

## Digital competence and SMEs: Review of the relevant literature

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### Abstract

In the new digital world, globalisation as well as automation have reduced the number of routine, low-skills jobs. Instead, we see a rising demand in jobs with tertiary education and a shift in an enhanced skills set that could enable organisations to seek new opportunities and product innovations. Therefore, the European Union (EU), and various national governments, emphasised on the need of digitally capable graduates to satisfy organisational needs (Bilal et al., 2017; European Union, 2015; Stifterverband für die Deutsche Wissenschaft, 2018; Staatssekretariat für Bildung, Forschung und Innovation SBFI, 2017). As SMEs make out a large proportion of most national economies, it is worthwhile exploring how SMEs value digital competences on behalf of potential recruits (graduates).

Keywords: digital competence, SMEs, graduates employability

### 1 Introduction

Digital transformation peacefully and universally challenge and change the way we work. Demirkan, Spohrer and Welser (2016) defined digital transformation (DT) as "the profound and accelerating transformation of business activities, processes, competence, and models to fully leverage the changes and opportunities brought by digital technologies and their impact across society in a strategic and prioritized way" (p. 14). New emerging technologies such as mixed reality, cognitive computing, block chain, artificial intelligence have an big impact on work conduct (Gartner, 2017) which makes it paramount for business enterprises to seek the required digital capabilities to master the new challenges and exploit new opportunities (Economist, 2014; Aepli et al., 2017, p. 6; SECO, 2017; Bughin et al., 2018). Digitalisation and automation are gradually reducing low skills and routine jobs (Economist, 2014; (Organisator 2016; Aepli et al., 2017, p.6; Demirkan et. al., 2016), further shifting to non-routine and knowledge based jobs (SECO 2017). Furthermore, as organisational teams become more heterogeneous and interdisciplinary in nature, it is not only the digital competence that are required, but also cross-sectional skills such as communication and other soft skills (Bughin et. al., 2018; Aepli et al. 2017; SECO 2017). As such, a new set of highly demanding skills was introduced by the EU, namely the *digital competence* (EU, 2015). Recently, digital competence has become a key concept in the discussion relating to the skills the workforce should possess (Ilomäki et al., 2016).

Having most national economies comprised by SMEs (e.g. SMEs make out 99.7% of all organizations in Switzerland - Fueglistaller, Fust, Brunner, 2018, p.3; Floyd & McManus, 2005), it is worthwhile looking into the role digital competences play

for SMEs workforce. Due to their limited resources, SMEs are specifically dependent on the proper selection and allocation of their workforce and of their skillset (United Nations, 2005).

The current literature on the concept of digital competence is rather heterogeneous though, as such a thorough literature review on this topic seems to be justified also with regards to implication on the HRD for SMEs. Therefore, the purpose of this paper is to discuss the concept of digital competence and to raise awareness of their importance for the successful operation of SMEs in the digital business environment. Initially, the challenges SMEs are facing in the digital environment are discussed. Secondly, the paper presents a systematic literature review on digital competences in an attempt to address the literature gap and thus to suggest future actions on addressing it. The paper also aims to generate discussions for future research on digital competence. In this digital environment, there is a need to provide clarity as to how digital competence are defined and evaluated in the literature and how organisations could respond to future challenges. The paper is structured as follows. Firstly, we suggest the methodology used to identify the most relevant sources relating to our topic. Then, our literature review discuss the challenge of digitalisation for SMEs, followed by general suggestions in relation to digital competence. We continue by referring to specific digital competence clusters, namely the digital professional expertise, the digital methodical expertise, digital social competence, and the digital self-competence, all of which inform our understanding of digital competences. Finally, concluding remarks are offered.

## **2 Methodology**

This literature review paper discusses the challenge of digitalisation for SMEs. To serve its purpose, several books, research and conference papers, dissertations etc. were reviewed. Databases such as Google Scholar, Web of Science, JStor, EBSCO library, British Library EThOS, and Science Direct were accessed. Our literature review was limited only to those sources featuring one or more of the chosen keywords within their abstract, main body, or title, as well as being published in English or Dutch in various academic journals or included in books.

The inclusion criteria comprised key search terms such as '*digital competence*' "*SMEs in digital world*", "*digital economy*", "*digital revolution*", "*graduates' skills in digitalised world*" etc. The inclusion criteria were also informed by the year of publication, as well as the country where the research was conducted. All other search results, without a primary focus on the key search terms, were excluded.

## **3 SMEs and the challenge of digitalisation**

For most European economies, SMEs are the drivers of economic prosperity due to their specific expertise and innovation potential growth (Lindner et. al., 2017). However, they often find themselves in a conflict to meet long term strategic goals and to live up to the challenge of a fast paced digitalization of their business environment. Goerzig and Bauernhansl (2018) highlight challenges such as customer involvement, iterative development and increasing business orientation that arose from digitized products and services, all of which requiring new approaches and methods. New digitized products and services are often mentioned

in conjunction with the term internet of things (IoT). Sensors and resulting data are valuable to companies and may lead to new business models such as the case with Rolls Royce selling turbine / flight hours instead of turbines as they are able to calculate the price of a turbine hour due to the large data they collect from the turbine's sensors. Some companies even create a virtual, digital product of their physical product with this data and call this digital instance of their product the "digital twin". Understanding such technologies, as well as the capability of making sense, typically of a vast amount of data derived from the sensors, is an important capability that can be assigned to the essential skill set of employees who want to be prepared for the DT and its challenges.

However, SMEs are confronted with the challenge of having less resources than their global corporate counterparts. This leaves them only a limited scope of action to respond to the rising complexity of their business environment that often involves a substantial increase in costs (Lindner et al., 2017). Cravotta (2019) has developed a framework of challenges that German family firms are facing arising from digitization and highlights three main characteristics of family businesses: more human / less informal and therefore more flexible attitude, close relationships with customers and the difficulty to raise equity. Less financial resources, less DT specific know-how and the heavy burden of daily business are hurdles SMEs are facing regarding DT (Goerzig and Bauernhansl 2018). Lindner et al. (2017) have raised a wide range of challenges: To begin with, it often does not suffice to introduce new IT infrastructure to keep up with digitalisation – although automation reduces the pressure on head counts and enables leaner processes (Lindner et al., 2017). However, investments need to pay off and high costs are also occurred through the necessity to meet legal requirements and high quality and professional standards. With regards to their workforce new man-machine-settings require new attitudes and skills. Also, Köffer (2015) identifies four core aspects leading to tensions in digital workspaces: collaboration, compliance, mobility and technostress. Finally, in order to remain competitive, SMEs are required to understand, adapt or even anticipate customer needs at a very high speed (Lindner et al., 2017). In high turbulent environments, relying on past knowledge and procedures is no longer possible as existing concepts are not fit to provide answers to completely new challenges and settings. Instead, improvisational capabilities such as creativity and out of the box thinking are required (Pavlou and El Sawy 2010).

So how can SMEs respond to the challenges outlined above? Sometimes, there are quick wins to be gained: digitalized home office work space (Di Domenico, Daniel, and Nunan 2014) or the use of digital media as eased the pressure on heavy infrastructure (Lindner et al., 2017). But more importantly, to compete within the constantly evolving environment, many SMEs turn to open innovation by involving customers more directly and at an early stage of the development process (Scuotto et al. 2017). This can be achieved by resorting to agile methods: client focus, iterative and incremental working methods enable a faster product cycle and increased customer satisfaction with substantial positive effects on business outcomes (Lindner et al., 2017). Being small or medium sized, SMEs are specifically prone to resort to agile methods. Scuotto et.al. (2017) have shown that agility can impact an SME's innovation performance more than twice as much than in-house R&D Activity. To do so, they need to ensure that their workforce is competent enough to meet those challenges and thus to drive the business forward.

Agility however, is not only a mere work technique, it has to encompass the entire organisation which has to develop dynamic capabilities in order to be successful (Garavan et al., 2016). Dynamic capabilities is a term that refers to "... higher-level competences that determine the firm's ability to integrate, build and reconfigure internal and external resources/competences to address, and possibly shape, rapidly changing business environments" (Teece 2012, p. 1395). This form of capability applies to employees and management alike and therefore Li et al. (2018) refer to the term of dynamic management capabilities (DMC). Even though IT is a driver as well as enabler of DT management, DCM play an important role to support changes to the business models, organizational strategy as well as culture by building strategic business alliances (ibid). Especially in SMEs the CEO is involved or takes important decisions and he/she should therefore be involved in the process of decision making regarding DT topics (Goerzig and Bauernhansl, 2018) and thus engage in acquiring DMC. With regards to the workforce it is obvious that a whole range of new capabilities is needed to help to stem the challenges of digitalisation in the SMEs.

#### **4 Systematic literature review of digital competence**

The discussion above has shown that SMEs employees require a new set of competences that will enable them to master the challenge of DT. In order to understand the construct of digital competence, we thoroughly reviewed the relevant literature. Interestingly, there is not a common definition of "digital competence" and academic literature suggests that further investigation and empirical research is needed in this field to reach a common understanding (Murawski & Bick, 2017; Prifti, Knigge, Kienegger & Krcmar, 2017). However, the emergence of new competence that could help organisations to stem the digital transformation in the context of the new work is unquestioned (Bedwell et al., 2014; Davies, Fidler, & Gorbis, 2011; Hartmann & Hundertpfund, 2015; Murawski & Bick, 2017; Pan & Seow, 2016). Also, there is an understanding, that digital competence is a transversal key competence which enables the acquisition of other key competence as well (Ngoasong, 2018; Vuorikari, Punie, Carretero, & Van den Brande, 2016; Sefton-Green, Nixon & Erstad, 2009, Susskind & Susskind, 2015). Since academic sources on digital competence are still scarce and ambiguous, the authors also included practitioner-focused publications.

Despite the "jargon jungle" (Ferrari, 2012, p. 11), there are several concepts of digital competence that are very similar in their essence. According to Ala-Mutka (2011), digital competences encompass instrumental knowledge and the skills for an extensive set of capabilities such as tool and media usage, advanced skills and knowledge for communication and collaboration, information management, learning and problem solving, meaningful participation as well as attitudes towards strategic skill usage in intercultural, critical, creative, responsible and autonomous ways. The author further argued that this concept has a generic character and needs to be tailored to specific target groups (ibid), supporting the postulation of Hoel and Holtkamp (2012) to consider a specific context. A recent definition of digital competences that considered an organisational context is the one developed by Vieru (2015, p. 6718): "Digital competence consists in the ability to adopt and use new or existing information technology to analyse, select and critically evaluate digital information in order to investigate and solve work-related problems and develop a collaborative knowledge body while engaging in

organizational practices within a specific organizational context". Digital competence is a new type of competence that goes further and involves new components and greater complexity, at the same pace as the society is becoming more digitalized (Ferrari et al., 2012). Ilomäki et al. (2016) provide a thorough review of the most recent policy papers on the concept of digital competence. These authors define digital competence as a set consisting of: technical competence; the ability to use digital technologies in a meaningful way for work, study and in everyday life; the ability to evaluate the digital technologies critically; and the motivation to participate and engage in the digital culture. Brown et al. (2018) define digital competence as "the set of knowledge, skills, attitudes, abilities, strategies and awareness that is required when using ICT and digital media to perform tasks, solve problems, communicate, manage information, behave in an ethical and responsible way, collaborate, create and share content and knowledge for work, leisure, participation, learning, socializing, empowerment and consumerism." (p. 84).

Hartmann & Hundertpfund (2015) identify the following digital competences: Consolidation of information and knowledge, social intelligence and understanding, critical and flexible thinking as well as dealing with cultural and social heterogeneity. Further, they name the abstraction and modelling as well as using digital tools as further digital competences (ibid). Creative and productive thinking, informal and self-determined learning as well as virtual cooperation add up to their list of digital competences (ibid). They develop their classification based on the results of the "Future Work Skills 2020" report and the report of the German Ministry of Education and Research "Kompetenzen in einer digital geprägten Kultur<sup>1</sup>" (Bundesministerium für Bildung und Forschung, 2010).

The proposed concepts of digital competence cover a very wide range of capabilities and skills. In the following section will give more detail on how digital competences have emerged from the challenges of digitalisation. Furthermore, to get more structure in the "jungle" of competence (Ferrari 2012, p. 11), the various aspects will be categorized. Also, a categorization provides the benefit of supporting the process of operationalisation - which will ultimately be required in order to make use of digital competence by SMEs. There are various options to categorize competence starting from the mere distinction between hard and soft skills (North et. al, 2013) down to elaborate competence matrices that are aimed at providing practical support to the business (Erpenbeck, 2012). This paper uses the well-established four general categories by Erpenbeck (2012) as the main building blocks for the digital competence: a) professional and b) methodical expertise, c) social competence and d) self-competence.

#### **4.1 Digital professional expertise**

Due to the interconnection of machines, products, materials, robotics and other technologies an enhanced understanding and professional expertise in the field of technology grows in importance (Hammermann, Stettes, 2016). Software development and the management of various digital networks raises demand for technical experts. Although those employed in non-tech professions are not likely to possess coding or programming skills, they still have to be able to use the software applications effectively due to the certain and wide-ranged impact on their daily work routine (Schweizerischer Bundesrat, 2017, p. 32, Sure, 2016, p.

50). Consequently, everyone should have a certain understanding of how new technologies work and are applied (Abele, 2017). The author even alleges that all employees should learn programming languages in the future, such as Java, to deepen the understanding of technologies (ibid). With the increasing regulation of the virtual sphere, legal knowledge for instance regarding data protection laws (Sure, 2016) and the rights and possibilities to protect one's identity and anonymity is critical (Porath, 2011). In order to be able to evaluate data, the ability to do the statistical analysis is vital (Davies, Fidler, Gobris, 2011). In addition to the technological basic skills, general business knowledge and understanding of business links becomes more important in the digital age. Hammermann & Stettes (2016) suggest that business knowledge fosters flexibility, adaptability and personal initiative. To be digitally competent, a person should possess a broad general interdisciplinary knowledge and understanding of the connections between different disciplines (Davies et al., 2011, p. 11). The increase in networking between the teams also requires excellent language competences (Davies et al., 2011, p. 9) or at least fluency in English is crucial, since most technical data are produced in English (Abele, 2017). Having all points considered, it is critical for all kind of businesses including SMEs to carefully consider whether their existing workforce possess the skills required, as well as to develop the most appropriate recruitment and selection practices, and training and developmental activities, to attract and retain highly digitally competent employees to drive the business forward.

#### **4.2 Digital methodical expertise**

The growing amount of information, as well as the accelerating speed of change, require the ability to prioritize and select data according to specific business problems, further emphasizing the importance of analytical competences, such as critical, process-oriented and networked thinking (Porath, 2011,; Davies et al.; 2011,; Swiss Federal Council, 2017,; Ashoff, 2017,; Eilers, Möckel, Rump & Schabel, 2017). The ability to screen out the important data of the information flood is viewed as critical - though this can be supported with the appropriate technology and processes (Davies et al., 2011). However, employees should not only be able to work with sets of big data and focus on the relevant information, they must also be competent to analyse, evaluate and contextualise the given data (Susskind & Susskind, 2015; Grzybowska & Lupicka, 2017). Diverse opportunities and multiple alternatives are bound to become overwhelming specifically in the context of decision-making (Herrmann, 2017; Grzybowska & Lupicka, 2017). In order to succeed in this, one needs to elaborate a critical, innovative and reflective approach at work (Murawski & Bick, 2017) which should also include research skills - especially for young people (Grzybowska & Lupicka, 2017). Finally, as work moves away from routine tasks, project orientation and project management skills should be developed (Hermann, 2017; Murawski & Bick, 2017). Such competence presents a valuable element of an SME's success; thus, many SMEs welcome employees with such a skillset to support their business' growth and sustainability.

#### **4.3 Digital social competence**

Digitalisation requires the use of new communication technologies. This begins with advanced reading and writing skills which are essential for daily

communication such as email but also for the production of relevant web-contents on the internet and intranet (Porath, 2011; Susskind & Susskind, 2015). Employees are also expected to communicate at ease via social media or video conferences which requires presentation and moderation skills (Schweizerischer Bundesrat, 2017; Herrmann, 2017). As online-shops change the classic retail model, customers often make use of the consulting services in shops and order the goods online. In this case, specific consulting competence as well as social competence are required (e.g. for the sales force). Salespersons should be able to persuade a customer to buy the goods in the shop instead. Even cashiers now work as consultants at self-checkout stations at the supermarkets. Therefore, there is a rise and a high demand for social competence on behalf of employees (Aeppli et al., 2017). Lehmann & Wendt (2001) talk about a higher service and quality orientation among employees. The interconnectedness of technologies forces experts from diverse disciplines to work together on a temporal or virtual basis, embedded in rather fluid (holocratic) and heterogenic structures. This requires a high level of communication and cooperation competence (Sure, 2016; Eilers et al., 2017). According to Lehmann & Wendt (2001, p. 220), assertiveness to make one's point clear and show that a certain action leads to results and being able to negotiate make up a part of social competence in the context of new work. Social competence becomes more important especially through virtual collaboration across long distances (Hammermann & Stettes, 2016). Lehmann & Uepping (2001) emphasise the increased importance of teamwork and the necessity to coach and motivate other team members. Accepting new communication forms and fostering them is just as essential as the ability to show empathy and desire for cooperation (Lehmann & Wendt, 2001, p. 220).

Since virtual teams are dispersed, a new type of social competence is required in a digital world. The main challenge is to motivate team members to work towards a common goal by communicating effectively with each other (Davies et al., 2011). The authors further argued that one of the most important qualities for a successful cooperation in a virtual environment is emotional intelligence that could enable team members to discern others' emotions and show appropriate reaction to them (ibid). In the context of globally dispersed and multi-cultural teams intercultural competence is deemed to be critical as well (Davies et al., 2011, p. 9). Frey & Osborne (2013, p. 34) believe the human and social perceptivity to be an important social competence. Supporting and taking care of others as well as showing empathy towards employees and customers will be increasingly important in the digital age.

#### **4.4 Digital self-competence**

Finally, digitalization has a direct impact on the personality, one's attitudes and behaviour. Employees are facing chances and risks of the digital transformation and are forced to adapt to changes at their workplace incurred by this transformation. They need to understand their role and the interaction with the new automated processes (vom Berg et al., 2010, p. 10). Life-long learning through self-reflection, self-management and the ability to find a proper work-life-balance is important (Lehmann & Wendt, 2001; Hammermann & Stettes 2016; Siemann, 2016).

The employees bear the responsibility for their impact on others and their employability (Eilers et al., 2017). As employees are likely to work remote and the

setting of their jobs becomes more project oriented it is critical that they should take over responsibility concerning their own employability. This involves being kept well informed of developments and trends in the labour market as well as continuous learning beyond their narrow field of expertise. The technological progression has also evolved in the way of learning. One should be open to new learning approaches and learning in groups. Employees need to be resilient, show high level of perseverance and adaptability (Z\_punkt The Foresight Company, Centre for Research in Futures and Innovation, 2014, p. 4). "That means people will need to be more adaptable and flexible in their career aspirations, ready to move on from areas that become subject to automation, and seize new opportunities where machines complement and augment human capabilities" (Brynjolfsson & McAfee, 2014, p. 203). Creating one's own differentiating but congruent "brand" in the real world and in the virtual space is essential in the context of employability but also in the context of employer branding: SMEs can benefit from positive employee self-images in the virtual space using them as immediate ambassadors for the enterprise.

Resilience, recovery skills, spontaneity and intuition as improvisational capabilities and disciplined flexibility, ability to learn and act quickly and judiciously as dynamic capabilities are required (Pavlou and El Sawy 2010). This can only happen when people are willing to embrace and accept change and be open to new ideas (Swiss Federal Council 2017, p. 30). Leaving the comfort zone and experimenting with new approaches requires creativity and out-of-the-box thinking (Neuburger, 2015, p. 10, (Pavlou and El Sawy 2010).). Lehmann & Wendt (2001, S. 219) use the term "innovation ability" while Herrmann (2017) calls it the "entrepreneurial spirit". According to Brynjolfsson & McAfee (2014, p. 191f.) creativity is one of the most important methodological competence since until today no machine has been invented that is as innovative and acts as entrepreneur as a human despite the progresses in Artificial Intelligence. Brynjolfsson & McAfee (2014, p. 191) elaborate on this idea: "Ideation in its many forms is an area today where humans have a comparative advantage over machines". And "Computers [...] are still machines for generating answers, not posing interesting new questions" (Brynjolfsson & McAfee, 2014, p. 192). Nevertheless, the authors still emphasise the need for humans to learn to co-work effectively with machines and robots (Brynjolfsson & McAfee, 2014, p. 193).

This literature review clearly suggests that digital competence comprise all four dimensions of competence with an increasing emphasis on the importance of self-competence. The implications for SME's and their HRD strategy could also be evidenced: there is a clear need to focus more the development of "T-shaped" careers (Demirkan and Spohrer (2015), referring to employees which have a generalist profile (broad) as well as a specialization in a specific field (narrow) resulting in a T or specializing generalist profile. The need for I-profiles (specialist) will not disappear but the need for broader understanding of the business context and an extensive soft skill set to communicate within DT environments as they are becoming increasingly complex is in rising demand. As to that, HRD professionals should design and develop training programmes for their employees to ensure that they are up-to-date in relation to their skillset. Thus, HRD professionals should remain sensitive to all changes performed within business environment to secure that they are ahead of competition.



## 5 Concluding remarks

The systematic review of literature on digital competences and skills has shown that the gap exists in literature regarding the exploration of digital competences in SMEs. As a result of the review there is a strong need to discuss the importance of digital competences within SMEs as they comprise more than 95 per cent of all organisations. This paper represents the first attempt to discuss the importance of digital competences for the human capital bearers working for SMEs. If SMEs want to prosper in the digital economic environment, there is a necessity to employ and develop digitally competent workforce.

We argue that there is a growing interest on examining the relationship between graduates' digital competence and the likelihood to be recruited by SMEs. It is important to evaluate whether promoting graduate digital competence can improve SMEs competitiveness. Having graduate underemployment became a real problem, many graduates are unable to utilise their knowledge and skills to their benefit. Therefore, there is a need for greater emphasis on setting learning outcomes to reflect a broader, ideological shift regarding the role of universities, increasingly perceived as serving 'market' or 'knowledge-based economy' (Boden & Nevada, 2010; Prokou, 2008). Recent changes in the socio-political environment ('Brexit', economic reforms, higher education changes and tax changes) reinforces the necessity to explore SMEs attitude towards graduate talent and the identification of 'good practices' that can be adopted to address the issues highlighted above. The study could prove vital to policy makers in order to review how SMEs are supported in the current digital economy. This includes changes in regional development policy, support mechanisms and higher education curriculum development. We need to go beyond the traditional skills based perspective like technical skills and assess how skills and competence are utilised in a digital environment, especially amongst SMEs. There is also a need to address call for undertake more rigorous research on digital competence (Spante et al., 2018).

Furthermore, research is nascent with regards to graduate digital competence within SMEs through a cross-national comparative evaluation. Thus, a comparison between the Swiss and the British case could provide critical insights into this relationship through the lens of 'different' national models in education and public policy. Exploring the Swiss approach to digital competence and SMEs decisions will shed some light into the future direction of the UK's approach to competence development outside the EU.

The review also shows that there is not an agreement on the meaning and context of digital competence. This shows the need to provide more clarity as to how digital competence can be developed and assessed in the workplace. Policy makers have highly engaged in the debate as to how policy, infrastructure and education can support organisations future capability development. Nevertheless, there is a need for a new framework that provides clarity on the key competences needed in a modern organisation, and most importantly how digital competences are related to competitiveness and performance. Organisational capability is core in sustaining their competitive advantage, hence digital competences might play a crucial role in support future success. Organisational

size, leadership, learning practices and location should be considered as part of any future study on digital competence.

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