter's 5 forces framework (new entrants, substitutes, customers, suppliers and rivalry) and transversal innovation drivers: key enabling technologies, resource efficiency, digital transformation and service innovation.

During the project lifetime CHAIN REACTIONS will publish about every third month an INNOVATION BRIEF presenting the rationale behind specific innovation drivers and illustrate them with practical examples.

This first INNOVATION BRIEF is about PRODUCT-SERVICE SYSTEMS. Within CHAIN REACTIONS, methodologies and tools for supporting the development of PSS will be integrated in the VALUE CHAIN INNOVATION TOOLBOX to be delivered by the beginning of 2020. Stay tuned!

PRODUCT SERVICE SYSTEMS

Definition

The changes brought about by digitization dominate often the entrepreneurial discourse. The focus of this innovation brief is on the question of how companies can successfully shape change for themselves and tap into new business potential. The combination of **digitized products (smart products) in combination with services** opens up new opportunities for companies to secure and improve their market and competitive position in the future.

Product Service Systems (PSS) are hybrid products composed of a material good, the product, as well as one or more services. Information technologies often play a decisive role in these services or are what makes them possible in the first place. Depending on the PSS, there may be different proportions of service and product, the ratio of which may change over time, for example, due to technological developments or changing customer needs.

The driving role of digitization

The speed of digitization is advancing rapidly. At the centre of this digital transformation is the customer with fundamentally changed expectations. Companies must meet the

demand for immediate availability of the individualized complete solution and continuous access to digitally networked products and services at all times. In general, public perception of the digital transformation has increased recently. In some countries, the focus is on industry 4.0, in others on the Internet of Things (IoT). While the focus in Industry 4.0 is on the use of digital technologies, especially in production to increase efficiency and optimize costs, the IoT concept is much broader. This not only deals with production but is also considered across industries and divisions and addresses, for example, changes in customer access. This broader understanding ultimately also shows the need for change in single companies. Not only production and in particular value creation are considered, but also completely new business opportunities and models are discussed as shown in

Figure 1

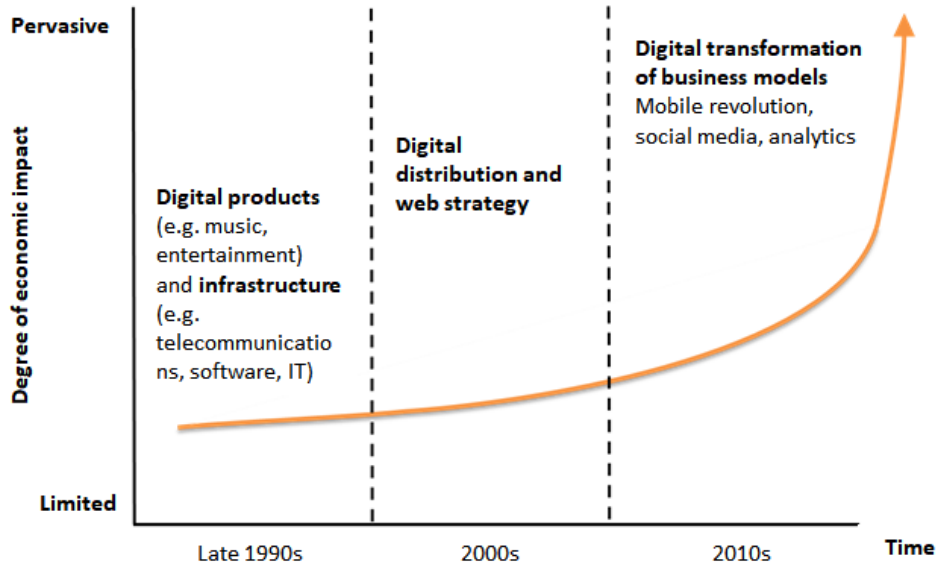


Figure 1: Development of digital transformation

Source: Berman and Bell (2011), p. 2.

This not only changes the demands of customers but also the way classic products have to be offered to customers. In the context of IoT, each physical product will in future receive a digital shell in addition to a digital twin, giving the product itself the opportunity to interact with the outside world. The exponential increase in the number of Internet-enabled objects simultaneously results in immense amounts of data, which, through the application of powerful analytical methods and technologies, enable completely new, digital approaches to solutions for customers. Overall, the digital transformation will in future shift the focus from the classic product to integrated services to a comprehensive PSS. By developing and selling such networked products and services, companies can leverage the opportunities of digital transformation to create unique solutions and continue to successfully differentiate themselves from the competition.

From product to product-service system

One trend is that more and more manufacturing companies are developing from a product to a service or solution provider. In this context, the company must know and analyse the needs and problems of its customers in order to offer a service at any time and in any place. The company no longer acts as a product seller but offers solutions that include comprehensive services for the customer. (cf. Kagermann and Österle 2007; p. 14). PSS are suitable for providing such a complete solution. They consist of a traditional product component, which is supplemented by services during the product life cycle. Ideally, both merge to form an innovative overall solution. In the design of such combinations, the possibilities offered by digitisation are of central importance and in many cases, they are what makes them possible. The basic idea behind this model is to combine intelligent products with physical and digital services to create so-called smart services that satisfy customer needs and thus focus on the customer. These services can then be made available to the customer independent of location and time.

The following figure shows the PSS classification according to Tukker (2004). PSS is divided into three categories, ranging from product-oriented to benefit-oriented to result-oriented. With a product-oriented PSS, the share of the product in the total range is high. In addition, such a solution includes either a product-related service or consulting and training. A relatively balanced relationship between product and service exists with a benefit-oriented PSS. This includes concepts such as the leasing of vehicles or Car-Sharing. If the offer has a high service share, it is a result-oriented PSS. As an example, one payment per service unit can be cited. Likewise, agreeing on a specific result, e.g. a pleasant indoor climate, which can be provided by the manufacturer in any way, as long as the result is correct, is a result-oriented PSS.

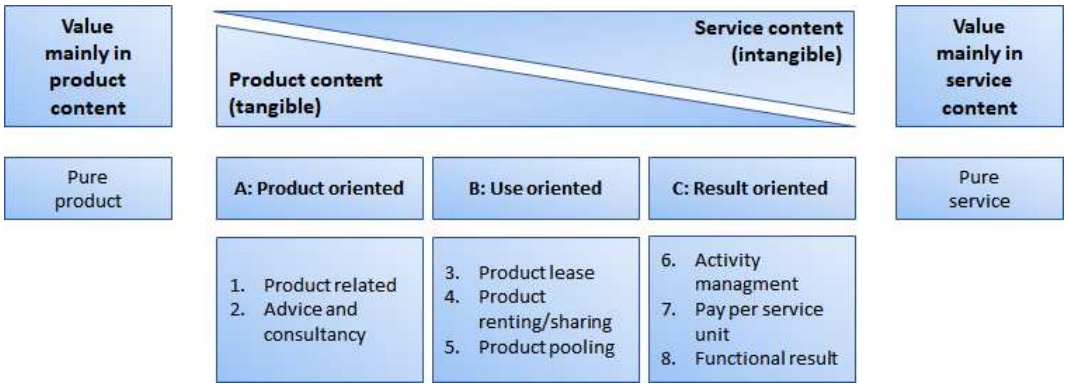


Figure 2: Modified representation of Tukker

Source: In the style of Tukker (2004), p. 248.

An example of a PSS in which the customer pays per service unit received is the "Power by the Hour" concept. The term was coined in the 1960s by the engine manufacturer Bristol Siddeley. He realized that his customers were not interested in the actual product - the engine - but in its performance and offered them a payment per flight hour. Following Rolls Royce's acquisition of this engine manufacturer, the company took up the approach again after several years and developed the "TotalCare" offer. The engine

remains the property of Rolls Royce after delivery of the aircraft. The airlines pay a certain amount and receive services such as complete engine overhauls, repairs or the replacement of wearing parts. (cf. Baines et al. 2007, p. 1 ff.).

Traditional business model:

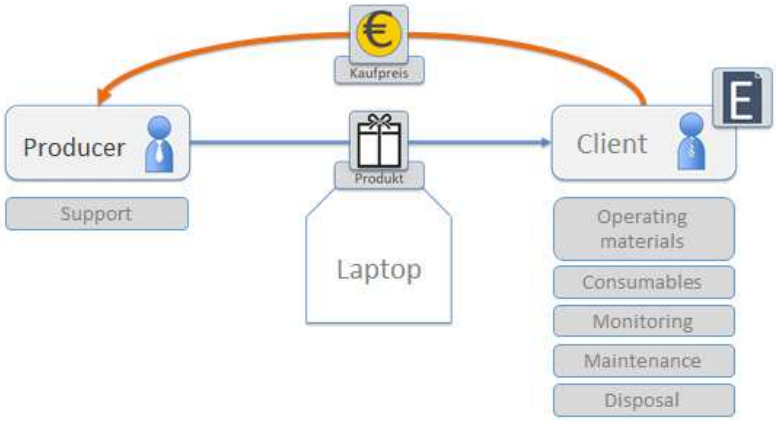


Figure 3: Traditional Business Model for a Laptop

Source: BWCON

The following chart shows the business model described above. The manufacturer (Rolls Royce) leaves the product to the customer (airline) for use and invoices the performance per unit of performance, in this example per flight hour. The ownership (shown as E inFigure 4) of the product remains with the manufacturer, only the owner changes. In this example, the manufacturer ensures the operational readiness of the product, takes care of maintenance, modernization, upgrades and guarantees the customer a certain degree of availability for the product. The customer merely provides feedback on the product and determines the usage requirement prior to procurement.

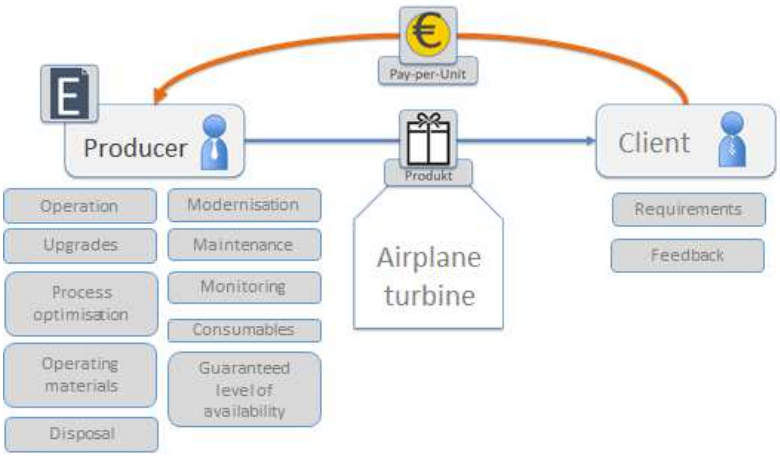


Figure 4: Illustration of the business model "Pay-per-Unit" for aircraft turbines

Source: BWCON

The emergence of new business models and value chains

In order to meet customer needs in the long term and not to miss out on competitors, companies have to react to the far-reaching developments of advancing digitization (cf. Figure 5). Most companies are still facing this transformation. The great challenge they face is how to sensibly transfer new and innovative business models to traditional business. This requires companies to analyze existing product and service portfolios, radically rethink and revise them, abandon obsolete products and services at an early stage and develop new business areas and customers.

Another phenomenon of digital transformation is the convergence of previously separate industries. For example, IT is becoming increasingly important in the automotive sector in the direction of autonomous driving or in the field of building services in the direction of smart buildings. This leads to the alignment of products and services, the development of integrated solutions and the **break-up and redesigning of previously known value chains.**

The following picture illustrates the stepwise transformation of business models and value chains for a producer of industrial products according to the level of servitization:

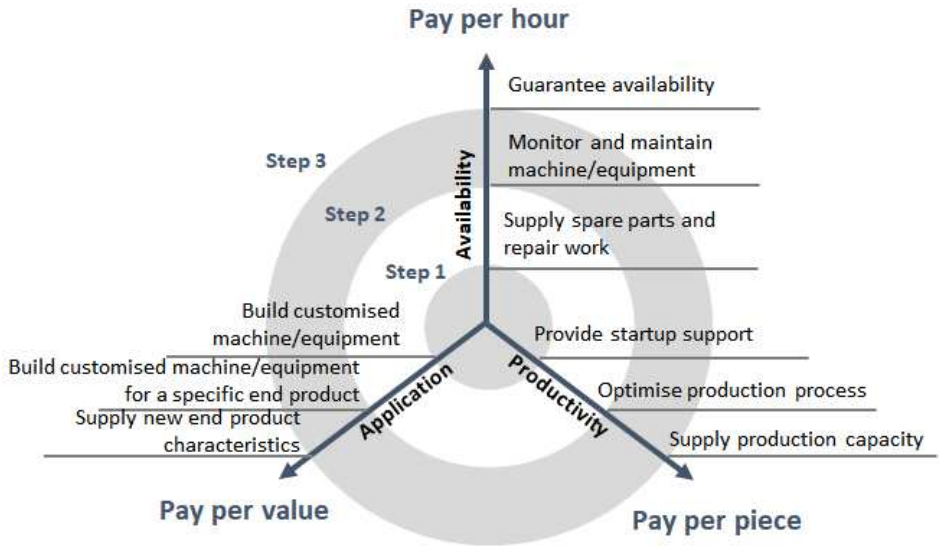
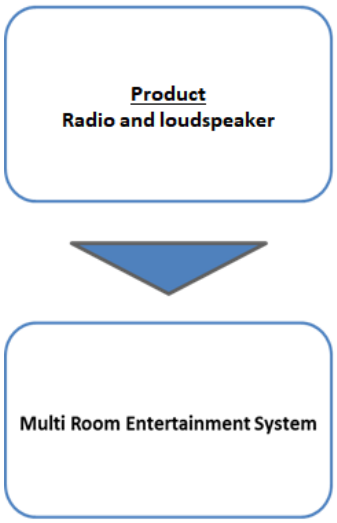


Figure 5: New billing models according to customer outcome

Source: Representation based on Ministry of Finance and Economics Baden-Württemberg and Fraunhofer Institute for Manufacturing Engineering and Automation IPA

The following figures provide two specific examples of new business models and value chains based on PSS:

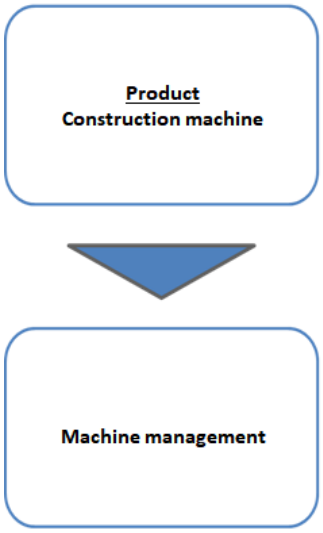


Multi Room Entertainment System at Sonos

- **Digital transformation:**
  - WLAN
  - Mobile terminal device for navigation and configuration
  - Modern loudspeaker technology
- **PSS potential:**
  - Music streaming with personal recommendations
  - Integration of common streaming services and online offer through app
  - Interlinking of all components and control through app
  - Trueplay spatial anaysis for optimised rendering
- **Time horizon:**
  - Immediately

Figure 6: From product to PSS using the example of a loudspeaker manufacturer

Source: BWCON



Mining Operation Management and Mobile Equipment Management at Caterpillar

- **Digital transformation:**
  - Data-Mining
  - Sensor technology
  - Communication link
- **PSS potential:**
  - Increase of availability and reduction of operating costs through monitoring of singly machines (e.g. fuel consumption, operating hours, etc.
  - Support production monitoring and efficiency management (e.g. location, utilization rate, etc.)
  - Security increase (e.g. tires monitoring and security protocol)
- **Time horizon:**
  - Immediately

Figure 7: From product to PSS using construction machinery as an example

Source: BWCON

Benefits and challenges of PSS

The trend towards servitization of businesses is growing in importance. But most traditional businesses have difficulties to adopt this new paradigm of the value of services and the importance of a product service offering.

The following figure provides an overview of the benefits and challenges of PSS from the point of vie of an industrial company:

Benefits	Challenges
Sustainability Increase of market barriers to competition and product differentiation Intensified customer relationship and loyalty Financial benefits Innovation through attachment of additional value to traditional products Growth strategy in mature industry Better monitoring of products and customer data use	No existing market yet Close cooperation required Sustainability trade-off Sustainability seen as slowing down time to market Change from short-term to long-term profit Extended involvement with a product beyond point-of-sale Shift in corporate culture and market engagement required Ownerless consumption Lack of knowledge about life cycle costs of product ownership High labour costs Integration problems Lack of care (customer side) Opposition of the personnel (provider/customer)

Figure 8: Benefits and challenges of PSS

Source: Richter, A.; Schoblik, J.; Kölmel, B.; Bulander, R. (2018)

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