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EXECUTIVE SUMMARY OF THE THESIS

A framework to measure competences for digital transformation in the public sector: evidence from a pilot survey in Italy

TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

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1. Introduction

Digital transformation is not a novelty anymore, but many of its impacts have not been assessed yet, particularly regarding Public Administration (PA). Several elements hinder the digitalization of the public sector, and one of the preeminent is the shortage of digital competences among public employees.

2. Literature review

Digital transformation is “A fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders.” (Cheng Gong & Vincent Ribiere, 2021). The effective implementation of digital transformation of public administrations will lead to outstanding advantages that may be summarized in increasing

employee productivity; decreasing decision-making time; creating new work opportunities; minimizing the time needed for providing public services. The process to achieve these benefits is not linear, instead, some major problems slow down, and sometimes grind to a halt, its implementation. The major one is the lack of qualified personnel, in particular regarding digital competences (Belyakova, 2021; Casalino et al., 2020). These competences are important not only for digital transformation but also for the implementation of eGovernment, which means using ICT and the internet as tools to achieve better governments (OECD, 2003). These are some of the reasons why digital competences are relevant, it is, therefore, important to define them. Possibly the most complete definition of digital competences is: “The set of *knowledge, skills, attitudes, abilities, strategies* and *awareness* that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly,

ethically, reflectively for work, leisure, participation, learning and socializing” (European Commission, 2012). During the last few years, research on this theme has increased and new elements have emerged. Nevertheless, my literature review on this topic highlights two main results: first, the frameworks that define the digital competences of PA employees are fragmented and incomplete; second, few attempts to measure such competences have been made so far. The most relevant frameworks on digital competences are presented in the following documents:

- DigComp 2.2 (Vuorikari et al., 2022);
- Syllabus “Competenze Digitali per la PA” (Presidenza del Consiglio dei Ministri - Dipartimento della Funzione Pubblica, 2019);
- The OECD Framework for digital talent and skills in the public sector (OECD, 2021);
- Digital skills: unlocking the information society (Van Dijk & Deursen, 2014);
- Digital competence development of state civil servants in the Russian Federation (Elena Vasilieva et al., 2018).

2.1. Research questions

The purpose of my analysis is to solve the issues listed beforehand, by answering the following research questions:

- RQ.1 How to build a complete framework to define digital competences for civil servants?
- RQ.2 How to measure digital competences among public servants?
 - RQ.2.1 What are the fundamental items that should be measured?
 - RQ.2.2 Do different measurement approaches yield different results?

3. Methodology and Data

3.1. Development of the framework

To answer the first research question, I applied qualitative research. Based on the literature gaps that emerged from the literature review, I made additional research to determine the viable opportunities to develop a new framework: the DigCompPA.

In addition to the framework, I collaborated with the Digital Agenda Observatory of Politecnico di Milano to design a pilot survey to measure the digital competences of the public employees of the

Piedmont region. To answer the second research question, I conducted a quantitative analysis to understand the results of the survey.

3.2. Survey structure

The survey was developed in collaboration with the Piedmont region, to help them to create a tool to measure the digital competences of their civil servants. The respondents were selected to obtain a variegated sample. It was issued to 152 respondents, even though only 119 people (78%) completed the survey entirely. The survey was based on DigComp 2.2, the most complete framework available. Thus, the survey includes items from the five dimensions of DigComp. The survey is made of six main blocks, which are:

1. Socio-economic data, like gender, year of birth and salary;
2. Access to the internet, which investigates the means and frequency of internet usage;
3. Test, which contains items that measure specific digital competences;
4. Online activities, which investigates some activities that are performed online;
5. Self-assessment, where respondents are asked to self-declare their level of digital competences;
6. Engagement, which investigates the level of vigor, dedication, and absorption at work. This module has been included for further investigations that do not concern this study.

The sections of the survey were developed based on several sources, namely: the ICDL (ICDL, 2022) for the Test; a social investigation made by the Istat (Istat, 2022) for the Online activities; an article for the Self-assessment (Deursen et al., 2016) and the Engagement (Seppälä et al., 2009) sections.

3.3. Exploratory Factor Analysis

To answer the second research question, the quantitative analysis of the survey was mainly conducted through the application of an Explanatory Factor Analysis (EFA). EFA “is an analytic technique that permits the reduction of a large number of interrelated variables to a smaller number of latent or hidden dimensions.” (Tinsley & Tinsley, 1987).

I conducted a unique EFA analysis, subdivided into four parts, for sections 3 to 6 of the survey. As

a result, I have identified some underlying factors, to be compared with the theoretical dimensions defining digital competences. Afterwards, I computed different composite indexes that differ either in terms of weighting or in terms of items included. These indexes are useful to determine the correlation between the different sections of the survey and provide the required information to answer the second research question.

4. Results

The main output of my thesis is the proposal of a thorough framework to measure digital competences for civil servants: DigCompPA. Even though it is designed for citizens, I used it as a starting point DigComp 2.2, and then I customized it for public sector employees. Based on my analysis of the current frameworks, I followed a process made of four steps to extend the DigComp. The first one concerns proficiency levels. I stressed the difference between the first six levels of proficiency, which require basic competences, with the last two, which are highly specialized. In addition, I proposed the introduction of six highly specialized roles, which are defined in a document published by the OECD (OECD, 2021). This choice enables me to design a comprehensive framework that can define the digital competences of both basic and advanced users.

The second decision concerns the opportunity to extend DigComp by adding new areas of competence. DigComp neglects two relevant aspects: Socio-emotional competences and Leadership competences. These competences are presented and described in another framework, proposed by the (OECD, 2021). Socio-emotional competences are the third level of the framework proposed by OCDE, while Leadership competences are at the top of that framework because those traits allow a person to actively shape an environment to encourage digital transformation.

Third, DigComp could be further extended through the introduction of competences that are specific to civil servants of PAs, i.e., do not apply to citizens in general. Most of the new competences that I added derive from the Syllabus

“Competenze digitali per la PA” (Presidenza del Consiglio dei Ministri - Dipartimento della Funzione Pubblica, 2019). In particular, I introduced two elements that are crucial for the public sector: Online services and Digital transformation. Last, I introduced a new area of assessment of competences. DigComp defines how competent a person is based on three traditional elements: Knowledge, Skill, and Attitude. However, there is also another relevant component: strategies (Horst & Prendergast, 2020). For instance, two might have the same level of knowledge, skills and attitudes, but differ in the capability to achieve certain outcomes, either online or offline. Hence, I extend the KSA model, transforming it into the KAS-O (Knowledge, Skill, Attitude, *Outcomes*).

The main output of my quantitative analysis of the survey are the factors that emerged from the EFA analysis. At first, I provided a qualitative interpretation of those factors. Then, I computed nine indexes and the correlation among them, and I reported the result in Table 1.

To answer the RQ.2.1, I computed the correlation coefficients between the two indexes that belong to the same section of the pilot survey, which are: .905 for Online activities; .996 for Self-assessment; .975 for Engagement. This result means that measuring digital competences through either the items of the survey or the factors (thus, the items that are related to those factors) returns almost the same result.

To answer the RQ.2.2, I considered the correlation between different sections of the survey. The Test index has low scores ($< .40$) with the other indexes, which means that it measures different competences. Thus, this section of the survey has to be retained. Nevertheless, it is important to add some items to obtain results which are closer to the ones from the other sections of the survey (Sections 4 and 5). The Online activities and the Self-assessment indexes have a moderate correlation ($\approx .50$) among them. Thus, my conclusion is that they measure the same digital competences, utilizing different approaches. As a result, either section 4 or section 5 could be removed from the survey, if time constraints require a more synthetic tool.

Table 1: Correlation coefficients among Indexes

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) test_avg	1.00								
(2) att_avg	.381	1.00							
(3) att_efa	.402	.905	1.00						
(4) self_avg	.278	.552	.493	1.00					
(5) self_efa	.273	.554	.499	.996	1.00				
(6) eng_avg	.076	.181	.177	.285	.295	1.00			
(7) eng_efa	.067	.155	.156	.293	.302	.975	1.00		
(8) index	.264	.546	.505	.939	.945	.581	.594	1.00	
(9) index_norm	.264	.546	.505	.939	.945	.581	.594	1.00	1.00

5. Conclusions

My study contributes to academic scientific literature in several respects.

Firstly, I carried out a comprehensive literature review on the actual frameworks available on digital competences and I classified them. Based on that, I highlighted the main literature gaps that emerged, and I proposed a framework that aims at filling those gaps. In addition, I propose a new model to measure competences, the KSA-O model, which is a novelty in the literature. Secondly, I crafted and analysed a pilot survey. As it emerged from the literature review, few attempts to measure such competences have been made so far. Based on the results of the literature review, the DigCompPA could represent the reference point for PAs which intend to measure the digital competences of their employees. So far, the information regarding digital competences and how to measure them were contained in many different frameworks, and this process was overly time-consuming. Having all the information located in one framework will increase PAs efficiency; furthermore, public sector organizations could achieve a common understanding of how to measure digital competences for their workforce. In turn, this would lead to an improvement in the comparability of results among PAs. In addition to that, the introduction of new areas of competence, new competences specific to the PA, the definition of highly specialized roles and a new driver to measure the digital competences – through the KSA-O model – will increase the completeness of the measurements. DigCompPA lists many practical tasks that could be easily monitored by PAs.

Regarding the survey, it can be considered a starting point for PAs. If different PAs used the same survey to measure the digital competences of their workforce, they would obtain comparable results.

However, this dissertation is not without limitations. The three main limitations are:

- The allocation of new competences to the respective area of competence;
- The small sample size of the survey;
- The qualitative interpretation of the factors.

In terms of future research, I suggest replicating this study to obtain a more complete dataset as input, considering a broader geographical scope. An additional opportunity for future research would be to improve and complete this pilot survey. To do so, it will be important to finalize its integration with the DigCompPA, but also to modify the current items based on the issues spotted throughout my analysis.

Lastly, the results of the pilot survey could be used to measure the actual level of digital competences among the respondents. Focus groups and events where stakeholders and policymakers meet up to discuss their needs in terms of competences could be used to improve the assignment of competences to the respective area of competence, replicating the process that led to the creation of DigComp.

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