

Digital Platforms Building Blocks: Focusing on Agile Organization and Product-Service Systems

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Abstract. *Many companies struggle from dynamic business environment, volatile markets, lack of resources, and multiple restrictions. At the same time, digital platforms emerge as industry disruptors, providing new business models, networking patterns and channels of cooperation.*

The present research aims to outline how the principles behind agile organization and product-service systems can support companies to explore digital platform opportunities. Stepping on theoretical research, the paper proposes a conceptual model enabling companies to consider how to fit to the logic of the digital platforms. The paper is part of the project DEMO, focusing on preparing the next professionals in digital platform enterprises.

Keywords. Digital Platforms, Agile Organization, Product-Service System, Digital Platform Enterprises

1 Introduction

The evolving market dynamics and increased global risks impose many new hardships for companies. To survive and remain competitive, organizations need to be flexible and constantly innovate, adopting new digital strategies, new working styles, and new product-service offerings. Many of businesses consider the transition from established organizational practices and governance to digital platforms, adopting more adaptive methodologies and capacity for real-time reactivity. In this regard, more and more organizations are considering new platform technologies to restructure their value offering and governance structure.

Digitalization further challenges traditional business principles, business models, and value-creation mechanisms. For example, digital technologies increasingly blur the distinction and the differences between “goods” and “services”. In the digital world, the value offerings are organized in complex “product-service offerings” (Gaiardelli et al., 2014), often constructed within complex ecosystems,

combining institutions, companies, and infrastructure (Vargo & Lush, 2016). The ongoing digital transformation further steps on personalized and adaptable smart services (Beverungen et al., 2017) provided by digitally-enhanced products within the aligned systems and platforms.

At the same time, the digital platform companies and their disruptive business models expanded dramatically in size and scale over the last decade (de Reuver et al., 2018). Platform thinking offers many benefits such as better models to connect third parties, facilitating transactions and efficiency in assets management and innovations. However, very few platform businesses originate from the EU and Central and Eastern Europe (CEE). Furthermore, not every industry or business can benefit from adopting new platforms. Even more, it is still unclear how existing companies and mainly small and medium enterprises (SMEs) can benefit from platform principles. Considering that digital platforms play a crucial role in digital transformation, for example in the field of Industry 4.0, and smart manufacturing, it is necessary to study and conceptualize more precisely which industries and business processes can successfully transit toward platform businesses. Moreover, digital platforms continue to raise public debates on various social, technological, and tax issues and need further attention, regarding policy regulations, data protection and much more.

The present paper aims to investigate agile organizations and product-service systems as building blocks toward considering digital platform opportunities. On one hand, agile organizations’ principles support companies to become more adaptive, agile, fast, and reactive to changes. In parallel, servitization approaches enable them to transfer value offerings from pure products to more complex and digitally supported product-service systems. However, adopting a digital platform enterprise thinking is not just about online operations and leveraging the networking effects.

This paper is based on the literature review of the ongoing EU Erasmus+ project DEMO. DEMO focuses to design and deliver quality training solutions,

learning materials, and practice-oriented case studies for CEE graduate students in business and technical specialties, in order to prepare next professionals in the field of digital platform enterprises.

The first part of the paper provides a general summary of the key concepts and characteristics of agile organizations and PSS. Next are outlined the building blocks of digital platforms, described in a general conceptual model. Finally, the discussion provides several considerations on the platform's constraints, benefits and factors for success.

2 Background

The first section focuses on main theoretical principles behind agile organization and product-service-systems, serving as starting point for next theoretical and practical investigations toward digital platform transition.

2.1 Agile organizations

Agility is defined as “the ability to both create and respond to change to profit in a turbulent business environment.” (Highsmith, 2002; Highsmith, 2010). In this context, the term *Agile* or *Business Agile* refers to “the approach of providing greater flexibility and faster decision-making in the modern business world, a world where organizations that aren’t Business Agile will take longer to succeed and be less flexible in this modern, demanding business world, and fail at a faster rate potentially” (Taylor, 2021). The *Organizational Agility*, described in (Ozbayrac, 2020) represents “building cross-functional teams that can deliver an end-to-end business or process in the organization. *Agile organizations* aim to combine both features and create a system where the bricks are built on the platform. The *Agile organization* is sustainable as a large corporation and is fast and flexible as a start-up at the same time.”

Concepts of Agile Methodologies and Project Management

Agile methodologies are closely related to software development projects, management of customer requirements, and general project management practices. Although the biggest popularity of Agile methodologies is within project-based organizations (PBO), these principles are increasingly suitable for all types of businesses.

The introduction of innovative and flexible methodologies and practices often result from different challenges related to the management of linear business processes. In 2001, the "Manifesto for Agile Software Development" (Beedle et al., 2001) was created, presenting the following four central values:

- Individuals and interactions over processes and tools;

- Working software over comprehensive documentation;
- Customer collaboration over contract negotiation;
- Responding to change over following a plan.

This gives the launch of agile methodologies and practices and their permanent place in software development and the adoption of agile practices in organizational management and every business area.

Examples of such agile methodologies are Extreme Programming, SCRUM, Dynamic Systems Development Method (DSDM), Crystal, Feature-Driven Development, and Pragmatic Programming (Taylor, 2021). Other examples are Lean, Agile modelling, Agile Unified Process (UAP), Kanban, and Scrumban.

Aligning with the “Manifesto for Agile Software Development” which describes twelve main principles, Perkin & Abraham (2021) propose **twelve agile business principles**. Three of them are especially relevant for digital platform enterprise building blocks (Perkin & Abraham, 2021):

1. “The primary orientation is towards customer needs, delivered through constant improvement of customer experience”;
2. “Strategies and tactics are highly adaptive and responsive, and change is welcomed”;
3. “The best results emerge from small teams with a high degree of autonomy”;

Considering these twelve agile business principles, the management board of an organization should align and synchronize in order to meet all the requirements of the business environment and stakeholders and reach a higher degree of flexibility and adaptability.

Furthermore, management often has to face the challenges of doing agile and being agile at the same time in order to improve performance and achieve business goals and performance, and also to be adaptive leaders who react adequately to the fast-changing ecosystems and requirements. Figure 1 represents the perception of the enterprise agility vision, adapted from (Highsmith, 2014). The diagram illustrates the overall vision concerning the management and its positioning toward doing agile or being agile leaders.

Figure 1 presents the two main directions of the *Enterprise Agility Vision* as a relationship between doing things in an agile way and being an agile leader. Part of the things directly related to doing your job in an agile way and involve indicators of capability, quality, do less, speed-to-value, and so on. All this leads to being an agile leader, which includes indicators and capabilities such as engaging, adapting, exploring, and so on, which undoubtedly lead to the adaptation and perception of agile methods and principles.

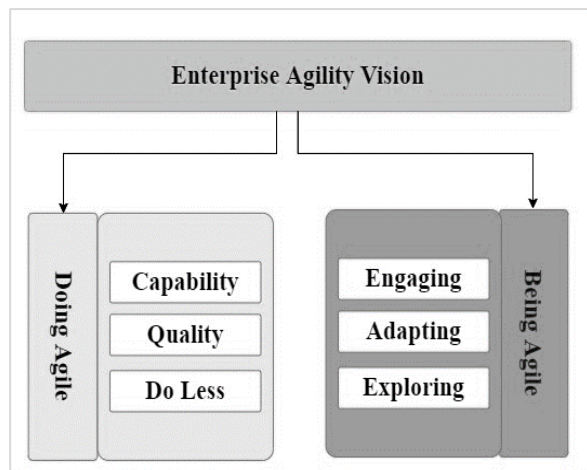


Figure 1. Enterprise Agility Vision adapted from (Highsmith, 2014)

2.2 Product-Service Systems

The main idea behind the emergence of the Product-Service System (PSS) is the changed perspective from “products” (material artifacts) to “services” (intangible offerings), considering the whole system that facilitates value creation and value exchange. The term PSS is first mentioned in a Dutch policy paper on the environment and economy (Goedkoop et al., 1999). In this definition, the authors state that PSS is “a system of products, services, infrastructure and network support that continually strives to be competitive, satisfy customer needs and result in less environmental impact than traditional business models” (Goedkoop et al., 1999).

A more general summary of other PSS definitions highlights some of the main background concepts:

- PSS is a complex value offering composed of a mix of tangible and non-tangible elements that can be labelled as products, services, and infrastructures (Goedkoop et al., 1999; Barravecchia et al., 2021);
- PSS is a systematic package in which intangible services are attached to tangible products to finish various industrial activities in the whole product life cycle (Zhang et al., 2012);
- PSS and customer-centricity – PSS elements interact to fulfil customer needs (Manzini and Vezzoli, 2003); Interactions between providers and customers are extended to different phases of the PSS lifecycle (Cavalieri & Pezzotta, 2012);
- PSS is a new business model: A system of products, services, supporting networks, and an infrastructure designed to be: competitive, satisfy customer needs, and have a lower environmental impact than traditional business models (Mont, 2002);
- PSS and sustainability - PSS-based strategies have positive environmental effects compared to

traditional business models (Roy, 2000); PSS integrates a product and service into a system that provides the same necessary functionality but reduces the environmental impact (Baines et al., 2007).

Some PSS definitions further emphasize "selling the use" instead of "selling the product", focusing on value-in-use and not on the value of “ownership”. As discovered in (Tukker, 2015), the focus is not on the products and services per se but on the customer needs and how organizations define their responsibilities and relationships in a more complex value-chain system.

The field of PSS research is multidisciplinary, addressing various problem areas and research directions as discovered in the reviews, focusing on PSS and economy “servitization” (Baines et al., 2007), PSS and business model innovation (Reim et al., 2015); PSS and sustainability (Tukker, 2015), and others. From the very beginning, the PSS covers a large area of sustainability, prospects for sustainable economic growth, and a circular economy (Fernandez et al., 2020). It is interesting to outline how the literature review by (Barravecchia et al., 2021) ranges the accumulated literature within the main PSS topics – PSS design, sustainability, environmental, social impact, and servitization (Table 1). Figuring out that some of the papers can address few topics, the sum is exceeding 100%.

Table 1. Main PSS topics, Barravecchia et al., (2021)

PSS design (methods/tools)	21%
PSS environmental and social impact	18%
PSS and servitization process	13%
Sustainable PSS	11%
PSS Business models	10%
PSS performance analysis	10%
PSS requirements analysis	9%
Industrial PSS	9%

The emerging concepts of Service Science (Maglio & Spohrer, 2008) and Service-Dominant logic (Lush & Vargo, 2008, Vargo & Lush, 2016) contribute to defining a general model of service systems research, mainly focusing on service innovations and service ecosystem view (Vargo et al., 2017). Thus, PSS can be explored from socio-technical systems theory view (Baxter & Sommerville, 2011). There, the socio-technical system consists of two components (subsystems):

- **the technical subsystem**, covering assets such as machines and equipment, as well as processes and tasks that are responsible for the conversion of input resources into outputs;
- **the social subsystem**, made up of people (such as customers and employees), structured in groups, roles, and functions.

Most of the papers and current research is focused on applying the PSS systems in the context of Industry 4.0 and manufacturing digitalization. There many PSS

involve intersectoral interactions and configurations of vertically or horizontally integrated agents (Sony & Naik, 2020). This way, the rising digitalization poses new challenges for designing and delivering complex value offerings, combining services and tangible products within interconnected socio-technical systems.

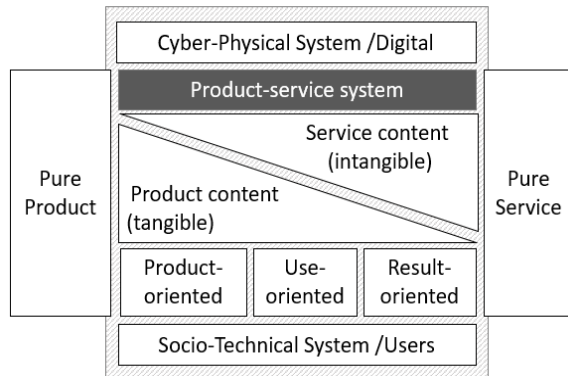


Figure 2. Product-Service System model, adapted from (Tukker, 2004)

Further, Cyber-physical systems represent the convergence of PSS with digital technologies. Figure 2 explore the general model of PSS, CPS and company value creation. The CPS definition is “an intelligent system, connecting the physical and the digital/cyber world through influence and control using sensors and actuators” (Martin et al., 2019). The authors further reflect its capabilities to recognize and act upon signals from the environment, connecting through machine-to-machine communication. The definition of CPS by (Gölzer et al., 2015) states that CPS are “able to communicate with each other, to detect their environment, to interpret available data and to act on the physical world”. CPS combines a cyber part that provides computational capabilities, sensors for collecting data, and actuators. It is more often characterized as a technical system than a socio-technical one. However, considering the emergence of increasingly intelligent CPS machines that can further support autonomous actions, multi-criteria decision making, and complex interaction between humans and technology, and reflecting that these terms are often used within different disciplines, CPS should be further reflected when defining smart service, smart service system, and smart products capabilities (Martin et al., 2019).

2.3 Digital Platform Enterprises

The fast-accumulating literature in the field of “digital platforms” finds many overlapping definitions, mixing interchangeably concepts of “digital platforms” with “platform ecosystems”, “multi-sided platforms”, or “digital platform enterprises”. Stepping on the building blocks metaphor, the authors perceive the definition of

a digital platform as “a building block that provides an essential function to a technological system and serves as a foundation upon which complementary products, technologies, or services can be developed”, formulated in (Spagnoletti et al., 2015).

Digital platforms specifics

Considering some of the main classifications of platforms, such as (Evans & Gawer, 2016), the digital platform enterprises can be identified as:

- **Transaction platform:** focusing to excel at demand and supply matching of products and/or services;
- **Innovation platform:** providing backbone technology or facility for other firms to design their technologies, products, or services;
- **Integrated/Hybrid platform:** facilitating transactions and forming an ecosystem of stakeholders;
- **Investment platforms,** supporting a portfolio and investment strategies.

The main functions of the digital platforms are to facilitate (1) effective matching and easy interactions (and transactions), (2) efficient innovation backbone, speed and scale of innovation, ROI, and profitability; (3) ecosystem building, connecting a pool of investors, partners, buyers and relevant stakeholders (Figure 3).

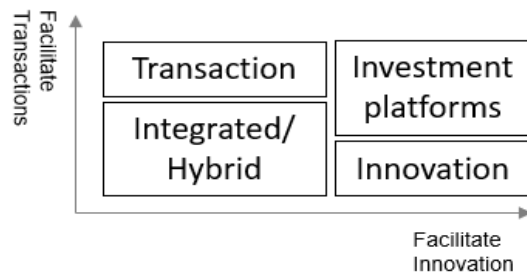


Figure 3. Digital platforms differentiation, adapted from the classification of (Evans & Gawer, 2016)

3 Conceptual Model Building Blocks

Considering the concepts behind digital platforms, our aim is to define both organizational and technical elements, addressing the main challenges behind company management. On one hand, agile methodologies come from software industry and explore the easiness to build-on and excel prototypes until reaching the final version and output. On the other hand, the product-service-system thinking come from manufacturing industry and focus on delivering physical artefacts. Therefore, the authors propose to combine the both elements (fig.3) in order to develop a conceptual model for better understanding the digital platform enterprise way of thinking, management

processes, value creation mechanisms and platform model of functioning.

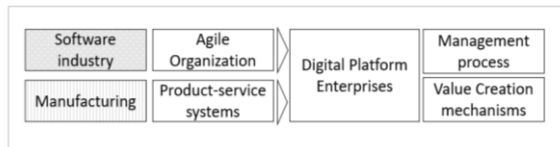


Figure 4. Building blocks of the Digital Platforms Enterprise – the authors' conceptualization

This way, the building blocks of a digital platform (fig.4) cover the social sub-system - the business and management level and the technological sub-system - components, products and artefacts, both corresponding to relevant agile and PSS concepts.

3.1 Agile levels

There are three different levels of agility that an organization can perceive and achieve, considering the benefits and impact on organizations, business strategies and goals (Highsmith, 2014):

- **Agility at the operational level** represents the company's transition to an agile organization. There is *operational agility* that does not significantly affect the expansion of the organization and responsiveness or other changes within the organization, despite that some of the staff have become more agile. Still, project, product, and managers are the same and do the same job they did before introducing the agile practices in the organization.
- **Agility at the strategic level** – is focused on achieving responsiveness in the organization. This level is achieved mainly by the organization's managerial and leadership staff, which strategically contributes to the company's overall agility.
- **Agility at the portfolio level** – focuses on the agile practices introduced in the organization and the strategic decisions that the management has to make when applying them for high-value and vital projects. Therefore, applying these practices takes place strategically and is targeted only for essential projects. Thus, all other projects may not apply agile practices. The management of the agility at the portfolio level represents the bridge between enterprise agility and the successful execution of agile projects.

There are existing requirements for agile organizations, such as agile office, governance, facilities, and technology, that the organization must consider to achieve the desired level of agility in the organization.

3.2 Types of PSS

The Product service system (PSS) is traditionally classified into three different types (Baines et al., 2007) as *Product-oriented PSS (POS)*, *Use-oriented services (UOS)*, and *Result-oriented services (ROS)*. A brief description of the terms is provided next, based on (Baines et al., 2007).

Product-oriented PSS. This involves the sale of a product in a traditional way, in which the customer retains the ownership of the product, although including some associated services. For instance: after-sales service to ensure functionality and durability of the product (maintenance, repair, reuse, recycling, training, and consulting). In this case, the company is motivated to introduce a PSS to minimize costs of use throughout the product lifecycle;

Use-oriented services. The producer owns the product, and sells the use or functions of a product (e.g., leasing, sharing, etc.). In this case, the company is motivated to create a PSS to maximize the use of the product, to meet the demand, to extend product life, and reuse materials;

Result-oriented services. This involves the sale of a result or competence rather than a product. Companies offer a mix of personal services, and when the result is delivered in a product, the PSS provider maintains its ownership, and the customer only pays for the results.

4 Conceptual Model of a Digital Platform Enterprise

The platform business models differentiate from pipeline business mainly by network effects, increasing value by adding more users, self-reinforcing cycle of growth; digital technologies, capturing, transmitting, and monetizing data over the Internet; economy of scale, and lock-in effects (Gawer, 2014). Although platform businesses cannot be applied to all companies and all sectors, many companies can improve their model of functioning by applying both agile and service-oriented methodologies.

In this perspective, before considering how and if the firm should implement a Digital Platform Enterprise business logic, it can address the following elements on strategic, development, and portfolio level, as described in Table 3. The conceptual model, proposed in Table 3, builds on the service science priorities, extending and improving the model of (Ostrom et al. 2010).

First, on strategic level, the company has to reconsider the focus on customer and customers' needs. Design thinking models offer appropriate management tools and persona to outline customer needs, considering ethnographic research methods and focusing on user expectations and real situation. In this model, servitization thinking and PSS models can

improve value-creation mechanisms transferred to multiple-platform experiences.

Second, on development level, agile methodologies improve company business processes, considering innovation, service design, and organizational channels. Third, on portfolio level, companies can expand the platform model of PSS for further personalization and adaptation, adequately transforming customer data into customer-centred offerings.

Table 3. Digital Platform Enterprise building block model, adapted by (Ostrom et al., 2010)

Strategic Level- PSS	Development level - Agile	Portfolio Level - Platform
Improve the organization's ability to offer PSS successfully.	Stimulate Innovation	Effectively brand and sell PSS through personalized user-centered offerings;
Improve well-being through transformative PSS	Enhance Service Design	Enhance PSS user experience by enhancing contextualization and personalization approaches
Create and maintain a relevant organizational culture and mindset	Optimize service networks and value chains around customer experiences;	Measure and optimize PSS value offerings by adopting complex KPI;

Furthermore, companies adopting digital platform business thinking have to:

- Use socio-technical system paradigms to build the PSS ecosystem and drive PSS innovations;
- Adopt appropriate business models, supported by new PSS and CPS technology offerings (e.g., combining smart services, cloud computing, machine learning, artificial intelligence, and others);
- Accelerate the adoption and acceptance of new service-oriented PSS technologies (connect to and invest in ecosystem and innovation providers);
- Capture and deliver PSS service-oriented information for real-time decision making;
- Enable and accelerate mobile access for consumers and employees;
- Enhance privacy and security to protect service consumers, employees, companies, and society;
- Enable agility and integration through PSS architecture and appropriate technology platforms.

5 Discussion and future work

The identified two fundamental building blocks of the Digital platform enterprises – agile organizations and product-service systems, enable companies to decompose organizational and technical challenges and to reflect on practical steps to address platform thinking in their digital transformation strategies.

On a strategic level, agile principles allow companies to easily extend their capacity for structural changes on a horizontal and vertical level. For example, many companies add new departments to respond to the current business dynamics, such as Data Analysis, Digital and Innovation departments, and Customer Experience departments, leading to vertical expansion and additional management staff. However, if not appropriately managed, this expansion can lead to substantial difficulties most commonly related to (Ozbayrac, 2020):

- Lower rate of adjustment to market dynamics;
- Inefficient decision-making;
- Lack of cross-functional collaboration;
- Less innovation or emerging new revenue streams;
- Talent attrition and low employee engagement, and so on.

The positive effects of the business transformation to an agile organization include (but are not limited to): employee engagement, resource optimization, time to market (Ozbayrac, 2020), data analytics use for extracting valuable knowledge from data (Dankov and Birov, 2018), and so on. In the same time, a summary of the main benefits of adopting agile organizations include: (1) resource optimization; (2) improved cross-functional collaboration; (3) higher employee satisfaction; (4) faster realization of benefits. Thus, neither adopting agile methodologies or PSS model will automatically lead to better business performance.

Table 4. Main advantages of adopting PSS for customers and companies, based on (Baines et al., 2007)

<p>For Customers</p> <ul style="list-style-type: none"> • More customized offers and higher quality; • New functionalities and PSS combinations; • End-of-life tasks transferred to the producer.
<p>For Companies</p> <ul style="list-style-type: none"> • New market opportunities and competitive advantages; • Alternative to standardization and mass production; • Improvement in the total value delivered for the customer through increasing service elements; • Access to data about product performance during the use phase.

On the development level, adopting PSS allows companies to consider new technologies as supporting infrastructure, improving value offerings, business model structuring, innovation potential, boosting ecosystem and networking effects and circle economy, green and sustainability principles. Table 4 lists the main advantages of PSS based on the target groups (Baines et al., 2007).

Future work

The study represents only the first step toward for researching implementation and deployment of digital platform enterprise. It represents a theoretical model, conceptualizing some relevant topics of platform management and platform value creation. Further work will contribute for evaluating existing platform companies and exploring more examples and case studies, contributing to fine-tune the model and its elements.

Furthermore, the current complexity and dynamics in the domain of Digital Platform Enterprise deployment require further attention on other issues such as digital platforms business models, digital marketing and customer-centricity, digital platform architecture management, platform interoperability, all of them to be further addressed in the future DEMO innovative learning solutions.

The final aim is to facilitate companies and experts from the CEE to better understand and approach digital platforms design and development in a consistent and relevant to the theory and practice way, further advancing their companies' digitalization and servitization.

6 Conclusion

The present research outlined the theoretical concepts behind agile organizations and product-service systems as building blocks of digital platform. In the near future it can be expected further advancement of PSS and CPS, evolving to increasingly "smart" (product) service systems, focusing on further personalization, adaptation, and customization of product-service offerings, fuelling innovations and new digital platform business models.

Thus, this paper provides a conceptual model for adopting digital platform thinking, improving understanding of the main platform value-creation mechanisms. This can help both the young companies and start-ups, defining new value-creation offerings, and the established businesses, benefiting from new platform-based user-oriented and experience-focusing offerings, further preparing for digital economy transformation.

Acknowledgments

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