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The Competences for Digital Servitization: A Survey on Italian based Firms

**Theoni Paschou*, Federico Adrodegari*, Nicola Saccani*,
Mario Rapaccini****

**Department of Mechanical and Industrial Engineering, University of Brescia, Via Branze 38, 25123, Brescia, Italy
(t.paschou@unibs.it)*

** Department of Industrial Engineering, University of Florence V.le Morgagni 40, 50131, Florence, Italy

Abstract: Today's world is changing faster than ever before. Recent research argues that digitalization offers a series of opportunities for companies, enabling servitization. The convergence of digitalization and servitization, namely digital servitization, is reshaping the working environment, guiding companies to develop new competences for workers. While this phenomenon is proving increasingly popular, there is limited specifications or empirical investigations that focus on the extent to which it is being adopted in practice. This research gap is addressed by exploring these competences on a conceptual and empirical basis using a structured framework. This article reports the results from a survey of 141 companies based in the Italian region, seeking to empirically investigate the competences that support digital servitization. The results show that although there is an increasing interest in practice by companies that are trying to fill in the gap between the competences' importance and presence, supportive literature is rather limited. Finally, we identified the most critical competences for the examined sample, which are problem solving, data analysis and team working.

Keywords: Digital Servitization, digitalization, competences, skills, survey

1. Introduction

In the current global economy, academics and business practitioners agree that the growing use of digital technologies across industries has been a major driving force in the evolution of servitization (Kowalkowski, Kindstrom and Gebauer, 2013) generating new revenue opportunities (Rymaszewska, Helo and Gunasekaran, 2017). The convergence of servitization and digitalization trends, namely digital servitization (Vendrell-Herrero *et al.*, 2016; Paschou *et al.*, 2018), offers plenty of opportunities for manufacturers by developing sophisticated service offerings (Coreynen, Matthyssens and Bockhaven, 2016; Grubic and Jennions, 2018), enabling new service-oriented business models (Adrodegari and Saccani, 2017) and eventually reshaping the industry competition (Porter and Heppelmann, 2014). As a matter of fact, this shift is challenging and companies struggle with this transformation that requires fundamental changes in a company's structure, culture and competences. Due to the disruptive nature of this transformation process, the working environment is reshaping as well. In particular, employees need to develop higher and diversified competences by acquiring new knowledge and ways of working (Bondarouk and Ruël, 2009) to encounter increasingly interactive tasks and take data-driven decisions (Carnevale and Smith, 2013). It is essential to identify the core competences that support the digital servitization phenomenon in a successful way. Despite the growing research interest of the topic, up to date, there are few models, which explore and systemize the most essential competences (Baines, Lightfoot, Smart, Fletcher, *et al.*, 2013; Paschou *et al.*, 2018; Süße *et al.*, 2018), in

particular regarding the digital servitization. It is this gap in the literature which this paper seeks to address, by presenting the main results of a survey, carried around 140 companies from different sectors. Following this standpoint, this study aims to:

(i)   Analyze and define the competences state-of-art by validating the theoretical competences framework which was developed in a previous study

(ii)   Investigate competences' diffusion in Italian based companies to boost digital servitization

In order to achieve these objectives, we conducted a survey. We addressed companies which are based in the Italian region. The contribution of the paper lies in the fact that it is one of the first to unpack the notion of digital servitization competences empirically. This article is structured as follows: Section 2 sets the background of the paper and describes the digital servitization and competences. Section 3 provides a description of the research methodology. Section 4 presents the findings of the survey. A discussion and future research avenues are presented in Section 5, while the final section presents the concluding remarks.

2. Theoretical background

In this section, we describe the phenomenon of digital servitization and explore the required competences for this transformation.

2.1 Digital servitization

Servitization was coined by (Vandermerwe and Rada, 1988) and refers to the process where firms set out to create greater value by increasing the services they offer. It

is considered a key strategy by manufacturers because of its benefits such as strategic (Baines and Lightfoot, 2014; Adrodegari *et al.*, 2017), financial (Neely, 2009) and marketing (Gebauer and Fleisch, 2007; Gebauer *et al.*, 2017). In addition, the process of servitization develops the firm's innovative capabilities, creating value at the consumer level by offering a balance of products and services (Visnjic *et al.*, 2017). The application of digital technologies disrupts the way product firms compete and offer services (Porter and Heppelmann, 2014; Lerch and Gotsch, 2015; Vendrell-Herrero *et al.*, 2016). In particular, manufacturers introduce digital technologies to increase their service delivery efficiency (Vendrell-Herrero *et al.*, 2016) and raise their service value (Geum *et al.*, 2011) by offering higher quality services and deeper customer relationships. The term digital servitization refers to the convergence of servitization and digital technologies (Vendrell-Herrero *et al.*, 2017; Bustinza *et al.*, 2018; Paschou *et al.*, 2018). Previous studies have focused on how digital technologies enable service offerings to compete in complex markets (Coreynen, Matthyssens and Van Bockhaven, 2017) and how new business models are delivered with higher effectiveness and efficiency (Baird & Raghu, 2015). Industrial cases such as Rolls-Royce (Parida *et al.*, 2014), and KONE (Ardolino *et al.*, 2018) have shown how new business models and smart services can be delivered with high efficiency and effectiveness through the use of digital technologies. Notably, Rolls-Royce's program, "Power-by-the-Hour", is a servitized business model in which airline manufacturers pay a fee for the use and availability of engines instead of buying them. Furthermore, Rolls-Royce has implemented Internet of Things technologies to monitor the engine data in real time in order to provide effective maintenance (Baines, Lightfoot, Smart and Fletcher, 2013). However, likewise previous industrial revolutions, digital servitization is reshaping a company's culture, specifically the working environment.

2.2 The role of competences for digital servitization

Over the last 200 years, employment figures have persistently increased due to the technological development. A 2016 OECD study (Arntz at al., 2016) maintains that just 9% of the jobs analyzed in their research are at high risk of full automation but at least 70% of their tasks could be automated in the medium term. One of the main challenges in facing the digital servitization journey concerns the development of new competences and strengthening the existing ones, which acquire greater value in the new context of digital service provision (Cenamor, Sjödin and Parida, 2017). Competences can be a collection of information, skills and abilities needed to perform effectively in different tasks (Havelka, Merhout and Havelka, 2015). The digital transformation of companies will impact profoundly the required competences and job profiles (Prifti *et al.*, 2017). For instance, automated technologies and robots will take on many of the more repetitive, process-driven tasks and future workers should be encouraged to focus on softer "social intelligences" like problem solving, creativity, adaptive thinking and people management (World Economic Forum, 2019). Nowadays, the lack of

competences to manage this transition is one of the major challenges that companies are facing in industrial implementation of digitalization applied to the service offering (Coreynen, Matthyssens and Van Bockhaven, 2017). Human will remain the core factor of this transformation (Forbes. 2018) and specific investments, regarding the workforce's competences, are needed (Adolph and Tamis-Lemonda, 2014). Therefore, it is essential to identify and systemize the required competences for this transformation aiming at supporting managers to guide recruitment and requalification of employees. Scholars have already developed some models for that reason, which propose sets of the so-called "digital competences". Baines et al., 2013 describe the desirable behavior of people in the front-line of service delivery by identifying the supporting skill-sets, such as flexibility, relationship building, service centricity, authenticity, technically adept and resilience. In addition, (Dworschak and Zaiser, 2014) propose a more extensive perspective including both technical and basic competences. Another holistic approach, including a wider variety of skills, is proposed by (Prifti *et al.*, 2017) in which competences are grouped in eight categories, leading and deciding, supporting and cooperating, interacting and presenting, analyzing and interpreting, creating and conceptualizing, organizing and executing, adapting and coping, and enterprising and performing. Similarly, (Süße *et al.*, 2018) divide the competences into three subcategories: technical handling, critical evaluation and problem-oriented usage. In addition, the framework of (Hecklau *et al.*, 2016) is considered to be one of the few competence models that consist of both hard and soft skills, including four categories, namely technical, methodological, social and personal.

2.3 A competences framework

Based on the above literature, a framework for the competences of digital servitization is provided in this paper aiming at systemizing and harmonizing the existing scientific knowledge. This framework is based on the one proposed by Paschou et al. (2018) in a previous part of this research. The new framework operationalizes the four categories proposed in Paschou et al. (2018) (data analysis and management; digital content creation; soft skills; innovation appetite) with detailed competences derived from literature that can support the development of the digital servitization.

Data Analysis and Management. The first category consists of: 1) *research, acquisition, process and analysis of data*, which includes the ability of a) articulating needs, searching and filtering, elaborating and organizing (with the proper formats and tools) large set of structured and unstructured data in order to carry on purpose-specific analyses (e.g. using SQL script and pivot tables to properly aggregate data and calculate total amount) (Dworschak and Zaiser, 2014; Carretero, Vuorikari and Punie, 2017; Prifti *et al.*, 2017), b) analyzing, comparing and critically evaluating the credibility and reliability of sources of data, information and digital content, c) organizing, storing and retrieving data, information and content in digital environments, and d) organizing and processing them in a structured environment, and 2) *management of data security and action to*

protect digital assets, that covers the use of proper technologies to treat the digital asset in cyber secure way, protect them from leakages, mis- or fraudulent use, virus, faults and hacker/cybercriminal attacks (e.g. installing and updating antivirus, avoid sharing sensitive data via email) (Carretero, Vuorikari and Punie, 2017; Prifti *et al.*, 2017; Vila *et al.*, 2017).

Digital Content Creation. In the second category, there are three main competence areas: 1) *creation and editing of digital content in technical and commercial form to express oneself through digital means* (Carretero, Vuorikari and Punie, 2017; Cotet, Balgiu and Zaleschi (Negrea), 2017), 2) *problem-solving, creativity, logical thinking, design new solutions*, which includes the developing of qualitative and quantitative models (logical, statistical, heuristic, analytical and business models), reports and applications to study a specific technical and/or business problem, comparing and ideating solutions, getting insights and taking decision (e.g. develop a data-driven simulation tool to study the accuracy of demand forecasts, using different techniques such as time series analysis, Support Vector Machines, Regression Models, develop a new business model to sell services in a foreign market, etc.) (Schuh *et al.*, 2017; van Laar *et al.*, 2017), and 3) *development, design and programming of software and hardware*, that includes the ability to a) code (writing software codes), b) develop digital applications and software/hardware tools such as mock-ups, interfaces, websites, scripts, algorithms, prototypes, etc., and c) solve a specific technical and/or business problem (e.g. developing and application to support people in forecasting demand), modeling, simulation (Schuh *et al.*, 2017).

Soft Skills. The third macro-category contains: 1) *communication*, that is the skill of choosing the right communication media/channel (traditional – email, or new – social and instant messaging applications), creating the right communication contents, using the proper language (technical, business, customer, written and spoken Italian English, and/or other languages), and facilitating the right replies from the audience and recipients of messages (with actions, solicitations and behaviors) (Ochôa and Pinto, 2017; van Laar *et al.*, 2017), 2) *teamwork attitude*, which is the ability of collaborating with colleagues, working and achieving results in team, enjoying social experience and relationships established in the working environment, sharing knowledge and contributing to create collective intelligence (e.g. being agreeableness, extrovertness, socially skilled) (Carretero, Vuorikari and Punie, 2017; Prifti *et al.*, 2017), 3) *leadership*, the skill of mobilizing and leading people towards innovation, showing emotional intelligence, listening and getting in touch with needs of colleagues and stakeholders, meeting expectations, establishing social relationships in the working environment, creating a network, acting as a leader and self-entrepreneur of the organization (Schuh *et al.*, 2017), and 4) *results orientation, time and stress management*, the ability to work in conscientiousness ways, be resilient, reliable, responsible, respect time programs keeping adequate performance under work pressure (Gronau, Ullrich and Teichmann, 2017).*Innovation Appetite.* The last macro-area consists of:

1) *knowledge of new technologies, impact assessment, costs, benefits and related risks*, which covers the ability of understanding the potential impact of new technologies on the business models, channels, operations and acting as an evangelist to create consensus on the opportunities of embracing and introducing new technologies (Parida *et al.*, 2015; Schuh *et al.*, 2017), 2) *management of projects for the introduction of new technologies, products, services and processes*, that includes the participation/management of innovation projects for the introduction of new technologies (ideating, requirements definition, communicating, planning, developing, execution/implementation, testing, reviewing, controlling, expending, etc.), innovation and process analysis (Gronau, Ullrich and Teichmann, 2017; Vila *et al.*, 2017).

In the remainder of this paper, the proposed framework is used as a reference model to conduct a large-scale survey and collect empirical evidence about the digital servitization competences, relevant to successfully undertake this transformation. In the next section we illustrate the research strategy that we followed to contribute to this topic.

3. Research design

As mentioned above, gaining a deeper insight into this phenomenon is a relevant issue since most companies are heavily investing in digital technologies, which are nowadays considered a key enabler of servitization. Moreover, many firms strive to improve their competences since this is essential to compete especially in some industries. Thus, it is worthwhile investigating on the conditions that must occur to make such an investment convenient. In order to conduct this study, we carried out a survey through a questionnaire (Forza, 2002) between October 2018 and January 2019. The questionnaire-based survey was designed using (De Vaus and Francis, 2014) design approach, the indicators and items were taken from the digital servitization literature and the developed competences framework. It was consisted of 22 statements assessed through a 0 to 4 Likert scale. Before administrating the questionnaire to the target sample, three researchers validated it on a MS document. This step was undertaken to check whether the overall research framework was fully understandable. Minor changes were made to improve the survey layout and readability. On the basis of the feedbacks, we achieved the final structure of the questionnaire and replicated in an on-line survey editor.

We used a professional structured database of well acknowledged servitized firms from different industries located in Italy. Before distribution of the survey, telephone calls were made to each manager on the list to ensure they were experienced enough to complete it, i.e., they were knowledgeable about their organization's services or whether there was someone else more appropriate in the organization. The focus was on managing directors, country managers, service and HR directors. After the survey was distributed, two follow-up approaches were made to maximize the response and minimize non-response bias (Iacobucci, 2018): first, via email and subsequently by telephone. The telephone follow-up in particular increased the response rate and helped to identify reasons for non-response

(predominantly recipients did not have time to complete the survey). The answers collected have been coded using a "coding map" in order to assure the consistency and readability of data collected and then gathered into a comprehensive database in order to perform the analysis. Each answer has been analyzed in order to assess its validity and to find out imputation errors. Eventual double answers from the same company have been deleted. Descriptive analyses have been performed both considering the whole set of answers and respondents' segmentation following criteria derived from contextual variables such as: a) size of a company, b) industry sector in which a company operates, and c) job function of the respondent. Finally, descriptive analyses have been also performed considering respondents' segmentation based on organizational variables such as: presence and importance of each competence for every company. A competence's presence responds the question of how capable is someone of performing a task or job effectively (N/A= don't know; 0= absent; 1= elementary; 2= intermediate; 3= advanced; 4= master), while the parameter of importance concerns the relevance of mastering this competence for a company (N/A= don't know; 0= not at all important; 1= slightly important; 2= important; 3= very important; 4= extremely important).

As a result, the survey was completed by 141 respondents coming from different companies. There are a few notable points. First, the profile indicates a high percentage of responses by males (i.e. 91%). In regards to the participants' functions; 38% belongs to the managing directors, 31% to service and the rest divided to HR, R&D, Marketing and Sales, etc. According to the dimension classification of European Community, we classified respondents based on companies' size: micro and small 30%, medium 21% and large 49%. The sample is characterized by a greater share of large companies compared with European Union population, where SMEs are largely predominant. This may be due to the greater awareness and interest on digital servitization by large companies, while SMEs are expected to have a lower degree of maturity on digital service-related aspects. Moreover, half of the participated companies belong to an international group. The responding companies mainly operate in the Capital Goods (39%; i.e. aerospace and defense, construction, medicine machinery, etc.), Consumer Goods (17%, i.e. consumer electronics, electrical appliances, etc.), Oil and Gas, Energy, Chemicals and Materials (15%, i.e. plastics, metals, mining, paper, etc.), Information technology (15%, i.e. hardware, software provider, system integration) and other sectors (14%) such as media and consulting services.

Aiming at better investigating the situation, specific questions related to the different revenue streams have been addressed to the respondents. In particular, we asked the percentage of the annual turnover, that is generated by product sales, spare parts, technical assistance, maintenance contracts, financing/leasing and product renting/usage fee contracts. Our results showed that around 70% of the sample consists of product-based companies and their revenue comes from base, intermediate and advanced services.

4. Evidence from the survey

This section is structured according to the preliminary framework presented in previous section and aims at providing the results of descriptive analyses for each competence investigated. First, we investigated the competences importance and presence of the sample based on the company's dimension (see Table 1).

Table 1: Average competence importance and presence based on company's size

Dimension	Importance	Presence	Gap
Small	2.68	2.40	0.27
Medium	2.61	2.38	0.23
Large	2.83	2.43	0.40

The data show that the average importance of the examined competences is much higher for the large-size (2.83) followed by small and medium enterprises. However, the average presence is lower, creating a significant gap mostly for the large firms. It is notable that medium size companies show the lowest both importance and presence. We executed the same analysis but segmenting the sample based on the different industry sectors. Table 2 shows the most common sectors and their average competence importance and presence.

Table 2: Average competence importance and presence based on company's industry sector

Sector	Importance	Presence	Gap
Capital Goods	2.60	2.28	0.29
Consumer Goods	2.77	2.48	0.32
Oil and Gas, etc.	2.70	2.48	0.22
Information Technology	2.87	2.69	0.18
Other	3.01	2.48	0.53

Important differences emerge among industrial sectors; in fact, companies operating in the information technology sector appear to be more advanced (presence 2.69 out of 4) comparing to the rest. Otherwise, capital goods sector seems to be the least skilled (presence 2.28). Another aspect is the difference among the competences' importance and presence. For instance, consumer goods sector has the greatest gap (0.32), which means that although they valuated the identified competences very important for their reality, their presence is rather low. Vice versa, information technology companies are in a better maturity position with a gap of 0.18.

The survey explored the average importance and presence of each competence (see Figure 1). Problem solving seems to be the most significant (average score: 3.20 out of 4) and present (2.84) competence as well, followed by data analysis (3.04; 2.59) and team working (2.91; 2.59). We notice that the importance of all the identified competences is above the average, which validates the framework's significance. On the other hand, there is an important gap among presence and importance. Hence, companies have to understand deeply their needs and problems, and then invest accordingly in order to fill it either by reskilling or recruiting new talents.
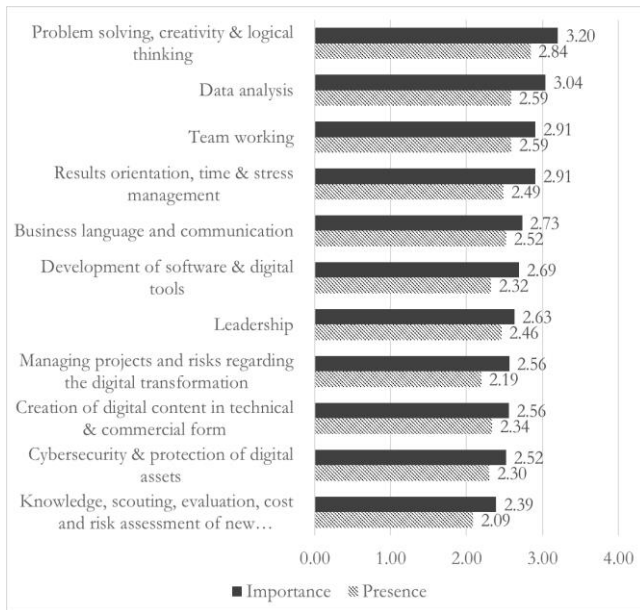
Figure 1: Average importance and presence of investigated competences (whole sample)

We aimed at understanding better the above results. For that reason, we proceeded by breaking down the whole sample based, initially, on the firms' size. In particular, the ability of solving complex problems and being creative remains in the first position for the small (3.14) and large (3.39) size firms. However, medium companies claim that data analysis (2.88) is the most important competence, followed by problem solving (2.84). Table 3 shows the average competence importance for all firms' dimension.

Table 3: Average competence importance based on a company's dimension

Competence	Small	Medium	Large
Data analysis	2.91	2.88	3.18
Cybersecurity	2.54	2.33	2.59
Problem solving	3.14	2.84	3.39
Creation of digital content	2.44	2.54	2.63
Programming	2.79	2.58	2.68
Communication	2.79	2.72	2.70
Results orientation	2.74	2.76	3.07
Team working	2.86	2.84	2.97
Leadership	2.59	2.40	2.75
Knowledge of new technologies	2.29	2.32	2.48
Managing projects	2.35	2.55	2.69

As we can see in the Table 3, competences like problem solving, data analysis, team working and results orientation are positioned always in the first places but sometimes with different order. This strengthens the fact that these are the most crucial competences regardless the company size. In addition, investigating the competence significance based on each sector, a series of important differences emerge. In fact, for companies which operate in oil and gas (3.26), capital goods (3.11) and information technology sectors (3.39), the competence with the higher value is the problem solving. We found the same competence in the second position for consumer goods sector (3.14). Furthermore, the ability to search and analyze data gets tons of attention as well in all sectors. Another essential soft skill is team working, which is placed in the third (oil and gas sector) and fourth position of the rest sectors. Table 4 presents in detail the importance of the competence for every examined sector.

Table 4: Average competence importance based on a company's sector

Competence	Oil & Gas	Capital Goods	Consumer Goods	Information technology	Other
Data analysis	3.17	2.78	3.27	3.12	3.24
Cybersecurity	2.59	2.16	2.64	2.94	2.82
Problem solving	3.26	3.11	3.14	3.39	3.29
Creation of digital content	2.29	2.44	2.77	2.41	3.00
Programming	2.39	2.66	2.73	2.75	3.00
Communication	2.63	2.67	2.64	2.71	3.19
Results orientation	2.79	2.80	3.14	2.88	3.06
Team working	3.00	2.76	3.00	3.00	3.00
Leadership	2.63	2.52	2.45	3.16	2.71
Knowledge of new technologies	2.42	2.26	2.32	2.50	2.71
Managing projects	2.50	2.42	2.38	2.75	3.06

Figure 2: Average importance and presence of investigated competences (companies that offer advanced services)

As mentioned before, the revenues of the participated companies come mainly from products and services (base, intermediate, advanced). Concerning only the companies

that offer advanced services, in particular pay-per-use and pay-per-performance contracts (21% of the sample), we identified the competence average importance and presence (see Figure 2) and we compared them with the whole sample. The results are coherent with the whole sample. Once more, being creative and solving complex problems is the first competence (3.22) in the list classified based on their importance, followed by data analysis (3.01). Although, we expected some important differences, there are no significant ones.

5. Discussion and Conclusion

The first objective of this study was to analyze and define the competences state-of-art by validating the theoretical competences framework which was developed in a previous study (Paschou et al., 2018). The theoretical framework identified four main categories: a) data analysis and management, 2) digital content creation, 3) soft skills, and 4) innovation appetite. Those competences determine companies' competitiveness and the capacity to drive innovation. Given the rapid rate of change and the crucial role of digital technologies in servitization, employees need to develop the competences above aiming at coping and thriving in this continuously changing world.

The second objective was to investigate the competences' diffusion in Italian based companies. Therefore, an exploratory survey was carried out. The main messages emerging from the survey are summarized in the following, also in relation to the extant literature. Summing up all the different analysis (based on size, industry, offered services), we conclude that all the identified competences are relevant but the most critical ones are: a) problem solving, creativity and logical thinking, b) data analysis, and c) team working. Large size companies are the most skilled in most of the investigated competences, which seems logical due to the different needs that they have comparing to SMEs. We should mention that programming and communication are the only two competences, in which SMEs overtake large ones. In addition, information technology sector is the most advanced, since its average competence presence is the highest related to the rest. This can be explained by their higher maturity of digital technologies application.

Independently the company's size, sector and service offerings, all the participants expressed their sensitivity towards the competences' importance and development.

As with any research, our study comes with some limitations that outline directions for future research. In particular, the data collection can be further extended in terms of sector and geographical areas besides the analyzed ones, to increase the generalizability of the findings presented in the article. This data is a result of an online survey panel so it is presumed respondents are experienced with the digital environment and so the sample may have a bias.

There is an urgent necessity for companies to cover the existing gap between the competences importance and presence if they really want to be successful during their digital transformation. Thus, future studies could adopt the presented framework to develop assessment methods, aiming at establishing the needed skill proficiency, in a specific team or transformation or even to elaborate the

organizational strategies related to the recruitment and requalification of the existing employees. Finally, future research may use the digital competence framework to identify a list of competences for every emerging professional role, e.g. which competences a data scientist should bring.

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