LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

MESTRADO EM

GESTÃO DE SISTEMAS DE INFORMAÇÃO

TRABALHO FINAL DE MESTRADO

DISSERTAÇÃO

THE DIGITAL TRANSFORMATION INFLUENCE IN TODAY'S ORGANIZATIONS: A RESEARCH FOR THE COMPETENCIES NEEDED IN THE WORKPLACE

PATRICK FELIPI CURSINO FONSECA

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Simplicity is the ultimate sophistication.

- Leonardo da Vinci.

Acknowledgments

The writing of this thesis has been an exciting journey. During my master's degree at ISEG and in relation to this project, I met many remarkable people who taught me much about Information Systems, management, and inter-organizational cooperation. I would like to express my sincere gratitude to them and everyone who helped me arrives at my final destination – the successful completion of this dissertation. To all of them, I want to say a big thank you, however, I'd like to highlight some cases:

My adviser, Professor Doctor Winnie Picoto, for the opportunity and confidence deposited for the accomplishment of this work and for all the knowledge transmitted, support and guidance provided.

To my dear LG Electronics friends from São Paulo, who have encouraged me to take a risk and try a different and new life by leaving my old job and starting a master's degree in another country.

To my family, parents, and brother for all the affection, understanding and patience. My mom Deborah and my cousin Myrella my deep admiration for all the power and strength that you have shown me and our family in difficult times.

Last but not least to my friends in Brazil and Portugal, who with their friendship helped me to overcome this stage.

Thank you!
Patrick Fonseca

Lisbon,
October 1, 2019

Resumo

Parece ficção. Apenas parece. Devido aos recentes avanços tecnológicos, as organizações atualmente enfrentam grandes mudanças em seu trabalho, onde um produto pode não ser tecnologia, uma empresa talvez não venda um produto on-line, mas essa mesma empresa é conhecida, reconhecida, comunicada e julgada por meios tecnológicos.

É importante que as empresas possam conectar e satisfazer seus clientes por meio de experiências baseadas em software. É isso ou elas serão deixadas para trás. Para ajudar as organizações a repensar suas estratégias de acordo com o desenvolvimento de habilidades para responder aos desafios da atual transformação digital, onde a transição da organização digital não é um processo prosaico, este estudo pretende contribuir com a literatura existente e tem como objetivo identificar as competências digitais que são importantes no ambiente de trabalho das organizações de hoje.

A fim de fornecer uma visão geral atualizada do desafio da lacuna de competências digitais resultante da transformação digital, estruturar nossos conhecimentos existentes neste domínio, e para melhor compreender a relevância de cada uma das competências identificadas, decidiu-se colocá-las à disposição de um painel composto por 16 profissionais de forma a criar uma ordenação de acordo com o grau de importância.

Para este processo foi utilizado a metodologia de rankings Delphi, dividida em duas fases e com duas rondas. De acordo com os resultados obtidos as cinco competências digitais mais importantes são: (1) avaliação de dados, informações e conteúdo digital; (2) navegação, pesquisa e filtragem de dados, informações e conteúdo digital; (3) integração através de tecnologias digitais; (4) gestão de dados, informações e conteúdo digital; (5) colaboração através de tecnologias digitais.

Palavras chaves: Transformação digital, Competências Digitais, Metodologia Delphi.

Abstract

It seems fiction. Just seems. Due to recent technological advances, organizations currently face massive changes in their work, where a product may not be technology, a company may be not selling an online product, but this same company is known, recognized, communicated and judged through technical means.

It is important that companies be able to connect and satisfy their customers through software-based experiences. Is this or will they be left behind. In order to help organizations rethink their strategies according to the development of competencies to respond to the challenges of the current digital transformation, where the transition of the digital organization is not a prosaic process, this study intends to contribute the existing literature and aims to identify the digital competencies which are important in today's organization’s workplace environment.

In order to provide an up-to-date overview of the challenge of the digital competencies gap resulting from digital transformation, to structure our existing knowledge in this field, and to better understand the relevance of each of the identified competencies, it was decided to make them available to a panel of 16 professionals in order to create an ordering rank according to the degree of importance.

For this process was used the Delphi rankings methodology, divided into two phases and with two rounds. According to the results obtained the five most important digital competencies are: (1) evaluating data, information and digital content; (2) browsing, searching and filtering data, information and digital content; (3) interacting through digital technologies; (4) managing data, information and digital content; (5) collaborating through digital technologies.

Keywords: Digital Transformation, Digital Competencies, Delphi Methodology.

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Abbreviations

- AI – Artificial Intelligence
- BI – Business Intelligence
- DT – Digital Transformation
- ICT – Information and communication technologies
- IS – Information Systems
- IT – Information Technology
- IoT – Internet of Things
- RPA – Robot Process Automations
- SME – Small and Medium-sized Enterprises
- UX – User Experience

1. Introduction

1.1. The Motivation for the Research

Far beyond the aspects of our personal lives, technology is drastically influencing the business sectors. Having all your communication turned into the digital universe has become only the first step towards progress and contributes to a more complete saturation with information, integration of various areas of knowledge and faster decision-making (Moroz, 2018). The transformation of companies is no longer a question of "what if", but rather a question of "when it will happen".

Communication technology now has its direct channel, responsible for reading and translating the voice of the customer and directing the actions of every company. The digital age has brought countless advantages to consumers, especially the power to be heard (Vaz, 2013).

Technology has become the most powerful ally of companies, turning all processes into digital ones. Using it as a primary means of customer relationship is more closely linked to the way the company organizes itself and operates than the way it communicates. The brand is the digital experience that companies offer to their customer (Gardien et al., 2014). In this sense, according to a Walker study (2013), by the year 2020 customer experience will overtake price and product as the key brand differentiator. According to the same survey, 86% of shoppers will pay more to have a better experience, as a consequence, the modern world performs the so-called digital transformation (Moroz, 2018).

The result of implementing the digital transformation is the expansion of the scope of using information and communication technologies in the daily functioning of the organization (Moroz, 2018). However, the number of possible applications of digital services, types of software and their interaction with the user is so large that is necessary to consider professionals with the proper skills, not only soft, to deal with all those new digital tools, in this new digital era.

1.2. Research Aim and Objectives

Digital transformation will take place when organizations embrace the potential of social learning in the design and the process of delivering contents, problem-solving, knowledge sharing and user-generated content (Sousa & Rocha, 2018).

In light of this context, this research main focus is to promote organizations digital transformation by identifying the competencies required to help round out the human experience in digital environments.

The relevance of the study and theme to digital transformation will help organizations to rethink their strategies according to different sets of skills (not only soft) and roles to facilitate IT; fill the gap found in the existing literature; awareness among SMEs; and prepare students to the digital age.

Based on the aspects cited above and taking into account the relevance of these themes, it is expected to answer the following research question: **What are the digital competencies which are important in today's organization's workplace environment?**

The primary goal of this thesis is to contribute to the discussion of an effective digital transformation of organizations based on the latest trends of competencies. It is also intended to analyze and identify the perceptions of what are the most important digital competencies for a digital transformation to occur within an organization.

2. Literature review

2.1. The Digital Opportunity

Smartphones, tablets, computers, and the internet have become integral parts of this world (Müller & Hopf, 2017). According to Moroz (2018), the current state of civilization development and the process of transition to the digital economy is irreversible.

In order to transform a business and allow new channels to generate real value, companies need to rethink their actions and integrate digital into the core of your business, making it part of their DNA.

For this, it is important to be aware and to know how to interact perfectly with the drivers of the transformation (Gardien et al., 2014). And above all, act with speed (Transformação Digital, n.d.). The business needs to turn now, not in a few years.

2.1.1. The historical context of transformations

Due to the growing use of information and communication technologies, the dissemination of the Internet for many different purposes allowed the factors that create DT (Moroz, 2018). The process of digital transformation begins with a business evaluation strategy in a scenario dominated by uncertainties and requiring a focus on the challenges ahead.

As a design moves from one paradigm to another, its role changes with respect to the user, society, business, and manufacturing (Gardien et al., 2014). However, according to Transformação Digital (n.d.), the DT can be preceded by eras of Transformations:

1995 – IT era:

- Technology Drivers: Personal computer; Democratization of broadband.
- Proposal: Reduction of costs; Improved productivity.
- Digital Disruption: Music; Photography; Video rental.

2010 – Digital Marketing era:

- Technology Drivers: Social media; Web 2.0; Smartphones; HTML 5.
- Proposal: Social networks; Purchase online media.
- Digital Disruption: TV; Travels.

2.1.2. The digital revolution

While many companies continue to think in terms of a particular paradigm and to cling to their approach, society has already moved towards a new era (Gardien et al., 2014).

What once focused on the functionality of the application as the main metric for a successful technology, today is centered on a constantly evolving, user-focused experience and its opinions.

This is a revolution that is fundamentally altering the way we live, work and relate to one another, and will transform the way every business in every industry operates (Bourne, 2016). And according to Telegescu (2018), in order to survive and eventually thrive in a fast-paced environment, enterprises need to undergo a digital transformation.

Transformação Digital (n.d.), points the 2016 – Digital Transformation era as:

- Technology Drivers: Digital and automated processes; Cloud technology; Machine-Learning; IoT.
- Proposal: Creation of new marketing experiences; Creation of new products or services.
- Digital Disruption: Banks; Health; Cars industry; Retail; Education.

2.2. What is Digital Transformation?

"*With the turn of the 20th century, societies in advanced industrial economies developed a shared aspiration to modernize their lives through the acquisition of products that fulfill functional needs, automated many aspects of people's lives and provided pride of ownership*" (Gardien et al., 2014, p. 120).

According to Moroz (2018), the term "digital transformation" is not uniformly recognized in the literature. However, the phenomenon of digital transformation is seen as a disruptive change in the industry, which has various potentials for industrial enterprise (Müller & Hopf, 2017). More definitions of DT are presented in Annex I.

As described by Transformação Digital (n.d.), when addressing this theme, the essence of digital transformation basically consists of:

digitization → dematerialization → demonetization → democratization → disruption

In light of the acute portent of disruption, DT is not a massive adoption of new technologies, but a digital revolution in the business world. According to Telegescu (2018), the current society is in the middle of a new era of "industrial" revolution, but this time the output is not tangible, it's intangible – or digital.

Digital transformation is about embracing change – and accelerating it. New digital services from automation to the IoT, cloud services to shared applications, provide opportunities for efficiency and growth (Center for Creative Leadership, 2018). By understanding the connections between three main dimensions: (1) human; (2) technology; (3) organization, small ideas can grow big in a very short space of time.

2.2.1. Pillars of a digital transformation

As Müller & Hopf (2017), describes, the horizontal and vertical integration of business and technological process in and between companies represent the basis for the digital transformation. This means that a hierarchical and rigid structure will not resist the dynamism of digitization (Transformação Digital, n.d.).

Also, in this sense, it is expected to say that digital transformation goes far beyond marketing. The MIT Center of Digital Business & Capgemini (2011), address this problematic by describing that DT is based on three pillars (present in Annex II):

I. Operational Process

Companies historically have used automation to make processes more efficient and scalable (MIT Center of Digital Business & Capgemini, 2011). ERP, for instance, has enabled significant efficiency and quality gains in core processes.

Digital transformation has technology as the center of its process and applies in all areas of the enterprises, where new technologies are extending this trend of gaining benefits beyond efficiency. Concepts of agile methodologies, working anywhere anytime are widely used, aiming at the adoption of automation on many activities in the intangible value chain; collecting, processing and using large data sets, which reduce costs and time (Moroz, 2018). But for these operations to become valuable, Telegescu (2018), raises the fact that the real changes must happen first in the mindset of the company.

II. Customer Experience

According to Müller & Hopf (2017), if companies, humans, and machines work together, the result offered consists of a better product, the most appropriate interaction channel or even serve more efficiently.

It is necessary to deeply understand the profile of the customer to offer what will make the experience with the brand pleasant. "*The human being with his cognitive abilities is the key element for the digital transformation*" (Müller & Hopf, 2017, p. 1496).

III. Business model

In the economic sense, the use of information and communication technologies generates a number of benefits, such as a more profitable business model (Moroz, 2018). It's now necessary to think about the different channels where customers are on, how best to prospect them, what tools they can use to optimize their performance, in order to accelerate productivity (Transformação Digital, n.d.).

In addition to the digital business model, there is also the possibility of creating new online businesses (Transformação Digital, n.d.). Companies are introducing digital products that complement traditional products (MIT Center of Digital Business & Capgemini, 2011). A simple example is the newspapers, which had only the product printed a few years ago and now has the digital version for marketing.

2.2.2. The stages of digital maturity

There is no easy way to pass through digital transformation. Without human-centered input, direction, or best practices, companies can be led astray. (Solis & Szymanski, 2016). According to Transformação Digital (n.d.), the organization's performance is directly linked to its level of digital maturity.

In a Digital Future Executive Summary from Dell Technologies in 2016, 15% of all respondents do not have a digital plan, limited initiatives, and investments in place. 34% of all respondents are gradually embracing digital transformation and planning for the future. And only 5% of all respondents have a digital transformation in the DNA of their business.

Addressing this emergent topic, Solis & Szymanski (2016), organized Six Stages of Digital Transformation reflecting the state and progress of an organization in motion:

1. **Business as Usual:** Organizations operate with a legacy perspective of customers, processes, and technology, believing that it remains the solution to digital relevance;
2. **Present and Active:** Experimentation are driving digital literacy and creativity, aiming to improve and amplify specific touchpoints and processes;
3. **Formalized:** Initiatives become bolder, and as a result, change agents seek executive support for new resources and technology;
4. **Strategic:** Individual groups recognize the strength in collaboration as their research, work, and shared insights contribute to new strategic roadmaps;
5. **Converged:** A dedicated digital transformation team forms to guide strategy and operations based on business and customer-centric goals;
6. **Innovative and Adaptive:** Digital transformation becomes a way of business as executives and strategists recognize that change is constant.

By contrast, the MIT Center of Digital Business & Capgemini (2011), also propose a maturity digital model, but as a classic 2x2, highlighting four different types of approaches to driving digital transformation which is presented in Annex III and IV.

2.3. Critical Factors to Consider

In such a digitized environment, agility, speed, adaptability, and innovation through disruption are key attributes for enterprises to be effective and efficient in order to achieve organizational goals (Telegescu, 2018).

2.3.1. Who should lead the digital agenda?

As referred by Solis & Szymanski (2016) to address this problem: "*the path to transformation is most often shaped by the person or group leading the effort, which can limit the implementation of a holistic, persistent, and meaningful enterprise-wide*

transformation" (p. 6). The Center for Creative Leadership (2018), reinforces this idea stating that there is a very mixed approach for digital leadership when it comes to engaging and inspiring teams to achieve the company vision. It's time to lead the way.

2.3.2. Challenges on the road to transformation

The pressures to transform are coming from every direction, from customers, competitors, the board and heads of department. According to Bourne (2016), on average only 23% of IT budgets will be tied to digital transformation efforts over the next three years.

Bourne (2016) and Moroz (2018), points out that the top barriers to progress are: Insufficient funding; Lack of executive support and lack of willingness to take risks; **Inadequate expertise and skills**; Lack of vision and strategy; Data privacy and security concerns.

Just as IT has to evolve and adapt to new needs, every industry must focus its efforts on creating agile processes, mutant and digital business models. In this regard, Solis & Szymanski (2016), states that the: Governance and Leadership; Data and Analytics; People and Operations; Technology integration; **Talent teams and skills** are key elements that support overarching organizational competency to provide a better experience for the end-user.

2.4. Skills for the Workplace

The experience offered to customers must be dynamic and continuous (Müller, E., Hopf, H., 2017). Digital is entering companies to move static processes, slowness, and lack of knowledge of its consumer. The information happens to live (Transformação Digital, n.d.). And that is the heart of the Digital transformation process, as shown in Figure 1.

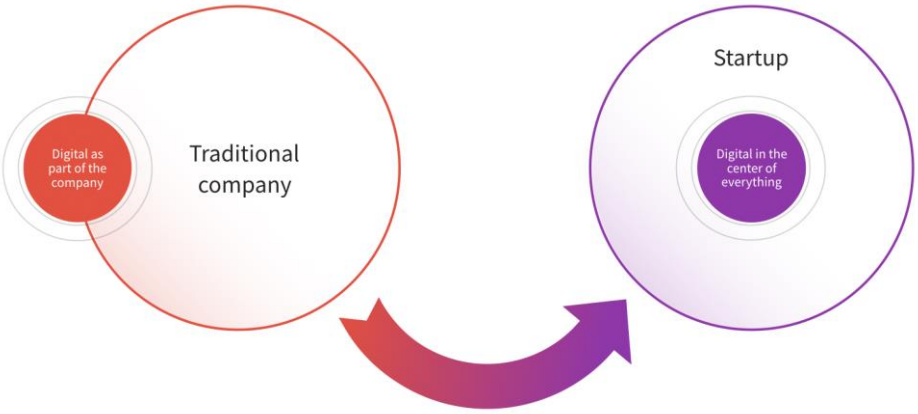


Figure 1 - Digital Transformation Process

(Source: Adapted from Transformação Digital, n.d.)

It becomes clear that new technologies are the basis of digital transformation (Müller & Hopf, 2017). However, technology is just one requirement. The most important one belongs to humans, with abilities and skills that help organizations to rethink their strategies to respond to the challenges of DT.

According to the Center for Creative Leadership (2018), once organizations have built their digital transformation strategy, they need to identify those who are able to own and implement these changes within their teams.

2.4.1. New trends in skills development context

Historically, the word skill has been used to refer to individuals' characteristics (Sousa & Rocha, 2018). However, new concepts about skills development are becoming perceived as a strategic management tool to cope with the current business environment (Kyllonen, 2013).

Telegescu (2018), define new technologies, like AI, IoT, Augmented & Virtual reality, quantum computing, blockchain technologies and RPAs irreversibly and materially changing the business landscape at a pace never before seen. For the workplace, the need to fill technical roles are likely ignoring some medium digital" skills and even other competencies required to round out their digital transformations.

This problematic and complexity, partly due to the globalization and the accelerated rhythm of above technologies, demand more and more human resources with suitable skills that help the organizations to overcome the appearing challenges of digital transformation and build a better user experience (Sousa & Rocha, 2018).

Skills for organizations digital transformation (Annex V) are becoming emerged in the market and the perceived impacts of new technologies are being integrated into organizations and in people lives, as:

- Organizations can enrich the roles of employees;
- Creation of new products and services with higher quality;
- Changes in the way organizations structure themselves;
- Greater flexibility and short delivery time for products to the market;
- And new challenges in employment and educations.

2.4.2. The digital talent gap

While a top-level support for digital transformation is important, it is often not enough. According to a CIO study on March 1st of 2018, companies are struggling to hire staff with skills who can help shape the user experience around digital services.

Paul Daugherty, CTO, and Chief Innovation Officer at Accenture wrote in his book Human + Machine: Reimagining Work in the Age of AI (2018), that companies require a rethinking of how to leverage people and technology. In this regard, the author addresses that, in five years, we won't be worried about coders, but the lack of people with soft skills (Annex VI). We are short of people who can understand the human experience.

Another 2017 survey of 753 employees and 501 executives conducted by Capgemini and LinkedIn points out that 55% of organizations acknowledge that the digital talent gap is widening.

From the perspective of digital transformation, the MIT Center of Digital Business & Capgemini (2011), sees emerging technologies are another area where skills may be scarce internally. For instance, Fujitsu Future Insights (2018), address that the biggest overall challenge is the lack of skilled staff. Even with seven years of difference, both reports reinforce the importance of qualified skills in the organization environment.

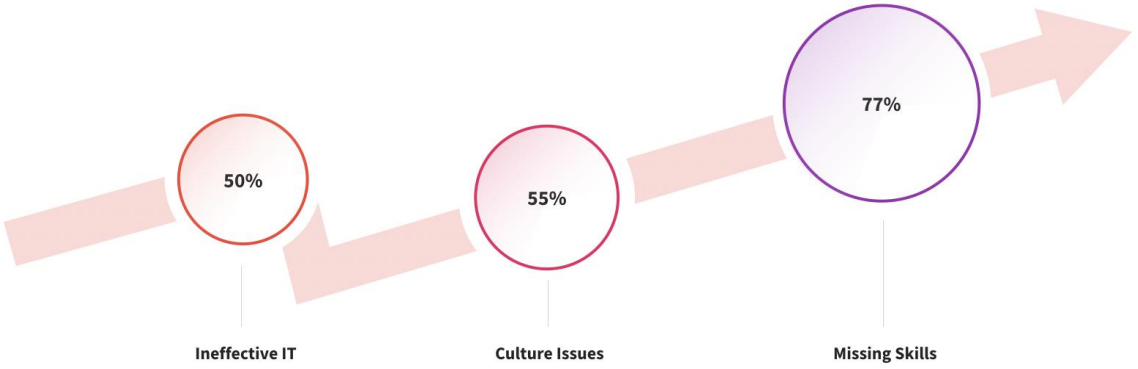


Figure 2 - Organizational gaps in digital transformation

(Source: Adapted from MIT Center of Digital Business & Capgemini, 2011)

As raised, digital has transformed organizations, and this change as brought about new circumstances in which many organizations struggle to cope, Figure 2 clearly shows that the basic barriers (gaps) to the implementation of digital transformation do not result from technological, but organizational, cultural and human resources skills aspects. To reinforce this topic, Moroz (2018), states that it is worth to pay attention to these aspects when preparing for the digital transition plan and strategy.

2.4.3. Digital competencies

Although the very word *skill* may suggest the concept is the same as competencies, they are different. Resuming, competencies or "capabilities" are perceived by the authors Johnson, Scholes, & Whittington, 2008, as complex bundles of skills and accumulated knowledge, exercised through the organizational process, that enables organizations to coordinate activities and make use of their assets.

Going in the same direction as this concept of digital competencies, in one hand, Buvat et al., (2017) refer a list of digital roles (Annex VII) that have been created as a result of digital transformation activities within an organization or the emergence of disruptive technologies. And on the other hand, according to Boulton (2018), hiring enough full-stack developers, Web managers, robotics specialists and other roles required to facilitate digital transformations remain tall tasks for CIOs.

However, the talent gap is not limited to those with only technical skills, organizations are also struggling to find and hire employees with competencies who can help build a better UX in this new digital era. (Boulton, 2018).

2.4.4. Digital Learning

In order to obtain such competencies, an alignment between an individual's competency development and innovation processes in the organization should exist (Schuchmann & Seufert, 2015). Based on these assumptions:

- Employees: are required to learn continuously and reflexive in their daily working processes;
- Organization: needs to enable and implement innovations by providing learning and innovation-oriented conditions involve designing an adequate strategy.

A few authors understand the corporate capability for learning connected to its capability for coping with a complex phenomenon linked with many different interpretations in the existing literature. For instance, Sousa & Rocha (2018), define digital learning as a planned process when organizations create specific courses related to activities and procedures performed by employees.

According to Schuchmann & Seufert (2015), the relevance of the organizations' development capability also requires fostering the employees' self-organization for learning as well as for working terms which claims for implementation of new organizational forms, leadership modes, and management systems.

2.5 The Digital Competence Reference Model

In this paper, it is proposed the interpretation of what are the digital competencies which are important in today's organization's workplace environment, once the broadly understood digitalization of personal, social and economic life is constantly increasing its scope (Moroz, 2018). For this component of the study were analyzed scientific articles, books, content of different types, among them press releases, online articles, and news.

Given the current interest in digital transformation, little has been written so far on digital competencies related to organizations workplace. Therefore, it is relevant to elaborate a study on this subject. These competencies were identified according to the European Digital Competence Framework for Citizens, also known as DigComp. "*DigComp was first published in 2013 and has become a reference for many digital competence initiatives at both European and Member State levels.*" (Vuorikari et al., 2016, p. 02). This *Digital Competence Framework for Citizens* is composed of four dimensions as shown in below Figure 3:

Dimension 1:	**Areas** identified to be part of the digital competence
Dimension 2:	**Competence descriptors and titles** that are pertinent to each area
Dimension 3:	**Levels of proficiency** for each competence
Dimension 4:	**Examples of the knowledge, skills and attitudes** applicable to each competence

Figure 3 - Main dimensions of DigComp 2.0.

(Source: Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G., 2016, p. 6)

The present study will focus only on Dimensions 1 and 2, highlighted in gray in Figure 3 above. Those two dimensions compose the called *conceptual reference model* (more details of both Dimensions on Annex IX).

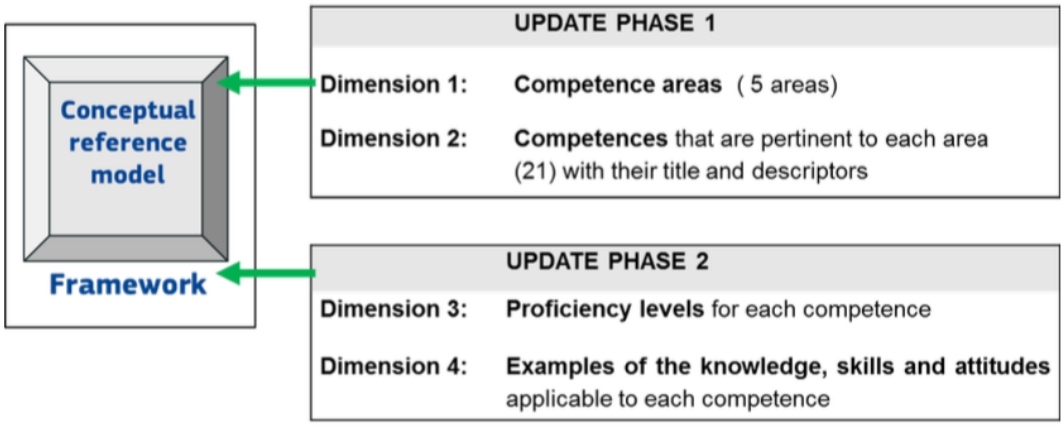


Figure 4 - The two-phase process to update the DigComp Framework

(Source: Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G., 2016, p. 6)

Vuorikari et al. (2016) state that "*boosting digital skills is one of the European Commission's priorities*" (p.3). This can be reverted in helping with self-evaluation, setting learning goals, identifying training opportunities and facilitating job search for younger workers and for the workers that are in the market for years but need to be updated. This idea is reinforced by Buvat et al., (2017), when referred that "*47% percentage of Gen Y and Gen Z employees who consider their skill set is redundant or will be redundant in the next four to five years*" (p.11).

The same authors of the Framework, propose and introduce the interpretation of a first phase (Figure 4) presenting the DigComp conceptual reference model with its 21 competencies descriptors divided into five competencies areas (Vuorikari et al., 2016).

The first competency area concentrates its efforts on gettering information and data literacy. The second competency area has the aim to communicate and collaborate through digital technologies while being aware of cultural diversity (Vuorikari et al., 2016). The third competency area focuses on improving and integrating information and content while understanding how copyright can influence this. Safety is the fourth competency area that allows being aware of the impact of digital technologies and their use. Last but not least, the use of digital tools to innovate processes and products is the fifth competency area.

3. Methodology

The main research question in this study is "what are the digital competencies which are important in today's organization's workplace environment?". Following the collection of key digital competencies based on the literature review, this research proposes a qualitative exploratory study and a methodological approach of Delphi rankings (Schmidt, 1997), to better understand the topic under study.

3.1. Delphi method

The Delphi method was first used by Dalkey & Helmer (1963), in their work for the RAND Corporation in a U.S. sponsored military project, when they sought a technique to obtaining consensus from a group of experts reliably (Okoli & Pawloski, 2004). The Delphi method is based on rounds of questions and a group decision-making process, from the iterative feedback, where the opinions of a panel of experts are evidenced and a consensus is reached (Deng et al., 2013).

In this sense, the primary goal of the Delphi method is to build consensus and consistency of opinion from a group of experts regarding an area of interest or inquiry (Hasson, Keeney & McKenna, 2000). Currently, the Delphi method is used widely in studies related to health care, communications, public relations, education, and scientific disciplines (Deng et al., 2013).

The classification of the Delphi method does not have a specific work scheme, however, Marques & Freitas (2018), proposes to divide this methodology into three distinct phases (Figure 3). The first phase focuses on the selection of the group of experts, and construction of the questionnaire 1. First contact with the experts and invitation to participate in the research. Submission of questionnaire 1 and receipt of the replies to the questionnaire 1. The second phase performs a qualitative and quantitative analysis of responses. Construction and sending of questionnaire 2 with feedback. Receipt of the answers to the questionnaire 2 and its analysis. In the third phase the submission of the following rounds of questionnaires, interspersed with the respective analyzes. Finally, the end of the process and writing the final report.

To use this methodology, it is necessary to take into account four important aspects (Rowe and Wright, 1999): (1) **The anonymity of Delphi participants**: allows the participants to freely express their opinions without undue social pressures to conform to others in the group. Decisions are evaluated on their merit, rather than who has proposed the idea; (2) **Iteration**: allows the participants to refine their views in light of the progress of the group's work from round to round; (3) **Controlled feedback**: informs the participants of the other participant's perspectives and provides the opportunity for Delphi participants to clarify or change their views; (4) **Statistical aggregation of group response**: allows for quantitative analysis and interpretation of data.

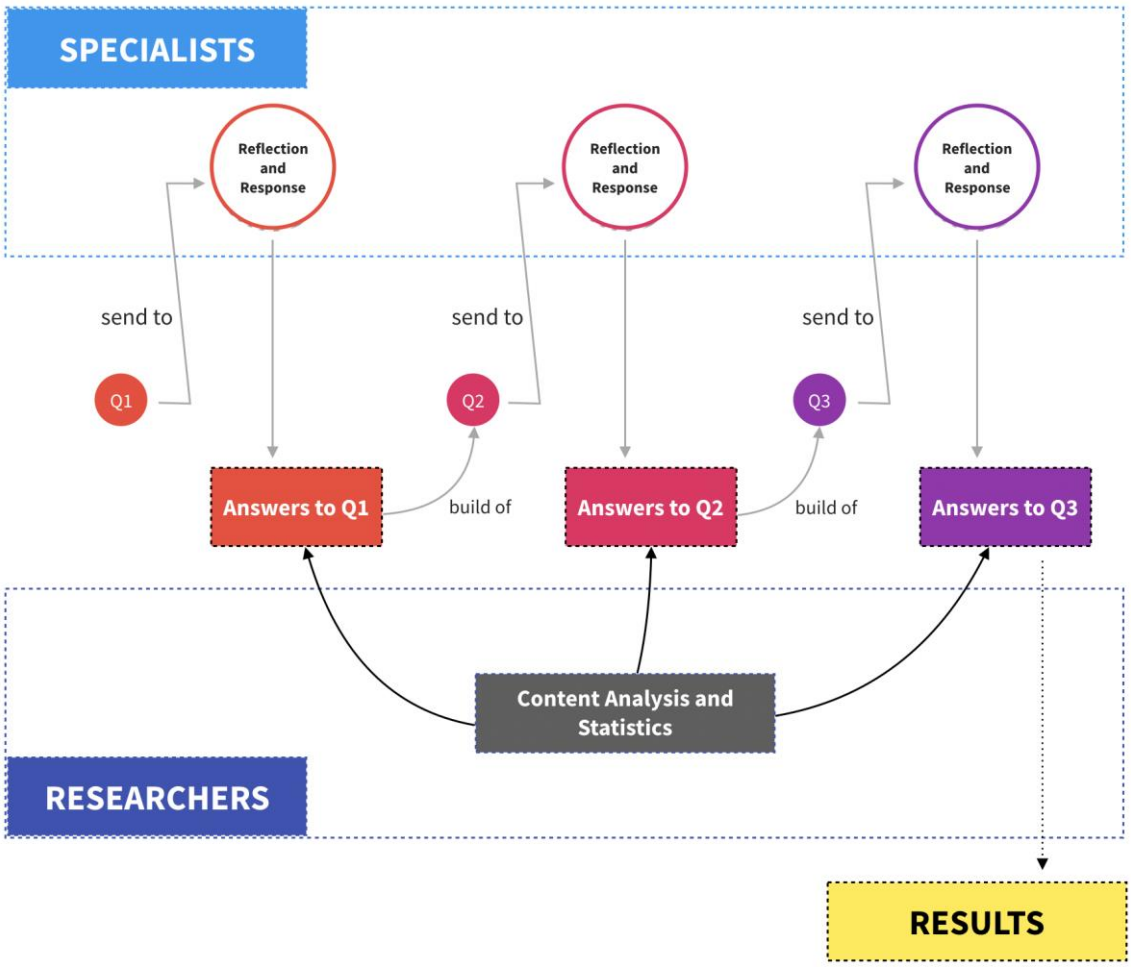


Figure 5 - Generic scheme of Delphi implementation method with three rounds

(Source: Adapted from Marques & Freitas, 2018)

To measure the consensus, the coefficient of agreement of Kendall W is used. This coefficient allows to determine realistically if consensus was reached; whether consensus increased or decreased between rounds; and the relative strength of consensus. This method is most popular largely because of its simplicity of application. Schmidt (1997), proposes the following interpretation of the values of Kendall W:

W	Interpretation	Confidence in Ranks
0,1	Very weak agreement	None
0,3	Weak agreement	Low
0,5	Moderate agreement	Fair
0,7	Strong agreement	High
0,9	Unusually strong agreement	Very high

Table 1 - Kendall W Values

(Source: Adapted from Schmidt, 1997, p. 767)

After each round, it is necessary to consider whether a new round can garner greater consensus. It is essential, however, to take into account the feasibility and potential gain of a new round. When Kendall's W is small this decision is easier to take. However, when there is moderate consensus it becomes more difficult to weigh the advantages and disadvantages.

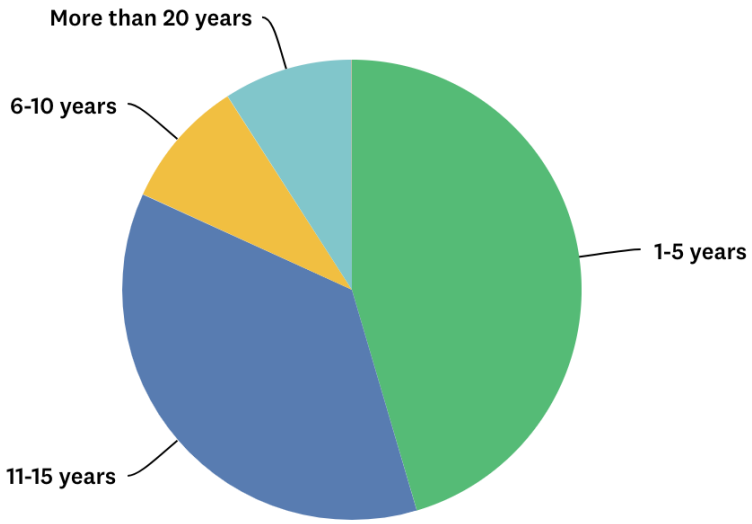
To evaluate the correlation of opinions between rounds, the correlation coefficient of the ranking order of Spearman rho will be used since this emphasizes the magnitude of difference between the positions of the items in the ranking (Schmidt, 1997). The values of this test vary between -1 and 1, and the closer to the value 1, the greater the convergence of opinions between rounds. On the other hand, the value -1, indicates that there is no understanding in the ordinations between rounds (Kalaian & Kasim, 2012).

4. Results

4.1. First phase

The first phase focuses on gathering information about the subject experts and selecting the list items to formulate the questionnaire (Marques & Freitas, 2018). According to Okoli & Pawloski (2004), the ideal size of the panel is ten to eighteen people and a maximum of four panels can be applied at one time. The constitution of the panel was aimed at choosing professionals who are knowledgeable about the theme understudy and was also based on the same authors. The identification of these professionals was made through direct contacts using the American business and employment-oriented

service, LinkedIn. The panel consists of eight professionals assigned to digital transformations projects and activities, four business intelligence consultants, two project managers, one mobile specialist developer, and a senior software developer. Regarding the characterization of the panel according to gender, from the total experts, 3 were a woman and 13 men.



ANSWER CHOICES	RESPONSES
1-5 years	45.45%
11-15 years	36.36%
6-10 years	9.09%
More than 20 years	9.09%
16-20 years	0.00%

Table 2 - Average years of experience in the IS/IT sector

It is important to mention that all panel experts were contacted through LinkedIn in advance to explaining the methodology and objectives to ensure participation in this study (Deng et al., 2013). And related to the experts' location: 8 from Portugal; 3 from France; 2 from Sweden; 1 from the UK; 1 from the Netherlands; and the last expert from Brazil.

In this sense, the characterization of the panel according to the types of IS projects in which they were already involved, presented by the following table, shows the experience and relevance of the constituents for the study:

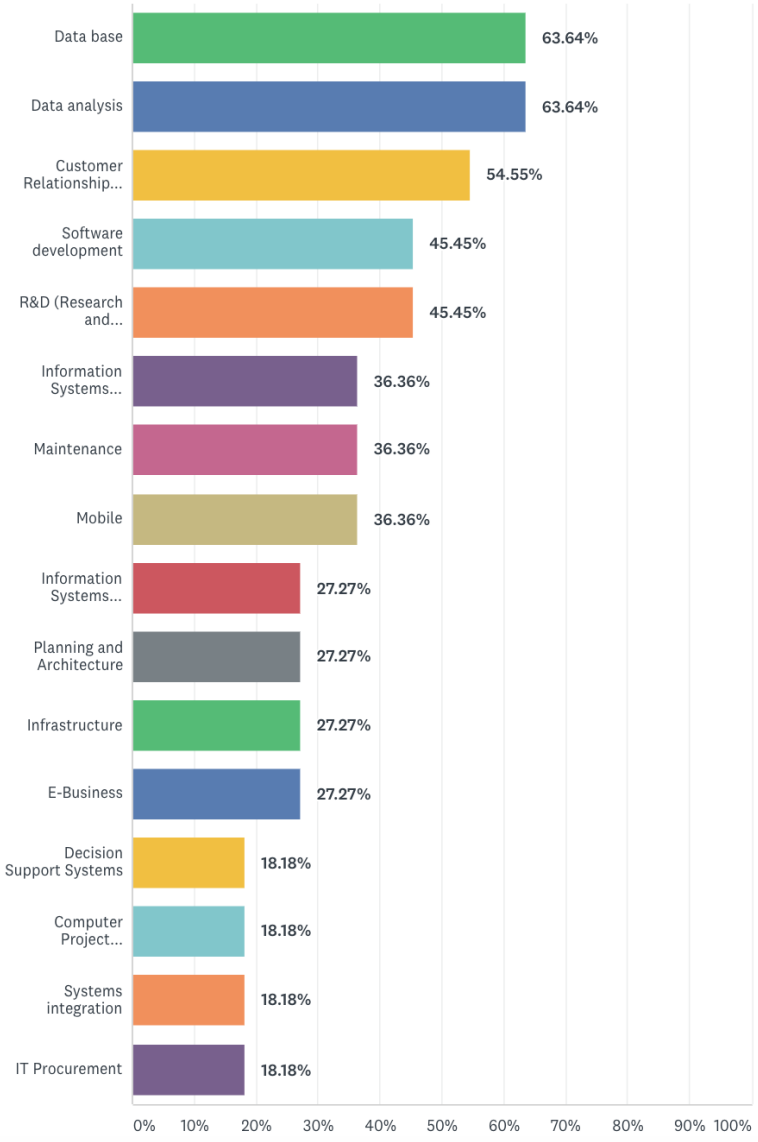


Table 3 - IS projects the experts have been involved

4.1.1. First phase – Questionnaire

According to Schmidt (1997), at this phase, it is indicated a list with a maximum of 10 to 20 items to be reached. For the present study, was chosen to identify the main issue from the literature review. Consequently the 21-competencies list was chosen without specifying their competency area because it appeared to be a satisfactory amount, according to three important aspects of the Delphi rankings identified by Hasson, Keeney & McKenna (2000): account should be taken of the time available for the study; whether the researcher has indicated the Delphi sequence with one broad question or with a list of questions, and consideration of levels of experts fatigue.

For the rounds, it was decided to perform one to three at most because according to Hasson, Keeney & McKenna (2000), this is the ideal number. In turn, for each round, the target response rate should be at least 70%, since this is a suggested rate by the same authors for the study to become relevant.

Regarding the level of consensus, for this study, was adopted the value proposed by Hasson, Keeney & McKenna (2000), of Kendall W equal to 0,5 representing the high agreement. However, if this value is not reached but the iterations result in similar Kendall W values, Schmidt (1997) argues that the process should be brought to an end. On the other hand, the value of the Spearman correlation coefficient between rounds is intended to be as close as possible to 1.

In this phase, a specific feature of the surveys designed in the online tool SurveyMonkey (https://www.surveymonkey.com/) was used, which allows creating rankings (present in Annex X). The survey was also sent to the study professor adviser before being sent to the panel for errors to be detected and corrected. After that, the panel was then invited to rank the 21st competencies, placing first the most important and the 21º as the least important.

4.1.2. First phase – First Round

The first round began on July 23, 2019, and ended on July 30, 2019. The total response rate was 73%, once on questionnaire 1 from 5 questions, one was not mandatory. At this phase, was used also the GNU PSPP for data processing which is a program for statistical analysis of sampled data. It is free as in freedom replacement for the proprietary program SPSS and appears very similar to it with a few exceptions, but for this study purposes, the tool handles the solutions needed. For the input of the data in this tool, the competencies were ordered alphabetically as shown in Annex XI.

4.2. Second phase

Subsequent the analysis of the first round, the Kendall W value obtained is 0,280 which indicates a weak agreement. The following table shows the results:

Ranking	Competencies	Score
1º	*Evaluating data, information and digital content*	25,07
2º	*Browsing, searching and filtering data, information and digital content*	24,33
3º	*Interacting through digital technologies*	23,20
4º	*Managing data, information and digital content*	22,73
5º	*Collaborating through digital technologies*	21,73
6º	*Sharing through digital technologies*	20,33
7º	*Identifying needs and technological responses*	20,27
8º	*Protecting personal data and privacy*	20,20
9º	*Creatively using digital technologies*	20,20
10º	*Managing digital identity*	19,07
11º	*Solving technical problems*	19,00
12º	*Identifying digital competence gaps*	18,60
13º	*Engaging in citizenship through digital technologies*	18,40
14º	*Programming*	17,87
15º	*Protecting health and well-being*	17,53
16º	*Developing digital content*	17,00
17º	*Protecting devices*	15,67
18º	*Integrating and re-elaborating digital content*	15,60
19º	*Protecting the environment*	14,67
20º	*Netiquette*	13,80
21º	*Copyright and licenses*	13,73

Table 4 - Ordering of competences after the first round

The statistical data of this first round can be verified in Annex XII. In order to complement the richness of the present study, it was also asked two more questions to the experts in this round, related to the competencies they had just ranked. And those questions are (1) If there is another competency or competencies that weren't in the previous list, which would be?; (2) Describe an important project you've worked on, and if you would apply any of the first-page competencies.

For the first question, the experts pointed competencies like *Link between AI and common technological assets*; *Digital Strategy*; *Digital Planning of Activities throughout the team*; *Data analysis (Business Intelligence)*; and *Culture, Artificial Intelligence, Communication, Prototyping*.

Making a relation with the IS projects which the experts have been involved, for the second question, it is possible to notice that from the competencies presented to them seems that many of them would be or were applied. In a "*project on Health Inequalities; I applied several of the mentioned competencies.*". Related to databases and BI an expert answered for example "*on all my BI projects I've applied many of those competencies.*"; and another that "*we've been through several database related projects where a strong sense of data analysis and data manipulation was crucial to the success of the projects.*".

According to an expert who provided more details, he points out that "*I've worked in an important project to collect user data following EU, US and Brazilian rules of personal data protection to create reports to guide the development of new products and support planning team to create an accurate forecast of sell-in/sell-out. To develop this project, I applied or would apply following competencies: 1- Evaluating data, information and digital content 2- Protecting personal data and privacy 3- Managing data, information and digital content 4- Browsing, searching and filtering data, information and digital content.*". Is relevant to notice that three of the four competencies mentioned by the expert are in the top 5 of the rank resulted from the first round.

From new technologies perspective listed by the experts in the previous question, the competencies were applied in "*preventive maintenance with drones, computer vision and image processing with Machine Learning algorithms.*"; and in a "*portal da rastreabilidade do tabaco - cloud website for registering tobacco selling merchants and suppliers*".

To end, two experts draw attention to the fact that "*I'm applying most of them in a current project, on a digital transformation program. Don't forget Culture and People. Digital Transformation is not about Technology. Check some HBR posts and articles.*". And in "*any project I worked on, I used the first competency, being user first and understanding the needs and the tech response! All the rest is so generic and depends on your role.*".

4.2.1. Second phase – Second Round

Given the value of Kendall's W resulted from the first round, it was decided to run another round. The second round (questionnaire two in Annex XIII) began on August 12th, 2019 and ended on August 18th, 2019. The results of the previous round were shared with all experts (this time the competencies order in the questionnaire weren't random as in the first round, but instead, it was presented as the competencies order resulted from the first round) and indicated that the aim of running another round would be to increase the consensus among the experts. The response rate was completed at 100% as only one mandatory question was applied and is important to mention that the experts who answer the second round were the same from the first round.

The Kendall's W value obtained was 0,910 which indicates an unusually strong agreement. In Annex XIV it is possible to check the descriptive statistics information of this round. Spearman rho value found is 0,997 indicating a high convergence of opinions between rounds among all experts in the panel. Once the PSPP program only provides a Bivariate (Pearson) Correlation, it was calculated the Spearman rho value in the Excel and compared the results. The outputs can be seen on Annex XV and XVI.

After this round, it was decided to terminate the data collection, which consequently means that the third-phase proposed by Marques & Freitas (2018) in the Generic scheme of implementation of the Delphi method with three rounds won't be necessary. This decision took into account three factors in the literature that justifies stopping the rounds: (1) Hasson, Keeney & McKenna (2000) indicates that either two or three rounds are preferred; (2) one statistical criterion for potential gain that can be used as stopping rules is a strong consensus, which was seen after analyzing round two results

(Schmidt, 1997); (3) Finally, Kalaian & Kasim (2012) state that if the Spearman rho correlation value is close to 1, it is an indicator that there is already a strong convergence in opinion between rounds, and this will make it difficult to increase the degree of agreement Kendall's W. The final ranking of competences is as follows:

Ranking	**Competencies**	**Score**
1º	*Evaluating data, information and digital content*	19,81
2º	*Browsing, searching and filtering data, information and digital content*	19,06
3º	*Interacting through digital technologies*	18,50
4º	*Managing data, information and digital content*	18,00
5º	*Collaborating through digital technologies*	17,06
6º	*Sharing through digital technologies*	15,44
7º	*Protecting personal data and privacy*	15,19
8º	*Identifying needs and technological responses*	14,94
9º	*Creatively using digital technologies*	13,44
10º	*Managing digital identity*	12,69
11º	*Solving technical problems*	10,50
12º	*Identifying digital competence gaps*	9,94
13º	*Engaging in citizenship through digital technologies*	8,94
14º	*Programming*	7,19
15º	*Protecting health and well-being*	7,06
16º	*Developing digital content*	6,31
17º	*Protecting devices*	5,38
18º	*Integrating and re-elaborating digital content*	4,06
19º	*Protecting the environment*	3,94
20º	*Copyright and licenses*	1,88
21º	*Netiquette*	1,69

Table 5 - Ordering of competences after the second round

5. Analysis and Discussion of Results

After data collection, it was possible to verify that the panel formed by professionals with knowledge of the subject under study registered an unusually strong agreement in the opinions regarding the ranking. It is also important to emphasize that only one expert fully agreed with the order resulted from the first survey round scores (from all 16 interviewed). Given these values of agreement, the study may become an important support material to digital transformation, which still does not seem to gather much information on the topic of digital competencies which are important in today's organization's workplace environment. As Vuorikari et al. (2016) states, in the digital transformation, most companies face the strategic challenge of upgrading quickly both the specific ICT skills and the transversal digital competence of their workforce.

Also noteworthy is the strong convergence of opinions between the two rounds. In fact, as presented in Table 7, it was observed that there were no changes in the positions of the first five competencies, only four competencies from the total were changed after the second round. This maybe could happen due to the fact that by using the Delphi methodology allow the experts could check the competencies rank order resulted from the first round with their scores and after re-think their first ideas to change or not the perceptions of the most important competencies.

Taking into consideration the five top competencies resulted from this study, it is possible to notice that they are part of Competency Areas Dimensions 1 and 2 of the European Digital Competence Framework for Citizens, respectively: Information and data literacy; Communication and collaboration.

It is thus evident, the importance of evaluating data, information and digital content. This competency in both rounds it was in 1st place. In fact, to Moroz (2018), this new digital era requires citizens to gain a new level of skills appropriate for the current context, which can be divided into "*skills allowing the user to determine when information is needed and to search, evaluate and use information from various sources*"; and "*skills in using a computer and other electronic devices, using the Internet and various types of applications and software, as well as creating digital content*" (p.70).

Order Round 1 vs Round 2		
Ranking	Round 1	Round 2
1º	COMP7	COMP7
2º	COMP1	COMP1
3º	COMP11	COMP11
4º	COMP12	COMP12
5º	COMP2	COMP2
6º	COMP20	COMP20
7º	COMP9	COMP18
8º	COMP18	COMP9
9º	COMP4	COMP4
10º	COMP13	COMP13
11º	COMP21	COMP21
12º	COMP8	COMP8
13º	COMP6	COMP6
14º	COMP15	COMP15
15º	COMP17	COMP17
16º	COMP5	COMP5
17º	COMP16	COMP16
18º	COMP10	COMP10
19º	COMP19	COMP19
20º	COMP14	COMP3
21º	COMP3	COMP14

Table 6 - Order Round 1 vs Round 2

The second position in both rounds was held by the competency "Browsing, searching and filtering data, information and digital content". According to the own Vuorikari et al. (2016), this competency is linked to search for data, information, and content in digital environments, to access them and to navigate between them. Telegescu (2018), complements when describing that "*IoT technologies can increase workplace productivity by 'filtering' out relevant and personalized information, from sensors relevant only to the recipient of the information, thus contributing to tailored data streams.*" (p.961).

"Interacting through digital technologies" was third in both rounds. MIT Center of Digital Business & Capgemini (2011), exposes that this will help develop new ways of interacting and selling products to the customer via new technologies and self-service areas.

The fourth position was occupied by competency “Managing data, information and digital content”. A Digital Future Executive Summary from Dell Technologies in 2016, shows that businesses are starting to make purposeful, data-driven technology choices. Information technology not only influences where and when employees work but also how they work due to increased support through machines and information technology. Big data and tools for visualizing them increase control over work processes and allow for more informed decision making (Telegescu, 2018).

In the last place of the top 5 is “Collaborating through digital technologies”. Moroz (2018), indicates that immediate and very cheap communication, exchange of knowledge and ideas are the main factors triggering the digital transformation. The Center for Creative Leadership (2018), address also the idea that ease of use and networked connectivity are essential to true digital transformation. According to the same study, 39% of organizations interviewed agree that they are already using digital to improve the efficiency of employees and expand a network of collaborators, with only 6% strongly disagreeing.

Apart from the top 5, becomes important to see the four competencies from the total that were changed after the second round. The only Competency Area Dimension of the European Digital Competence Framework for Citizens, that does not make part of these four competencies is the Information and data literacy.

Seventh place in the final round was held by “Protecting personal data and privacy”. This way, this competency went up one position. From the Competency Area Dimension of Safety, a Digital Future Executive Summary from Dell Technologies in 2016, address this problematic by stating that one of the top barriers to DT progress is the data privacy and security concerns. To reinforce this idea, a 2017 survey of 753 employees and 501 executives conducted by Capgemini and LinkedIn points that from top 10 digital roles of the next 2–3 years the first position is regarding Information security/Privacy consultant.

The “Identifying needs and technological responses” competency came down one position, ranking 8th in the final ranking. From the Competency Area Dimension of Problem solving, data literacy has become more necessary thanks to new information

visualization tools and larger amounts of data available. As well, important updates relate to accessibility and social inclusion (Vuorikari et al., 2016).

"Copyright and licenses" and "Netiquette" were the other two competencies that were changed after the second round. The "Copyright and licenses" went up one position, and "Netiquette" in turn went down a position in the standings. For both competencies, it is important to mention that they occupy the two competencies less important in the whole rank, being positions 20th and 21st respectively.

From the Competency Area Dimension of Digital content creation, the "Copyright and licenses" competency focus on the understand how copyright and licenses apply to data, information and digital content (Vuorikari et al., 2016). According to the same paper, in order to a better comprehension of this competency, a conceptual illustration of it can be as shown in Figure 4 below.

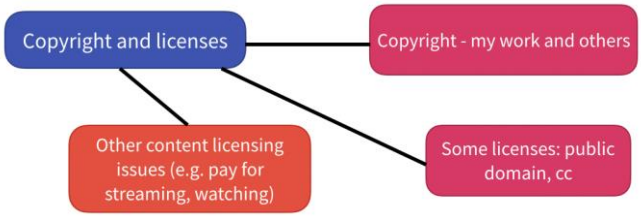


Figure 6 - Copyright and licenses conceptual illustration

From the Competency Area Dimension of Communication and collaboration, the "Netiquette" competency has the aim of being aware of behavioral norms and know-how while adapting communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments (Vuorikari et al., 2016). According to the same paper, in order to a better comprehension of this competency, a conceptual illustration of it can be as shown in Figure 5 below.

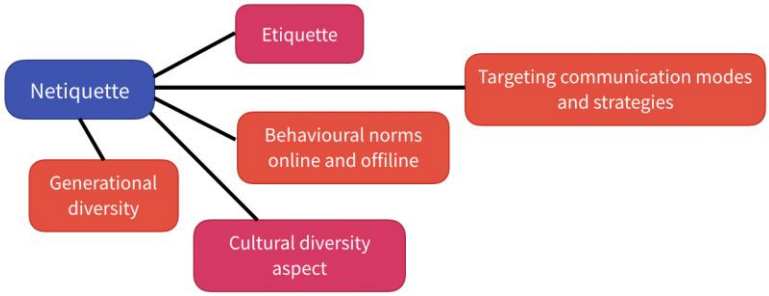


Figure 7 - Netiquette conceptual illustration

6. Conclusions

Although digital transformation is a global business movement that uses technology to radically improve the performance or reach of enterprises, technology alone isn’t the solution. The present study aimed to identify and rank according to their degree of importance, the digital competencies which are important in today's organization's workplace environment. The big motivation in choosing this theme is the growth of the phenomenon of digital transformation, and due to accelerated rhythm of new technologies is currently everywhere – across all industries, across economies, across organizations, and in their business processes. In addition, this particular topic of digital competencies is a theme still little studied, and according to Moroz (2018), the knowledge when and how to launch initiatives or the notion that new digital skills are needed is perceived as a secondary layer.

Due to the unusually strong agreement in the last round, this empirical study shows that the ordering of the five competencies considered to be the most important presented a great coherence through Spearman's correlation coefficient since they occupied exactly the same places in both rounds. In this case, the top five competencies considered to be the most important by the expert's panel, which allow responding to the research question for the present study are: (1) evaluating data, information and digital content; (2) browsing, searching and filtering data, information and digital content; (3) interacting through digital technologies; (4) managing data, information and digital content; (5) collaborating through digital technologies.

Thus, it can be concluded that the study reflects the view of the Vuorikari et al. (2016) when they claim that the knowledge is for everyone to have the key set of competencies needed for personal development, social inclusion, active citizenship, and employment. The strategic concern is also needed to adapt processes and organizational structures to meet changing demands and be able to derive value from change. Organizations and decision-makers need to address considerable challenges if they are to capture the full potential of digital competencies.

The major limitation of the present study was the number of experts willing to help and answer the research, which directly influences the fact that only one panel could be constructed and not others at the same time. This may reflect not so well-founded opinions present in the panel, about a subject still little studied. While more experts would allow other panels to run in parallel, and responses could be compared not only between experts but also between different panels. It was also taken into account the panel fatigue relative to the study. This was reflected by the increase in reminders sent in the 2nd round requesting panel participation again in the survey.

However, the study may provide a basis for workers as well as for future research. It would be interesting to understand and compare the differences between the most important digital competencies important in the workplace environment to extract value from digital transformation and to derive value from structured data.

From the results obtained it could still be beneficial to dive more deeply into Dimensions 3 and 4 of the European Digital Competence Framework for Citizens, and also to try to develop a new framework, with the aim of ensuring that the digital competencies identified in the study are realized and which metrics to measure success. Especially when it comes to SMEs where resources are not always available, a framework could streamline processes by putting in place effective results already studied.

Finally, it would be important to understand how the digital transformation is being approached in Portugal and to understand if the digital competencies present in the study differ greatly from those that the reality of Portuguese workplace organizations identifies as being the most important to extract value from digital transformation.

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APPENDIX

Annex I – Definitions of digital transformation

Author	Definition
N.K. Hanna	"Deep structural changes in the economy and society brought about by harnessing the full potential of the ICT revolution" (p.61)
M. Bracken	"Applying the culture, practices, processes and technologies of the Internet era to respond to people's raised expectations" (p.61)
J. Christensen	"The way in which organizations perceive and manage their assets, as products and services are enhanced with digital capabilities that increase their value" (p.61)
D.M. Mazzone	"The deliberate an ongoing digital evolution of a company, business model, idea, process or methodology; both strategically and tactically" (p.61)
L. Herbert	"A company's ability to react and successfully utilize new technologies and procedures – now and in the future" (p.61)

Table 7 - Definitions of digital transformation

Adapted from Moroz (2018)
(*Source*: Hanna, 2016; Bracken, 2016; Christensen, 2016; Mazzone, 2014; Herbert, 2017)

Annex II – Building blocks of the digital transformation

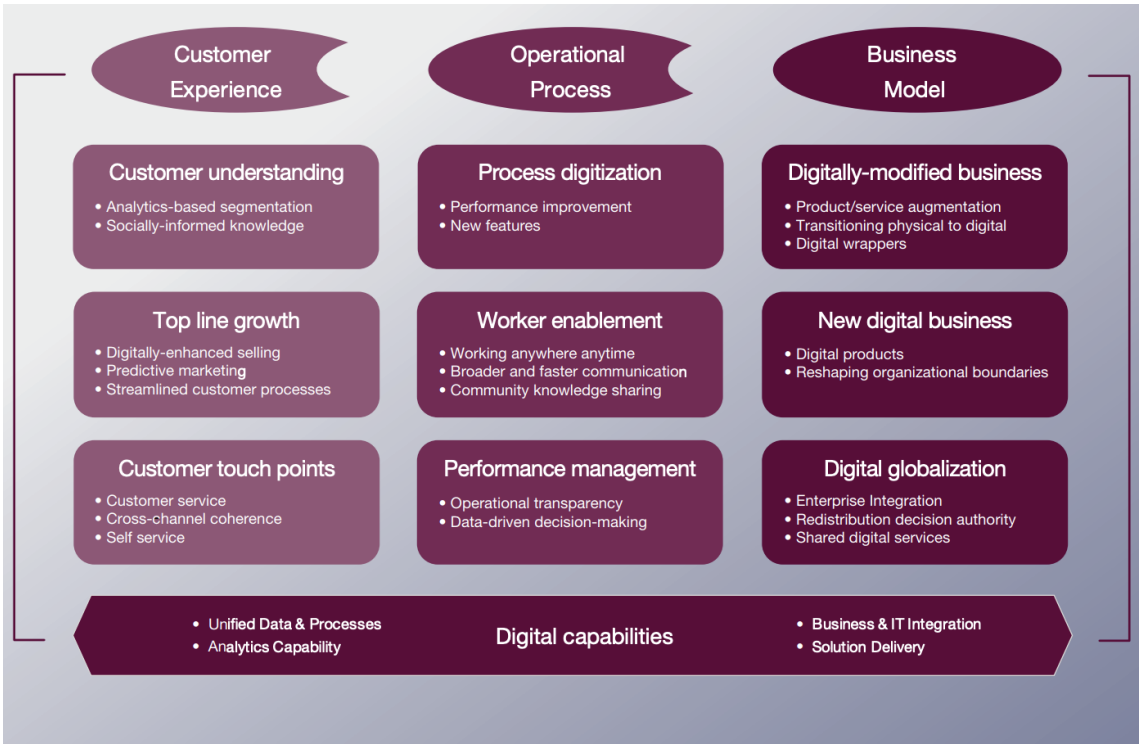

Figure 8 - Blocks of the digital transformation

Annex III – Digital maturity matrix

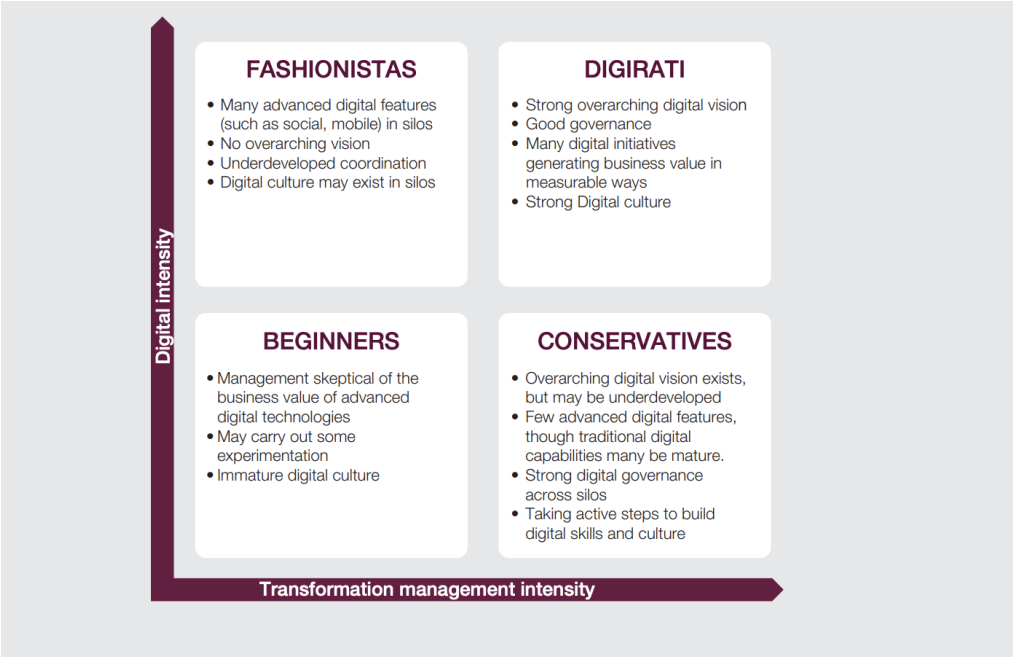

Figure 9 - Digital maturity matrix

Annex IV – Distribution of digital maturity

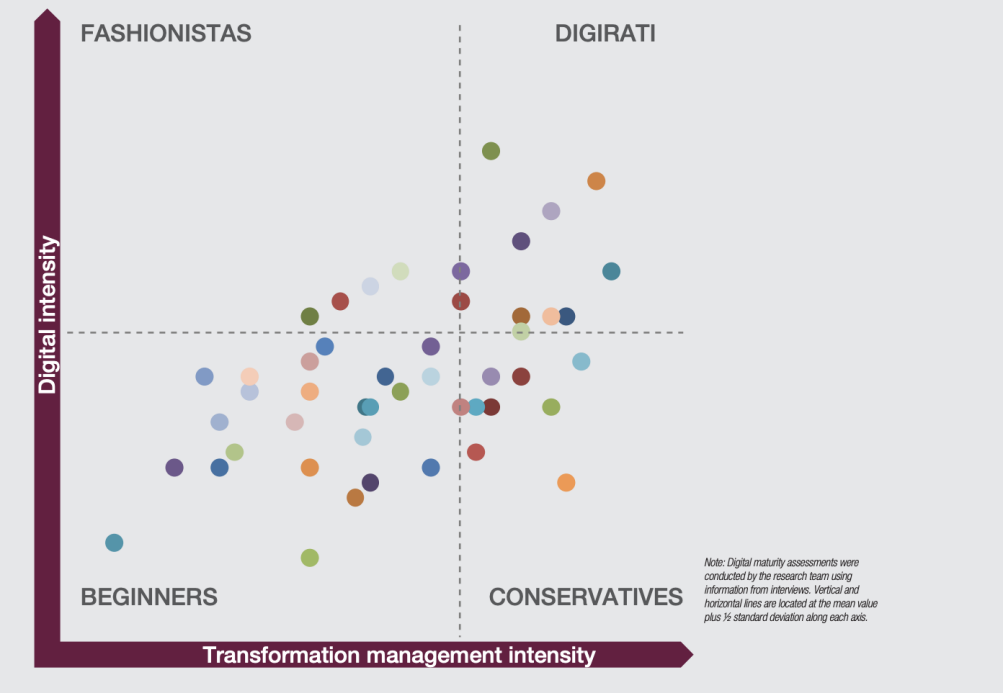

Figure 10 - Distribution of digital maturity

Annex V – Hard digital skills

Hard Digital Skills	Definition
Agile	A time-boxed, iterative approach to development that divides a product or program into short phases of work, which is then tested early and often throughout the development lifecycle
Analytics	The systematic approach to transforming data into actionable insights to make data-driven decisions
Artificial intelligence	Software that enables computers to reproduce or surpass tasks that would require intelligence if human workers were performing them
Augmented reality	A live view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory inputs
Automation	Application of machines/computers to tasks in order to increase efficiency and reliability
Behavioral sciences	Combines knowledge of sociology, psychology, and anthropology with strong observation, research, and communication skills to examine human behavior and decision-making
Big data	Technology that enables the handling of massive amounts of structured and unstructured data (that cannot be handled by traditional database technologies) as well as their storage and analysis for better insights and decision-making
Cloud computing	The practice of using a network of remote servers hosted on the internet to store, manage, and process data rather than a local server or a personal computer
Community management	The process of creating or altering an existing social media community through content, messaging, interaction, moderating, etc. in an effort to make the community stronger
Cybersecurity	The protection of information systems from theft of/damage to the hardware, the software, or the information they contain
Data science	Field which employs statistics and computation to derive meaningful algorithms and business insights from data
Digital manufacturing	The use of an integrated, computer-based system comprised of simulation, three-dimensional (3D) visualization, analytics, and various collaboration tools to create product and manufacturing processes simultaneously
Search engine optimization (SEO)	The process of maximizing the number of visitors to a website by ensuring that the site figures high on the list of results returned by a search engine
Innovation strategy	Creating new products, services, and customer experiences in an effort to drive sustainable growth
Master data management	Ensuring the uniformity, accuracy, stewardship, consistency, and accountability of the enterprise's official shared master data assets
Mobile application design and development	The ability to create experiences end-to-end (conceptualize, design, build, test, run) for any device
Robotics	Technology dealing with the design and development of robots and the computer systems for their processing

Table 8 - Hard digital skills

(*Source*: Buvat, J., Slatter, M., Pasquet, L., Crummenerl, C., Puttur, K. R., As, V. J. (2017))

Hard Digital Skills	Definition
Robotic process automation	Automation in which a software robot is configured to manipulate existing application software in the same way a person works with those systems and the presentation layer to perform a specific task
Internet of things (IoT)	A network of physical objects (e.g., devices, vehicles, buildings) embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data
User experience design	The process of development and improvement of quality interaction between a user and all facets of a company across research, testing, development, content, and prototyping
User interface design	The practice of transferring a brand's strengths and visual assets to a product's interface to enhance the user's experience and visually guide the user through an interface via interactive elements across platforms
Virtual reality	A computer technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment in a way that allows the user to interact with it, artificially creating a sensory experience
Video content marketing	The marketing technique of creating and distributing valuable, relevant, and consistent video content to attract and acquire a clearly defined audience
Web development	Coding or programming that enables website functionality as per the owner's requirements and mainly deals with the non-design aspect of building websites

Table 9 - Hard digital skills part 2

(*Source*: Buvat, J., Slatter, M., Pasquet, L., Crummenerl, C., Puttur, K. R., As, V. J. (2017))

Annex VI – Soft digital skills

Soft Digital Skills	Definition
Change management	Helping an organization transform itself by focusing on organizational effectiveness, improvement, and development
Collaboration	Processes that help multiple people or groups interact and share information to achieve common goals
Comfort with ambiguity	Feeling comfortable and confident in acting within an environment of uncertainty or constant change and having higher risk tolerance
Customer-centricity	Committing to a top tier level of service to the customer and considering the customer experience above all
Entrepreneurial mindset	State of mind which orientates human conduct towards entrepreneurial activities and outcomes; drawn to opportunities, innovation, and new value creation and able to take calculated risks and accept the realities of change and uncertainty
Data-driven decision making	Using data and insights to develop a theory, testing the theory in practice to determine its validity, and making business decisions
Organizational dexterity	Flexibility to perform varied roles, actions, or activities with skill and grace and the ability to transition between roles, actions, and activities quickly and effectively
Passion for learning	A deeply ingrained enthusiasm for seeking out and acquiring new information and knowledge, often across a variety of fields and topics

Table 10 - Soft digital skills

(*Source*: Buvat, J., Slatter, M., Pasquet, L., Crummenerl, C., Puttur, K. R., As, V. J. (2017))

Annex VII – Digital Role

Digital Role	Definition
Automation/Robotics engineer	Researches, designs, develops, or tests robotic applications
Behavioral scientist	Studies how the actions of people affect their development, their relationship with others, and their future behaviors (also known as social scientists or sociologists)
Chief analytics officer/ Chief data officer	Executive overseeing the data function/capability
Chief customer officer	Executive responsible for the customer relationship to provide a single vision across all customer interaction points
Chief digital officer/Chief digital information officer	Executive charged with helping a business transform its traditional information technology policies and practices
Chief internet of things officer	Executive overseeing the IoT function/capability
Crowd funding specialist	Designs, launches, runs, and promotes campaigns for gathering small amounts of capital from a large number of individuals to finance a business venture
Data architect	Designs, creates, deploys, and manages an organization's data architecture (e.g., defines how the data will be stored, consumed, integrated, and managed by different data entities and IT systems)
Data engineer	Gathers and collects data, stores and processes it, and provides it in a ready-to-use format to data scientists and analysts
Data scientist	Performs statistical analysis, data mining, and retrieval processes on a large amount of data to identify trends, figures, and other relevant information
Digital project manager	Responsible for managing online/digital projects from concept to completion within budget; involves, planning, delegating, tracking, reviewing, and measuring results using online project management, collaboration, and cloud storage software
Digital solution architect	Develops solutions based on predefined processes, guidelines, and best practices with the objective that the developed solution fit within the enterprise architecture in terms of information architecture, system portfolios, and integration requirements
Drone designers	Uses engineering and technical skills to design and build unmanned aerial systems (UAS)
Drone operators	Uses engineering and technical skills to operate unmanned aerial systems (UAS)
Enterprise architect	Works closely with stakeholders, including management and subject matter experts (SME), to develop a view of an organization's strategy, information, processes, and IT assets and is responsible for using this knowledge to ensure IT and business alignment
Full stack developer	Leverages IoT and hardware-engineering skills to work on front-end and back-end software and hardware technologies
Growth hacker	Merges the principles of marketing and engineering to create more accurate marketing strategies; Note, the term hacking indicates a use of logic processes and technology toward a specific goal (e.g. customer retention and sales) rather than illegal or aggressive behavior toward networks and IT systems
Head of automation	Leadership position overseeing the automation function
Head of robotics	Leadership position overseeing the robotics function
Information security/Privacy consultant	Understands key security and privacy issues, risks, exposures, and vulnerabilities to manage and safeguard digital information
Integration architect	Responsible for "breaking down silos" and helping different software programs communicate and for using application programming interfaces (APIs), middleware, and cloud to cobble together workable architectures that successfully integrate their many parts
Personal web manager	Creates and manages online personas and protects client's privacy and reputation
Technology architect	Plans and designs information technology solutions and services (e.g. architect software, hardware, network) that give the best results to the business

Table 11 - Digital Role

(*Source*: Buvat, J., Slatter, M., Pasquet, L., Crummenerl, C., Puttur, K. R., As, V. J. (2017))

Annex VIII – Levels of organizational learning

Global Level	• Connect the organization to its environment; • Motivate actors to share the same vision.
Organizational Level	• Ensure to take learning impulses into account; • Ensure to generate, use and share knowledge.
Team Level	• Afford collaboration and "learning to learn".
Individual Level	• Encourage the actors for trial, asking questions and discussions; • Afford continuous learning (create learning infrastructures and appropriate working conditions); • Foster employees' intrinsic motivation.

Table 12 - Levels of organizational learning

Adapted from Schumann & Seufert (2015)
(*Source*: Schumann, D., Seufert, S., 2015)

Annex IX – The DigComp conceptual reference model details

Competence areas Dimension 1	Competences Dimension 2
1. Information and data literacy	**1.1 Browsing, searching and filtering data, information and digital content** To articulate information needs, to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies. **1.2 Evaluating data, information and digital content** To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content. To analyse, interpret and critically evaluate the data, information and digital content. **1.3 Managing data, information and digital content** To organise, store and retrieve data, information and content in digital environments. To organise and process them in a structured environment.
2. Communication and collaboration	**2.1 Interacting through digital technologies** To interact through a variety of digital technologies and to understand appropriate digital communication means for a given context. **2.2 Sharing through digital technologies** To share data, information and digital content with others through appropriate digital technologies. To act as an intermediary, to know about referencing and attribution practices. **2.3 Engaging in citizenship through digital technologies** To participate in society through the use of public and private digital services. To seek opportunities for self-empowerment and for participatory citizenship through appropriate digital technologies. **2.4 Collaborating through digital technologies** To use digital tools and technologies for collaborative processes, and for co-construction and co-creation of resources and knowledge. **2.5 Netiquette** To be aware of behavioural norms and know-how while using digital technologies and interacting in digital environments. To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments. **2.6 Managing digital identity** To create and manage one or multiple digital identities, to be able to protect one's own reputation, to deal with the data that one produces through several digital tools, environments and services.

Figure 11 - DigComp conceptual reference model details (part. 1)

(*Source*: Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G. (2016))

3. Digital content creation	**3.1 Developing digital content** To create and edit digital content in different formats, to express oneself through digital means. **3.2 Integrating and re-elaborating digital content** To modify, refine, improve and integrate information and content into an existing body of knowledge to create new, original and relevant content and knowledge. **3.3 Copyright and licences** To understand how copyright and licences apply to data, information and digital content. **3.4 Programming** To plan and develop a sequence of understandable instructions for a computing system to solve a given problem or perform a specific task.
4. Safety	**4.1 Protecting devices** To protect devices and digital content, and to understand risks and threats in digital environments. To know about safety and security measures and to have due regard to reliability and privacy. **4.2 Protecting personal data and privacy** To protect personal data and privacy in digital environments. To understand how to use and share personally identifiable information while being able to protect oneself and others from damages. To understand that digital services use a "Privacy policy" to inform how personal data is used. **4.3 Protecting health and well-being** To be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies. To be able to protect oneself and others from possible dangers in digital environments (e.g. cyber bullying). To be aware of digital technologies for social well-being and social inclusion. **4.4 Protecting the environment** To be aware of the environmental impact of digital technologies and their use.
5. Problem solving	**5.1 Solving technical problems** To identify technical problems when operating devices and using digital environments, and to solve them (from trouble-shooting to solving more complex problems). **5.2 Identifying needs and technological responses** To assess needs and to identify, evaluate, select and use digital tools and possible technological responses to solve them. To adjust and customise digital environments to personal needs (e.g. accessibility). **5.3 Creatively using digital technologies** To use digital tools and technologies to create knowledge and to innovate processes and products. To engage individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments. **5.4 Identifying digital competence gaps** To understand where one's own digital competence needs to be improved or updated. To be able to support others with their digital competence development. To seek opportunities for self-development and to keep up-to-date with the digital evolution.

Figure 12 - DigComp conceptual reference model details (part. 2)

(*Source*: Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G. (2016))

Annex X – SurveyMonkey questionnaire round one

Figure 13 - SurveyMonkey questionnaire round one

(*Source*: Own elaboration)

Annex XI – Alphabetical ordering of competencies

Variable	Competencies description
COMP1	*Browsing, searching and filtering data, information and digital content*
COMP2	*Collaborating through digital technologies*
COMP3	*Copyright and licenses*
COMP4	*Creatively using digital technologies*
COMP5	*Developing digital content*
COMP6	*Engaging in citizenship through digital technologies*
COMP7	*Evaluating data, information and digital content*
COMP8	*Identifying digital competence gaps*
COMP9	*Identifying needs and technological responses*
COMP10	*Integrating and re-elaborating digital content*
COMP11	*Interacting through digital technologies*
COMP12	*Managing data, information and digital content*
COMP13	*Managing digital identity*
COMP14	*Netiquette*
COMP15	*Programming*
COMP16	*Protecting devices*
COMP17	*Protecting health and well-being*
COMP18	*Protecting personal data and privacy*
COMP19	*Protecting the environment*
COMP20	*Sharing through digital technologies*
COMP21	*Solving technical problems*

Figure 14 - Alphabetical ordering of competencies

(*Source*: Own elaboration)

Annex XII – Round one statistics data

Variable	*N*	*Mean*	*Std Dev*	*Minimum*	*Maximum*
COMP1	15	5,67	3,54	1,00	12,00
COMP2	15	8,27	4,74	1,00	19,00
COMP3	15	16,27	3,08	10,00	21,00
COMP4	15	9,80	6,27	2,00	20,00
COMP5	15	13,00	3,57	6,00	21,00
COMP6	15	11,60	4,90	4,00	20,00
COMP7	15	4,93	3,24	1,00	11,00
COMP8	15	11,40	6,78	1,00	21,00
COMP9	15	9,73	7,66	1,00	21,00
COMP10	15	14,40	4,00	9,00	21,00
COMP11	15	6,80	4,96	1,00	17,00
COMP12	15	7,27	5,34	1,00	20,00
COMP13	15	10,93	4,68	5,00	20,00
COMP14	15	16,20	4,57	7,00	21,00
COMP15	15	12,13	6,55	1,00	21,00
COMP16	15	14,33	3,94	6,00	19,00
COMP17	15	12,47	6,67	1,00	21,00
COMP18	15	9,80	5,77	1,00	18,00
COMP19	15	15,33	5,56	3,00	20,00
COMP20	15	9,67	6,29	2,00	21,00
COMP21	15	11,00	6,38	2,00	21,00

Table 13 - Round one statistics data

Adapted from PSPP

Test Statistics	
N	15
Kendall's W	,28
Chi-Square	83,67
df	20
Asymp. Sig.	,000

Table 14 - Kendall W coefficient result in first round

Adapted from PSPP

Annex XIII – SurveyMonkey questionnaire round two

Figure 15 - SurveyMonkey questionnaire round two

(*Source*: Own elaboration)

Annex XIV – Round two statistics data

Variable	*N*	*Mean*	*Std Dev*	*Minimum*	*Maximum*
COMP1	16	2,94	1,57	1,00	6,00
COMP2	16	4,94	1,34	2,00	7,00
COMP3	16	20,13	1,63	15,00	21,00
COMP4	16	8,56	1,50	4,00	10,00
COMP5	16	15,69	,87	13,00	17,00
COMP6	16	13,06	1,61	10,00	18,00
COMP7	16	2,19	2,56	1,00	11,00
COMP8	16	12,06	1,91	9,00	18,00
COMP9	16	7,06	2,17	1,00	12,00
COMP10	16	17,94	,44	17,00	19,00
COMP11	16	3,50	1,37	1,00	6,00
COMP12	16	4,00	1,32	2,00	7,00
COMP13	16	9,31	2,52	3,00	13,00
COMP14	16	20,31	,48	20,00	21,00
COMP15	16	14,81	2,48	10,00	20,00
COMP16	16	16,63	,81	14,00	17,00
COMP17	16	14,94	2,17	11,00	20,00
COMP18	16	6,81	3,12	1,00	12,00
COMP19	16	18,06	2,49	10,00	21,00
COMP20	16	6,56	1,90	3,00	12,00
COMP21	16	11,50	1,41	9,00	15,00

Table 15 - Round two statistics data

Adapted from PSPP

Test Statistics	
N	16
Kendall's W	,91
Chi-Square	292,35
df	20
Asymp. Sig.	,000

Table 16 - Kendall W coefficient result in second round

Adapted from PSPP

Annex XV – PSPP Bivariate Correlation results

Correlations			
		Round 1	Round 2
Round 1	*Pearson Correlation*	1,00	,97
	Sig. (2-tailed)		,000
	N	21	21
Round 2	*Pearson Correlation*	,97	1,00
	Sig. (2-tailed)	,000	
	N	21	21

Table 17 - PSPP Bivariate Correlation results

Adapted from PSPP

Annex XVI – Spearman rho correlation coefficient result in Excel

Variavel	Competencie	Round_1	Round_2	Rank_1	Rank_2	d	d2
COMP1	Browsing, searching and filtering data, information and digital content	24.33	19.06	2	2	0	0
COMP2	Collaborating through digital technologies	21.73	17.06	5	5	0	0
COMP3	Copyright and licenses	13.73	1.88	21	20	1	1
COMP4	Creatively using digital technologies	20.20	13.44	9	9	0	0
COMP5	Developing digital content	17.00	6.31	16	16	0	0
COMP6	Engaging in citizenship through digital technologies	18.40	8.94	13	13	0	0
COMP7	Evaluating data, information and digital content	25.07	19.81	1	1	0	0
COMP8	Identifying digital competence gaps	18.60	9.94	12	12	0	0
COMP9	Identifying needs and technological responses	20.27	14.94	7	8	-1	1
COMP10	Integrating and re-elaborating digital content	15.60	4.06	18	18	0	0
COMP11	Interacting through digital technologies	23.20	18.50	3	3	0	0
COMP12	Managing data, information and digital content	22.73	18.00	4	4	0	0
COMP13	Managing digital identity	19.07	12.69	10	10	0	0
COMP14	Netiquette	13.80	1.69	20	21	-1	1
COMP15	Programming	18.87	7.19	14	14	0	0
COMP16	Protecting devices	15.67	5.38	17	17	0	0
COMP17	Protecting health and well-being	17.53	7.06	15	15	0	0
COMP18	Protecting personal data and privacy	20.20	15.19	8	7	1	1
COMP19	Protecting the environment	14.67	3.94	19	19	0	0
COMP20	Sharing through digital technologies	20.33	15.44	6	6	0	0
COMP21	Solving technical problems	19.00	10.50	11	11	0	0
					SUM d2 =		4
	Spearman correlation (CORREL function)	0,997402597					
	Spearman correlation (tradicional formula)	0,997402597					

Table 18 - Spearman rho correlation coefficient result in Excel

(*Source*: Own elaboration)