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Public Procurement in times of Emergency: an Analysis of Digitalization in Italian Public Universities

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Authors: Lorenzo Montanari, Matteo Migliavacca

Student IDs: 10572697, 10494494

Advisor: Tommaso Agasisti

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Abstract

This dissertation investigates the effect that the digitalization of the procurement process of public Italian universities had in managing the disruption caused by the global pandemic, and, at the same time, if the emergency situation caused by the COVID-19 pandemic acted as a catalyst in digitalizing public procurement. A thorough literature review has been made on the main internal levers and external variables of public procurement in order to elaborate a unique framework to be a guide for the implementation of protocols, instruments, and strategies for the digitalization of procurement to increase the efficiency in ordinary times, and to be prepared and flexible in the advent of a new disruptive emergency. To verify the applicability of the framework proposed, a mixed-methods approach was implemented. At first, a survey was distributed to all the public Italian universities to explore their level of digitalization and verify their degree of reactivity to the emergency, and then follow-up interviews were conducted to design specific case studies of the six most interesting respondents. The results show that digitalization of public universities is highly heterogeneous. Fully digitalized universities reacted promptly to the emergency, while those less digitalized had to implement digital enablers to allow continuity of activities. Indeed, the context of the global pandemic is very demanding on the procurement office and did not allow to focus also on the adoption of new digital platforms, which would be a time- and resources-consuming process. Therefore, digitalization is not a route that can be walked during an emergency since it is highly demanding on the procurement office. Nonetheless, the emergency worked as an accelerator and showed to public universities and the Italian government the importance of e-procurement and the necessity to push towards a complete and integrated digitalization of public procurement in the future.

Keywords: public procurement, public e-procurement, smart working, public universities, emergency, COVID-19.

Sommario

Questo elaborato investiga l'effetto che la digitalizzazione, del processo di acquisto nelle università pubbliche italiane, ha avuto nel gestire i problemi generati dalla pandemia globale, e, allo stesso tempo, se la situazione emergenziale causata dalla pandemia da COVID-19 ha agito come un catalizzatore della digitalizzazione. Un'approfondita analisi di letteratura è stata eseguita sulle principali leve strategiche interne e sulle variabili esterne degli acquisti pubblici in modo da elaborare un framework, unico nel suo genere, che possa essere una guida per l'implementazione di protocolli, strumenti e strategie per la digitalizzazione del procurement affinché si aumenti l'efficienza in periodi ordinari, e per essere preparati e flessibili in caso di una nuova emergenza. Per verificare l'applicabilità del framework proposto, si è adottato un approccio multi-metodo. In primo luogo, è stato distribuito a tutte le università pubbliche italiane un sondaggio esplorativo del livello di digitalizzazione delle stesse e che verificasse la loro reattività all'emergenza, e successivamente sono state svolte interviste di approfondimento con lo scopo di creare specifici casi studio dei sei rispondenti più peculiari. I risultati mostrano un livello di digitalizzazione degli atenei molto eterogeneo. Le università con il processo di acquisto totalmente digitalizzato hanno reagito e si sono adattate prontamente all'emergenza, mentre quelle meno digitalizzate hanno dovuto implementare strumenti digitali, che abilitassero il lavoro da remoto, per garantire la continuità delle attività. Infatti, il contesto pandemico è stato molto dispendioso sull'ufficio acquisti e non ha permesso di adottare piattaforme di eprocurement durante l'emergenza. Dunque, la digitalizzazione degli acquisti si è rivelata una strada non percorribile durante l'emergenza da COVID-19, essendo un processo oneroso sia in termini di tempo che di risorse spese. Ciò nonostante, l'emergenza ha agito come un acceleratore e ha dimostrato alle università pubbliche e al governo italiano l'importanza dell'eprocurement e la necessità di spingere verso una digitalizzazione completa ed integrata del procurement pubblico in futuro.

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Table of Acronyms

| | |
|-------|--|
| AGID | Agenzia per l'Italia digitale (Italian Digitalization Agency) |
| ANAC | Agenzia Nazionale Anti-corruzione (National Anti-corruption Agency) |
| B2G | Business to Government |
| BDOE | Banca Dati Operatori Economici (Database of Economic Operators) |
| CAPPO | California Association of Public Procurement Officials, Inc. |
| CIPS | Chartered Institute of Procurement and Supply |
| CPB | Central Purchasing/Procurement Bodies |
| CRM | Customer Relationship Management |
| CSF | Critical Success Factor |
| DESA | Department of Education of South Australia |
| DESI | Digital Economy and Society Index |
| DL | Decreto-legge (Decree-law) |
| DM | Decreto Ministeriale (Ministerial Decree) |
| DOI | Digital Object Identifier |
| DPCM | Decreto del Presidente del Consiglio dei Ministri (Prime Ministerial Decree) |
| EC | European Commission |
| ECB | European Central Bank |
| eDES | Electronic Document Exchange Systems |
| ERP | Enterprise Resource Planning |
| ESM | European Stability Mechanism |
| EU | European Union |
| FPA | Forum Public Administration |
| GDP | Gross Domestic Product |
| HEI | Higher Education Institution |
| ICT | Information Communication Technology |
| IS | Information System |
| IT | Information Technology |
| MBO | Management by Objectives |
| MEAT | Most Economically Advantageous Tender |
| MEPA | Mercato Elettronico per la PA (Electronic Market for the Public Administration) |
| NGEU | Next Generation European Union |
| NIGP | The Institute of Public Procurement |
| OECD | Organization for Economic Co-operation and Development |
| PA | Public Administration |
| PCP | Pre-Commercial Procurement |
| PIAO | Piano Integrato di Attività e Organizzazione (Integrated Plan for Activities and Organization) |
| PIN | Prior Information Notice |
| PNRR | Piano Nazionale di Ripresa e Resilienza (National Recovery and Resilience Plan) |

| | |
|-------|---|
| POLA | Piano Organizzativo del Lavoro Agile (Organizational Plan for Agile Work) |
| PPE | Personal Protection Equipment |
| PPP | Public-Private Partnership |
| RFP | Request for Proposals |
| RRF | Recovery and Resilience Facility |
| SIOPE | Sistema Informativo delle Operazioni degli Enti Pubblici (Information System of the Operations of Public Organizations) |
| TA | Technical-administrative |
| TCO | Total Cost of Ownership |
| TED | Tender Electronic Daily |

1 Introduction

1.1 Research Question

In this dissertation, the topic of **public procurement** will be discussed, considering the huge impact that public procurement activities have over public and private organizations, especially as an instrument of digital innovation and restart for a country's weakened economy after the **COVID-19** pandemic. However, public procurement as a whole is a wide and complex theme that would not fit alone inside a single study, because there are many small differences inside public institutions' structures and behaviors that would increase the difficulty, time, and resources spent on the single project, which would then result too wide and with a lower degree of depth that us authors would like to achieve. Therefore, we decided to investigate a specific type of institution that, to a certain extent, is more familiar to us authors than public institutions in the general sense: this typology is represented by **public HEIs**. Specifically, our dissertation has the aim to investigate the effect that the **digitalization** of the procurement process of public Italian universities had in managing the disruption created by the global pandemic; how the pandemic itself had a role in the digitalization of the procurement offices of universities, as it inevitably brought about changes in the daily usage of technology; and how these changes caused by the coronavirus will be to a certain extent irreversible – for example, the reduction of paper usage and increased sustainability as a byproduct – leading to a change in the procurement process and a change in the behavior of its several stakeholders. The COVID-19 pandemic will serve as a base for the creation of a model of response to emergencies in general, and to understand how the level of digitalization of an organization, and, more specifically, the digitalization of procurement, impacts the response to an emergency, but, at the same time, how an emergency promotes digitalization of procurement.

To sum them up, the following are the two research questions of this dissertation:

- How did the digitalization of procurement processes of public universities affect their capacity to respond to the disruption generated by an emergency?
- How did the pandemic emergency have a role in the digitalization of procurement processes and activities and what are the implications of this phenomenon?

In the following introductory paragraphs, the context of the COVID-19 pandemic outbreak will be presented, as well as the general and university-specific measures enacted by the Italian government. Successively, a model of universities' activities and services is presented to position procurement activities and have a better understanding of their fundamental role, which is also described in *Relevance of the study*.

1.2 COVID-19 in Italy

Italy was the first state to deal with COVID-19 outbreaks outside of China, where the virus was discovered in December 2019. The first outbreaks occurred in February 2020 in the regions of Lombardy and Veneto, more precisely in Codogno, a small town in the Lodi area, and in the Vo Euganeo area, in the province of Padua.

On February the 23rd, the Italian Prime Minister Giuseppe Conte, after a series of meetings with the Council of Ministers and the head of Civil Protection Angelo Borrelli, issued a decree that quarantined the inhabitants of the 11 municipalities affected by the first outbreaks for a total of 50.000 people. Except for emergency reasons, it was not possible to leave or enter this so-called “Red Zone”. This first measure intended to circumscribe the diffusion of COVID-19 and not allow a nationwide spread. On the same day, a press conference was organized by the head of civil protection to update on the numbers of the pandemic in Italy. This began a daily ritual that lasted for the next 7 months, in which at 6 p.m. every day on live television the data of the contagions were updated. In the following days, there was still not a strong perception of the emergency, and even different political forces, including the mayor of Milan Sala, invited the population not to be afraid and not to stop normal life routines with the social campaign #Milanononsiferma – #Milanodoesnotstop (Bassan, Simonetta, & Salvioli, 2021).

On March the 7th, after the explosion of contagions in the province of Bergamo, it was decided to extend the Red Zone to the entire region of Lombardy. After only two days, the government decided to issue a decree that put all of Italy in lockdown. Italy was the first western country to adopt such a rigid measure to contain the pandemic.

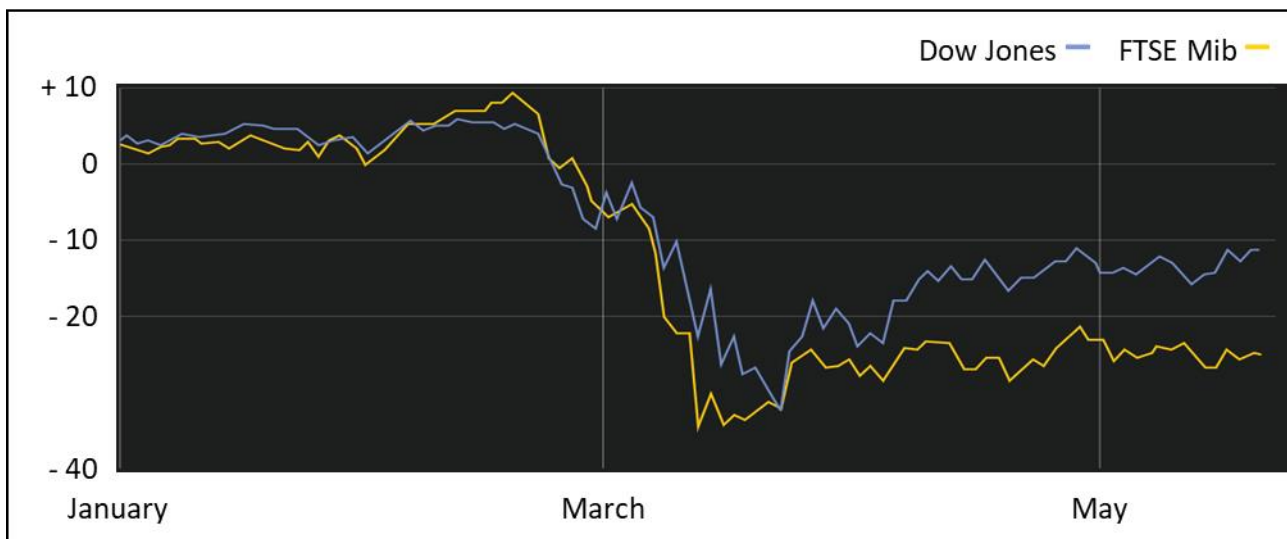


Figure 1 - Stock market indexes. Percentages in the period January-June 2020. (Bassan, Simonetta, & Salvioli, 2021)

The economic consequences of the announcement of the national lockdown showed dramatically at the opening of the Stock Exchange on March 13th, with the FTSE Mib closing the negotiations with a drop of 16,92%, marking the worst daily drop in its history (Figure 1).

The pandemic has fallen on a state that was already in difficulty from an economic and social point of view, suffice it to say that in the last 20 years Italy's GDP has grown in total by only 7.9%. Comparing this result with Spain, France, and Germany, EU member states with a population and GDP comparable to Italy, it can be seen that, in the same period, the increase in GDP in the three countries was 43.6%, 32.4%, and 30.2%, respectively (Parlamento Italiano, 2021). The difficulties of the Italian economy in comparison with the most advanced EU member states are also found in the analysis of GDP per working hour,

a useful indicator for verifying the level of productivity growth. Compared with a general increase in EU member states, productivity in Italy has fallen by 6.2% since 2001 (Parlamento Italiano, 2021). The consequences of the economic crisis in which Italy has found itself in recent years are manifested in the increase in social imbalance. In 2020, 9.4% of the Italian population lives below the absolute poverty line, while the same indicator in 2005 was 3.3% of the population (Parlamento Italiano, 2021).

From these data, it became clear how fundamental it was for the government to issue economic support measures as soon as possible, so that the health emergency would not also turn into a social and economic emergency whose consequences, if uncontrolled, would be catastrophic (Bassan, Simonetta, & Salvioli, 2021).

The government allocated during the lockdown measures to support businesses, families, and workers to counter the effects of the emergency on the economy. A preliminary package of measures to support the economy was approved on February 28th, 2020, and targeted only the first areas afflicted by outbreaks, while on the 17th of March 2020, the “Cura Italia” decree-law was approved targeting the entire state. The latter includes several measures operated to manage the effects of the pandemic on the economy including (i) the postponement or suspension of fiscal and contribution payments for self-employed people, micro, small and medium enterprises, and for all the firms in the sectors most vulnerable to the pandemic, (ii) fundings for the production of personal protective equipment (PPE), (iii) and 70 million in funds for less wealthy families to allow participation of children to online schooling and 10 million euros for platforms for distance teaching. With the ‘Cura Italia’ decree, emergency smart working became an ordinary work modality for all of the public administration’s employees and it could be applied to any subordinate type of work agreement in the private sector.

On March 19th, the ECB announced a temporary €750 billion asset purchase program to respond to the risks to which the market is subjected during the pandemic crisis. This program was launched after some statements by President Christine Lagarde in the previous days, which caused the financial markets to crash. The following day, the European Commission suspended the Stability Pact, not only the 3% deficit/GDP limit and the 60% debt/GDP limit, but also the obligation to reduce the structural deficit annually. This suspension had momentous implications because it temporarily allowed governments to introduce money into the economic system as long as it was needed.

On the 8th of April a second package of measures, named the ‘Liquidity Decree’, was enacted to provide liquidity to small and medium enterprises, which constitute one of the pillars of the Italian economy. This decree mainly makes the existing Guarantee Fund more flexible, by simplifying access procedures, increasing coverages of the state guarantees, and expanding the potential beneficiaries of the Fund.

Finally in mid-July, a third group of reforms, labelled ‘Simplifications Decree’ was designed to speed up the digital transformation of PAs, to simplify the procedures and relationships between government agencies and citizens and to innovate digital infrastructure, and information and documents storage. Of the many articles of the ‘Simplifications Decree’, some were about the simplification of public procurement, in particular the threshold for

direct procurement was raised to 150.000€ – successively reduced with the conversion into law at 75.000€ in September 2020, and raised again on the 31st of May 2021, with decree-law n.77/2021, at 139.000€.

Also in July, the Next Generation EU (NGEU) plan was instituted to relaunch and manage the damages inflicted by COVID-19 to the European economy. This will be done with an overall European economic aid of €750 billion. Italy will receive €210 billion from the NGEU, which will be spent according to the Recovery and Resilience National Plan (PNRR).

1.3 University-level measures

On February the 23rd, two days after the establishment of the first Red Zone, the Lombardy Region President Attilio Fontana, in agreement with the Minister of Health Roberto Speranza, ordered the closure of all universities for a week, starting from the following day. Successively to the ordinance of the Lombardy region, all other regions of Northern Italy prepared the same measures. These measures were then extended nationwide starting on March the 5th and, initially, until March the 15th.

As far as universities are concerned, the 2019/20 academic year ended with complete distance learning classes and exams. Starting from the new academic year it was left to the individual university to decide how to organize the didactics, some solutions adopted were:

- in-person teaching reserved for freshmen;
- reservations system for classroom seats;
- In-person lessons in separate teams staggered on the basis of students' badge number or other criteria;
- Full distance learning.

The closure of the universities coincided with the beginning of the second semester of most of the universities which, in a few days, had to deal with the emergency by shifting the delivery of lectures from an in-person to a distance learning modality, consequently having to provide for the purchase of the materials to be supplied to the professors for the setting up of tele-didactics in order to guarantee a good level of learning.

In our experience as students of Politecnico di Milano, the postponement of didactics activities happened at the beginning of the second semester of the academic year 2019/2020, and it was short-lived. The supposed beginning of the semester, scheduled for February the 24th, was delayed of one week for the majority of the study programs, and of two weeks for the remaining ones.

The lockdown not only had an impact on teaching but was most importantly relevant on the 'back office', and in particular on the procurement stations of HEIs. Procurement stations had to go through an overwhelming number of extraordinary activities in a limited amount of time.

In the next section we will have an overview of a model of university activities, in order to show why procurement has such a relevant impact on the whole system, especially with the disruption originated from the new COVID-19 pandemic.

1.4 Model of Universities

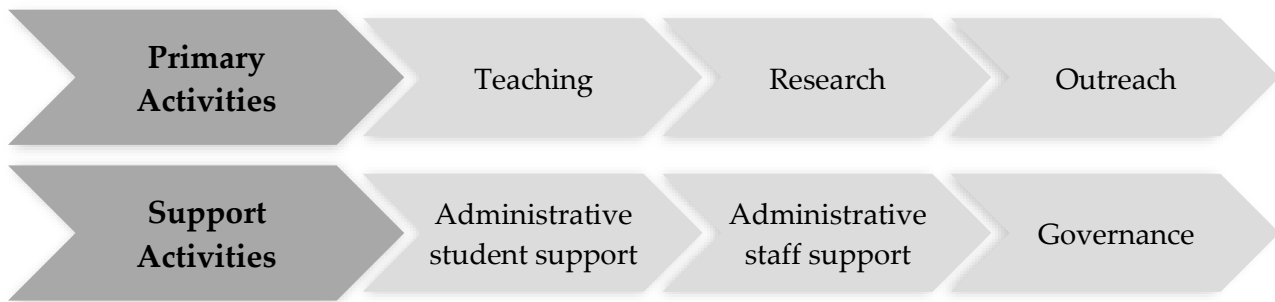


Figure 2 - Model of university structure. (Agasisti & Soncin, 2021)

(Agasisti & Soncin, 2021) elaborated a simple, yet insightful model of universities activities that can help understand the extent of the effect of COVID-19 on universities and especially on their procurement function.

University activities can be divided into two main groups: primary and support activities. Between the **primary activities** there are teaching, which includes both the delivery of contents to student as well as the ability to make use of these contents in the real world, and the social interaction between students and with professors that happen in classes, in the school buildings and in the campuses in general; there is research, that is fundamental to make society as a whole advance, and can give, especially in times of crisis, answers for managing it – as this dissertation hopes to do; and there is outreach and engagement of the community, that, according to Agasisti and Soncin (2021) “includes all the activities that put the university faculty in contact with the external audience by means of dissemination, events, civic engagement potentially involving a large set of activities”.

Then, there are the **support activities**, which enable the efficient and effective fruition of the primary activities to all the stakeholders involved. For instance, there is administrative student support, which include the students offices and student career services. Similarly, there are administrative staff support functions, such as teaching support and research support, essential for primary activities, and staff management. Finally, there is the governance function, which identifies who is responsible and thus accountable for setting and overseeing operations towards the university goals. According to the authors own opinions, **procurement** can be seen as **administrative staff support activity**, necessary both for the correct dispatch of teaching services on the professors side, and for the execution in of research and other staff activities.

1.5 Relevance of the study

Public procurement is one of the fundamental functions of public administration and "it refers to the process by which public authorities, such as government departments or local authorities, purchase work, goods, or services from companies" (European Commission, n.d.-a).

Public procurement is evolving conceptually and, public authorities are required to be more and more transparent and efficient in their procurement activities. In addition, governments are facing an ever-changing environment characterized by emerging technologies, an

increase in the variety and complexity of purchasable products and services, the growing importance of environmental issues and constantly updated regulations influenced by international and regional trade agreements (Thai, 2015).

Public procurement is responsible for a huge share of public expenditure (up to 70% in Greece) and national GDP (up to 25% in Netherland). In general, in the EU, every year over 250.000 public authorities spend around 14% of GDP (around €2 trillion per year) on the purchase of services, works and supplies (European Commission et al., 2016). In Italy, PAs made purchases above the European threshold¹ for €170 billion in 2019, 9.5% of GDP, a value that has doubled in the last 7 years (Agenzia Nazionale Anticorruzione, 2019).

These numbers clearly show how much impact public procurement has on the economy of a country, so it is crucial that the available resources are spent efficiently and effectively. Suffice it to say that even a 10% gain of efficiency could save €200 billion per year (Donato, Mariconda, & Mirrione, 2020).

This exponential increase in the number of purchases by public administrations is expected to become even more significant in the current period, given the growth in economic resources available as a result of the pandemic, contained in state decrees and European funds for economic recovery.

In Italy, the main resources have been provided in the 'Cura Italia' and 'Rilancio' decrees, for a total of €180 billion, 14.7% of which are managed through public tenders. In addition, the EU makes available to Italy 27% of total funds for the NextGenerationEU and 15% of Pandemic Crisis Support (MES) for a total of €242.1 billion, provided in the form of loans and grants (Osservatorio Agenda Digitale, 2020b).

To date, in Italy, public procurement is often considered a source of inefficiency rather than a source of innovation. Public tenders, in many cases, are managed with the concern to avoid disputes, and there are still few PAs that seek to purchase the best available solution as quickly as possible (Osservatorio Agenda Digitale, 2020b). Indeed, on average in Italy in 2019, it took 137 days to award a public tender for digital solutions, without considering the time for any appeals and preparation of the tender. It is therefore necessary to compress the time needed to assign a tender (Osservatorio Agenda Digitale, 2020b), especially in emergency periods where timeliness has a major impact.

Considering the importance, but also the amplitude of this field, our research will focus only on public universities procurement, which is a particularly interesting area, since efficiency and effectiveness of purchases directly correlate with the quality of services offered to students and researchers (Scuttari & Agasisti, 2016). Indeed, the beginning of online teaching, meant that procurement offices of all Italian universities were to purchase the goods and services needed to allow the synchronous or asynchronous recording of lessons, performed by professors working from home (i.e., webcams, computers, headsets, digital boards, software licenses for streaming). At the same time, research facilities of universities,

¹ For supplies, services and design tenders the threshold is set at €431.000. For works and concessions the threshold is set at €5.382.000

which were open for those research project that could not be postponed and for the study of the evolution of the pandemic, had to work in safety and for this to happen a large amount of PPE was to be purchased in a period in which PPE was in short supply. The 22nd of March 2020, the government imposed the closure of all non-essential and non-strategic activities, thus making procurement offices' employees to work remotely, even though the majority of them was already working from home since the 16th of march. This increased the complexity of their work, since in Italy the level of digitalization of public institutions is fairly low and this applies to public universities as well, meaning that in a minimal amount of time employees were to adapt to use digital tools and learn requirements of the different PPE to satisfy the university's needs.

Following this first introductory chapter, the next will provide an in-depth literature review of public procurement, e-procurement systems for universities and a brief but thorough review of smart working academic research. The third chapter will focus on legislation regarding public contracts in Italy, including elements of European Legislation since it is the backbone of all EU member states' regulations. In the fourth chapter, it will be presented the authors-made theoretical framework, which analyzes how different levels of digitalization of procurement impacts the response to an emergency. The fifth chapter will be dedicated to the description of the methodology used to develop a survey which was sent to all the 67 public universities in Italy, and interview questions with the purpose of deepening the analysis on selected universities that managed the situation with creative or innovative perspectives, for the purpose of developing case studies of their responses. Finally, the sixth and conclusive chapter will summarize and highlight the major findings of our study and give a direction to future studies in this field.

2 Literature Review

2.1 Introduction

In this introductory paragraph we will describe the organization of the Literature Review and Legislation chapters by analyzing what influences the performance of procurement activities.

According to (Patrucco, Walker, Luzzini, & Ronchi, 2019), decisions on how to organize public procurement are of great importance as they directly affect the achievement of desired performance and goals. The organizational design characteristics should match both the **external factors** and **firm's strategy** in order to guarantee a positive performance impact (Mintzberg, 1980). For Glock and Broens (2013) it is not possible to define what is the most efficient and effective organizational model because there is no optimal structure that adapts to each variable inside and outside the organization, it is the purchasing organization that must adapt and evolve its organizational model by adapting to the changing context so as to find an efficient organizational response in that particular environment. This statement is consistent with the **contingency theory**. Scholars who support this theory argue that an organization would perform better if the organizational structure were designed not only according to the public procurement goals but also considering the contextual factors (Thai, 2009), and any change in the contextual factors implies an adjustment of the organizational structure and resources at its disposal in order to adapt to the new conditions (Pennings, 1992).

Contingency theory is based on the classical operations management approach of Hayes and Wheelwright (1984), i.e., a given strategy is followed by a series of levers and practices that influence the performance achievable by that strategy. If there is a misalignment between the objectives and the results achieved, a series of feedback loops are necessary to make changes to achieve the objectives. The operations management approach has also been applied to the field of public procurement in order to analyze which procurement levers influence the performance of the process.

The main **procurement levers** or, in other words, the factors within the organization that influence the achievement of budgeted results, are (Patrucco, Luzzini, Ronchi, & Walker, 2016):

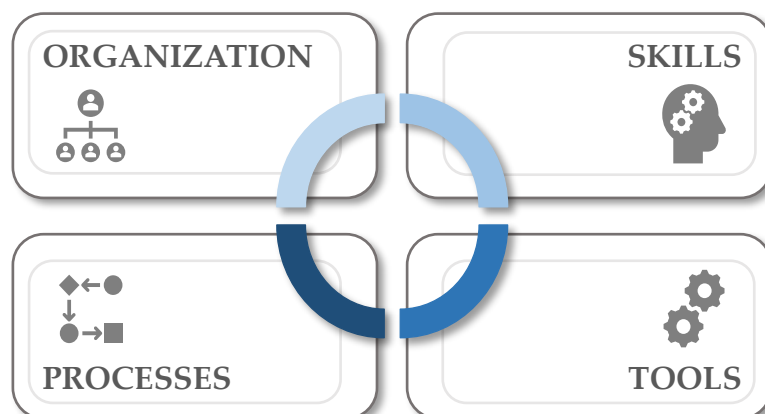


Figure 3 - Internal Procurement Levers. (Patrucco, Luzzini, Ronchi, & Walker, 2016)

- **Organization** (level of centralization, position of the purchasing department in the organizational chart, level of involvement in strategic planning);
- **Skills** (ability of purchasing department employees, level of competence in performing the task);
- **Processes** (purchasing process activities);
- **Tools** (methodologies, techniques, technological solutions).

At the same time, procurement organizations are influenced by **external variables** that affect the effectiveness of the organizational structure and consequently the performance achieved through the adopted strategy (Thai, 2016):

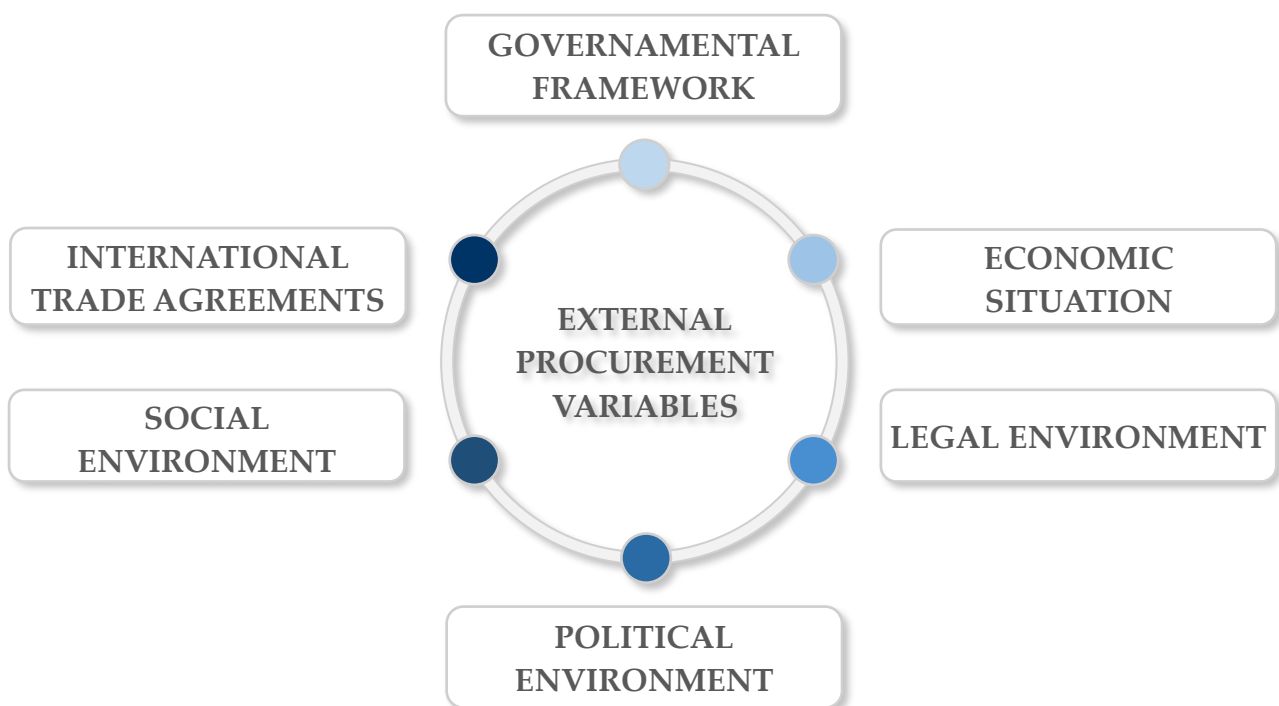


Figure 4 - External Procurement Variables. (Thai, 2016)

- **Governmental framework:** there are two main types of governmental system: unitary system and federal system. In the unitary system, the central government exercises control over public organizations and therefore decides the structure and procedures that each local organization must adopt. In the federal system, the local organization chooses what organizational structures and process to adopt, as the local government enjoys great autonomy;
- **Economic situation:** economic conditions have a great influence on the procurement system's effort to maximize competition. There are three main types of competition: perfect, imperfect (such as oligopoly) and monopoly;
- **Legal environment:** refers to the broad legal framework that governs public procurement and all business activities (Picho, 2017);

- **Political environment:** refers to all individuals and private sector organizations that are actively involved in all aspects of the public procurement system;
- **Social environment:** free media, a vibrant civil society, and an independent citizenry have a unique place in the accountability of procurement officials for transparency, fairness, and efficiency in procurement;
- **International Trade Agreements:** Markets become more globalized through regional and international trade agreements. Government procurement as a result of globalization becomes a more important and complicated topic as challenges such as uniform rules of interpretation for international transactions, foreign government regulations, trade agreements, transportation increase.

The combination of good internal procurement system design and flexibility in responding to the external factors just listed, not only affects operational performance, but also contributes to broader government goals such as social outcomes, environmental benefits, and economic growth (Patrucco, et al., 2017) (Flynn, 2018).

Considering the levers and external factors discussed above, we will organize the *Literature Review* as follows: first, we will discuss the **organizational structure** of procurement offices and the **level of centralization** of organizations; second, we will analyze in detail the procurement **process**; third, we will continue with the analysis of procurement **tools**, principally **e-procurement** and **smart working**, which played a huge role during the newly COVID-19 pandemic; then, the analysis of the external factors will consider the **legal environment** in Italy and Europe regarding public contracts.

To be precise, the **legal environment** will be analyzed in the third chapter, called *Legislation*, which will focus on the description of the laws that regulate public procurement and smart working in the Italian context. The remaining levers and external variables were not considered in the *Literature Review* since, after a careful search, there was not enough material in the existent literature that explored these areas of public procurement, and the documents that were found were discussing themes and fields out of the scope of this dissertation.

2.2 Methodology

To start the research of academic literature, a keyword was identified, namely **public procurement**, from which to filter and analyze the papers needed to examine the dissertation topic. The keyword was inserted in the main academic databases such as Scopus, Google Scholar, and Web of Science and the search was carried out considering the article title, abstract and keywords. Given the high number of filtered papers (11.897 papers), often far from the objective of this dissertation, it was decided to restrict the search more, increasing the level of detail of the keywords to increase their accuracy. The keyword previously presented was combined with other words to narrow the field of analysis and sharpen the focus. The primary keywords searched are presented:

- **Public Procurement University:** to focus on the institutions that the dissertation focuses on;
- **Public Procurement COVID-19:** in order to find the most recent papers on public procurement directly related to this study, that might lead to new insights;
- **Public Procurement Smart Working:** which allowed to find documents pertinent to smart working applied to the public administrations, and, in particular, to procurement in public institutions;
- **Public E-Procurement:** in order to filter information related to the digitalization of the procurement process and its advantages specific to the public sector;
- **Public Procurement Efficiency:** to analyze the papers that point out bottlenecks and critical areas in public procurement offices;
- **Public Procurement Organization:** which gave a deeper knowledge on types of organizational structures and the different levels of centralization that public institutions use for procurement activities.

After this second phase of filtering, in which the number of papers dropped to 1.932, a third filtering was carried out and only papers in the Business, Management and Accounting category that had been published in the last 20 years were included.

After reading the abstract of the filtered papers (175 papers, excluding duplicates), the authors excluded 91 papers as not relevant to the objective of the analysis. For the remaining papers, the full text was read and only the papers considered suitable and of value to the research were included in the literature review of the dissertation.

In addition to the papers found through the academic databases, there are also those analyzed as a result of backward and forward reference searching process.

The backward reference searching process refers to the analysis of the sources and theories that influenced the author of the primary source article in order to have a picture of the thinking and research up to the time the article was published (University of Wisconsin Whitewater, 2021). Instead, the forward reference searching process is used to expand the knowledge of a topic by searching for follow-up studies to the primary paper, and it also allows to assess the importance of the paper as it verifies how many times it has been cited in future research on a particular topic (Williams College, 2021).

For the research of the papers necessary for the *Legislation* chapter, the websites specialized in public procurement in Italy, such as ForumPa.it and Digital4.biz, have been fundamental, as for the writing of this chapter it was necessary to have a continuously updated picture of the legislation and regulations in Italy. Through the use of these websites, it has been possible to have access to a complete and exhaustive database, in order to deepen the past and current regulations, analyzing the processes of change in public administrations,

considering the technological, institutional, and organizational aspects of public procurement in Italy.

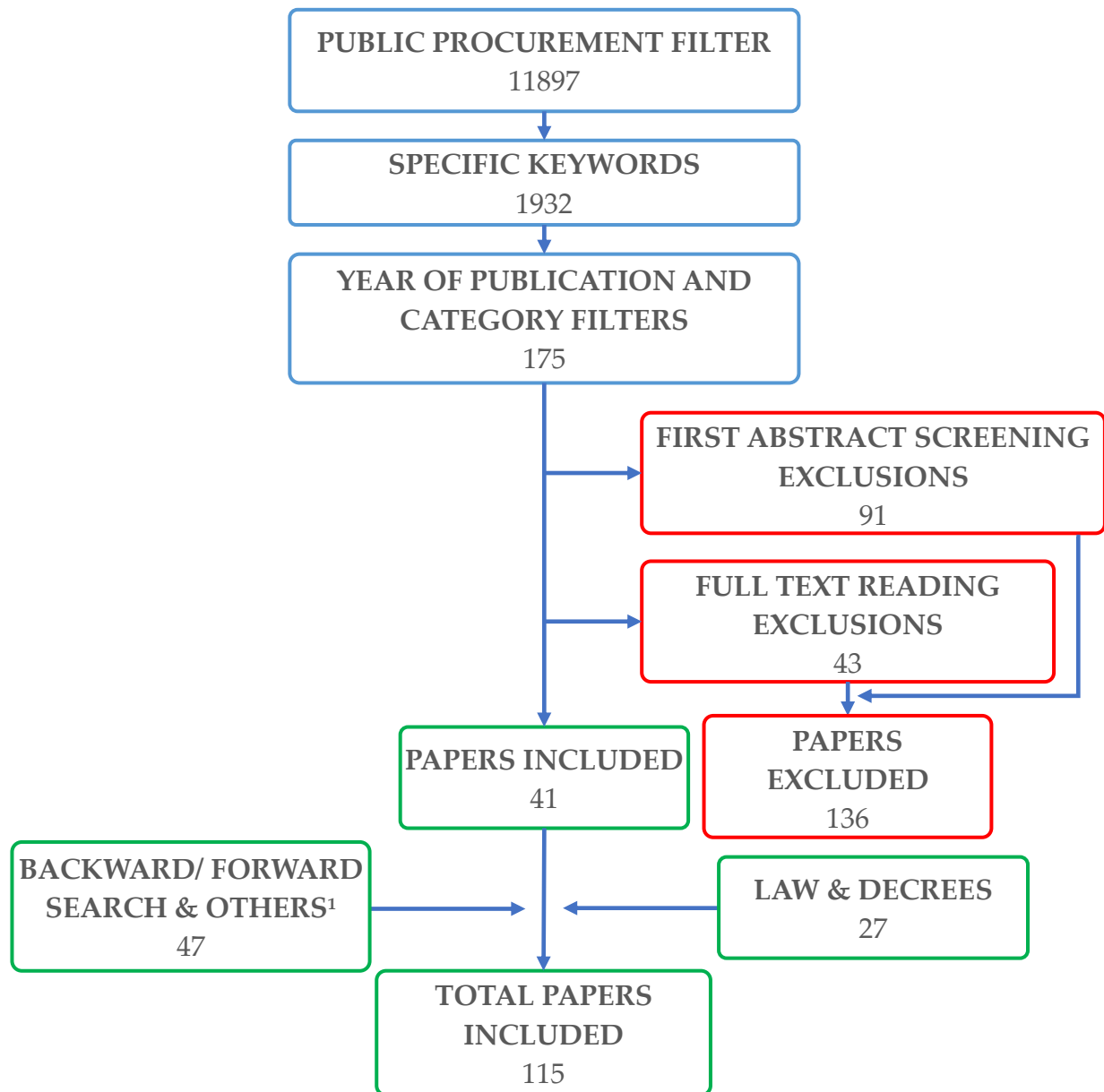


Figure 5 - Papers identified through database searching

Then, each document cited within this dissertation has been classified and included in an Excel database. The criteria for categorization are as follows:

- Title: the title of the paper/article, or chapter title if part of a book with multiple authors;
- Author(s): that can be people, organizations, or governmental institutions that wrote the document in question;
- Type of paper: journal article, book, conference paper, law and decree, institutional report and website articles were identified. As it can be seen from the graph, more

² Others includes Institutional reports and Website papers.

than half of the papers considered in the dissertation belong to the categories of journal article and institutional report.

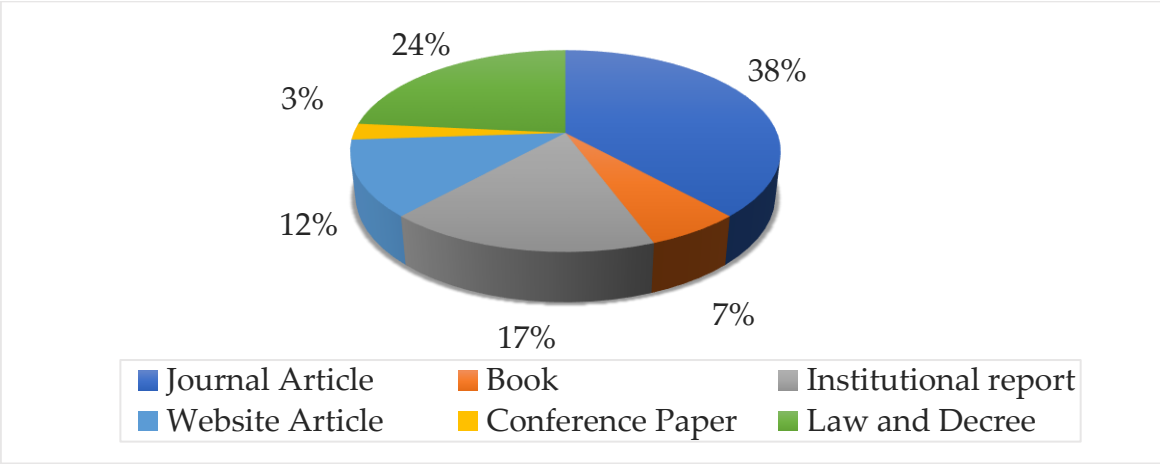


Figure 6 - Sources distribution by type

- Publication Year: the majority of the paper are clustered around 2006 and 2021. The papers older than 20 years are a result of backward reference searches.

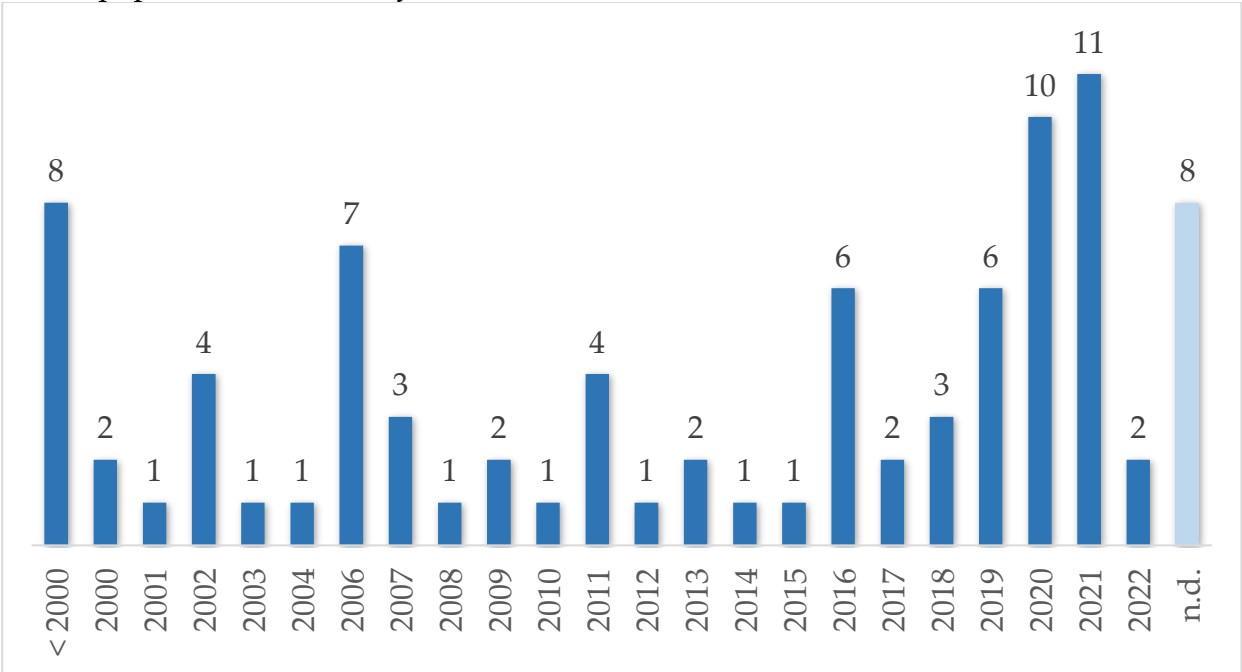


Figure 7 - Distribution of sources by year of publication³

- Link to or DOI of the source to the paper, if available.
- Language: most of the papers used are in English, the papers in Italian refer mainly to website articles which have been fundamental for understanding and analyzing the Italian legislation on public procurement.

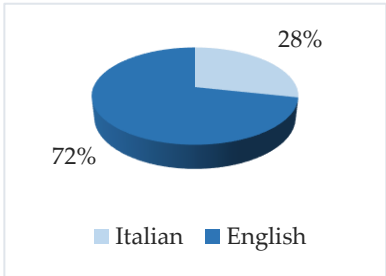


Figure 8 - Distribution of sources by language

³ In this categorization, Laws and Decrees are not included

- Brief Summary: short description of the content of the source.
- Paper Topic: each paper was categorized based on the literature topic it refers to. Eight different categories were assigned:
 - Contextual: papers that describe the emergency period caused by Covid-19 in Italy, with reference to the decrees-laws issued in the period to manage the pandemic;
 - E-procurement: description of the digital tools and electronic instruments for the stipulation and management of tenders and public contracts, and the related advantages and CSFs;
 - General: the paper considered refers to public procurement in the general field, without a particular focus. Generally, papers in this category were used for introduction and historical background;
 - Legislation: description of the European and Italian norms in matter of public procurement;
 - Organization Structure: the paper refers to the organizational structures used for the management of purchasing processes, with particular focus on the analysis of possible levels of centralization of procurement offices;
 - Purchasing Process: analysis of the various activities that make up the purchasing process;
 - Smart Working: the paper focuses on the definition and in-depth analysis of smart working with references to the regulatory framework in public administrations;
 - Stakeholders: description of the stakeholders of the process of purchase.

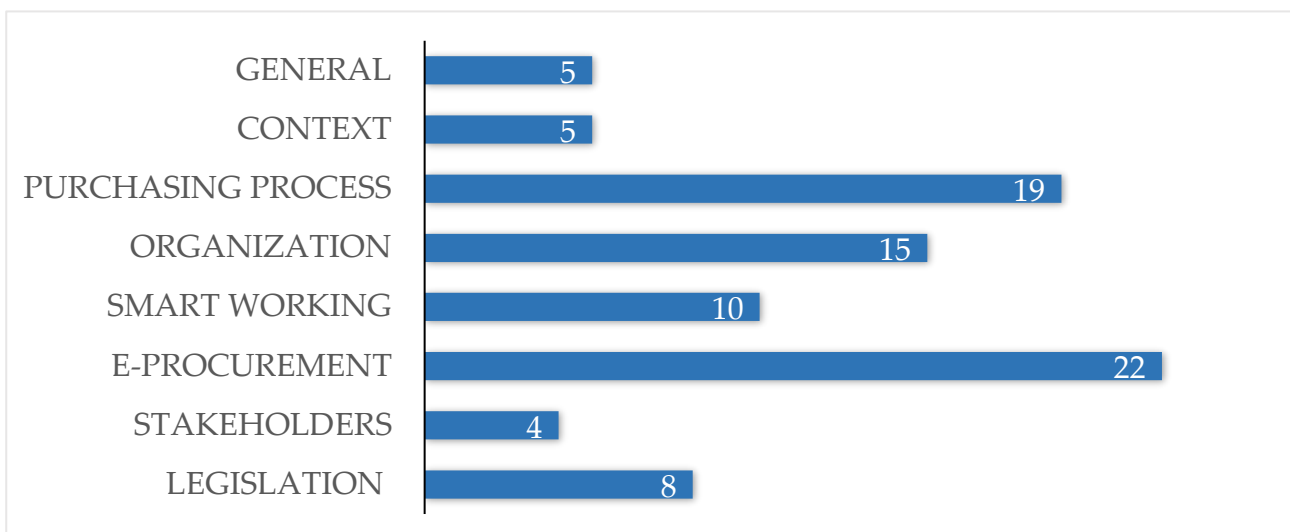


Figure 9 - Sources distribution by topic⁴

Considering how digitalization is the research question of this dissertation, it is obvious why the majority of paper refers to e-procurement, as it can be seen in Figure 9. The remaining papers are fairly distributed among other important topics connected to e-procurement and more in general to public procurement.

Without further ado, *Literature* will now be presented.

2.3 Organization

2.3.1 Introduction

The choice between centralization and decentralization is a key aspect to consider when choosing procurement organization (Dimitri, Dini, & Piga, 2006). The pattern of centralization in the public sector can affect entities along two specific dimensions of analysis:

- The degree of **internal** centralization;
- The degree of **external** centralization.

In the following paragraphs we will analyze more in detail these two configurations.

2.3.2 Degree of internal centralization

The degree of **internal centralization** defines internal responsibilities over purchasing procedures and 3 different types of models can be identified (Thai, 2009):

- **centralized models**, where all purchases are managed by a single central office;
- **decentralized models**, where all the purchases are managed independently by the single offices and sectors;
- **hybrid models**, where the management of the purchases is subdivided between central office purchases and departmental offices.

A **centralized** purchasing system, that combines demand from the departments, results in a substantial reduction of the costs connected to the management of the various procurement processes (reduction of transaction costs). Entrusting responsibility for the purchasing processes for all standard goods and services of common requirement (stationery, cleaning, computer, sanitary fittings etc.) to a central procurement administration allows to avoid an excessive fragmentation of the demand between the various departments and improves the quality and efficiency of the process (Karjalainen, 2009).

The **advantages of centralizing** the procurement process are the following:

- **Controlling public spending, rationalization of the purchases:** centralizing the purchases of the whole structure makes it possible to merge the purchases related to a specific class of goods, and consequently, considering the increased volume of the purchases, economies of scale guarantees cost reductions;

⁴ In this categorization, Laws and Decrees are not included

- **Minimizing duplication of procurement activities by central coordination, reduction of transaction costs:** if the process of purchase is not centralized, every department will have to go through the same procedures of purchase in order to satisfy requests for a specific category of goods issued by their respective department. This generates a duplication of the procedures with its connected transaction costs. Centralization allows to avoid this repetition of activities in favor of aggregation and one-time-only procedures;
- **Human resources specialization:** with the centralization of procurement, an institution has the possibility to carry out training to a reduced number of people and to have a better delivery of training services. Procurement practitioners with professional training will therefore be more efficient than less trained practitioners within the institutions' departments, reducing the risk of maverick procurement practices. Moreover, thanks to centralization, the concentration of procurement expertise will be focused on a single office with consequent better knowledge and information sharing abilities than that of departmental offices;
- **Advanced control over procurement practices:** having all the procedures of purchase managed from the same central procurement office, the control operations on the process will be simplified and more linear. Being all the purchases under the same source of control, there will be greater visibility on the process, an easier management of all the payable accounts, and of the quality and quantity of all the supplies. Therefore, it is obtained greater **transparency and measurability** of procurement practices;
- **Increased standardization:** if the procurement process is centralized there will be a greater degree of standardization of technical characteristics of purchased goods (within the same class of goods), procurement contracts and transactions.

There are also possible **disadvantages relative to centralization** of procurement, which are presented below:

- **Lack of sensitivity** to the unique priorities and operational realities of different users in the departments. It can happen that the specific and detailed requirements of end-users are not taken in consideration, and a central purchasing office tends to acquire standardized material in order to aggregate the demand;
- **Low engagement** of the central procurement office in the operational planning process;
- **Impact on the development of the local market SMEs:** especially in an economy like the Italian one, characterized by an elevated number of SMEs (around 206.000), with an impact of 41% on the total of generated turnover in Italy, is important to consider the impact of centralization of purchases of the public administration on SMEs. The larger the contract, the lower the possibility for a SMEs to offer the best value for money on that contract, which will reduce their participation in PPPs.

On the other side, the concept of **decentralization** of the procurement office can be defined as "the process by which each department controls the procurement of goods and services" (Leenders & Johnson, 2000), therefore each department is responsible in terms of what is to

be purchased, how, and when to purchase goods, services or works (Šerpytis, Vengrauskas, & Gineitienė, 2011)

The **advantages of the decentralization** of the public procurement process are the following (Aboelazm & Afandy, 2019):

- **Quick response to the operational needs and requirements:** departments are able to carry out the purchasing process more quickly than the centralized procurement office. In the case of a centralized procurement system, the central procurement office needs to receive all the departmental requests for the specific items before making the purchase, in order to take advantage of the economies of scale associated with a large-scale purchase. In addition, after the goods have been received by the central office, they must be distributed to the various departments, causing a further waste of time.
- **Reducing the costs and risks of storage and transportation:** the decentralization of the purchase process reduces the storage and transfer costs, because the goods can be acquired directly from the single departments in smaller amounts compared to a centralized purchase. The purchase of large quantities of goods by the central office would require a warehouse for the storage of the goods purchased, for the whole organization, and in addition, would add the costs related to the delivery from the central warehouse to the various departments.
- **Increased opportunities for SMEs to participate in procurement:** the purchase of goods in limited quantity, in order to satisfy the requirements exclusively of one department, guarantees greater opportunities to the local SMEs to participate and to be competitive in public tenders.
- **Linking the decentralized procurement units with their related programs:** decentralized procurement allows to satisfy the specific characteristics of the goods requested by departmental users, in contrast to a centralized procurement system, where similar goods would be clustered in order to standardize purchases and take advantage of economies of scale. Through decentralization it is possible to purchase ad-hoc solutions for single end-users.

The **disadvantages of a decentralized** procurement systems are the following (Aboelazm & Afandy, 2019):

- **Lack of experience:** the departments may not have enough experience in order to make purchases of high value goods that require specific processes and qualifications.
- **Lack of coordination between the departments:** the same products may be bought following different procedures by the different departments.
- **Economies of scale and scope are not exploited:** when more than one department acquires autonomously the same goods, the price that the departments will pay may be higher than a centralized purchase.

The existence of a purchasing structures within the departments, as well as in the central administration, would make it possible to structure a process of bottom-up planning, which would lead to the drafting of a plan of contracts for supplies and services to be activated

centrally, resulting from the aggregation of the plans drafted by the individual purchasing departments located in the various departments. This typology of planning, characteristic of a **hybrid** model, would benefit in terms of better management of the needs and processes of purchase of the public administration, going also to meet the need of providing a budget of purchases as an instrument of transparency to external stakeholders. Obviously, in evaluating the possibility and convenience of establishing a local purchasing office, it is necessary to consider the resources of the personnel of the administration, as well as their size (for example, volumes of purchasing activities carried out) (Scuttari & Agasisti, 2016).

According to (Dimitri, Dini, & Piga, 2006), hybrid models appear to prevail in public procurement with central units playing the key role of defining common strategies and policies. In the last period, however, there is an increase in centralization at all levels in Europe.

All these three clusters of possible configurations for the procurement organization (centralization, decentralization, hybrid), can be divided further into two subcategories each (Patrucco, Luzzini, Ronchi, & Walker, 2016).

2.3.2.1 Centralized models

The two main alternatives, when considering centralized organization, are the following:

- **Authoritative procurement model:** The central procurement office is responsible for all the procurement activities of the institution, and it is responsible for both **operational** activities and **strategic decisions**. It is essential in organizational models, in which the level of centralization is high, that the procurement staff coordinates and interacts frequently with the various departments, so that the decisions made are shared and accepted by all levels of the institution. To facilitate communication within the institution, it is important to have an **advanced e-procurement system**. Moreover, the coordination with the departments is important in order to plan in an accurate way the requirements of the goods and services, and to support the choices of purchase of specific goods and services for which the central procurement office might have a lack of technical and specific competencies.
- **Supportive procurement model:** The central procurement office is responsible for the procurement of the goods, services or works where **specific expertise** in regulations and government instruments is required. As an example, the central purchasing office of a university would be in charge of purchases above direct awarding threshold, which require the adoption of instruments provided by CPBs (regional or national), or above communitarian (European) threshold which require particular expertise on national and European regulations about public contracts.

2.3.2.2 Decentralized models

The two most adopted decentralized models are the following:

- **Staff procurement model:** all purchases are managed **independently** by the individual organization departments and the central procurement office has the function of **supervisor** of the various departments, so as to verify that the purchasing processes follow internal procedures and comply with the law. It is not entrusted to

the central procurement office the purchase of any category of goods but simply support and monitor the execution of the processes of purchase of the various offices.

- **Integrated procurement model:** The purchase of **non-strategic** and **non-technical** product categories is entrusted to the central procurement offices. For the remaining categories it has the function of support, supervision, and verification of the processes of purchase of the several departments' procurement offices. Even if the purchase of strategic product categories are responsibility of the various departments, the central procurement office has a strong decision-making power, in that it is highly involved in each part of the purchasing process (requirement definition, planning, supplier scouting) and acts like a point of connection between the various departments.

2.3.2.3 Hybrid models

Hybrid model are in between of centralized and decentralized organization and are able to capture the advantages of both structures and avoid some of their disadvantages. There are two hybrid organizational structures to be considered:

- **Silo Procurement model:** the purchase of different categories of goods is **divided** between the central procurement office and the departments: generally, the purchase of technical goods and services are under the control of individual departments while the non-technical are under the responsibility of the central procurement office for both operational and strategic aspects. Since the central procurement office does not have the function of supervisor on the activities of the single departments, there is the **risk of duplication** of the procedures of purchase inside the institution, with possible misalignments, above all at the strategic level, including how much the departments can purchase following their own strategies and procedures.
- **Hub Procurement model:** the responsibilities regarding the purchase of different categories of goods is divided between the central procurement office and other departments as already described in the silo model: non-technical goods and services are in the hands of the central procurement office, while technical goods and services are a responsibility of the individual departments. The main difference between the first model and the Hub model is the introduction of mechanisms and integrated solutions to prevent misalignment between the various departments that can happen in the silo approach. For instance, **internal rules** are established to provide clear and univocal procedures to be followed when procuring certain goods and services, in order to avoid duplication of activities or unlawful actions of the departments.

2.3.3 Degree of external centralization

External centralization is based on the principle that organizations centralize their procurement activities through an external body. OECD (2011) defines central purchasing bodies as "a contracting authority that acquires supplies or services intended for one or more contracting authorities; or awards public contracts for works, supplies or services intended for one or more contracting authorities; or concludes framework agreements for works, supplies or services intended for one or more contracting authorities." There are multiple points of view to examine why it is useful to establish a CPB. There is that of

public administrations, which are the customers of CPBs, which search in CPB an efficient and effective way to establish **value for money** procedures; there is the viewpoint of suppliers, which often see in CPBs **economic opportunities** and efficient and effective sales; and last, there is the perspective of the owners of the CPBs – typically the government, or a lower level administration like regions or provinces – which are interested in **reducing public expenditure**, increasing the utilization of value-for-money procedures, and obtain **policy goals**, including **environmental sustainability** and **social responsibility** of procurement practices (OECD, 2011).

There are different **advantages** for establishing CPBs:

- **Lower price of supplies and services:** the aggregation of demand generates large volumes, which in turn will reduce prices of purchased goods. This is obtained due to the fact that larger volumes enable more competition, driving the prices down, at the advantage of the PAs (contracting entities). On the other hand, larger volumes may allow suppliers to exploit economies of scale, reducing their internal costs, therefore, making them able to lower their prices.
- **Reduction of transaction costs:** centralized framework agreements, where conditions of contracts are fixed from the beginning, should reduce the time of a tender procedure both for administrations and economic operators. Consequently, this allows to free resources and dedicate them to other significant activities.
- **Increased administrative efficiency:** coordinated solutions may help in providing standardization and greater efficiency. For example, this might assist in bringing about digital tools and IT systems.
- **Expertise and capacity enabling:** CPBs may give to smaller public administrations an enhanced level of expertise in procurement, which may be too costly to maintain “in-house”. This allows for better prices and higher efficiency levels even in the smaller administrations – and in our case in smaller universities.
- **Reduction of contractual risk:** the technical, economic, and legal expertise of CPBs can give more certainty when contracting out. This will decrease the operational risk for contracting entities, but it will also give more guarantees to suppliers.
- **Respect of economic principles and transparency:** the use of electronic instruments provided by CPBs ensures that supplies, services, or works are contracted transparently and in compliance with regulations.

However, there are also **disadvantages** to central purchasing entities:

- **Market concentration:** the large volumes involved in CPBs activities are difficultly provided by smaller economic operators. This can favor larger companies and establish a monopolistic structure of the market that would be unequal and therefore against the law.
- **Reduction of possibilities for SMEs:** large tenders will not allow SMEs to participate in public contracting if they don't form consortia or act as subcontractors of larger firms. Otherwise, they will only be able to tender for smaller contracts or contracts organized in lots. Furthermore, participation to CPBs tenders require high technical skills and digital knowledge, which in turn creates a barrier of entry for small

companies, that are generally less digitalized. For example, the Italian economy is mainly based on SMEs – 92% of the companies in 2019 were SMEs (Prometeia, 2019) – which will be unable to participate to tenders and therefore will have less opportunities than bigger Italian and other European firms.

- **Unresponsiveness of agreements:** long framework agreements, that can take up to 4 years, are often unresponsive to changes in market characteristics or unexpected events – the most striking example being COVID-19. Designing contracts to support changes will become much more costly and time consuming. However, it is important that framework agreements are kept of a relatively short time and designed to respond to external technological and market price changes to cope with these risks.
- **Uniformity:** framework agreements are often too limiting and standardized, especially when considering technical specifications. This can limit the effectiveness of the procedures and limit applicability to less-standard products and services.
- **Unavailability of products:** it is not always possible to obtain framework agreements on certain standard products, limiting the possible usages of CPBs.
- **Time delays:** since the purchasing body must aggregate demand of different public offices, it might take some time before it reaches a satisfactory level of requests to make a call for competition. This would exclude the usage of CPBs' instruments in time-critical purchases.

Consip S.p.A is the CPB in the case of Italy. It is a company fully owned by the Ministry of Economic Development and it was established with the objective of giving more purchasing power to the public buyers and increasing the usage of value for money as a criterion for purchasing. The usage of Consip has grown vastly, also due to the fact that article 1, comma 2 of the DL n.165/2001 made compulsory the usage of the electronic market managed by Consip – described in *Consip and central purchasing bodies e-procurement tools* – for all the purchases under the European threshold (DL 165/2001) and above the direct awarding threshold set at 5.000€ by the Budget Law of 2019 (Legge 145/2018).

From the 2020 data, the platform of Consip S.p.A. reached 13.441 authenticated public administrations, of which 10.557 with at least one transaction (active users); 157.457 authenticated suppliers, of which less than half (66.832) with at least one sale (Bettacchi Roberto, 2021). A total of 710.179 transactions was performed in 2020, with a total estimated saving of €3.305 million (Consip S.p.A, 2021).

As Consip for the central government, also local jurisdictions noticed the advantages enabled by a CPB and often created their own. For example, in the regions of Emilia Romagna, Piedmont, and Lombardy, there are regional CPBs, respectively, Intercent, SCR Piedmont, and ARIA. They vary with the services provided, but overall, they allow to purchase from e-catalogues, are compliant to international procurement regulations and, enable cost and time advantages, and aggregation of demand at a smaller level than Consip.

2.4 Public Procurement Process

2.4.1 Introduction

This chapter will focus on the description of the purchasing process in all its phases, from the demand analysis of a public organization to the selection of a supplier and the management of the contract. Furthermore, it will present the main stakeholders involved in the procurement process.

2.4.2 Purchasing Process

2.4.2.1 Introduction

We will proceed with a thorough description of the public procurement process, following the most recent model presented on “The legal framework for responsible procurement” (2020), a European Commission official website. This model outlines the main phases of the procurement process and suggests the general guidelines that all the public organizations should follow in order to procure goods, services, or works, especially in the context of innovative and sustainable procurement, which is becoming a more and more relevant matter for scholars (Young, Nagpal, & Adams, 2016) (Islam, Murad, McMurray, & Abalala, 2016) (Filho, et al., 2019). Indeed, the process of public procurement is structured so that it allows the transparency of the public organizations (The legal framework for responsible procurement, 2020).

The main phases of the purchase process are (The legal framework for responsible procurement, 2020):

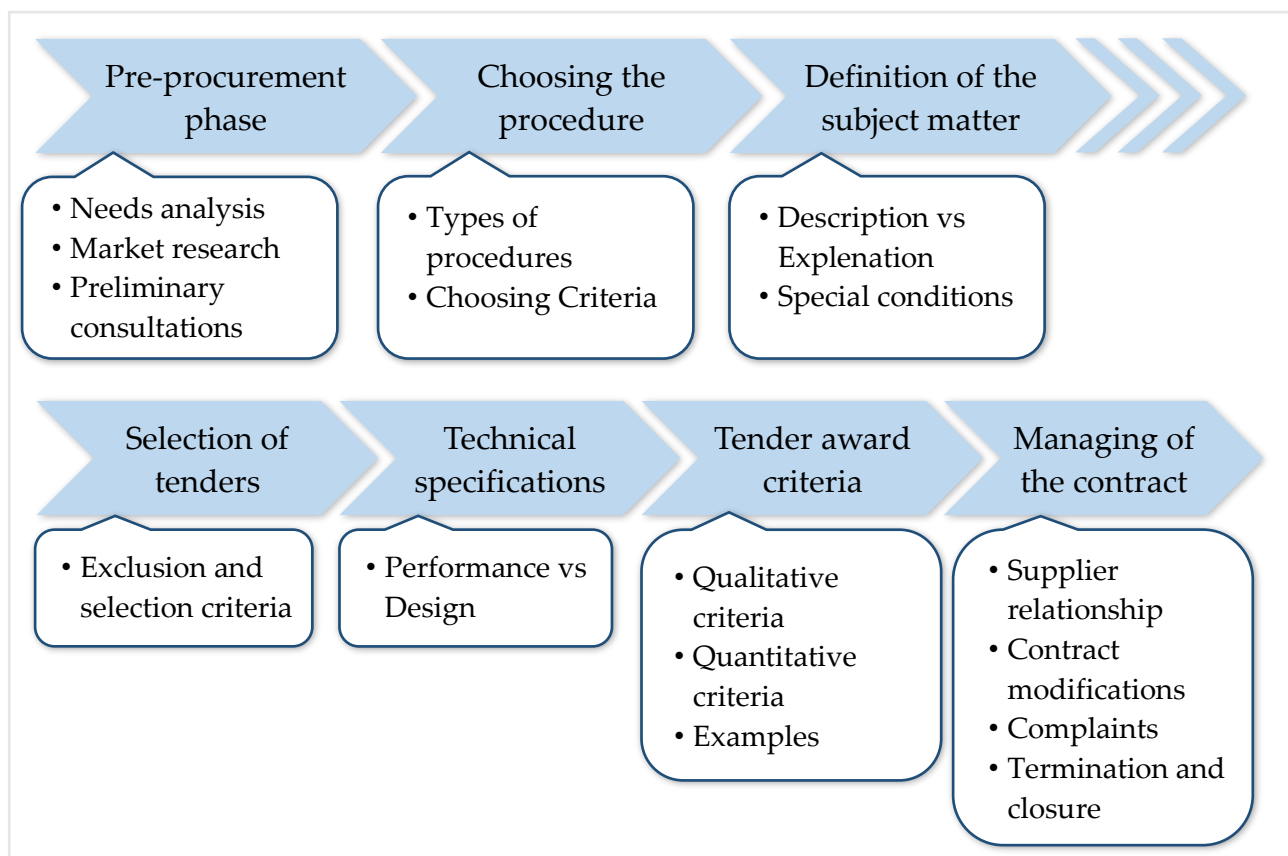


Figure 10 - Phases of the procurement process

- Pre-procurement;
- Choosing the procurement procedure;
- Definition of the subject of the contract;
- Selection of tenderers;
- Technical specifications;
- Tender award criteria;
- Management of the contract.

In the next paragraphs we will provide a description of each of these steps.

2.4.2.2 Pre-Procurement

Before procurement occurs, a public organization has to understand its needs, and this is all pre-procurement is about. The **analysis of the needs** of a public organization is the first step in creating a sustainable and efficient procurement process, since the planning of purchasing activities can help aggregate the demand, avoid transaction costs, and, overall, **simplify procurement** procedures. Pre-procurement operations involve all those activities that have the aim to **inform** the future procurement decisions. It is important for a procurement office to study and analyze in detail their needs and also to compare them with other public organizations which may already have possible solutions for the organization's problems and other invaluable data and experiences. In this preliminary evaluation it is necessary to **know the market**. Often it is made a preliminary market consultation where public authorities, market participants or independent experts give information and suggest courses of action to take in selecting the right procedure and drafting the contract for the good, service or work that is needed.

It is fundamental that in this preliminary phase, all contacts with the market are made in a transparent and non-discriminatory way. Therefore, market consultations must be discussed with all possible tenderers and participants to the future procedure. As noted by "The legal framework for responsible procurement" (2020), this can be done by publishing in the Official Journal of the EU a PIN, in which the needs of the public procurer, or buyer, are described. Then, all the information gathered through the market consultation will be published in accordance with the transparency and non-discrimination principles.

2.4.2.3 Adopting the right procurement procedure

Following needs assessment and market consultations, it is now possible to decide which type of procedure to use to define the contract. To procure a good, service or work there are the following procedures given by the 2014/24/EU Directive:

- **Open procedure:** all market players interested in the contract can submit an offer to provide the goods, services or works requested. All offers must be considered and only after the submission time is concluded, the offers will be evaluated and selected.
- **Restricted procedure:** this procedure is built of two phases and only invited suppliers may present tenders. A minimum of five participants is required by the 2014/24/EU Directive.

- **Competitive procedure with negotiation:** in this format, the public procurer publishes a tender for implementing a solution already defined. Then, the possible providers discuss one on one the technical specifics of this solution with the buyer, which will then select the best offer – in terms of lowest cost or ‘best value for money’ – also known as best price-quality ratio.
- **Competitive dialogue:** similarly, to the competitive procedure with negotiation, the public buyer will negotiate one on one with all the possible suppliers, but in this case, the procurer only provides the needs it wants to satisfy. Therefore, the negotiations will be on the possible solutions that the suppliers can come up with. Each negotiation is discussed separately and is not disclosed with other participants, and the winner of the tender is selected through the principle of best value for money. This procedure is particularly indicated in case the public authority is looking for an original and **innovative solution**.
- **Innovation partnership:** article 31 (Directive 2014/24/EU) states that the innovation partnership procedure is operated with the intent of purchasing an innovative product, service or work that is not available on the market. The public organization will publish a tender and contract the best potential provider of innovation.
- **Pre-commercial procurement (PCP):** this procedure allow a public entity to **procure R&D** services, where the public contractor gives up on the intellectual property rights of the newly developed project but maintains the right to use and to distribute it to third parties. This type of procedure is particularly indicated when a public authority is looking for sustainable and innovative solutions.
- **Design contest:** design contest is a procedure that allows to acquire “a plan or design selected by a jury after being put out to competition with or without the award of prizes” (Directive 2014/24/EU). As stated in the European directive, it is mainly used for the procurement of town or country planning, architecture and engineering or data processing (Directive 2014/24/EU).
- **Direct award:** direct award is the award of a public contract without the requirement of publishing a call for competition in the Official Journal of the EU. To award a contract directly there must be a sound justification and it cannot be done above a certain threshold, that varies depending on the member state national laws and on the type of contract (goods, services, or works contracts).

In a study of Osservatorio Agenda Digitale (2020a), 51% of the respondents where more than satisfied with the performance achieved by PCP and innovation partnership procedures, and 57% declared that they were able to obtain above-average results in terms of sustainability of the solutions.

In order to decide the correct procedure, these main aspects are involved:

- Selection of tenderers;
- Size of the market;
- Involvement of the market and flexibility of the procedures.

2.4.2.3.1 Selection of tenderers

The methodology for the selection of contractors is different based on the procedure that is applied for the contract, thus choosing the procedure influences this following stage of the procurement process. For example, in case of an open procedure, the evaluation of selection criteria and of the tenders is done in the same time period. In case of a multiple stages procedure, such as the restricted procedure, contractors that are interested in proposing a bid will have to go through a first phase of exclusion that usually evaluates their technical skills and professionalism, and only the remaining organizations will be invited to tender for the contract. More in detail discussion about exclusion and selection criteria will be done in the following paragraph (2.4.2.5).

2.4.2.3.2 Size of the market

When choosing the procedure, the size of the market plays a non-negligible role: on the one hand, if the market is small, meaning that there is a reduced number of companies that can provide the needed good, service or work, then an open procedure is recommended to foster competition and limit the price. On the other hand, if the market is large, a multiple stage model can be applied in order to control more efficiently the number of tenders received.

2.4.2.3.3 Involvement of the market and flexibility of the procedures

This aspect of procedure selection is relevant when considering environmental and social sustainability of procurement practices. In particular, public authorities are often less willing to include environmental and social responsibility in contracts since this will reduce the number of tenders received due to the fact that the number of companies that provide innovative and sustainable initiatives is low in the B2G markets.

Furthermore, the use of flexible procedures can foster interaction between public and private organizations and help in understanding each side's point of view through negotiation. As stated by "The legal framework for responsible procurement" (2020), with a negotiated procedure it is possible to discuss environmental performances that will be required. Also, innovation partnership is of huge advantage when considering sustainability, as the procedure is built specifically with the intent of providing a solution that gives the greatest value in terms of environmental and social responsibility.

2.4.2.4 Definition of the subject of the contract

The European Directives leave space to the public entities for the definition of the subject of the contract, or the so-called 'subject matter'. This is allowed by the fact that the Directives give a direction to the buying process, rather than stating the products and services to be bought. Therefore, public authorities can keep this in mind when determining the subject matter of the contract as they can add special conditions, for example economic, environmental, social, innovation or employment-related conditions, if they pertain with the subject-matter (Directive 2014/24/EU). To avoid incurring in legal complications, it is of the utmost importance that the links of sustainable and responsible objectives to the subject

of the contract are clear and thoroughly described. In the case of The Netherlands, tenders usually include a condition to hire vulnerable minorities in the development and implementation of a project.

In the subject matter, it is important to allow a certain level of flexibility. Indeed, it is preferable that the subject matter is presented in a descriptive way and not through the explanation of the required good, or service. The flexibility of wording might result in an increased number of tenders, since some innovative companies might present a different product than expected but with the same functionalities and at a lower cost. A clever example is provided by “The legal framework for responsible procurement” (2020): instead of requiring a “recyclable steel suspension bridge”, it would allow more flexibility a functional description such as “permanent means of transport over a waterway, structured in a way to diminish waste, reuse materials and contribute to a circular economy”. It is clear how the second phrasing allows to receive a much broader set of solutions compared to the first one and might procure even better solutions in terms of sustainability, efficiency, and cost effectiveness.

2.4.2.5 Selection of tenderers

We enter now in the fourth phase of the process: the selection and exclusion of participants. The selection of tenderers must follow clear criteria: the principles of competition, equal treatment, transparency, non-discrimination, and proportionality, as it will be explained in the *Legislation* Chapter. With these principles in mind, we will proceed in discussing the exclusion and selection criteria.

2.4.2.5.1 Exclusion criteria

There are some minimum criteria that all tenderers must comply with. For example, public organizations have the power to exclude all companies that are proven unreliable, in case they infringed sustainability obligations or laws on accessibility to disadvantaged groups (Directive 2014/24/EU). Also, as stated by the European Commission, all contracting organizations must exclude companies that were convicted for child labor, human trafficking, environmental, social, and labor law infringement.

2.4.2.5.2 Selection criteria

Selection criteria are set to evaluate the participants’ professionalism and technical skills, as mentioned before in the dissertation. By applying selection criteria, a public procurer can limit the number of companies and operators that present tenders in order to simplify a negotiated procedure, and only have to discuss with few tenderers. However, it is stated in the directive that these criteria must be non-discriminatory and objective and only focused on assessing the tenderers’ ability to perform the required job (Directive 2014/24/EU).

2.4.2.6 Technical specifications

The CIPS and NIGP (2016) define a specification as “[a] precise description of the physical characteristics, quality, or desired outcomes of a commodity to be procured, which a supplier must be able to produce or deliver to be considered for award of a contract”. Specifications can be formulated in terms of performance or design criteria, or functional requirements or by reference to standards (The legal framework for responsible

procurement, 2020). Below are listed the main items that may be included in a specification (Government of South Australia, 2012):

- An introduction;
- The **scope** and **context**;
- Procurement **objectives** and **outcomes**;
- Statement of **requirement(s)**;
- Other documents relevant to the requirement;
- **Service conditions** and **environmental factors**;
- Technology, systems, and management techniques;
- **Quality** requirements;
- Occupational health, safety, and welfare;
- Whole of life support;
- **Security measures** relevant to the requirements;
- **Training** requirements;
- **Documentation** requirements;
- **Transition** requirements;
- Implementation timetable;
- Glossary;
- Attachments.

Now we will look more in detail the two main types of technical specifications, which are performance and design specifications, and eventual sub-categories.

2.4.2.6.1 *Performance specifications*

A **performance specification** is the description of the **required outcomes** or of the **intended functionalities** of the good. Performance metrics are used to test the achievement of the intended level of performance of the good (service or work) procured (Supply Chain Process Improvement, Inc., n.d.). In general, performance specification allow tenderers to be more innovative and creative in providing a possible solution. While the outcome is set, the way to achieve it is decided by the producers. Usually, this type of specification is adopted when there is no known product that has the functionalities or performances that the public procurer is looking for. This, on the one side, is useful for the public procurer who has a means to obtain its objectives but, on the other side, put a high degree of **risk on the supplier**, who will be evaluated on the criteria defined during the negotiation (complications may arise during the development of innovative projects).

Literature proposes the following pros and cons for applying performance specifications: those in favor argue that it provides space for **innovation**, allowing participant to propose **unique systems**; it allows for the usage of the **newest technologies** and goods; if service levels are not achieved it is possible to adjust the aim of the project, allowing a certain degree of **flexibility**. On the contrary, it is difficult to define good and specific performance metrics case-by-case; it requires time consuming tests of performance in terms of reliability, practicality of usage and cost-effectiveness and efficiency.

Different characteristics can be included in performance specifications, for example:

- **Functional description:** functional characteristics that define the task required or the desirable outcome of the project. This descriptor is usually used in procuring technological goods and aim at giving an experience during the usage of the product.
- **Brand name description:** it identifies a particular product of a certain brand. It is used for standardization of products in an organization to simplify employees' training (for example all laptops in the administration office will have a specific operating system to allow for easiness of usage and interconnectivity), but in turn it is very restrictive on the supplier side.
- **Brand name or equivalent description:** it is more flexible than brand name performance specification. It gives to the tenderers a product of a certain brand as a comparison of the required performance and functionality. Both 'brand name' and 'brand name or equivalent' descriptions will limit the innovation level of the solution, may limit competition and in turn increase price of the solution.
- **Combination of the above:** for certain categories of products which are more complex, it is possible to adopt multiple types of descriptions in order to be more specific on the required commodity.

2.4.2.6.2 Design Specifications

A design specification includes the description of the characteristics that a commodity must have, also considering how a certain commodity will be produced. The aim of design specifications is to obtain a **custom product or service**. It limits the tenderers on one side, but it puts the majority of the **risk on the procurer** since there might be designing errors or omissions in the specification. Indeed, suppliers may argue that poor performances are due to problems in the design provided by the public organization rather than to poor production skills of the supplier.

Here is reported a list of descriptors and documents that a design specification might contain, according to DESA (2012):

- Drawings;
- Dimensions with tolerance level;
- Definition of terms;
- Description of materials so that the supplier can meet the cost, manufacturing process and delivery requirements;
- Minimum requirements;
- Detailed testing, sampling, and inspecting methodologies;
- Industry standards;
- Considerable alternatives.

As for performance specifications, also in design specifications are present advantages and disadvantages. On the advantages side, it is argued that this specification gives more assurances to the buyer, and it allows for an **objective evaluation** of the solution but there are several disadvantages, for example it increases the risk of the public authority, it **reduces the possibility to innovate** (more that brand name equivalent) and the preparation of the design specification is **expensive** and **time consuming**, requiring many technical experts

and multiple reviews, since a small mistake can make the procurer liable for non-satisfactory performances and other issues that may arise during the production stage.

2.4.2.7 Tender award criteria

The three criteria used by public procurers when evaluating the award of a contract are **price-only criteria**, which overlooks all aspects prior to and following the purchase of a good or service; **most economically advantageous offer**, so the lowest cost tender, which evaluates also transaction costs, and usage and maintenance costs (depending on the model adopted, some costs are more relevant than others); and **best price-quality ratio**, which is evaluated based on qualitative and quantitative assessments, sustainability measurements, and social responsibility criteria.

Price-only approach only considers the price of acquisition when choosing the best offer. There are no cost analysis and no quality considerations involved (European Commission, Directorate-General for Regional and Urban Policy, 2018). This criteria for evaluation can be useful for **simple, standardized supplies**, works with design specifications so that the processes and materials are already defined, and the only important aspect is who provides them at a lower price.

When looking at MEAT, the cost of the commodity can be defined in different ways. There is TCO, which aims at understanding the true cost of buying a certain good or service from a supplier, in that it considers all the significant costs derived from the acquisition, possession, use and subsequent disposition of a good or service (Ellram, 1995). Similar approaches, as described by Ellram (1995), are life-cycle costing, which puts an emphasis on the price of the asset and pre-transaction costs, and considers cost of use, maintenance and disposal to a smaller extent than TCO (Jackson & Ostrom, 1980); there are zero-base pricing (Burt, Norquist, & Anklesaria, 1990) and cost-based supplier performance evaluation (Monckza & Trecha, 1988), which should compute total costs, but compared to TCO, the first focuses on the supplier side costs (for example cost of doing business and cost structure of the supplier), and the second focuses on external cost of doing business rather than external and internal as TCO (Ellram, 1995).

For what concerns price-quality ratio, or so-called '**value for money**', it is intended to identify the offer that gives the **best quality** while managing to **contain costs**. The criteria to evaluate the best value for money are based on the subject of the contract and may include environmental, social, and qualitative aspects (European Commission, Directorate-General for Regional and Urban Policy, 2018). It can be applied in works where the design is provided by the tenderer, in supplies of innovative and **specialized products** or services, or in case of **technical maintenance** with a high degree of complexity involved. Generally, the award criteria chosen will be evaluated with a system of weights and then a final score is given to each proposed solution. The European Commission (2018) provides a table of the main award criteria used in best value for money approach (Table 1).

| Criteria | Sub-Criteria |
|----------|--------------|
| Price | Fixed Price |

| | |
|--|---|
| | Rates (i.e., Daily fees, unit costs) Life-cycle cost |
| Quality | Technical merit Aesthetic and functional characteristics Accessibility and design for all users Social, environmental, and innovative conditions |
| Organization | Project management Risk analysis Quality control |
| Staff assigned to carry out the contract | Where the quality of the staff assigned has a significant impact on the way a contract will be carried out: <ul style="list-style-type: none"> • Qualification of staff; • Experience of staff. |
| Service | Delivery conditions such as delivery date, delivery process, and delivery period or period of completion Maintenance After-sale service Technical assistance |

Table 1 - Possible award criteria and sub-criteria of best value for money evaluations. (European Commission, Directorate-General for Regional and Urban Policy, 2018)

Lastly, there can be sub-criteria in case of two or more equally good solutions. Such sub-criteria can be the presentation of action plans to achieve the final outcome, the delivery of the project with zero emissions and other initiatives (The legal framework for responsible procurement, 2020). Of course, the same principles of non-discrimination and transparency apply to the sub-criteria as well.

2.4.2.8 Management of the contract

Finally, we arrive at the last step of the procurement process, the management of the contract. Once a tender is selected the contract is awarded and the implementation of the contract starts. The goal of contract management is to ensure that both the public authority and the contractor meet their contractual obligations (European Commission, Directorate-General for Regional and Urban Policy, 2018).

In public contracts, which usually last a long timeframe and involve multiple stakeholders, there is always the possibility of unforeseen issues that can cause delays and complexities in development. This is the reason why investing in contract management is fundamental for every public organization.

The fundamental phases of contract management, according to “The legal framework for responsible procurement” (2020), are:

- **Communication and relationship with the supplier:** it is beneficial to the public entity as well as for the supplier to be in a constructive and healthy relationship throughout the implementation of the contract. This can ease the process and allows to avoid issues related to lack of communication.
- **Contract management:** some common project management techniques can be implemented, such as progress reports, interim reviews, service level agreements (in case of complex contracts), and self-assessments, which should be kept simple and not time consuming in order to keep a good relationship with the supplier. Too strict control can damage the trust of the contractor and result in a lower performance than expected.
- **Contract modification:** good contract planning, and specifications should minimize the need for contract modifications. In very specific occasions, modifications of existing contracts are allowed by EU and national laws, otherwise, supplementary services, works or goods should be again tendered to new suppliers (or the current one if the existing supplier is awarded the new contract, considering all the evaluation criteria and fairness principles that would apply to a new contract).
- **Complains and remedies systems:** contractor can complain that the public organization did not respect the legal framework (the intentionality of the infringement does not play a role) and therefore ask for compensation, if needed. Regarding remedies, there are several directives in the EU procurement law that allow for the suspension of unlawful decisions of the public authority and can in certain case close the contract itself and award compensations to the supplier.
- **Anticipated termination of the contract:** there are several reasons for which a public organization may be forced to close a contract prior to it being completed. For example, in case the contract is modified whereas a new contract should have been issued; in case the contractor infringes its obligations or makes unlawful actions during the period of the contract; or in the event of unforeseen natural disasters that cause the impossibility to meet the contractual obligations (COVID-19 is a perfect example of the latter).
- **Closing of the contract:** when the project contracted is completed and the reviews, tests, and final evaluation of performance are executed, the contract will be closed, and the contractor will be paid. In case of big and long contracts there is the possibility of a closing ceremony that involves the interested stakeholders.

2.4.3 Stakeholders

Stakeholders are individuals or groups of people which have a stake in a certain company or organization, and therefore have an interest in the company or organization doing well. Most of the scholars agree on the fact that public procurement involves a broad range of stakeholders (Boyne, 2002) (Rowley, 2011) (Oliveira, Simão, & Caeiro, 2020). Indeed, public

procurement has a considerable amount of both external and internal stakeholders. External stakeholders are those people or organizations that interact with the procurer or with the public entity. There can be two categories of external stakeholders: governmental and private. The **governmental stakeholders** are the public authorities that control the behavior of other public organizations' purchases or other partnered public entities. Instead, **private stakeholders** include the population, for example the local community, and private companies, such as the suppliers and economic operators, and other members of the society who interact with procurement practitioners and the public organizations, such as the students at a university which indirectly benefit from the public procurers' purchases. Furthermore, if we consider the usage of sustainable and responsible public procurement practices, it is argued that also the **environment** is a stakeholder in the procurement process (Haigh & Griffiths, 2007) (Oliveira, Simão, & Caeiro, 2020). On the other hand, internal stakeholders are all the **public employees** that work in the procurement department from the assessment of the needs to the management and the closure of the contract, including professionals that work on the specifications as well as the **legal department** that checks the right stipulation and execution of the contracts, or, for example, the **general director** inside a public university who oversees the procurement office.

2.5 E-Procurement

2.5.1 Introduction

E-procurement, short for electronic procurement, was defined as "the use of integrated (commonly web-based) communication systems for the conduct of part or all of the purchasing process; a process that may incorporate stages from the initial needs identification by users, through search, sourcing, negotiation, ordering, receipt and post-purchase review" (Croom & Brandon-Jones, 2007). From this definition it is clear that public e-procurement is a broad and complex concept that involves the digitalization of parts or all of the procurement processes of public organizations, covering all those steps identified in the *Public Procurement Process* Chapter, from pre-procurement to management of the contract. Indeed, e-procurement is of great importance as Nelson et al. (2001) observed that purchasing structures account for the majority of organizational spending, and many scholars have seen and still see in e-procurement the chance for a great reduction in total cost of acquisition (Croom, 2000) (Essig & Arnold, 2006) (De Boer, Harink, & Heijboer, 2002) (Wyld, 2002) (Rai, Tang, Brown, & Keil, 2006).

In recent years, many efforts have been made by the EU, and subsequently its member states, to increase the number of PAs that adopt digital tools and electronic instruments for the stipulation and management of tenders and public contracts. JoinUp (2008), an EC official website, highlighted that e-procurement is composed of a great quantity of sub-phases that we will report below:

- **eSourcing**: process in which the contracting entity collects information to prepare a call for competition. Potential participants, if compliant to regulations, can be contacted through electronic tools or present interest to the contract.

- **eNoticing:** advertisement of the contract published on the Official Journal, at first that of the EU, and then on the national one.
- **eAccess:** electronically available documents and specifications, accessibility, and support for potential suppliers in the presentation of tenders.
- **eSubmission:** e-Submission is the process of submitting tenders by electronic means to the public procurer. The buyer can then receive, accept (or decline), and process the tenders in compliance with national and European regulations.
- **eTendering:** it is used to address the phases of e-Access and e-Submission together.
- **eAwarding:** is the process of opening and evaluating the offers received, awarding the contract to the lowest-price bidding, MEAT, or best-value-for-money offer, depending on the type of procedure adopted.
- **eOrdering:** refers to the use of internet to simplify ordering, order approval, order receipt and payment of the orders.
- **eInvoicing:** invoicing to the supplier through electronic tools.
- **ePayment:** payment of goods, services and works by electronic means.
- **eSignature:** data that serve as method of authentication of the public entity and the economic operator. It is attached to the documents of the contract or the tender if needed.
- **eIdentity:** electronic information that pertain to the identification of a person, enterprise, or object.
- **eAttestations:** they refer to the set of certificates and documents that confirm the compliance to regulations of the suppliers.
- **eCatalogues:** they are the supplier catalogues translated into a digital format. They are used to submit bids.
- **eArchiving:** usage of electronic storage or cloud-based archives for the storage of documents, ensuring security, transparency, and easiness of retrieval.

This classification of the sub-phases of e-procurement are mentioned to better understand the European Directives in this matter, discussed in Digitalization of the procurement process, within the *Procurement regulation* Chapter.

In Italy the digitalization of public administrations, including public procurement processes, is proceeding slowly. In terms of suppliers, of the 112.339 Italian producers of

digital solutions, only the 15% works with governmental agencies, and the distribution on the territory of these suppliers is strongly heterogeneous. Furthermore, the market not only is small, but it is concentrated as well, being only 13 the suppliers that satisfy 60% of the needs for digitalization of the PA (Osservatorio Agenda Digitale, 2020a). Nonetheless, in terms of public organizations, Italian public services place in 19th position – out of 28 – in the area dedicated to digital public services of the 2020 edition of DESI, maintaining the position of the previous year and shortening the gap with the other member states.

In the last years, in Italy, some steps have been taken in the direction of integrated electronic solutions for PAs. The objective is to reach with cloud solutions the 75% of PAs within 2026. For this purpose, the 27% of the PNRR fundings are destined to digital transformation (Parlamento Italiano, 2021). While before COVID-19 cloud solutions were adopted as infrastructure alone, now it is starting the trend of employing cloud solutions as a service provided by a third party, making scalability and integration with existing systems much easier, and removing the costs of management, maintenance, and space restrictions.

2.5.2 Critical Success factors to the implementation of e-procurement

Gardenal (2010), in its paper “Public E-Procurement – Define, Measure and Optimize Organizational Benefits”, analyzed the critical success factors to the implementation of IT solutions in procurement. These factors relate to four different areas: **technology**, **process**, **people**, and **environment**. First of all, when looking at technology, it is fundamental for the implementation of e-procurement a well-established and functional **IT infrastructure**. Infrastructure for a cloud-based system is the first CSF for the realization of e-procurement. Then, there is the need for a **transition** from existing systems – that may already be electronic, but not automated – **to e-procurement platforms** or ERP systems that are **integrated** with other software of the organization, for example the accounting or planning software, if in use. However, technology alone does not enhance the performances of the office, unless the employees adopting it are **skilled** or facilitated in its usage. Therefore, it is fundamental that e-procurement platforms follow three principles:

- **completeness**: it should allow to follow a procedure from the request of purchase or request for offers to the payment of the supplier;
- **User-friendliness**: the user interface must be simple and easy to use for the majority of the public employees with a limited training;
- **Free**: developed with open-source software to limit costs of licenses.

When looking at process, **business process re-engineering** must be used to change the procurement process in order to adapt it to the new needs of the procurement office, to maximize the efficiency and effectiveness of ICT-based procurement systems. Then, to further increase the efficiency, the **standardization** of processes and commodities purchasing must be adopted, where possible. The standardization of activities and standards for commodities simplifies the work of public procurers and allows for time saving, so that this time can be employed in more complex and consuming tasks for non-standard products or services. Third CSF in the process theme is the adjustment of **internal rules** of the organization. Especially in hybrid or decentralized organizational structures, in which different departments may follow different rules, changing and homogenizing

internal rules is a must to strengthen **inter-units cooperation** and **coordination**. This also means that there has to be a **shared logic** and methodology for measuring, reporting and publicize the results of **performances evaluation**, supplier satisfaction surveys, and other evaluation documents.

Regarding people involved in procurement, **user awareness** is of the utmost importance. Indeed, practitioners are the ones that will have to use e-procurement tools, so their awareness must be risen. End-users can realize the immediate benefits of the e-procurement system once they understand the operational functionalities (Consortium for Global Electronic Commerce, 2002). This is done through seminars, **training sessions** as well as through **top management support**. Training should be highly prioritized, together with the need to understand the abilities of practitioners. Since technology on its own would not guarantee successful adoption of e-procurement, it is fundamental that both public procurement practitioners and end users make use of the new digital systems (Thai, 2009). A key enabler in the people perspective is the **willingness to change** the status quo and adopt a new process, a new technology and a new organizational culture. Furthermore, technical, legal, and strategic support can be provided for the first e-procedures to help practitioners in adapting to the new processes and to online procedures.

Lastly, there is the environment perspective, which is a relatively new focus of political agendas in the majority of the countries. E-procurement can contribute to the reduction of paper usage and thus allow for better **sustainability** of the process than before. The first CSF in the environmental area is to give a clear political definition of the goals related to the effectiveness that e-procurement tools must provide. For this to be achieved it would be necessary to create a **comprehensive and unique set of regulations** in the field of sustainability so that organizations have a direction to pursue given by the government, that can guarantee **uniform adoption** and **interoperability** of adopted systems. Also, **innovation** should be a key point to allow environmental responsibility and 'centers of excellence' should be developed to provide knowledge about innovative best practices and tools. On the other side, also the **suppliers** should be involved in transforming their business activities **towards greener solutions**. Indeed, cooperation between public and private organizations is necessary to create truly sustainable projects.

Vaidya et al. (2006) have also analyzed CSFs and showed some different points with respect to what Gardenal (2010) presented in his study. For example, it is mentioned that a CSF in the technological sphere is **security and authentication** of e-procurement tools. Since the data and information about payments and orders should be maintained confidential, the encryption of electronic data is the first requirement of any e-procurement software. Also, in the process area, Gardenal (2010) did not point out the need for an **implementation strategy**. Many project failures, both in the private and in the public sector, derived from poorly planned implementation strategies and not from the complexity of the system to be implemented. Other CSFs mentioned by Vaidya et al. (2006) are end-user uptake and training, supplier adoption, system integration, business case best practices, process re-engineering, top management support, change management, performance measurement,

technical standards, which are all similar to what is presented more recently by Gardenal (2010).

Dooley and Purchase (2006) analyzed the factors influencing the adoption of e-procurement systems. As Vaidya et al. (2006) and Gardenal (2010) did, also Dooley and Purchase (2006) pointed out that cooperation with and **participation of suppliers** is of great importance in choosing and implementing electronic procurement tools, since any e-commerce platform involves both the supplier and buyer sides. Furthermore, if practitioners perceive that the adoption of e-procurement technologies can make their tasks easier, then their desire to adopt a new system would increase (Dooley & Purchase, 2006). As the other authors, they highlighted the need for **internal organization**, training of employees and integration with the organization's existing and suppliers' systems influences greatly the adoption of new technologies. Overall, there is much agreement and concordance in literature regarding the CSFs involved in the success of implementing e-procurement initiatives in an organization.

2.5.3 Benefits of E-procurement

Benefits are the positive impacts that derive from the implementation of e-procurement tools and as such they also are the drivers that can lead towards the implementation of e-procurement tools in the first place. Indeed, many PAs claim that public procurement should be **prioritized in Governments' agendas**, and they are already implementing buy-side electronic procurement platforms (Vaidya, Sajeev, & Callender, 2006) (Azanlerigu & Akay, 2015). Some of the main benefits that are present both for private and for public organizations are described by the Oxford College of Procurement and Supply (2014):

- **Reduction of transaction time:** single transactions are much quicker to be processed than before. Electronic systems remove the limit of office hours for transactions to take place, largely increasing efficiency.
- **Electronic catalogues:** they enable companies to market their products online, allowing for price transparency and fostering competition. E-catalogues (described in Chapter 2.5.4.3) are useful also when working on market analyses.
- **Increased standardization:** the adoption of e-catalogues led suppliers to produce more standardized products so that the buyers can more easily compare different vendors. However, standardization is usually in shape and aesthetics of the products rather than in quality and performances.
- **Wider spread supplier bases:** as the EU directives require to publish online calls for competition in the Official Journal of the EU, the internet enables many more suppliers to answer to the call, therefore there is a much higher selection of suppliers from which to choose for performing a contract. This can help diversify the risk related to unsatisfactory performance of suppliers or supplier's misconduct, since a contract can be assigned to more than one operator.
- **Increased productivity:** electronic procurement tools save time on tasks that were before performed manually by employees. Now employees can focus on other more strategically significant tasks, such as supplier relationship management and specifications definition.

- **Simple configuration and scalability:** e-procurement suites can grow together with the organization because web-based and cloud-based platforms can easily support scalability. Third party applications allow an increase in storage and computing power with bigger subscription packages.
- **cost efficiency:** with the higher competition, together with the reduction in time spend on each single transaction and procedure, both process costs and price of the products will decrease.

Other e-procurement advantages that may characterize public institutions are (Donato, Mariconda, & Mirrione, 2020):

- **Transparency:** public entities will be able to procure goods and services in complete transparency, which is a strength when considering stakeholders relationships and accountability to the public. Transparency is a cardinal and fundamental principle of all public institutions and of their relationships with the citizens (Donato, Mariconda, & Mirrione, 2020), and having instrument that can guarantee full accountability of public institution spending is positive for the citizens as well as for the public authorities that control public administrations. This new degree of accountability leaves also lower space for corruption.
- **Legal certainty:** through e-procurement tools, every action made by the procurement professionals, other public employees, suppliers, and any stakeholder involved in the process is traced and recorded. Therefore, there will be a **lower risk** of disputes since there is no space for interpretation, being every communication written, and usable in the court of law. Moreover, e-Actions and e-Tendering software, as well as all the other instruments available on the market, are programmed to be compliant with current legislation and are frequently maintained up-to-date, and this makes it almost impossible to commit mistakes that would end up in creating legal controversies.
- **Contrast to corruption:** this advantage derives from a combination of the considerations made for transparency and legal certainty. Since communications, tenders, awarding, and every other phase is made through digital tools, the margin to commit crimes is very limited, and **traceability** of communication will diminish the chance of fraudulent behavior of public entities or economic operators. For example, a digital tool will maintain **confidentiality of offers** of a tender until the time limit to present them is reached, while traditional envelopes can be, to a certain extent, tampered with.
- **Higher competition:** the public sector works in tight contact with businesses. Public procurement is the link between private and public sector and as such, its efficiency is a key component to attracting more businesses into making B2G contracts. The increase in efficiency that e-procurement tools bring to public procurement will increase the attractiveness of public contracts and, therefore, it will increase competition between economic operators.
- **Push for innovation:** technology usage not only will be an advantage for public institutions, but it will also stimulate innovation in the market and in other offices. If procurement were to be the only office with digital instruments, communication with

other offices would be slow and inefficient, therefore it is a must to innovate and digitalize every process and activity of an organization. On the suppliers side, digital, efficient public institutions will attract more economic operators to the B2G market and the only way they will be able to access the market would be by adopting themselves digital technologies to communicate, present proposals, and finalize contracts.

Croom and Brandon-Jones (2007) described the impact of e-procurement implementation on the UK public sector organizations. They thoroughly divided the results of their findings into five themes that were identified by existing literature. Of these themes, four include many benefits of e-procurement implementation: changes to total acquisition costs, changes in organizational characteristics, changes in governance structure, and system specifications.

Total costs of acquisition are highly influenced by the adoption of e-procurement technologies. In particular, the benefits can be divided into two sub-segments: decrease in process costs and purchase price reduction (Croom & Brandon-Jones, 2007). Process cost reductions are related to a reduction in the number of errors in transmission, re-engineering of the process, and increased compliance with the process. Regarding price reduction, they declare that their respondents were able to improve the management of information, therefore providing stronger specifications and improving their bargaining power, which in turn allowed for a price reduction.

The improvements related to process are not reached only by adopting a new e-procurement platform, but it was necessary to train, support and educate practitioners to use the platform correctly. User compliance is an important issue (Croom & Brandon-Jones, 2007) and the problem of 'maverick' purchases – it refers to the purchase of goods or services without adopting the formal procedure identified by the procurement office or authorized suppliers (Angeles & Nath, 2007) – or non-compliant procurement practices have been mentioned by many scholars (De Boer, Harink, & Heijboer, 2002) (Croom & Johnston, 2003) (Reunis & Raaij, 2006). Different departments implemented solutions to this problem such as specialized training, periodic seminars, help centers and the organizations benefitted with improved accessibility of users through e-procurement tools, increased internal service perception and enhancement of the status of the procurement function inside the organization.

Thirdly, supply governance was impacted by e-procurement in many ways. Electronic systems typically improved communication with suppliers, increased the suppliers' compliance and elevated the transparency of the whole process. Furthermore, it allowed for a reduction of the supply base, but an increase in quality of the suppliers and, where there were existing relationships, e-procurement allowed to strengthen them. Lastly, it helped to aggregate demand and allowed to share more knowledge with suppliers.

Finally, two areas of system specifications benefitted from e-procurement: system integration and data management. When procurement system specifications were linked to strategic IS investments, integration was a critical concern and therefore, obtaining it gave great advantages not only to procurement but also to other functions within the

organizations – for example a procurement system integrated with the accounting platform would make budgeted approvals automated and instantaneous, with a consequent reduction in time and costs on this operation. Furthermore, Croom and Brandon-Jones (2007) noted that many organizations improved information management and management of knowledge after the implementation of e-procurement.

These findings by Croom and Brandon-Jones are consistent with the theoretical benefits described in the first half of this paragraph by the Oxford College of Procurement and Supply (2014) and Donato et al. (2020).

2.5.4 E-procurement tools

2.5.4.1 Introduction

After a discussion about e-procurement theory and case studies evidence of its benefits, we will provide a description of the main instruments available to e-procurement. Some were already cited in the previous paragraphs of this dissertation but now they will be analyzed more in-depth. Some of the tools presented below were described by Scuttari and Agasisti (2016) in their book “Acquisti nelle Università” (Purchases in HEIs) and will follow the categorization proposed by a Report of “Osservatorio eProcurement nella PA” (2006) (EProcurement in PA Observatory). The report categorizes e-procurement systems in e-sourcing, e-catalogue, and e-marketplace systems.

2.5.4.2 E-Sourcing instruments

Within the category of e-sourcing are considered all those instruments that aid to many pre-procurement activities, for example the analysis of needs, search of suppliers, and qualification of suppliers, as well as requests for offers, and negotiations phases of the procurement process. Below are some examples of tools pertaining to this category:

- **Report and analyses instruments:** that support procurers in the pre-procurement step, so the analysis of needs, qualification of suppliers, market analysis, and those activities where elaboration of data occupies much of the productivity of the employees (in a manual system). Some examples of reports are spend reports, which aid to budgeting and cash flow management; supplier base reports, that help to keep track of the inventories and usage of supplies; category analysis reports, which are supplier base reports for specific categories of goods or services, helpful in managing performance and supplier compliance; account payable reports, to create forecasts for next periods. (Murphy, n.d.)
- **Register of suppliers:** it is an effective instrument that supports in choosing the right suppliers (Scuttari & Agasisti, 2016). E-registers of suppliers allow to collect and control general and professional requirements of different suppliers in a single space. Usually, it is built as a web-based platform where suppliers can register and provide their credentials. This platform will then serve as a digital archive of suppliers, both old and potential. This allows the PA to analyze the different economic operators and select those that are best fit to tender for a certain contract. The main functionalities of these instruments are: gaining access to all suppliers' information, including product categories sold, certifications and related documents; managing of the

information of companies that supply goods, services or works or other activities; managing fairly and transparently the rotation of invited suppliers; and managing communications, invitations, and reports through electronic means (for example certified e-mails). (Net4market, n.d.)

- **Instruments for requests for proposals (RFP software):** these instruments are created to support the process of sending, aligning, and exchanging proposals and quotations with suppliers before the actual tender starts. They allow, on the buyer's side, to have a first overview of the price offers, and, on the supplier's side, it allows to prepare a well-defined and structured offer to present to the buyer during the real tendering process. The main advantage of these instruments is that they allow for a great level of transparency of this pre-procurement phase. Also, they allow to compare offers of different suppliers easily and to determine the best proposal with minimal efforts, in terms of time and costs for the evaluation. On the supplier side, these tools allow for real time tracking of the result of their submitted proposals, and for collaboration with other stakeholders.
- **Negotiation instruments:** that can be auction or tender negotiation instruments, or both. eAuction instruments allow competition between potential providers that will lower the price of their bid in order to get awarded with the contracts in question. These kinds of instruments are made to send and receive proposals and counterproposals by a multitude of suppliers and give the possibility to know in real time the offer with the lowest price until the closure of the auction (Osservatorio eProcurement nella PA, 2006). Telematic tendering instruments instead are programmed to be identical to traditional tenders, where suppliers give their offers in closed envelopes and await the opening of these electronic envelopes and the award of the contract to the best offer (Osservatorio eProcurement nella PA, 2006). Through the use of available technology, it is possible to ensure security of this procedures even more than with traditional means, and it can also ensure transparency and privacy. Overall, both eAuction and eTendering instruments are tools that allow the holding of procedures online. Through these instruments, the publication, the acquisition of documents, and the procedure itself happen in a dematerialized and collaborative manner (Scuttari & Agasisti, 2016). Different instruments can support different types of procedures. For example, SATER, Emilia Romagna's System for Telematic Purchase, since 2015, can support any type of procedure, above and below European threshold.

2.5.4.3 E-Catalogue instruments

The procurement process from catalogue involves the following activities: management of the catalogue, generation of an internal request for order, authorization and dispatch of the order request, logistics (shipping and delivery of the goods, reception, and verification of compliance), and management of the administrative-financial-accounting cycle (confirmation that contractual aspects have been met, reception of the invoice and payment). In support to these tasks there are the following instruments:

- **Web Catalogue:** it is a web-based platform where items for sale include a photograph and a description of their specifications, and it allows to purchase items by placing

an order on the selected ones. In particular, it allows to view products and services on virtual showcases, to purchase items by filling your virtual “shopping cart”, and to search products and services by category or by supplier. Furthermore, suppliers can update themselves the products without the approval of the administrative office if the web catalogue is implemented jointly with the register of suppliers, allowing only credible supplier on the catalogue. The strong advantages provided by a web catalogue suite are evident when considering that it enables fast and simple comparison of different products and services, different suppliers and different goods categories that may satisfy the same need, so that it is possible quickly to find the best available solution, both in terms of the provider of the product or service and the technology or activity to be provided. Furthermore, it is in line with the principle of transparency, non-discrimination of suppliers, which can all partake to the catalogue, if they have the necessary legal and financial requirements, and ensures competition.

- **Workflow management tools:** these tools allow to automate purchases from e-catalogue by automating the process of budget approval for requests of order of the public entity. It is possible to set different budgets to different departments of a university, for single transactions and for defined time periods. When the limits are exceeded, the decision of approval will fall in the hands of the central administration. In other words, workflow management software can optimize workflow, eliminate redundant and, often, time consuming tasks, integrate with the processes of other offices and overall improve efficiency.
- **Digital signature:** it is a security technology. It is a set of data that defines univocally an individual or an organization, and it replicates online the value that a signature would have on paper. Usually, in public administrations’ e-catalogues, it is used as a form of authentication to enter e-marketplaces and e-commerce. Digital signature is extremely important in terms of protection of confidential information, accountability, and traceability of actions on official, or reserved, documents. Furthermore, it is essential for the security of all the steps of public procedures and gives access to e-Catalogues or other resources only to authorized employees. An example of digital signature is provided by Titulus, a software for document management that allows to manage, organize, and store internal documents, and it gives access to different documents on the basis of digital signatures and employees authentication.
- **E-Document exchange systems (e-DES):** These tools concern the last steps of the accounting cycle – namely the emission or receipt of invoices, payments, and reconciliation. With e-DES, it is possible to digitalize these steps and, to a certain extent, automate them, allowing to manage orders, delivery notes, invoices, and payment notification in a simpler manner. E-DES integrates with ERPs or procure-to-pay suites, guarantying fully automatized operations. This is an advantage for different stakeholders: the public organizations, suppliers, but also partners. Communication becomes, easier, faster, and transparent, in case of disputes.

2.5.4.4 E-Marketplace instruments

As stated in the Report of “Osservatorio eProcurement nella PA” (2006), e-marketplace is an aggregation of e-sourcing and e-catalogue instruments into a unique “offer model”. Usually, E-Marketplaces are platforms controlled and managed by an external organization. They did not receive in the private sector the same attention that have received in the last two decades from public entities. Indeed, there is great usage of e-marketplaces in the purchase of low-complexity, high-standardization items, because they allows to find more competitive prices without the need to setup a costly procurement procedure. E-Marketplaces allow to:

- **Use already-certified suppliers:** as for e-sourcing instruments, public authorities can make market analyses, which will include exclusively suppliers that were already vetted by the platform. This guarantees a high degree of reliability of the suppliers, leading to less disputes or litigations, and increases the overall quality of suppliers and offers received.
- **Purchase from catalogues:** e-marketplaces can allow direct purchases of suppliers’ showcased products. The catalogues of products include different producers and should allow to compare different suppliers – but it is not always the case. From a theoretical point of view, it presents all the advantages and plug-ins offered by e-Catalogue, with the addition of being already integrated with e-Sourcing instruments, and the ability to be integrated with internal software.
- **Create FRP:** the procuring entity can send requests for offers to different suppliers that produce the requested product or service. In this way it is possible to make a comparison of prices and negotiate with the suppliers, as it would happen through e-sourcing instruments. This is also integrated with catalogue instruments and direct purchase from it, but also allows to make requests for offers for certain product categories, therefore combining these two tools into a single, more powerful solution. Furthermore, the usage of digital signatures to access the e-Marketplace will make the whole system secure and reliable.

Some examples of e-marketplaces are the Electronic Market of Public Administration (MEPA), managed by Consip S.p.A., and regional e-marketplaces such as SATER, managed by Intercent in Emilia-Romagna, and Sintel, managed by ARIA S.p.A in Lombardy. Also, the other 19 Italian regions own their e-Marketplace, as well as 10 other public authorities, divided between metropolitan cities and provinces⁵. The objective of these *aggregating*

5. In this note are reported all the central procurement bodies in Italy, listed with this formatting: **name of the institution (region or province or metropolitan city of origin)**. Consip S.P.A (Italy); ARIC (Abruzzo); UOC CRAV of Azienda Zero (Veneto); SUA-RB (Basilicata); SUA-RC (Calabria); So.Re.Sa S.P.A. (Campania); Intercent (Emilia-Romagna); CUC (Friuli Venezia Giulia); Purchasing Center of Lazio Region (Lazio); SUA – RL (Liguria); ARIA S.P.A. (Lombardy); ERM (Marche); SCR (Piedmont); Public Contract Agency (Bolzano Autonomous Province); APAC (Trento Autonomous Province); Innovapuglia S.P.A. (Apulia); Regional

subjects is to aggregate demand of public institution in order to **rationalize public spend** and help those small PAs that do not have the tools or the knowledge to stipulate on their own more complex public contracts and tenders. (Donato, Mariconda, & Mirrione, 2020)

2.5.4.5 Other e-procurement tools

Internally to the organizations, there are tools that aggregate different systems of the sourcing and catalogue area, like in the case of e-marketplaces externally. These multi-purpose tools are called procure-to-pay suites. Procure-to-pay suites cover all those activities from the request of purchase created by employees to the receipt of the invoice and payment to the suppliers. These activities usually are time consuming for public organizations, since they deal with a large volume of purchases and procure-to-pay systems try to automate the majority of the processes involving these activities in order to create advantages in efficiency of the process as well as a reduction of costs, a better and simpler management of the relationships with and a more effective monitoring of the suppliers (Scuttari & Agasisti, 2016), and an increased level of sustainability of the procurement process overall. In particular, procure-to-pay suites usually are developed to manage the following activities:

- Electronic purchase requests;
- Authorization of purchase cycle;
- Automated ordering;
- Receipt of the goods or services ordered;
- Testing of the product or confirmation of regular execution of the service;
- Payment of the invoice or interconnectivity with the ERP to allow for the payment to occur with one click.

2.5.4.6 Consip and central purchasing bodies e-procurement tools

Consip provides its own e-procurement platform, which incorporates e-catalogues and an e-marketplace for all the registered public administrations. The services and instruments provided by Consip are described below:

- **Conventions:** it is the first tool developed by Consip for PAs. Consip acts as the contracting authority tendering a certain good, service or work and signing a 'convention contract' with the awarded economic operator. Successively, the economic operators must sign 'actuation contracts' with the public entities that require their products, services or works at the conditions and prices established by the 'convention contracts'. All the convention contracts signed by Consip are then

Purchasing Center of Sardinia (Sardinia); Tuscany Region – Public Contract Area (Tuscany); Health and Services SCARL (Umbria); Inva S.P.A. (Aosta Valley); CUC (Sicily); CUC (Molise); Aggregating subject of the Metropolitan City of Catania (Catania); Provincial Administration of Vicenza (Vicenza); Aggregating Subject of the Metropolitan City of Naples (Naples); Aggregating Subject of the Metropolitan City of Turin (Turin); Aggregating Subject of the Metropolitan City of Bologna (Bologna); Aggregating Subject of the Metropolitan City of Milan (Milan); Aggregating Subject of the Metropolitan City of Genova (Genova); Provincial Administration of Brescia (Brescia); Aggregating Subject of the Metropolitan City of Florence (Florence); Aggregating Subject of the Metropolitan City of Rome (Rome).

collected on an e-catalogue system with all the products, services or works, and public authorities can use this catalogue for procurement activities.

- **Framework agreements:** they are contracts in which a first negotiation phase is made by Consip to select a pool of possible suppliers for a certain good, service or work. Successively, the single PA creates a second specific tender to appoint one supplier within this pool to provide the needed product, service, or work.
- **Electronic Market for the Public Administration (MEPA):** it is an e-marketplace where authenticated economic operators can add their products, services or works and public administrations can purchase from catalogue or post RFPs. Any negotiation is not managed by Consip, but by the single PA. This e-marketplace can be used only for purchases below the European-threshold.
- **Dynamic system:** It is a system that allows, for certain goods and services, the negotiation between single PAs and authenticated economic operators exclusively through electronic means. Technical and economic evaluations are computed automatically by the system, based on pre-selected criteria and specifications.
- **Tenders:** PAs can delegate Consip to sign conventions or framework agreements on their behalf for a certain product, service, or work. Therefore, the single public administration can rely on the technical, legal and market knowledge of Consip. This, as the other services, are provided through Consip's online platform, which guarantees transparency and compliance with European and national regulations.
- **Specific projects consultation:** Consip provides technical, and legal support to public authorities which are working on specific and complex projects. Furthermore, it also provides e-procurement, training, and communication services.

2.6 Smart Working

2.6.1 Introduction

Smart, or agile, working is a new work modality that consist in the removal of a fixed workplace and fixed hours in the optics of increasing an employee's productivity by allowing flexibility in his or her working schedule. But smart working envelops more than just this; it is a new managerial philosophy, a cultural, organizational and process revolution and its introduction is the result of a joint rethinking of four levers (Osservatorio Smart Working, 2013):

- **Organizational policies:** i.e., the guidelines related to flexibility of working time and place, as well as the possibility to customize and choose the most suitable working tools to achieve the set objectives.
- **Leadership behaviors and styles:** to provide direction, execute plans and motivating people.

- **Physical layout of workspaces:** The layout of workspaces has an impact on the efficiency, flexibility, and well-being of people. Smart Working implies a deep revision and redesign of the organization of spaces. It is called "**workplace change management**" and aims to rethink spaces and organize them according to the principles of team working, virtualization and flexibility.
- **Digital technologies:** they can enable and support, based on their diffusion and quality, new ways of working, and facilitate communication, collaboration, and professional networking.

Therefore, smart working is not a simple work-life balance and corporate welfare initiative for people, but it is a deep **process of cultural change**. It requires an evolution of corporate organizational models, for which a detailed phase-by-phase roadmap must be envisaged to remove constraints and inadequate models. These constraints and models are linked to the concepts of fixed workstations and single offices, which cannot adapt to the smart working principles of **personalization, flexibility, and virtuality** (Capoferro, 2022). Moreover, being an intrinsically **multidisciplinary project**, it requires an integrated governance among the actors involved. A smart working project is therefore a **complex process of change** that requires to act simultaneously on several business aspects and that must start from a deep analysis of the objectives, priorities, and technological, cultural, and managerial peculiarities of the organization.

It is clear at this point that Smart Working does not simply mean working from home, smart working is not teleworking, the two terms are not synonymous. It is important to explain well the difference between these two modalities of work because, nowadays, there is a tendency to misinterpret the meaning of smart working and the word is often used incorrectly.

Teleworking is based on the idea that the employee has a fixed workstation in a place other than the company headquarters, typically in his own home, and the company transfers the same responsibilities of the workplace to the employee's home (Capoferro, 2022). Smart working, on the other hand, requires the company and the employee to flexibly redefine the way they work in terms of place and time, adapting human resources according to the tools available. The main idea is that you can carry out your tasks virtually anywhere, at home or even within the company in places specifically redefined for co-working or in huddle rooms, spaces designed to organize brainstorming or video calls.

The key factors that must be considered in order to obtain concrete benefits from the implementation of smart working are the following (Osservatorio Smart Working, 2013):

- **People at the center:** it is necessary to analyze and understand the needs of individuals. Employees must feel involved in the process of change in the organization. It is important to act on the engagement of people (Stagno, 2019), to define together with the employees the characteristics of the spaces where they will work and make them understand the benefits of this change. Suffice it to say that in PAs, the public employee is used to having a fixed office and workstation, with a

well-defined working schedule. He or she is not strongly involved in the change process, but usually he or she will follow change that is decided at a higher level in the hierarchy. The risk is that there will be an aversion to change with the consequence that this change will not bring the desired results.

- **Digital tools integrated into work and private life:** digital tools, for effective use, must be at the service of people and must be perceived as necessary tools for carrying out business activities and for their private lives.
- **Attention to change management to accompany the transformation of leadership styles:** middle management is often anchored in leadership styles that rely on direct employee supervision, so management must be trained to adopt supervision methods that adapt to new organizational models. There is also a need to redefine MBO systems so that employees can have autonomy in decision-making and that people's evaluations are based on the analysis of results achieved regardless of where, when, or how they work.
- **Cross-functional involvement and top management commitment:** all departments must be involved in the redesign of working models.
- **Give evidence of the benefits obtained:** The benefits must be constantly monitored and, in order to obtain the commitment necessary for continuous performance improvement, the data from the analysis must be disseminated at all levels within the PA.

2.6.2 Advantages of Smart Working

According to Michela Stentella (2021), director in charge of FPA (forumpa.it), the advantages of smart working concerning public administrations, the public workers, and the environment, are:

- Enhancement of human resources and empowerment, focusing on the results of work and not on formal aspects.
- Rationalization in the use of resources and increased productivity, thus saving on costs and improving the services offered.
- Promotion of the use of the most innovative digital technologies and use of smart working as a lever for digital transformation and digital knowledge development.
- Strengthening of systems for measuring and evaluating performance based on results and service levels.
- Enhancement of the real estate assets of Public Administrations, as spaces are reinvented. In addition, costs related to physical space are reduced.

- Reconciliation of work hours and free time for employees, reducing costs and travel time.
- Impact on sustainability issues: CO₂ reduction and savings in electricity consumption for public administrations.

In order to take stock of the use of smart working in public administration and verify whether the main advantages listed above are also perceived by workers, in May 2020, a survey was conducted by FPA, with 5.200 respondents, of which 81% of the respondents were employees in public administration offices (ForumPA, Editorial Board, 2020). This survey was conducted during the period of the first lockdown, due to the COVID-19 epidemiological emergency, in which 98.8% of respondents carried out their duties in remote working. In this research it emerged that among the main advantages perceived by public employees were that of organizing and scheduling work better during the day for 69.5% of respondents and having more reconciliation between work hours and free time for 41.3% in addition to reducing costs and travel time. Moreover, 56% of respondents claimed that their productivity has slightly improved or definitely improved during the 'emergency smart working' period and 73.8% of workers claimed to have managed to carry out all the tasks required remotely, thus avoiding an interruption in the performance of office activities. The balance that can be drawn from the information gathered in this survey is that the 'emergency smart working' experience in public administrations has been positive, as 88% consider their experience a success and, above all, 93.6% of respondents say they are in favor of continuing smart working in the future.

We referred to the work modality adopted during the lockdown as 'emergency smart working' because, as it will be introduced later in the *Legislation* Chapter, it is the term used by the government. However, us authors do not agree with this improper use of the term 'smart working', as we cannot associate smart working with the imposition of work from home because of the pandemic, for the reasons described in the previous paragraph – where the differences between smart working and teleworking are highlighted. Therefore, when analyzing the results of this survey, it must be considered the fact that the smart working we are talking about is work from home carried out in an emergency situation that was forced in its adoption. Suffice it to say that for more than a third of public administrations, smart working was an absolute novelty in that it had never been introduced before the global pandemic, neither in a widespread manner nor as an experimental project limited to a group of workers (Osservatorio Smart Working, 2021). Consequently, there was no knowledge or experience on this subject. In fact, it was analyzed by FPA that public administrations that had already experimented with smart working in the office responded better to the emergency and were able to implement smart working throughout the office more quickly and effectively. This allowed them to overcome more easily the problems related to technology and organization, as employees had already followed agile work training and already put it into practice. The data collected by the survey can be considered as a fundamental starting point to build the future of public administration.

3 Legislation

3.1 Introduction

As anticipated, this chapter will describe the regulatory environment surrounding the public procurement process and smart working regulations in Italy. The analysis of regulation is of great importance, since the procurement process in Italy is strongly influenced by the regulatory framework when considering how the process itself is executed, the way in which practitioners have to consider candidates for procedures, and how economic operators have to behave and the certifications they have to present to be eligible to tender for public contracts. Compliance with legislation should influence the outcome of public procurement procedures so that competition is fostered, every participant to a tender is treated equally and only the best offers presented are considered for award.

In order to better understand the Italian regulations regarding procurement, also a brief overview of European principles is provided, since Italian public procurement legislation, as that of other member states, is founded on European Directives. Successively, we will address the issues of the laws in force in Italy to regulate agile work in the PA, so that also this aspect is clear to the reader as it will help in understanding the following chapters.

3.2 Procurement regulation

3.2.1 History of procurement regulation

To understand how public procurement works, it is necessary to introduce the jurisdiction that regulates its operations. In recent years, public procurement has undergone enormous regulatory changes, both at EU and national level. In July 2006, in Italy, the first Code of Public Contracts came into force, regulating public procurement of works, supplies and services. The Public Contracts Code had an importance of historical value as it was the first time since the unification of Italy that all the fundamental laws of procurement were collected in a single document. The Code regulates not only the tender phase, but also the upstream phases of the process, for example planning of purchases and design of procedures, and the downstream phase of execution of the contracts.

Some of the salient innovations introduced by the first Procurement Code are reported (Scuttari & Agasisti, 2016):

- The following contracting tools are introduced:
 - Framework agreements;
 - electronic auctions;
 - dynamic purchasing system;
- The use of electronic certification systems, i.e., digital signatures, is initiated;
- Centralized Purchasing Bodies are introduced, with the aim of rationalizing PA expenses.

The Public Procurement Code contains and is based on EU regulations issued by the EU in 2004, the so-called third generation Directives, more precisely Directives 2004/17/EC and 2004/18/EC. These directives regulate contracts for works, goods and services in ordinary and special sectors and introduce the principle of free competition that required PAs to undertake a thorough reform of the procurement system. For member states of the EU, it is mandatory to comply with the EC Procurement Directives in the creation and implementation by individual member states of their national code of public contracts.

The purpose of the EC Procurement Directives is not to create a single regulatory regime for all member states but requires the adoption of rules and procedures in the national code of public contracts that respect the basic principles contained in the EC Directives:

- **Equal treatment:** identical situations or persons should be treated in the same way; this implies that the contracting authorities must evaluate the different suppliers only based on the results of tenders that they send unless there is a clear and objective justification to treat them differently;
- **Non-discrimination:** The principle of non-discrimination is not simply an extension of the principle of equal treatment. It avoids the risk that conditions of origin (nationality or geographical proximity) generate discrimination, because in the selection of suppliers, according to Thai (2009), local politicians tend to favor local firms over non-local business;
- **Transparency:** all procedures of the procurement process must be public and available to anyone, so as to provide clarity to stakeholders. Economic operators are fully aware of the selection and award criteria so as to verify that there has been impartiality and that the principles of equal treatment and non-discrimination have been respected;
- **Proportionality:** proportionality means ‘in reasonable proportion to’. Contracting authorities have to publish contracts that are reasonably proportional to the subject-matter of the public contract both considering the nature and the scope of the contract. It relates to all stages of a procurement procedure, from the definition of the right procedure to adopt, to the definition of terms and specifications of the contract. (Instituut voor Bouwrecht, 2020)

Essentially, the EC Procurement Directives have been designed to achieve a procurement market that is as competitive, open, and well-regulated as possible (Directive 2014/23/EU) and consist in applying the basic principles described above in the following areas of the process:

- Publicity of proposed procurement contracts;
- Design of technical specifications;
- Choice of procurement procedure;
- Qualification and selection of candidates and tenderers;
- Award of contract

Following the issuance of European Directives 2014/23/EU, 2014/24/EU, and 2014/25/EU on the award of concession contracts, public contracts, and the procurement procedures of the regulatory bodies in the water, energy, transport and postal services sectors, the Italian New Public Procurement Code was presented and issued. The EU has requested the various states of the union to reform their public contract awarding procedures with the aim of (Scuttari & Agasisti, 2016):

- Qualifying supply and demand more;
- Giving more weight to the quality of bids rather than to price;
- Simplifying and digitizing public tender procedures;
- Favoring the collaboration between PAs and enterprises.

The New Procurement Code was published in 2016, 10 years after the first code came into force. It was intended to be a clear and concise text in order to reduce the interpretation problems present in the old version and avoid repetitions and contradictions. The New Code does indeed present a reduction in the number of articles, from 257 to 220, but they are composed of many paragraphs that lengthen and make the New Code difficult to understand. For example, Article 194, which deals with the awarding of contracts to general contractors, contains a total of 20 paragraphs. As a result, the slenderness of the code desired by procurement practitioners and declared by legislators was not reflected in the published document.

It is important to point out that the legal framework proposed by the New Code is coherent with the digitalization of public contracts, which would guarantee efficiency and certainty to the whole procurement process (Donato, Mariconda, & Mirrione, 2020), but more than 5 years after its publication, only 24 of the 45 implementing measures, considered key to making the code fully operational, have been adopted. Of the 24 measures implemented, none have been implemented within their deadlines, with an average implementation delay of 8 months (Osservatorio Agenda Digitale, 2020b). As made clear from this information, the legislation on public contracts is incomplete in that only a few more than half of the measures have been implemented, and of the 21 measures not yet adopted, five are considered necessary and urgent in order to make the new Code operational. The five measures that Osservatorio Agenda Digitale (2020b) of the Polytechnic of Milan suggests as necessary to make the Code operative and encourage collaboration between PA and companies are:

- Criteria for Registration in the Register of Qualified Contracting Stations;
- Digitization of procurement procedures;
- Documentation to be included in the new database that will replace AVCPass⁶;
- Procedures for taking over agreements stipulated regarding the AVCPass system;
- Establishment of the business rating system.

6. AVCPass is a platform managed by ANAC; AVCPass is the channel through which the Public Purchasing Bodies proceed to verify, through certifying authorities (Revenue Agency, Social Security Agency [INPS], and Criminal Record), if economic operators possess the requirements for tendering for public contracts.

A second problem that emerges is the instability of the code, in that a high number of short-lived amendments have been introduced to the rules contained in the code, and in doing so the code is continuously restructured. In the last 5 years, 5 to 6 modifications have been introduced for the various articles that regulate each phase of the procurement process. This provokes an interpretative difficulty and the necessity of continuous adaptation by procurement offices, increasing the time to be dedicated to the study of regulations and lengthening the overall time of the process. In addition, within the same measure it can happen to come across provisions of an opposite nature, which on the one hand simplify some procedures and on the other complicate other steps. As a result, the code is not only unstable and incomplete, but often inconsistent.

3.2.2 Digitalization of the procurement process

European supranational directives were the first that established a direction for the implementation in a structured manner of e-procurement tools. In particular, Directives 2014/24/EU, on public contracts, and 2014/23/EU, on concessions, imposed that the following phases of the procurement process were to be carried out only through digital means: e-Noticing, e-Access, e-Submission, e-Attestations (Agenzia per l'Italia Digitale, n.d.). Furthermore, the European Directives made compulsory the European Single Procurement Document (ESPD), which is a self-certification that supplying companies have to produce to attest their financial situation, their capability and production capacity, and their compliance with public contracts procedures. Following these two European Directives, in 2016, as mentioned above, the Italian government approved the new code of public contracts (DL 50/2016), which stated:

- in **Article 3**, that all electronic communications must be sent only once to a single database, and it is this database, which received the communication, in charge of sending it to other public entities if requested. Then to provide transparency, interoperability must be granted between the databases of the Ministry of Economics and Finance, the Ministry of Transportations and Infrastructures, ANAC, and the Conference of Regions and Autonomous Provinces. The function of this article would be to simplify the procedures by limiting the time spend on sending information of the single public administration, but as described in the introduction, interoperability has not yet been achieved, and public administrations can take up to 20 days to receive the information requested.
- in **Article 40**, that it is compulsory to adopt electronic means of communication during contracting procedures, to grant transparency of the procedures. In 2018, ANAC declared that electronic communications are not mandatory for contract of value below 1.000€.
- in **Article 41**, the simplification of procedures made by CPBs, such as Consip S.p.A. and other aggregating subjects. The contracting options were reviewed and made more efficient. A double perspective was kept, standardization of procedures and maximum aggregation, for standard commodities, and ad-hoc solutions, where

standardization was deemed impossible or too expensive. Furthermore, costs and fees for the management of negotiation platforms cannot be charged to economic operators.

- in **Article 44**, that the digitalization of the procedures will be defined with a decree of the Ministry of Simplification and Public Administration. This article also defines best practices in terms of organizational and work methodologies, planning strategies, and collection, management and elaboration of electronic data, and related tools.
- in **Article 52**, that communications made through electronic systems must comply with the non-discrimination principle, must be available and compatible with commonly used ICT products on the market and must not limit access to economic operators.
- in **Article 58** are stated the principles that negotiation platforms must comply with. They must not alter parity in access or in any way limit, distort or prevent competition, or change the subject matter of the contracts. It is possible to create an auction where each tenderer can offer only once. The rules pertaining these aspects are defined by AGID.
- in **Article 72, c.1**, that the transmission of tenders and notices to the publication Office of the EU had to be done through electronic means exclusively.
- and finally, in **Article 74** is stated that tender documentation must be made available freely, directly and without limits of access, exclusively through electronic means.

Also, digitalization of procurement was also promoted at the European level through the eGovernment action plan 2016-2020. This strategic plan set three priorities:

- **eForms**: which are the new European standard for publishing data about public tenders on the TED, the tenders section of the Official Journal of the EU. These forms will be adopted voluntarily starting from November 2022 and will be made compulsory from October 2023. In Italy, eForms will be adopted also for contracts below the European threshold.
- **eProcurement analytics**: it is an initiative launched by Italy in 2019, to promote solutions for the interoperability of systems in the PAs of the EU. A framework and infrastructure are being developed in order to control public tenders through analytical tools to obtain:
 - centralized data on public contracts;
 - more efficient public expenditure;
 - complex common public procurement policies and an increased competitiveness of the single market.

- **European Public Procurement Data Space:** The European Commission is working together with member states to create a single data space for public procurement data. This is one of the pillars of the European Data strategy developed in February 2020 to allow building of the data economy.

3.2.3 Emergency procurement regulation

Following the pandemic emergency, the introduction of the Simplification Decree made substantial changes in derogatory and exceptional regulations, initially valid until December the 31st, 2021, then extended until the 30th of June 2023.

The Simplification Decree, DL n.76/2020, which came into force on July the 17th, 2020, aims at simplifying administrative procedures, eliminating, and speeding up bureaucratic requirements, digitizing the PA, giving support to the green economy and to business activities. Among the provisions contained in the decree, it is relevant to mention the following:

- The introduction of stringent time constraints for awarding a public contract from the start of the procedure:
 - a. 2 months for direct awards;
 - b. 4 months for procedures with competitive tendering.
- Modification of the thresholds for direct awarding:
 - Works for amounts lower than €150,000;
 - Services and Supplies for amounts of less than € 75,000 (then raised to € 139,000 in the Simplification Decree Bis entered into force on June the 1st, 2021). (DL n. 77/2021)

Table 2, below, provides an outline of the changes to the legal framework:

| Type of Contract | Code of Public Contracts | | DL Simplifications (for procedures started from 17/07/2020 to 31/05/2021) | | DL Simplifications bis (for procedures started from 1/06/2021 to 30/06/2023) | |
|----------------------------------|--------------------------|---------------------|---|---------------------|--|---------------------|
| | Works | Services & Supplies | Works | Services & Supplies | Works | Services & Supplies |
| Direct award | €40.000 | €40.000 | €150.000 | €75.000 | €150.000 | €139.000 |
| Direct award (with 3 quotations) | €40.000 <x< €150.000 | | | | | |

| | | | | | | |
|------------------------------------|---------------------------------|----------------------------|---|---|---|---|
| Direct award (with 5 quotations) | | €40.000 <x< €214.000 | | | | |
| Negotiated (at least 5 operators) | | | €150.000 <x< €350.000 | €75.000 <x< €214.000 | €150.000 <x< €1.000.000 | €139.000 <x< €214.000 |
| Negotiated (at least 10 operators) | €150.000 <x< €350.000 | | €350.000 <x< €1.000.000 | | €1.000.000 <x< €5.350.000 | |
| Negotiated (at least 15 operators) | €350.000 <x< €1.000.000 | | €1.000.000 <x< €5.350.000 | | | |
| National open procedure | €1.000.000 <x< €5.350.000 | | | | | |
| European open procedure | x > €5.350.000 | x > €214.000 | x > €5.350.000 (with reduced deadlines) | x > €214.000 (with reduced deadlines) | x > €5.350.000 (with reduced deadlines) | x > €214.000 (with reduced deadlines) |

Table 2 - Recent changes in direct awarding and European thresholds

3.2.3.1 Ministerial fund for university building interventions and large equipment

Decree 81 of May the 13th, 2020 allocates the funds for university infrastructure for the year 2020, amounting to €60 million to the co-financing of intervention programs for the enhancement of technological infrastructure for the digitalization of teaching, including staff training costs and costs for the purchase of hardware devices and software. Each university was allocated a fixed share of €250.000 and a variable share proportional to the number of students.

3.2.3.2 Ministerial fund for the emergency needs of the university system

In Decree 294 of July the 14th, 2020, €75 million is allocated for the emergency needs of public universities. The resources are to be allocated to the following categories of expenditure:

- **Measures for planning the activities of the university**, in relation to the start of the academic year 2020/2021: purchase of hardware devices and enhancement of digital infrastructure to ensure the continuity of research activities and distance learning;

- **Measures in support of students:** purchase of the digital devices necessary to allow students remote access to databases and bibliographic resources. Beneficiary students will be selected by institutions according to criteria aimed at reducing the digital divide.

3.3 Smart Working regulation

3.3.1 State of the art

The definition of smart working in Italy is contained in **Law n.81/2017** drafted by the Ministry of Labor and Social Policies, which defines smart working (or agile work) as "a modality of execution of the employment relationship characterized by the absence of hourly or spatial constraints and an organization by phases, cycles, and objectives, established by an agreement between employee and employer. A modality that helps the worker to reconcile work and life moments and, at the same time, it promotes the growth of his or her productivity" (Legge 81/2017). Law n.81/2017 also emphasizes important concepts related to smart working like **organizational flexibility**, the **voluntariness** of the parties signing the individual agreement and the use of **technological tools** that allow to fully perform the required tasks. In addition, the employer is required to guarantee to workers who use smart working **equal economic and regulatory treatment** with respect to colleagues who carry out their tasks in the traditional way. The objective of this law is to promote agile work in order to "increase competitiveness and facilitate the reconciliation of work and personal hours. The law provides that the work is performed partly inside the company's premises and partly outside without the presence of a fixed location and within the limits of maximum duration of daily and weekly working time, arising from the law and collective bargaining" (Legge 81/2017). Paragraph 3 defines that these regulatory provisions are applied not only to private companies but also to employment relationships employed by the PA (Legge 81/2017).

The Law of May 22nd, 2017, implements the directives contained in Article 14 of the Law of August 7th, 2015, which sets out the guidelines for the reorganization of public administrations by the government, aimed at introducing more innovative ways of organizing work based on the use of flexibility, evaluation of objectives and allowing employees to reconcile work and personal time (Legge 81/2017; Legge 124/2015). Public administrations are required to adopt these guidelines within 3 years, and to allow to at least 10% of employees who request it to adopt agile working methods without being precluded or altering their professional development within the administration.

Following the spread of the COVID-19 epidemic, as of February 23^r, 2020, a series of measures regarding smart working have been issued to spread its use within PAs. The main directive is n.2/2020, which was issued by the Minister for PA, Fabiana Dadone, on March 13th, 2020. The directive provides for the strengthening of the use of smart working within the PA, providing that agile work becomes the ordinary organizational form for public administrations, so as to limit the presence of employees in offices and protect their health until the end of the state of emergency. Agile working is introduced in a simplified mode, i.e., it is possible to activate smart working without an individual bilateral employer-

employee agreement and without the employer's obligation to inform the Ministry of Labor and Social Policies. In the event that smart working cannot be adopted, the PA must use the tools of prior leave, leave of absence, rotation of employees in attendance, or other similar tools in compliance with collective bargaining. The directive was then included in Article 87 of Decree-Law n.18 of March 17th, 2020, called the "Cura Italia" decree (DL March 17th, 2020).

The "Decreto Rilancio" (Restart Decree) of May the 19th, 2020 (DL n.34 then converted with Law n.77 of July the 17th, 2020) integrates and partially modifies the provisions on agile work present in DL 18/2020, with the aim of adapting the measures of limitation of staff in attendance with the need for the gradual reopening of all public offices. It is expected that for 50% of public administration employees, agile work will be extended until December the 31st, 2020. In addition, the Restart Decree introduced the POLA, an organizational plan for agile work, which each public administration would have been able to compile optionally by January the 31st of 2021 and would have to be reworked every year thereafter (Legge 77/2020). The POLA defines organizational measures, technological requirements, training courses for staff, including managers, and the tools for detection and periodic verification of the results achieved, including, in terms of improving the effectiveness and efficiency of administrative action, the digitization of processes, and the quality of services provided, also involving citizens, both individually and in their forms of association. POLA also provides that at least 60% of public employees may use agile work, for activities that can be carried out remotely, ensuring that they are not penalized in terms of recognition of professionalism and career progression (Ministro per la Pubblica Amministrazione, n.d.). For public administrations that will not present the POLA there will be the obligation of smart working for 30% of staff, but the principle of organization by objectives is not applied.

To conclude, on October the 19th, 2020, Minister Fabiana Dadone issued the DM on smart working that contains and integrates the rules of the Relaunch Decree with the DPCMs of October 13th and 18th that establish the new measures to contain the pandemic, given the resumption of contagions and the spread of new variants of COVID-19. Some of the key points contained in the October 19th, 2020, decree are reported (DM October 19th, 2020):

- Staff rotation with a balanced alternation between in-person and agile work;
- Administrations must work to make available the necessary IT devices for employees to perform Smart Working tasks;
- Have at least 50% of employees perform agile work, ensuring the highest possible percentage of smart working, compatible with organizational potential and the quality of the service delivered;
- Public administrations must organize meetings in remote mode;
- Agile work is ordinarily carried out without time or place of work constraints, but can be organized, taking into account the type of tasks performed by the employee, for specific contact bands;
- Administrations must strengthen performance evaluation systems, adapting them to the specific nature of agile work. Assessment methods should be results-driven, and

managers should introduce both quantitative and qualitative performance indicators.

3.3.2 Future of smart working in Italy

Public administrations that completed and submitted the POLA by the January the 31st, 2021, deadline were 54 out of 162, or 33.3%. As for public universities, there were 26 out of 67 universities responding, or 38.8%. (Centro di Ricerca sul Valore Pubblico, Università degli Studi di Ferrara, Dipartimento della Funzione Pubblica, 2021)

Certainly, the low percentage of administrations responding to the POLA may indicate a difficulty on the part of public bodies in providing for reorganization of their offices. However, it must be considered that the low response rate is influenced by the fact that submission of the POLA was on voluntary basis and little time was given to public administrations to present the plan. Indeed, the guidelines were published in mid-December 2020, so it was foreseeable that many of the administrations would not be able to meet the deadline of January the 31st, 2021, for the presentation of the plan. Thus, the first year of POLA adoption should not be seen as a failure due to low PA adherence but rather as a necessary experimentation for the development of a new planning tool that will be crucial for the organizational evolution of PAs in the years to come. (Corso, Naddeo, & Deidda Gagliardo, 2021)

With decree n.80/2021 the POLA has been integrated within the new PIAO, that brings together the performance, agile work, gender equality and anti-corruption plans. The PIAO must be submitted by each administration by January the 31st, 2022, and has a three-year duration with annual updating.

The PIAO will have to contain:

- The list of procedures to be simplified and re-engineered each year;
- Actions and methods to guarantee full physical and digital accessibility to administrations;
- Actions and methods to guarantee full respect for gender equality.

In addition, it will have to define a way of monitoring performance on a periodic basis. The purpose of the new Plan, according to the Minister of Public Administration Renato Brunetta, is to create a mapping of change that will allow for constant monitoring of the path of administrative transition (D.L. Reclutamento, ok del Senato, 2021). The PIAO will allow public administrations to structure the adoption of the plan according to the characteristics and objectives of the specific administration, but it will be centrally guided and monitored so that it can best undertake the path of transformation for the benefit of citizens and the community.

3.4 Next Generation EU & PNRR

3.4.1 Next Generation EU program

The program NGEU aims to support and promote the recovery of the economy of EU member states in response to the pandemic crisis. It is an epoch-making plan with a financial

commitment of €750 billion, with the condition that the funds allocated to the member states provide for investments and reforms to accelerate digitalization, ecological transition, reduce gender, territorial and generational imbalance.

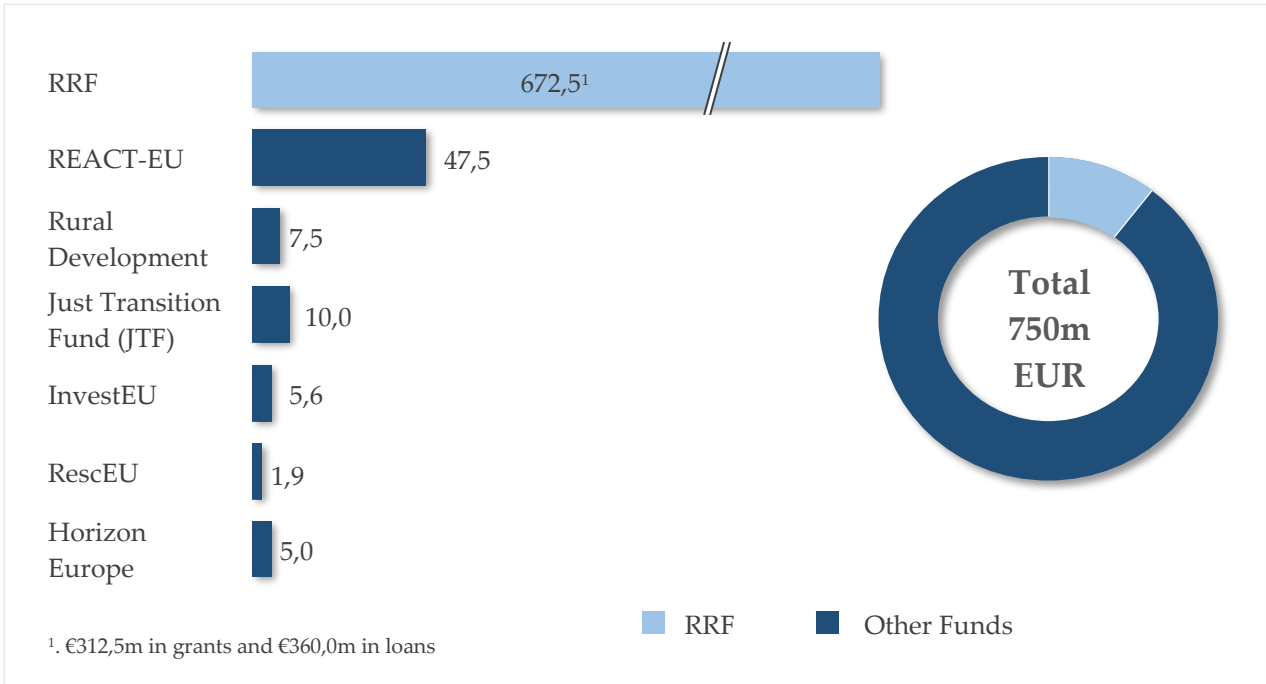


Figure 11 - Next Generation EU funding composition. (Parlamento Italiano, 2021)

The NGEU program is primarily composed of two instruments to support the economies of member states. The first instrument, REACT-EU, i.e., the package of 'recovery assistance for cohesion and territories of Europe', is in a short-term perspective (2021-2022), with the aim of bringing immediate resources to overcome the effects of the crisis caused by COVID-19.

The second instrument, RRF, has a duration of 6 years, and will make available €672.5 billion, of which €312.5 billion are grants and €360 billion are low-interest loans, and aims to "make the economies and societies of European countries more sustainable, resilient and prepared for the challenges and opportunities of the ecological and digital transition". (European Commission, n.d.-b)

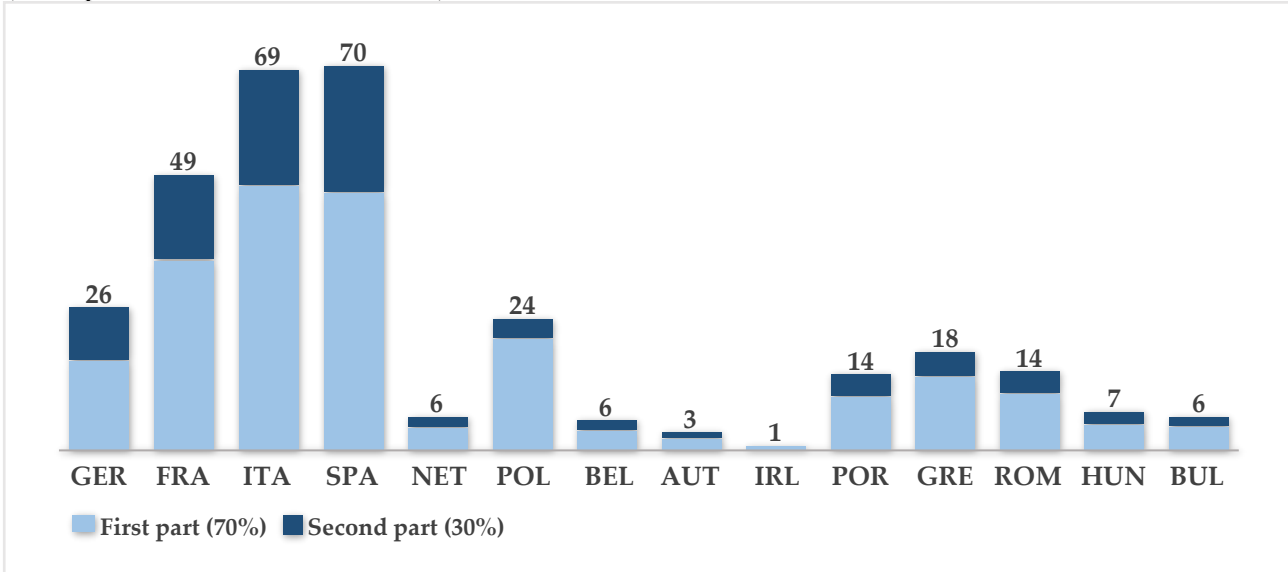


Figure 12 - Allocation of grants for the RRF. (Parlamento Italiano, 2021)

The mechanism of allocation of resources among the different members of the EU takes into account both structural variables such as the population of the state, and contingent variables such as the reduction of GDP caused by the effects of the crisis from COVID. Consequently, high resources are allocated to states such as Italy, which despite having a GDP higher than the European average, has suffered devastating effects from the pandemic crisis.

In order to access RRF funds, each member state must submit a recovery and resilience plan, PNRR, according to guidelines developed by the European Commission that identify the six reference areas on which PNRRs should focus (European Commission, 2021):

- Digitization;
- Ecological transition;
- Social and territorial cohesion;
- Policies for new generations;
- Sustainable growth;
- Health and economic, social, and institutional resilience.

Regarding digitization, the main theme on which this thesis is focused, each PNRR will have to devote at least 20% of the planned investments to it. Investment in this area will have to focus on the digitization and rationalization of public administrations and the development of digital public services. Furthermore, it is essential to expand the deployment of high-speed telecommunications networks in order to reduce the technological gap between different areas within the same state. The guidelines presented by the EC also highlight the importance of investments and reforms to increase the digital skills of public workers and citizens, in order to increase the ability to work and interface with digital tools. The goal is to improve the performance of member states as summarized in the DESI, the monitoring tool introduced by the EC in 2014 to track the digital progress of member states and identify critical areas in need of priority interventions.

3.4.2 Resilience and Recovery National Plan in Italy

3.4.2.1 Introduction to the Plan

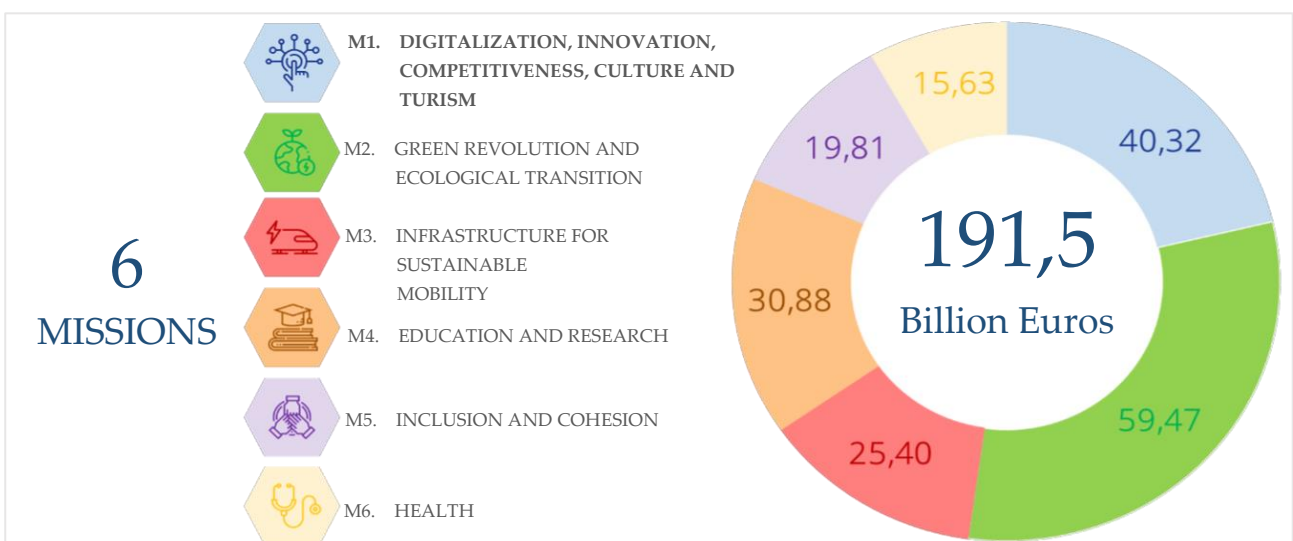


Figure 13 - Italian PNRR Missions. (Parlamento Italiano, 2021)

The PNRR in Italy was approved on July 13th, 2021, by an implementing decision of the Council of EU. Italy is the member state that will receive the largest amount of funds made available in the NGEU and consequently can and should be a crucial tool to pursue a path of economic growth. Italy will receive €4.7 billion from REACT-EU to be used in 2021-22 and €191.5 billion from the RRF, of which €68 billion in grants, to be used for reforms and investments in the period 2021-26. Given the large number of resources available, it is essential in the PNRR to correctly identify the areas and sectors to which investments must be directed, so as not to waste an unprecedented opportunity for economic and social revival. The plan is divided into 6 missions and 16 components, in full coherence with the guidelines presented by the European Commission.

The mission of the plan on which we focus our attention is "M1- Digitalization, Innovation, Competitiveness, Culture and Tourism", as it deals with the issues of digital transaction in Public Administration, and in particular in public procurement, in line with the topic of the thesis. At the theme of digitization in PA is allocated the largest share of investments within Mission 1, for a total of 6.14 billion euros.

3.4.2.2 PNNR for Italy: digital transition

An analysis of the results of the 2020 DESI Index shows that Italy is lagging behind the EU average in terms of digitalization. Italy is twenty-fourth among the twenty-seven EU members, with performance below the European average in all five categories analyzed by the indicator: Connectivity, Human Capital, Internet Use, Integration of Digital Technologies, and Digital Public Administration.

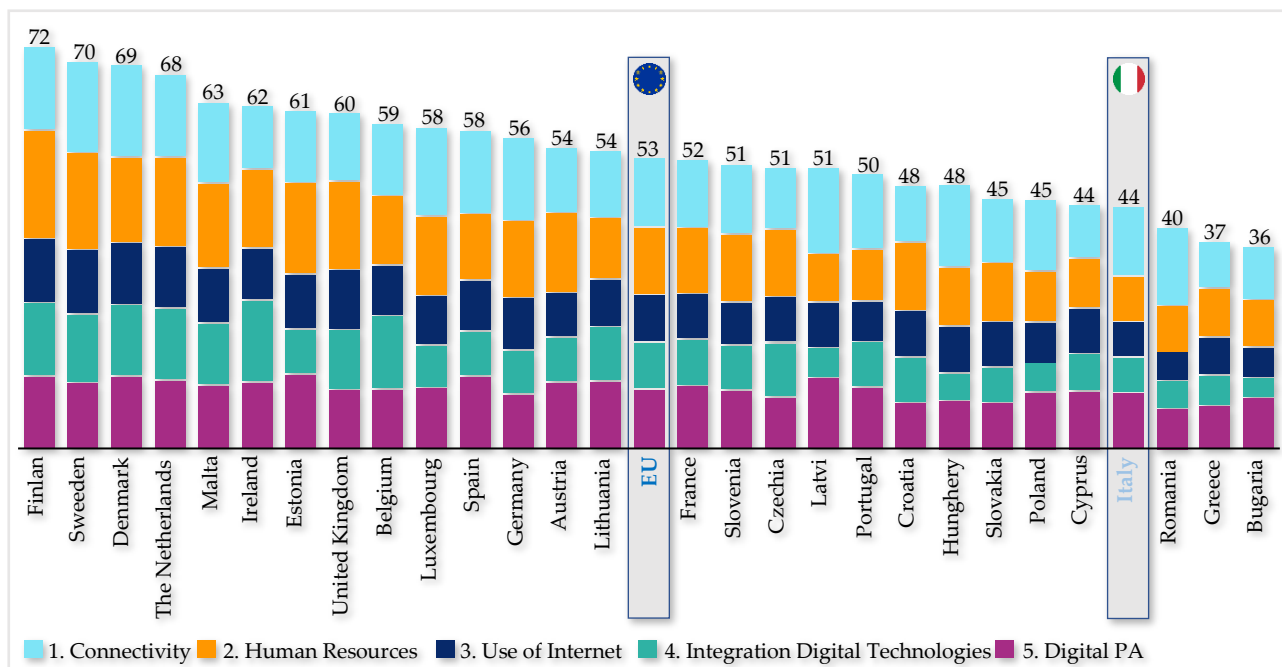


Figure 14 - DESI Index 2020⁷. (European Commission, Directorate-General for Communications Networks, Content and Technology, n.d.)

⁷ Data used to calculate DESI 2020 refer to 2019

In the light of these results, digital transition represents one of the fundamental themes on which to orient the investments provided by the NGEU.

As regards the digital PA, one of the indicators analyzed within DESI, an ambitious plan of reforms and investments is present in the PNRR. The definition of the plan on which to base the reform of the PA derives from an in-depth analysis of the obstacles that have not allowed, in recent years, the public administration to improve its services. Among these, it is important to mention the following:

- **High average age of public employees:** the average is 50 years of age (2019), with 16.3% of employees over 60 and only 4.2% under 30. It contributes to a mismatch between available and required digital skills;
- **Cutting government spending on employee training:** investments in training have halved in the last 10 years, from €262 million in 2008 to €164 million in 2019. Moreover, ICT training has involved only a marginal slice of employees, only 7.3% of PA employees in 2019;
- **Complex regulations:** articulated and complex procedures and regulations, often poorly coordinated and conflicting at national, regional, and local levels.

Based on the critical issues that emerged, the program of reforms and investments regarding PA is based on the following main points:

- **Access**, to streamline and make more effective and targeted selection procedures and encourage generational turnover;
- **Better administration**, to simplify regulations and public procedures;
- **Skills**, to align knowledge and organizational skills with the new needs of the labor market and modern administration;
- **Digitalization**, as a transversal tool to better achieve these reforms.

Among the programs of reform and investment of the PA, it is important to mention for the purposes of this research:

- Simplification of public contracts;
- Recovery Procurement Platform.

3.4.2.3 Simplification of public contracts

The complexity of the Code of Public Contracts has caused implementation difficulties; the NRP aims to overcome the limits encountered to date in the action of regulatory simplification, acting in parallel on the organizational side and in investments for the digitalization of PA. Simplification does not only involve the awarding phase, but all phases of the process. For the definition of the points on which to focus the reform, the regulations adopted in other countries, in particular Germany and the United Kingdom, are examined for their relevance in terms of simplification.

Among the most relevant points of the reform, it is important to mention:

- Reduction and **qualification of contracting stations**;

- Enhancing of the **database of public contracts** held by ANAC;
- **Reduction and rationalization of regulations** regarding public contracts;
- **Implementation of European directives**, integrated where not immediately executable;
- Provision of rules applicable to public contracts for works, services, and supplies for amounts below the EU thresholds;
- **Express regulation** of cases in which contracting authorities may use only the price or cost criterion, understood as the criterion of the lowest price or the highest bid price;
- Creation of an **e-platform** for the purpose of **evaluating procurement capacity**.

3.4.2.4 "Recovery Procurement Platform" Reform

The reform has the aim of modernizing the public procurement system through digitalization and strengthening the administrative capacity of contracting authorities. To achieve the envisaged objective, the reform is developed along three lines of action. First of all, a training and support program is defined for public administration employees and managers, carried out by specialists, for the management of purchasing procedures in digital mode and the use of advanced purchasing tools. Secondly, Consip will make available to all administrations specific contracts (ad-hoc contracts, contracts/frameworks, framework agreements) functional to the realization of the projects, taking care of the realization, management, and support in the use of the specific contracts. The last step of the reform, with implementation by the second quarter of 2026; concerns the evolution of the national e-procurement system, which includes the following projects:

- **Smart Procurement:** complete digitization of the entire purchasing process, from needs assessment to contract execution;
- **Interoperability** of the e-procurement system with the management systems of public administrations, economic operators and other subjects involved in the process;
- **Status Chain for verification and audit** activities of e-procurement processes through the use of blockchain technology;
- **Artificial Intelligence** for the analysis of trends in the use of purchasing tools, market dynamics and behaviors of PAs and economic operators;
- **Evolved CRM** with chatbot functions, social collaboration, e-learning, knowledge management, for information services, support and training of PA operators and economic operators.

4 Theoretical Framework

4.1 Introduction to the theoretical framework

After explaining the focus of this dissertation in Chapter 1, describing thoroughly the existing literature on the subject in Chapter 2 and the legal framework influencing public procurement and smart working in Chapter 3, it is time to present the authors' made comprehensive framework, that aims at unfolding some questions on how a public administration should manage an emergency situation efficiently and promptly. The framework's purpose, even though it was elaborated to sustain public universities through emergency periods – for which the COVID-19 is used as a base example for its application – is also a guide to the implementation of protocols, instruments, and strategies during ordinary periods, in order to be prepared in case of emergency, as well as being more efficient in ordinary times. The COVID-19 pandemic thought us that even though universities were more specialized and reactive to possible threats, being them places full of experts and academics, there was difficulty in managing a world-wide crisis due to the lack of digitalization and experience in new ways of working, such as smart working. Indeed, this model as the objective to make universities more efficient and resilient to extraordinary events, by enabling some practices and a change in culture than will be of advantage in these situations, for example pushing towards digitalization of procurement and the wide-spread adoption of smart working contingency plans, but by doing so, it enables digitalization and a change in culture that is healthy and that will strengthen public institutions in ordinary periods. The framework was for these reasons named Phoenix Framework. The name, taken after the mythical creature, is symbol of resilience, rebirth from its own ashes, considering that the framework objective is to increase efficiency in troubled times and that one of the cardinal points is, indeed, the people inside a public institution, which can drive the change to a newer, more efficient model of work. Furthermore, now more than ever is the best time to innovate towards e-procurement technology and to make a complete revision of internal processes in order to adapt them to the new digital instruments, because there is a strong involvement of the EU in funding these strategic objectives, in order to make the European public sector more competitive, resilient, efficient, and up to date. Without further ado, the Phoenix Framework will now be presented.

4.2 The Phoenix Framework

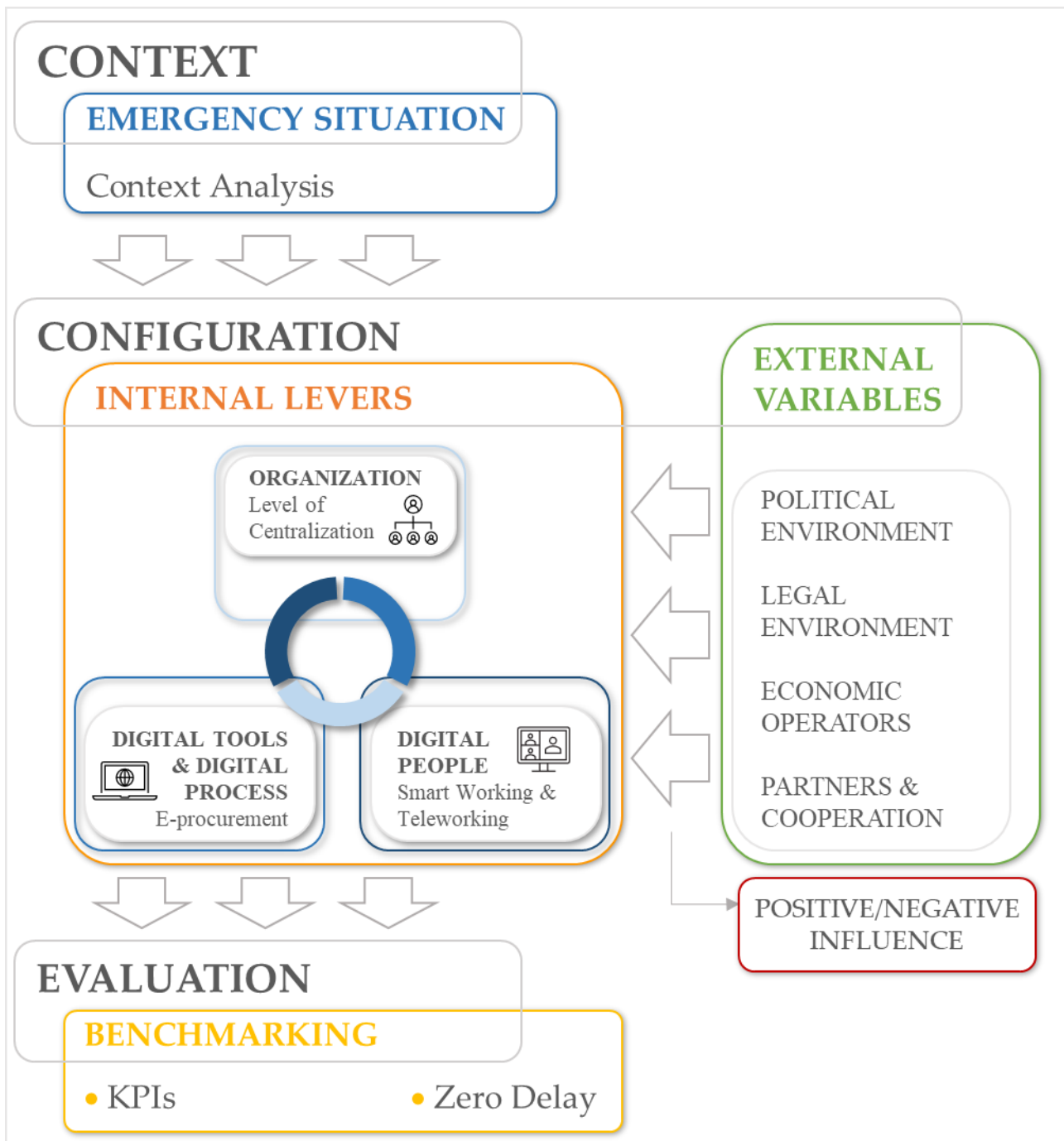


Figure 15 - Phoenix Framework. Authors' own work

As anticipated, the Phoenix Framework takes its name after the legendary animal since it consists of implementing and strengthening some core elements of an institution in order to overcome difficult contexts. In Figure 15, it is possible to see that the framework is simple, yet insightful. By analyzing an **emergency context**, the aim of this framework is to develop and plan in advance the **right configuration** of a mix of drivers in order to **obtain efficiency** of operations throughout the emergency. Now the different elements of the model will be analyzed more in detail.

First of all, the *context* in which the universities find themselves is to be thoroughly analyzed. The *context* refers to the emergency that is being faced and the changes that it brings with it. COVID-19, for example, is a peculiar emergency that involved many different aspects of peoples' lives and organizations' functions, and, moreover, it affected nearly every productive sector, weakening the supply chains of private companies as well as public institutions like universities. One peculiar characteristic of this context is that workers were to stay at and work from home, something that has never before happened. Therefore, understanding the intrinsic characteristics of a particular emergency is necessary in order to better evaluate the resources that have to be used, and what *internal levers* have to be the main pillars for an efficient response.

Configuration is the second and most important point of the Framework. This section refers to the *internal levers* that will lead to positive procurement outcomes during the emergency and to *external variables* that mitigate or worsen the damages brought by the emergency. These two spheres are connected to one another since public institutions are bounded to legislation and linked to private enterprises through supply and third mission initiatives. Indeed, the framework also aims at showing that an impeccable setting for what concerns *internal levers* will not lead alone to best efficiency if the *external variable* are not fully supporting the institutions. Therefore, without cooperation and coordination between internal and external drivers, the efficiency, analyzed within the *evaluation* section of the Framework, would be penalized. However, not always the issue is connected to legislation and suppliers, or to internal characteristics alone, but it could be a combination of the two spheres that damage efficiency. Now, *internal levers* and *external variables* will be discussed more in detail to have a deeper understanding of the core section of the framework, and then the *evaluation* section will be introduced and analyzed.

Internal levers are a combination of three of the procurement levers that were analyzed in the *Literature Review* Chapter: the **organization** of the procurement activity, **digitalization** and technology of the procurement process, and the **human capital** involved in **smart working**.

For **organization**, the Phoenix Framework refers to the level of centralization or decentralization of procurement activities, or some hybrid variants of the organizational structure, for example what happens when the central office supports more complex procedures and leaves the remaining activities to the departments. In the recent emergency, some categories of products like PPE and other safety devices were to be bought to enable work in presence in safety and the reopening of universities to students. These kinds of purchases, for some universities, were never needed before and procurement professionals needed to learn requirements, certifications, and other information relevant to the purchase of these goods without any issue, that can range from suppliers' disputes to non-conformity of the supplier or its products with legal requirements, in order to guarantee fast and reliable purchases. These purchases can be classified as *emergency purchases* which have some characteristics in common:

- at the outbreak of the emergency, demand far exceeds supply;

- They are characteristic of the emergency, meaning that in an ordinary period these goods were purchased in a minimal amount or not procured at all;
- Price is volatile, due to high and unstable demand of these goods;
- These purchases are necessary to all the divisions of an institution, not only to some of them.

During the pandemic, these characteristics are found in PPE, but not only. Electronic devices and PCs enter in this category of purchases as well, due to the high need to digitalize, enable online learning or renovate old equipment not suited for remote working. It is obvious that in this scenario, not all the possible organizational structures are best suited for a response. Indeed, when considering organization of the procurement activities, to better satisfy demand of *emergency goods and services*, some criteria can bring immediate value:

- High purchase power;
- The ability to train a lower number of employees, in order to use fewer resources and time;
- Better coordination.

These are all characteristics of centralized or hybrid models of organization, meaning that the best ways to face adversities on the organizational side are these types of structure. Centralized, and hybrid models, have the advantage of purchasing resources at the central level (for hybrid models this applies only on selected categories of goods, but *emergency supplies* could be one of them). The centralization of these purchases leads to the training of only the necessary staff in the central office, which limits the resources and time spent on training, rather than having to train more employees in a decentralized model. Being all the employees in the same office, smart working could be easier, since there will be more simplicity in communication between employees of the same office rather than employees from different offices and different departments, and from a managerial point of view, only one office director will be in charge of supervising the procurement activity and reporting to the top management – the general director of the university in question – which will lead to a simplification of the chain of command and reduction of times for communication. However, it is not feasible to change the organizational structure of the institution during the period of emergency, but an evaluation has to be made prior to it. Hybrid models are for sure favored since they include both the advantages of centralization and decentralization and allow for more flexibility than other models. This flexibility can be of great advantage during an emergency since it can allow, as said before, to centralize those goods typical of the emergency, which require higher coordination in their purchase and good purchasing power. However, not all the universities are best fit for this model. In particular, smaller universities might not have enough resources to have procurement offices dislocated in the various departments. Therefore, it can be said that for larger universities, which can afford it, a hybrid organization is recommended (both in emergency and ordinary periods), while in smaller universities, centralization is the best available choice. Even though the hybrid model might be more flexible, both models allow for the centralization of *emergency goods and services*, and shorten the chain of command, with the advantage of higher control on purchases with a lower effort.

However, simplifying the chain of command can bring some possible disadvantages, for example there can be greater difficulty in coordinating and controlling employees with only one office manager, since a single manager must supervise the work of all the employees in the office, who must deal with all the purchasing processes of the entire organization. In addition, it must be considered that following the introduction of the new work modality, smart working, it is no longer possible to adopt the coordination mechanisms that were adopted in the pre-emergency period, such as direct supervision; a new personnel management models must be developed that adapt to the new way of working.

To overcome this problem, it is essential to train managers through a training program to undertake a process of change management, related to the management of human resources, with the aim of introducing a culture of **work by objectives**, and adopting new modes of leadership that are based on the following principles (Gangai, 2021):

- **Sense of Community:** ability to foster a sense of belonging and collaborative spirit, to allow employees to feel part of the team even without being physically present in the office;
- **Empowerment:** the ability to stimulate the professional growth of the team, increasing their confidence and level of responsibility in carrying out their tasks;
- **Flexibility:** increasing flexibility in the way and time of carrying out tasks, to support the work-life balance;
- **Virtuality:** the ability to identify the most effective modes of interaction based on the type of activity performed, balancing virtual and face-to-face meetings.

It is therefore necessary to undertake a cultural change, moving from a “punching the timecard” logic and direct supervision to a **results-oriented structure**, based on flexibility, accountability, and trust. Working by objectives would allow the employees to be more autonomous and have the perception of being more empowered in the performance of tasks. On the other hand, it would allow managers to keep track, even remotely, of the activities performed by each individual employee without the need for continuous direct supervision. Work by objectives is not simply a new mechanism for controlling employees, but it has a more strategic importance: it allows the entire organization, through the analysis of objectives, to address the strategic management of the team and of individuals, going to define the priorities of intervention to improve performance. From the analysis of the **results of individual employees**, it is possible to define which are the employees’ weak points and consequently define a specific training program for them. From the analysis of the **results of the whole office**, processes can be mapped and redesigned to adapt them to the new organizational working model introduced in the organization or to improve the efficiency of the current model.

To define and set goals that are appropriate and achievable, they must possess the following characteristics:

- **Specific:** they must be well-defined and tangible;
- **Measurable:** They must be able to be expressed numerically;
- **Attainable:** they must be realistic;
- **Relevant:** must be important, in terms of costs/benefits;

- **Time-based:** must be defined a specific time for their realization.

In other words, the objectives should be SMART!

It is also clear that the category of indicators to be used is influenced by the characteristics of the work activities to be assessed. These can be standardized activities, for which it is possible to identify a concrete and objective result, or project-based activities, whose process is discontinuous and linked to the project itself. In this way, managers can identify a specific evaluation scheme for the activities carried out by their purchasing department, to make the team accountable for the results to be achieved and identify with them the critical points on which to focus attention.

In addition to the cultural change, the role of technology in allowing employees to perform at their best, and this is a key enabler for introducing smart working into the organization. When considering an institution with low digitalization already in the period of emergency, it is true that it will have issues of efficiency, but some digital tools, or better, digital enablers, can be implemented rapidly in order to 'dab the wound':

- **IT Security:** first of all, it is necessary to ensure IT security even when working from outside the organization. One solution, quick to implement and low cost, is the use of a private network service or VPN. A VPN guarantees the user remote access to a server on a private network via the Internet, i.e., it is a private and dedicated connection to the public administration's internal server;
- **Communication systems or applications:** these can be used to communicate remotely as if people were in the office. Currently on the market, there are different types of telecommunication platforms that meet all kinds of needs, among which it is important to mention Microsoft Teams. This platform makes it possible to organize meetings, communicate through individual or group chats, share files and collaborate on documents from the Office 365 package. It is also fundamental to show the importance of communication platforms to the institutions' clients, suppliers, and employees;
- **Online databases and applications with cloud storage:** they allow remote use of all the institution's digital applications. By starting a process of full dematerialization of databases, every document would be fully accessible in electronic format. The dematerialization would bring benefits in terms of efficiency as it would reduce search time and the risk of loss of files, as well as being an environmentally sustainable choice, given the elimination of paper copies, with also reduction in costs;
- **digital signature:** it is a simple yet powerful tool that removes the need for physical closeness of employees and for physical, paper-based documents. It can be said that sustainability is a byproduct of digitalization;
- **Reporting systems:** the definition, at the beginning of each week, of the tasks to be carried out and the people in charge. Each employee must keep daily track of the progress made so that the managers have a constant view of the progress of each activity in order to organize and assign resources based on the degree of urgency and complexity of the tasks, as well as assess the level of achievement of individual and team objectives.

After defining the basic tools that enable remote working – not smart working, for the reasons explained in *Literature* – to be implemented in a short time, even in less digitized offices, in order to respond quickly to an emergency situation, let us go on to define the next steps to be implemented to allow agile working while guaranteeing normal efficiency in office operations. The digitalization of the entire purchasing process is the essential condition for carrying out activities related to procurement in smart working mode, guaranteeing levels of effectiveness and efficiency that are comparable to, if not better than, traditional office work. Indeed, smart working and digitalization of the process are intrinsically linked with one another, since without digitalization, smart working is not possible. It is therefore important to carry out a study and mapping of all the processes that make up the procurement activity and to define the degree of applicability of smart working to the current level of digitalization of the process so as to build a road map of the phases that need to be digitized in the short term in order to carry out the tasks effectively.

Considering what was said above, technology is the main pillar on which the Framework stands. The usage of technological instruments is necessary in order to surpass emergencies with minimal impact. On a first note, the integration of operations with technology can be essential to facilitate success in institutions with organizational models that are not the ones described above. For example, in case of decentralized organization, which will probably be slower in response than a centralized model, if supported by a strong digital information system and e-procurement platform, that covers the different phases of the process, it can enable quick response or a partial and temporary change in organization to cope with the emergency situation. But technological solutions can provide much more help.

E-Sourcing instruments are fundamental in providing different potential suppliers for emergency goods and services and in making easy and fast a comparison of possible solutions. Furthermore, they allow to keep track of awarded suppliers and potential ones in case there is the need to call again some of them, of course in total respect of the current regulations on the subject. Another advantage, intrinsic of the register of suppliers, is the possibility to confirm the presence of certification in suppliers. Negotiation instruments can cut down times to make tenders for larger contracts. However, some analysis tools may lack behind, especially at the very beginning of an emergency. Indeed, some of these tools that forecast procurement needs based on historical purchases will not be of aid, since, as said before, a characteristic of emergency purchases is their novelty, and there are low or no historical data to refer to for a potential analysis.

Moreover, e-Catalogue instruments can come to aid, strongly improving times of procurement as in the case of registers of suppliers for e-sourcing tools, but these will help in selecting and comparing new suppliers, rather than calling old ones (both old participants and old awarded suppliers) to new tenders. For example, the pandemic led the Government to issue funds for the production of protective equipment. Of course, workflow management tools, e-DES and digital signature are of the essence, a backbone that sustains the digitalization of the process. Having a tool that helps with planning and checks when objectives are reached, can help managers in keeping track of the progress and understanding if the objectives set are feasible or not, and as said before, is fundamental

when employees are under a smart working regime; e-DES is fundamental for communication and connection with the accounting office; and digital signature, when all workers are at home, is essential to allow managers to sign documents, but also to guarantee access to documents only to who has authorization.

Of course, the best and most efficient solution would be to have a procure-to-pay suite, fully integrated with the IS of the institution and that allows interoperability with external e-marketplaces, for example that of Consip S.p.A (MEPA), or the regional e-marketplaces. Interoperability must be one of the staples in the research and adoption of technological and digital systems, for it is necessary to have multiple systems that can communicate with each other in order to eliminate duplication of activities and loss of time in feeding information to each software. However, the digital enablers described above for the 'quick' digitalization of critical phases of the process will be sufficient to manage the situation with a certain degree of efficiency, provided their interoperability with existing infrastructure and software. As can be seen in the description of the three drivers that make up the *internal levers*, we considered the complete digitization of the procurement process to be the most efficient and effective solution.

To be able to take full advantage of the potential of the optimal configuration of the *internal levers* it is necessary that there is support from and cooperation with the *external variables*, that impact on the level of efficiency attainable. These factors are the **legislation** in force, the **relationships** between **public entities** and between public institutions and **private companies**.

As far as legislation is concerned, the *external variable* with the greatest impact, it is clear that the theme of complete digitalization of the purchasing process is a prospect that is already consistent with the current regulatory framework, as described in the *Legislation* Chapter. In reality, however, it is a theme that is only hinted at among the lists of proposals to be implemented in order to resolve the criticalities of the sector, but without a well-defined and actual national e-procurement strategy. We firmly believe that, instead, the theme of digitization must be at the top of the priorities to be addressed in the PA sector for the virtuous mechanisms that it can generate. Fortunately, in the last period, following the pandemic, that has shown the importance of digitization even to the most skeptical opposers, digitalization has been included among the themes that make up the M1 mission of the country's PNRR. As a result, we expect a substantial increase in investments and reforms in this regard in the short and medium-long term. Among the reforms that we consider necessary to implement to increase the efficiency of the process, it is important to mention:

- **BDOE**: the BDOE would allow for a reduction in the time taken to conduct tenders, as it would allow for the electronic acquisition of the supporting documents needed by economic operators to verify compliance with tender requirements automatically, therefore making unnecessary to contact the various authorities that hold the required data. The BDOE could be managed by ANAC, so as to integrate the data already in its possession, for example within AVCpass, and consequently constitute a single database that effectively responds to the verification needed for economic

operators. Combining all the data already in possession in a single bank would avoid risks of data redundancy and will benefits in terms of greater IT completeness.

- **National e-procurement strategy:** the definition a more precise strategy in terms of digitization to extend the obligation of digitization to all phases that make up the procurement process will make digitization no longer a rewarding requirement but a mandatory one, allowing to improve the quality of contracting stations.
- **Adaptation of telematic platforms:** It is necessary to define common standards, following the model already in force in countries such as the United Kingdom, Denmark, and Sweden, where the possibility is given to private companies to design autonomously and place on the market telematic platforms, usable by the PA on condition that they meet the standards defined by the regulatory code of accessibility, interoperability, security, and interchange of information (European Commission et al., 2016). This solution has a double advantage, it allows the continuous innovation of platforms thanks to the high level of competition derived from the open market and, at the same time, by defining common standards, it allows the proposed solutions to be interoperable, secure, and modular, avoiding the risk of having PAs using uncoordinated solutions both externally, with other economic operators, and internally between the various stages of the process.
- **Qualification of contracting stations:** professionalization of contracting stations, in terms of tools and methodologies adopted and in training programs for the human resources involved regarding digital technologies. After all, it has been shown how the lack of qualified skills and knowledge generates economic consequences even more serious than corruptive episodes, with a quantifiable waste of resources of 83% compared to 17% of corruptive episodes. (Donato, Mariconda, & Mirrione, 2020)

In addition to legislation, the second *external factor* that impacts on *internal levers* is the network of relationships that the university establishes with other public bodies and private enterprises:

- **Public-public relationships at the territorial level:** having an ongoing relationship with other public entities in the territory would allow in a period of emergency to define and activate a task force quickly and effectively, making available the skills and information to every public entity. In addition, institutions could benefit from the sharing of best practices among the various public entities, so that through cooperation and sharing of different experiences in responding to the emergency crisis, a standardized plan of action could be defined.
- **Public-Public relationships at the international level:** Universities usually establish partnerships with other HEIs around the world, which allows to make students transfers and abroad studying much easier. Another advantage of these connections, if distributed in different countries, is a higher reactivity to potential national threats that may become global and send help in the form of donations to the countries struck by an emergency. Moreover, also the same advantage of territorial relationships are present, such as the share of best practices, but possible differences in regulations and procurement procedures must be considered.

- **Public-private relationships:** partnerships with companies close to the universities can present an advantage to both, since it is possible to use the know-how present in the university, thanks to the skills of researchers, and implement it through the production capacity of companies, to enable the production of emergency products when they are most needed.

Lastly, the Framework provides a *response* or *assessment phase* which will support universities in understanding if the difficulties were managed efficiently. Of course, implementation of correct tools and changing employees culture to support work from home is essential to the correct management of procurement (and all the other activities) during an emergency but evaluating the effects of these changes is necessary to determine if the change were, in fact, useful or not. Some key indicators can be days of delay. It will be important to determine the time of closure or slowdown of the procurement office as well as activities directly and indirectly connected to it. The procurement office is necessary when it comes to purchasing systems and equipment for didactics, research, and other activities, therefore, it will be important to measure days of delay of every service offered or office, for example didactics restart time and research interruption days. This metrics will be used in the first weeks of an emergency and, with a view to enhancing universities' response through cooperation, it would be a good practice to share indicators to allow benchmarking of performances with other HEIs. Benchmarking is a practice strongly used by the private sector, which can be of aid in measuring performance of the response in universities, due to the fact that no university ever had to measure such performances. In this way, comparing performance with other institutions would provide a sound measurement of relative efficiency, with the best university as objective to be reached by the others.

In the following weeks, other metrics can be adopted to understand if the level of performance is satisfying. For example, a comparison between previous years can be made in terms of number of orders made per period of time or average time to complete orders in the same period of the precedent year. This *internal benchmarking* can provide useful information on the speed of the procurement process during an emergency, with the aim of maintaining or, if feasible, increasing the speed of the process.

Another source of useful indicators is connected to smart working. As said before, agile work shifts the paradigm from working 'by the hour' to working 'by objectives'. The objectives set can be used as a measurement in itself, but other metrics derive from them: number of objectives completed on time, number of objectives completed on time per period (per week, 2 weeks, or month), average delay in completion of objectives, which should be zero or close to zero, otherwise a re-evaluation of the objectives set has to be made in order to make them SMART. Below is presented, in Table 3, a list of the indicators mentioned in this Framework, which do not represent all the indicators available, but are for sure a good slice of strongly useful indicators. Many other indicators, which the authors may not have come up with, can be 'discovered' by the universities themselves and should be shared to other institutions, following the logic of sharing knowledge and best practices to enhance the efficiency of every HEI, that was previously highlighted within the Phoenix Framework.

| Type of KPI | KPIs | Benchmarking |
|--------------|--|---|
| Qualitative | <ul style="list-style-type: none"> • Days of interruption of procurement activities • Days of interruption of research • Days of unavailability of lectures • Time to set up remote working • Average time to complete objectives • Average delay to complete objectives • Number of objectives completed in a certain period | <ul style="list-style-type: none"> • < 5 days • < 5 days • < 5 days • ≈ 0 days • Depends on objectives given • ≈ 0 days • Depends on size of the office, historical values, and types of objectives |
| Quantitative | <ul style="list-style-type: none"> • Variation of number of orders • Variation in number of suppliers | Both depend on the type of emergency goods purchased and the characteristics of the university (departments that can aid in the purchase of certain goods rather than others) |

Table 3 - KPIs for the evaluation of efficiency in response to an emergency

5 Empirical Analysis

5.1 Methods of the research

5.1.1 Introduction

Following the introduction to the topic of this dissertation and the exposition of extant theory in the previous chapters, as well as in the Theoretical Framework of reference for the analysis of the results, this chapter will focus on the explanation of the methods and methodologies used in this study. The research follows a mixed-method approach which combines survey and case study methodologies, since it permits to “collect a richer and stronger array of evidence than can be accomplished by any single method alone” (Yin, 2017). First, an online questionnaire was created using the Google Form online application. The data obtained from the survey was then combined with other sources of data available on the universities’ websites and SIOPE, the Italian database of operations of public administrations. Then, interviews were conducted on the most interesting universities which responded to the survey or presented peculiar information on their annual report. The interviews, together with data previously collected were fundamental in order to build case studies of the most relevant and particular universities. In the next sections, the methodologies used will be described in further detail.

5.1.2 Survey

5.1.2.1 Characteristics of the respondents

The survey was conducted to initially explore the setting of Italian public universities before and during the period investigated, that coincides with the start of the COVID-19 pandemic in February/March 2020. The analysis through a survey was intended to explore (i) the organizational configuration of the procurement function, (ii) total costs and costs related with the pandemic, (iii) the level of digitalization of the procurement process, (iv) continuity of the main activities of the university and (v) other main topics regarding the procurement office. An online questionnaire was distributed via e-mail to the 67 public HEIs in Italy. The responding universities were 21, which represent the 31% of the population. The respondents are well distributed across the territory, as shown in Figure 16, which indicates the regions in which there was at least one responding university. Universities from 14 regions participated in the survey, almost equally distributed between north and south, with 11 being located in northern Italy and the remaining in central and southern Italy.

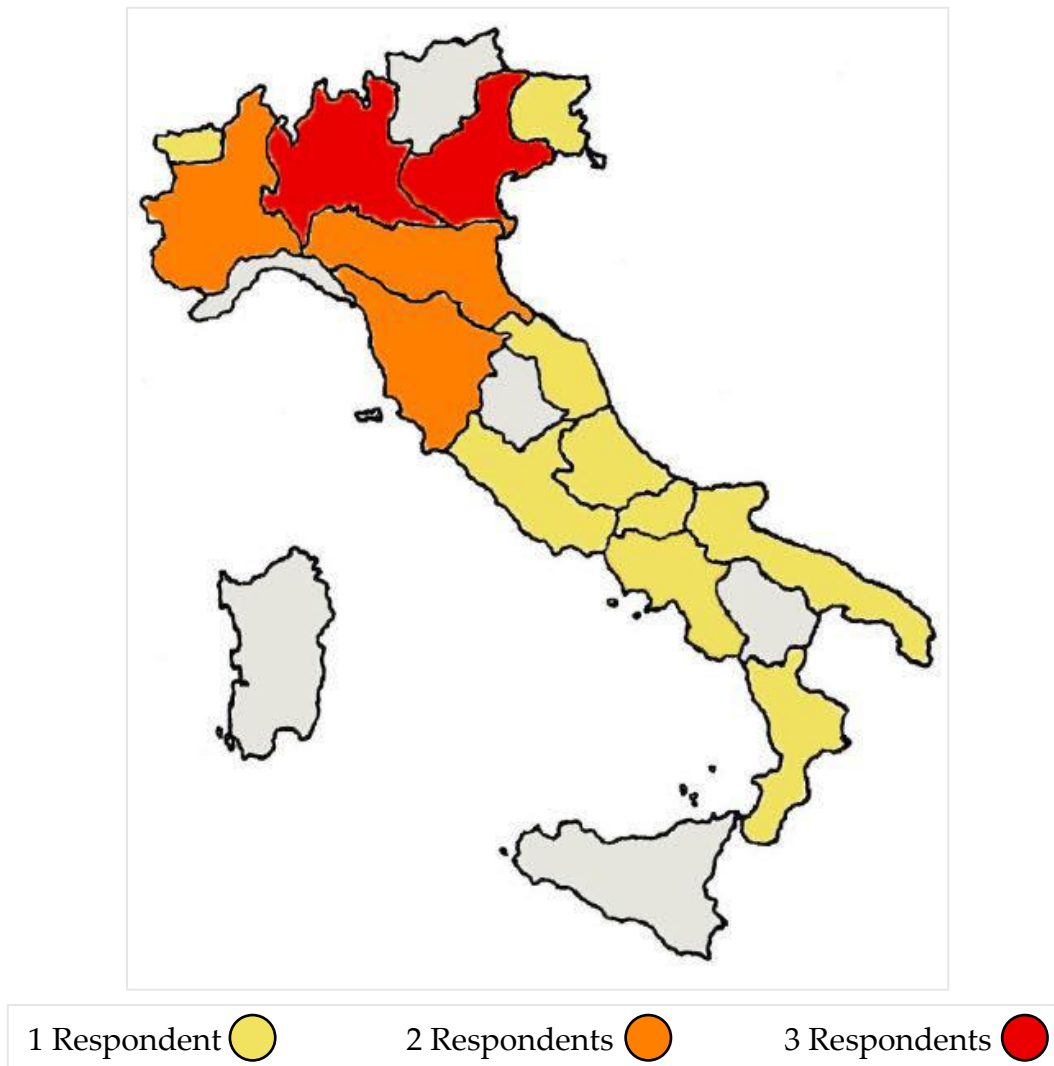


Figure 16 - Distribution of the respondents by region

The distribution of responding universities by size clusters was also analyzed. The number of students enrolled was used as the driver for the classification of the universities by size clusters, following the subdivision proposed in the Censis classification of Italian Universities 2021. With this classification it is possible to analyze how the size of the university is correlated with the structure of the purchasing process (Scuttari & Agasisti, 2016). The proposed classification is as follows:

- Mega Universities: over 40.000 enrolled students;
- Large Universities: between 20.000 and 40.000 students;
- Medium Universities: between 10.000 and 20.000 enrolled students;
- Small Universities: less than 10.000 enrolled students.

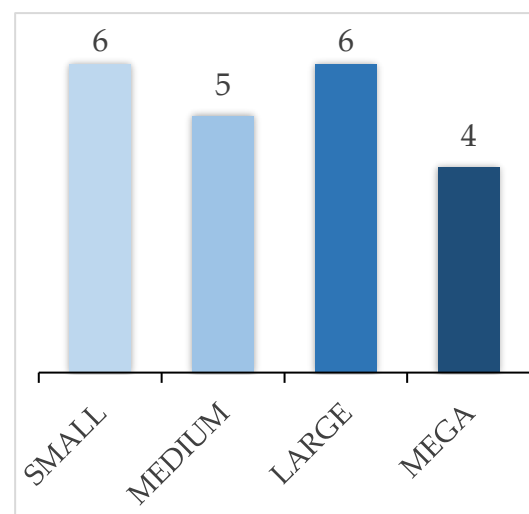


Figure 17 - Distribution of respondents by university size

Figure 17, on the right, shows the subdivision by size class of the universities responding according to the classification just presented. The results show how the number of respondents for each type is homogeneous among the various size classes.

The good distribution of the responding universities throughout Italy and the homogeneity in the percentage of each size class makes it possible to carry out research that is revealing and considers the specificity of the different geographical areas as well as the different sizes of the universities.

| Region | Small | Medium | Large | Mega | Total | % |
|-----------------------|--------------|--------------|--------------|------------|-----------|-------------|
| Abruzzo | | 1 | | | 1 | 4,8% |
| Basilicata | 1 | | | | 1 | 4,8% |
| Calabria | 1 | | | | 1 | 4,8% |
| Campania | | | 1 | | 1 | 4,8% |
| Emilia Romagna | | | 1 | 1 | 2 | 9,5% |
| Friuli Venezia Giulia | | 1 | | | 1 | 4,8% |
| Lazio | 1 | | | | 1 | 4,8% |
| Lombardy | | 1 | 1 | 1 | 3 | 14,3% |
| Marche | 1 | | | | 1 | 4,8% |
| Molise | 1 | | | | 1 | 4,8% |
| Piedmont | | | 1 | 1 | 2 | 9,5% |
| Puglia | | 1 | | | 1 | 4,8% |
| Tuscany | 1 | 1 | | | 2 | 12% |
| Valle d'Aosta | 1 | | | | 1 | 4,8% |
| Veneto | | | 2 | 1 | 3 | 14,3% |
| Total | 6 | 4 | 6 | 4 | 21 | 100% |
| % | 28,6% | 23,8% | 28,6% | 19% | | |

Table 4 - Distribution of the respondents by size and by region

5.1.2.2 Structure of the survey

The survey was developed to ask direct, simple, and quick questions in order to have an analysis sample that was as broad and comprehensive as possible. A total of 19 questions were posed, which required either multiple choice or short answers, or to include numerical data about purchases made in the years 2019 and 2020. The objective of the questions asked was to capture whether procurement facilities of different universities followed a pattern for responding to the COVID-19 pandemic (see all the questions posed in Appendix A)

In the first place, the organizational structure was investigated, in particular the degree of centralization of the purchasing function within the responding universities and the presence of dedicated offices, that are offices completely and solely dedicated to procurement, both in the central administration and in the departments.

Next, it was asked to provide some quantitative data about total expenditures in 2019 and 2020 for goods and services, the number of orders and active suppliers in the respective years, and the amount spent on instruments, tools, and equipment to manage the COVID-19 pandemic, in terms of safety of personnel and to allow the adaptation to online classes, therefore both direct and indirect costs related to the pandemic were included. The answer to these questions was not compulsory, therefore, not all the respondents filled this section. For the institutions that did not disclose these data, the information about total expenditure was collected on SIOPE.it, where public administration open data is stored. Where available, the costs related to the pandemic were collected in the integrating notes to the public annual reports of the respondents, which are located in the respondents' websites in the governance transparency section. This additional data was then integrated with the data collected through the survey to have a larger database for our quantitative analysis.

The next topic covered was continuity of services and activities of the universities. It was asked to the respondents whether the procurement offices, research activities and teaching services were interrupted or slowed down due to the start of the pandemic and the successive general lockdown of March 2020, and the number of days of delay in case a certain service was, indeed, interrupted. This also included a question on smart working, to understand if this practice was ever adopted before the pandemic.

The survey went more in depth in understanding the instruments and types of suppliers employed to purchase goods and services to cope with the emergency. It was asked to tick every instrument and type of supplier contracted for COVID-related goods or services between the following:

- Electronic Market of the PA (MEPA), already used suppliers;
- MEPA, new suppliers;
- Suppliers outside of MEPA but located in Italy;
- Supplier outside of MEPA but foreign;
- CPBs other than Consip S.p.A;
- E-commerce (i.e. Amazon).

Also, donations were considered, in particular, it was asked if international donations were received and if there were delays due to logistics issues, including long customs clearance times generated by the pandemic.

Finally, it was necessary to understand the evolution of the digitalization of the procurement process in order to understand the possible reactions to be adopted to face the pandemic emergency. This next section represents the core of the analysis performed by the survey and it aims at analyzing which phases of the process were digitalized before the pandemic (in 2019), if any phases were digitalized during the pandemic in response to it, and which were the most critical phases to be managed and controlled during the first

months of the COVID-19 pandemic, so during the national lockdown. Following the macro-phases identified in literature, the digitalization of these processes was asked adopting a categorization proposed by Bertezzaghi & Kalchshmidt (2004):

- **Analysis of needs**, pertaining to the *pre-procurement* segment of the procurement process;
- **Selection of procedures**, related to *choosing the procurement procedure*;
- **Definition of specifics and functionalities**, connected to the *definition of the subject matter*;
- **Research of suppliers**, which is the first phase in *selection of tenderers*;
- **Definition of tender specifications**, linked to *technical specification and selection of tenderers*;
- **Management of the tendering process**, which touches both *selection of tenderers and tender award criteria*;
- And **administrative and operating management of the contract**, and **performance analysis of the process**, all part of the large macro-area of *contract management*.

5.1.3 Open data

This paragraph is dedicated to the methodology for collecting data on the websites of the universities and SIOPE. The reports available in the universities' websites were 51, which were then analyzed to find information regarding different aspects already investigated in the survey. Total costs of goods and services were collected from SIOPE for all the 67 institutions contacted. The data collected from these two sources was formatted on an Excel workbook: information regarding costs related to the COVID pandemic were collected on a spread sheet and total costs for goods and services on another. Total costs and COVID costs were then paired with one another and COVID costs were also paired with total number of students, teaching and technical administrative staff, in order to calculate different statistics relevant to the analysis. Then, every qualitative information about the emergency period found in the annual report was collected on two separate documents: one which classifies information by university, and another that aggregates information of different universities by area of interest, which were: (i) didactics and research continuity, (ii) procurement office, (iii) smart working, (iv) costs related to the pandemic, (v) economies related to the pandemic, (vi) and other organizational information. This information was then compared with the results from the survey as well as used as an additional source of data for building the case studies. In this way, a better triangulation of data was possible, which allowed for a sounder development of the case studies, of which the methodology is discussed in the next paragraph.

5.1.4 Case Studies

The second method used in this dissertation is that of case studies. Yin (2017) defines a case study as "an empirical method that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident". Also, case study relies on multiple sources of evidence (Yin, 2017) and (i) answer to "how" and "why" research questions, (ii) do not require control over behavioral events, and (iii) focus on contemporary events (Yin,

2017). Indeed, the research objective is to determine **how** the digitalization of the procurement process in public universities influence the response to the global pandemic and **how** did the procurement office of universities respond to this disruption, therefore the context of public administration is intrinsic to the analysis and its consideration cannot be excluded. Furthermore, the absence of control over behavioral events and the focus on a contemporary event, that is the global pandemic, suggest that the use of case study as a method of investigation is valid and can lead to insightful contributions to the literature.

After establishing why case study was used as a method, it was necessary to define and bound the case in question. Case studies can focus on a large array of subjects: from a single person to a group, from an organization to an industry, from an event to a certain period. Also, a case study can be bounded by time, space, activity, and other explicit contextual boundaries (Yin, 2017). From the literature review it emerged that public procurement is too broad of an argument to be the case in a single study. This would impact negatively on the depth of the analysis of the research. For this reason, the case selected was public procurement within the context of higher education institutions, which the authors, as students, perceive as a reality close to them and interesting to be investigated. Another element used to bound the case further and give a precise objective to the research was selecting the start of the global COVID-19 pandemic as the period of analysis. Such a period can provide relevant information about digitalization in universities and their reaction to a massive emergency such as COVID-19 global diffusion. This allowed to focus data collection on specific events to be able to investigate in depth a limited set of data instead of only scratching the surface on a larger case.

According to Yin (2017) there are three types of case study research:

- Exploratory or pioneering case studies, which are utilized to explore new or unknown phenomena, with the objective to generate questions and possible propositions for future research in that field;
- Descriptive case studies, which are used to describe situations, processes and procedures, phenomena, and events, that are being studied together with the context in which they occur;
- Explanatory case studies, used to determine and explain causal links between real life events, situations, or interventions, and to connect it existing theoretical propositions and hypotheses, in order to generate new contributions to it and expand the knowledge in the studied field.

In the authors option, this dissertation will be an **exploratory** study, since the pandemic emergency brought about by the COVID-19 virus is an unknown, never-before-experienced situation in modern history, and, to the best of our knowledge, there is yet to be theory applicable to this situation, regarding public procurement. However, it will be possible to use existing theory of public procurement and digitalization in ordinary situations, in order to develop a framework that aims at being the starting point for more studies in this specific area.

Successively, other categorizations of the cases under scrutiny had to be made. The choices were between proceeding with a single- or multiple-cases case study and between

implementing a holistic or embedded analysis of the cases. The first choice, that is employing a multiple-case case study approach, was guided by its many advantages with respect to the single-case approach. For instance, Yin (2017) points out that the analytic benefits from having more than one cases may be substantial. Indeed, multiple cases give the possibility to confirm your results by direct replication, which happens when to cases lead to the same conclusion starting from similar behaviors, or theoretical replication, happening when results are different from one another, but the reasons can be explained in differences in starting conditions and actions performed by the subjects of the cases. The second choice was based on how the authors want to present the cases, and how many levels of analysis are present in them. Since the Phoenix Framework analyzes different perspectives, namely the *context*, *internal levers*, *external variables* and *performance evaluation*, an embedded structure would be more appropriate for the presentation of the case studies. In this way, different paragraphs can focus on different aspects of the Framework and of the universities themselves, and it will be advantageous when comparing the different cases (*Cross-Case Analysis*).

After choosing the expected characteristics of the cases, data collection was the next, and one of the most relevant, step. As said before, two different sources of data were first utilized: surveys and open data obtained from the public administration IS (SIOPE). First of all, the survey had a dual role: get preliminary information about the theme in question and help to complete some lacks in real world behavior of the procurement machine, and then to be the founding base for the case studies. Indeed, the cases selection process started from the dispatch of the surveys to all the Italian public universities. Then open data was collected, connected, and elaborated together with the information obtain through the survey.

From this thorough data collection process, it was possible to choose specific cases to be studied from the pool of universities that answered to the survey and had information on the SIOPE platform, or on their websites, that were relevant and interesting. Some respondents had interesting approaches to deal with the pandemic and were selected to be interviewed. Interviews were made to increase the depth of the research and to further understand the phenomenon that was being explored. The interviews followed a semi-structured approach, which involved the dispatch of some predetermined question to the respondents by e-mail, to allow for better preparation of the interviewees on questions that were used as the starting point for the conversation. Then, the authors asked other questions in order to address interesting points that were brought up by the interviewees or to redirect the interview on topics that would have been more relevant to the research.

Finally, after a session of interviews, it was possible to select the cases to be explored in this study. Differently from the survey respondents, who were granted anonymity, the universities that represent the cases to be studied will be presented in open format. Nonetheless, their answers to the survey will be maintained anonymous. Below, in Table 5, the “cases” are presented, as to show the relevance of the data that was collected, the sources it was collected from, and the variety in the cases.

| University | Region of Origin | Number of Students | Function of the Respondent within the University |
|--|------------------|--------------------|--|
| Università Ca' Foscari | Veneto | ~20.000 | Head of the Central Procurement Office; Employee of the Directorate General |
| Alma Mater Studiorum - Università di Bologna | Emilia-Romagna | ~80.000 | Employee of the Central Procurement office; Employee of the Central Procurement Office |
| Politecnico di Torino | Piedmont | ~30.000 | Head of the Central Procurement Office |
| Politecnico di Milano | Lombardy | ~45.000 | Employee of the Central Procurement Office, on behalf of the Director of the Services and Infrastructures Area |
| Università degli Studi di Bergamo | Lombardy | ~20.000 | Director General |
| Università di Camerino | Marche | ~6.000 | Head of the Central Procurement Office |

Table 5 - Case Studies

5.1.5 Structure of the results

Since multiple types of investigation tools have been used, it is necessary to describe in advance how the results of this dissertation will be structured, in order to avoid confusion in the reader. The results will be organized into five different chapters:

- **Survey results:** this chapter will present the survey data in a narrative way, with support of tables and graphs which highlight the aggregate answers to the questions posed through the survey. Some of the questions regarding quantitative answers will also contain information gathered from the public reports and SIOPE database. The chapter will follow the organization presented in *Structure of the survey*.
- **COVID-19 Economies and Costs:** within this section are presented more in detail voices of cost and economies generated directly or indirectly by the COVID-19 pandemic. The chapter is based on data obtain from public sources, namely SIOPE database and universities' annual reports. It will be divided into two sub-chapters to allow for an easier read: Economies will represent the first sub-chapter and costs will pertain to the second one. At the beginning of this paragraph and of *Survey results*, the main findings will be reported in the form of bullet points, so that the reader can always come back and review the main results in relation to the analyses made in the successive chapters.
- **Critical analysis of the survey results and public data:** in this section, a first analysis is performed on survey results, COVID-19 costs and smart working data obtained

from university reports. These analyses also include a first comparison with and application of the Phoenix Framework.

- **Case Studies and cross-case analysis:** this chapter will contain the single case studies, for which the methodology is described above, in this chapter. Successively, a cross-case analysis will be developed to let transpire similarities and differences between cases.
- **Cross-methods analysis:** this last chapter will integrate the different methods in a single analysis to confirm whether there is congruence in the findings of this research or not.

Without further ado, the results will now be presented.

5.2 Survey results

- Hybrid organization models are the most used by universities of all sizes;
- A small number of respondents reported delays or slowdown in the procurement office;
- There were no slowdowns or interruption in research activities;
- The delay in restarting teaching activities was generally low (except in one case where the delay lasted 60 days);
- Digitalization across universities is on average medium-low, independently of the size. It is stronger for *search of suppliers* and *management of the tendering phase*;
- Half of the respondents experienced smart working before the pandemic;
- There was low digitalization enacted during the pandemic emergency.

5.2.1 Organization of procurement

First of all, the survey was aimed at understanding how procurement offices are organized in Italian universities. This could contribute to understanding if there is an organizational setting that could adapt more efficiently and effectively to the COVID-19 disruption. The main organizational structure, used by 11 of the respondents (representing the 52% of the total), is the hybrid model. It is followed by 6 institutions adopting centralization above threshold tied with other 3 implementing full centralization. Only one respondent, is adopting a fully decentralized organizational approach. It is interesting to see in Figure 18, on the right, that hybrid organization models are used in small, medium, large, and mega institutions, while, on the other hand, centralization above threshold is used in medium, large, and mega universities. However, full centralization is present both in 2 small and a large university, UniT and UniAT, and UniF, respectively. The only university adopting complete decentralization is UniG, a medium-sized university.

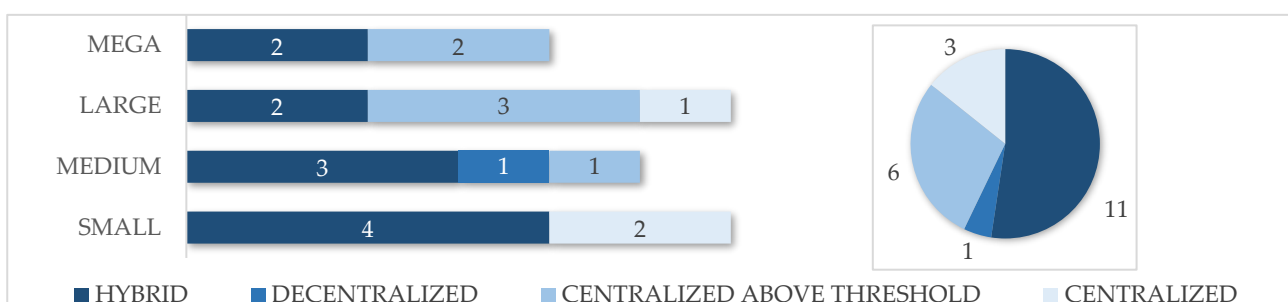


Figure 18 - Organizational structure in use: total (right) and by university size (left)

It was then questioned the presence of an office fully committed to procurement activities in the central administration and in the single departments of each university. The results, shown in Figure 19, highlight that only 5 of the respondents do not have in their central administration an office dedicated to procurement activities. When looking at universities by dimension, it emerges that all large and mega institutions have a procurement office in the central administration, while three out of five medium and two out of six small universities do not include in their organizational structure an office only for procurement, but they merged it with other functions. When considering dedicated procurement offices in the departments, there is a disparity in answers as shown in Figure 20. In small universities only one has a dedicated office in each department; two of the respondents from medium-sized universities have a dedicated procurement office in each department; only one large university out of six does have a dedicated structures in each department, three others do not have dedicated structures, while UniQ and UniB answered that not all their departments have a dedicated structure, but it is allowed by the two institutions to establish one if needed. A similar situation emerged for mega universities, where two universities have a dedicated office in each department, only one (UniO) does not have dedicated offices in any department and, lastly, UniM has a dedicated office only in some departments, while the other departments rely on the main procurement office in the central administration. These results clearly show a negative trend, whereas in smaller universities it is less likely to find dedicated procurement offices in the central administration and in the departments than in bigger universities.

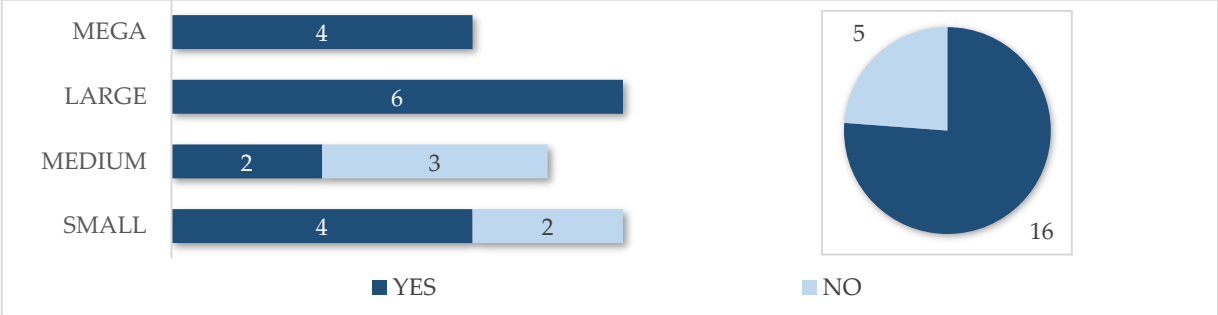


Figure 19 - Offices dedicated to procurement in the central administration: total (left) and by size (right)

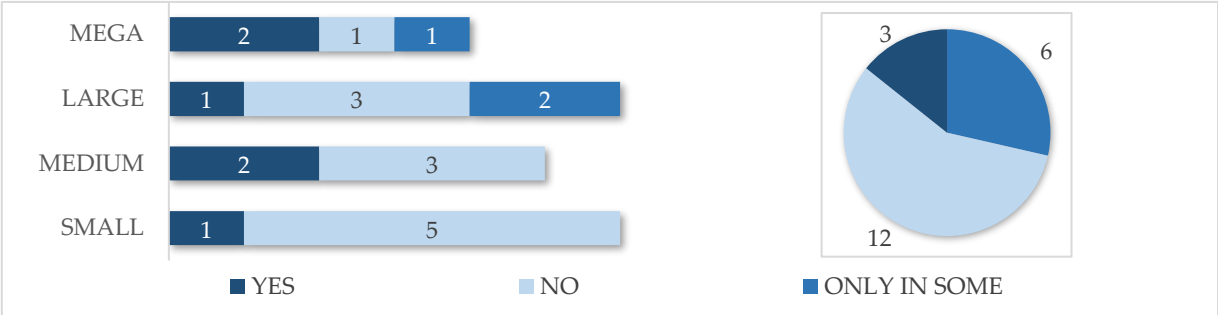


Figure 20 - Offices dedicated to procurement in the departments: total (left) and by size (right)

5.2.2 Costs analysis

Considering total expenditure, in 8 cases out of 66, it was recorded an increase from 2019 to 2020. The increase in expenditure oscillates from a minimum of 1,88% for UniAI, to a maximum of 12,12% in the case of UniAN. However, in 53 cases there was a decrease in costs, with a minimum drop of -1,42% in UniAT and a maximum drop of -23,99% in UniBM.

All the universities with a variation between -1% and 1% were considered to have maintained the total expenditure constant. These are: UniN, with a -0,31% decrease, UniBA, having increased expenditure of only 0,67%, UniAJ, reporting a 0,49% increase, then UniBO which recorded a decrease of -0,81%, and finally UniBI, with a slight increase of 0,54%. The results divided by university size are again variegated: only 1 small university saw an increase in costs, and 2 maintained constant costs, while the remaining 16 saw a decrease; 12 medium universities out of 16 decreased their costs, while two of them (UniN, and UniAJ) maintained the same level of expenditure; 16 out of 20 large universities saw a decrease in costs; and mega universities saw two institutions in their category with higher costs, and the remaining nine had a decrease in expenditure. A distinction was also made based on the macro-region of origin of the universities analyzed. It emerged that the average decrease in total costs of universities in northern Italy was of 7,8%, while in the universities located in the central regions there was an average decrease of 8,1%, and for the universities in the south of Italy the decrease was 9,2%. In each of the macro-regions there are 3 universities which saw an increase in total cost, except in the south, where only 2 universities saw an increase of 1,88% (UniAI) and 5,48% (UniX), respectively. However, the number of universities in each cluster is different, which means that the percentage of universities which incurred in higher costs is different for each cluster. In particular, the universities that increased their spending in the macro-regions are:

- 3 out of 24 in northern Italy, which represent the 12,5% of those universities;
- 3 out of 22 in the central regions, meaning a 13,6% of universities located in the center of Italy;
- 2 out of 20 in the south of Italy, which are the 10% of institutions in the south.

In Figure 21 is shown the variation of total costs for the participants to the survey (see Appendix B for a complete picture).

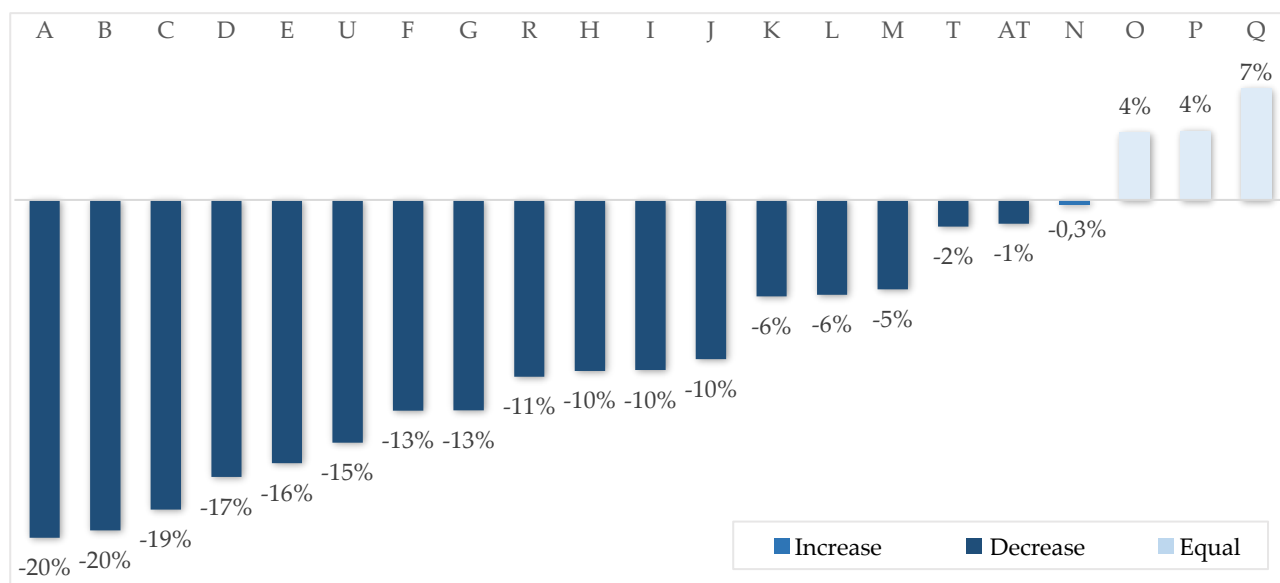


Figure 21 - Variation of costs of goods and services from 2019 to 2020

In terms of number of suppliers, one institution out of twelve maintained roughly the same number – UniF didn’t change in number of suppliers – while UniR had a slight increase of 1,25% - which is also the only university recording an increase – and all the other

respondents (10), independently of their size, decreased the number of their suppliers, from a minimum of -6,67% of UniT to a maximum drop of -52,33% of UniP. Furthermore, there was also a drop in the number of contracts executed, observable through the population that responded to this question (13 universities). Only in universities R and P there was no change, +0,11% and 0,00%, respectively. In UniT, it is registered an increase of 44%, the highest and only increase between the respondents. On the other hand, the decrease in number of contracts is significant and never higher than -16,7%, with a negative peak of -49% for UniK and an average variation of -14,8% from 2019 to 2020. To summarize the findings, 10 respondents out of 13 registered a drop in number of contracts awarded in 2020 with respect to 2019, 2 were constant and 1 recorded an increase.

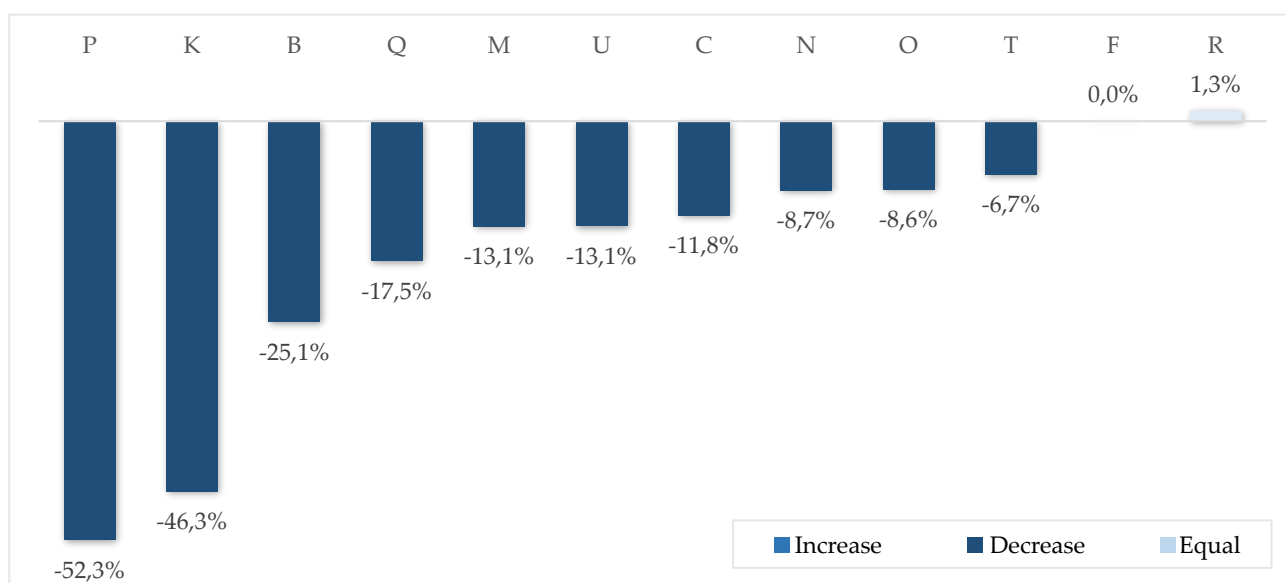


Figure 22 - Variation of suppliers of goods and services from 2019 to 2020

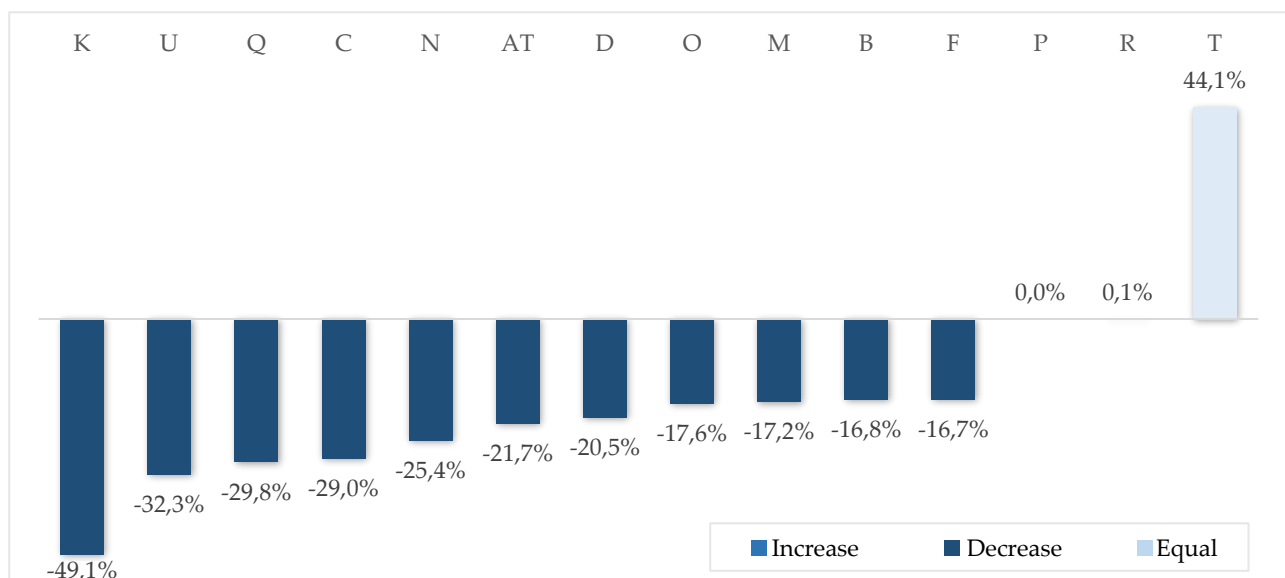


Figure 23 - Variation of contract for goods and services from 2019 to 2020

It was asked the expenditures of the universities on COVID-19 projects or emergency related purchases, including both costs for protective equipment, safety equipment and for ICT instruments for making distance learning possible, and 17 universities out of 21 reported these costs through the survey, as an aggregate value. Additionally, 37 universities wrote

this information in their 2020 annual report. The average impact of COVID-related expenses on the total expenditures of 2020 results to be 8,13%. It is interesting to see that, in 34 cases out of 54, representing 63% of the sample, the impact of COVID-19 expenses on total costs are lower than the average; 16 universities have spent between 8,18% and 16,36% (double of the average) of their total costs on COVID-19 projects; and four institutions spent more: UniBA spent the 18,2%, UniAB, and UniY both spent around 21,5% of their total on COVID projects, and UniT spent almost 32% of its total cost on COVID-related supplies and services.

The averages were then calculated for universities located in the same macro-region of Italy – North, Center and South – and these were the results:

- an average of 7,2% for the 21 universities located in the North of Italy;
- a mean value of 9,1% for the 19 institutions in the central regions;
- and 8,3% is the average for the universities located on the southern regions of the territory (including the islands), which were 12.

Below in Figure 24 are reported the percentages of COVID-related spending on the total costs for the universities that responded to the survey (see Appendix C for a complete picture).

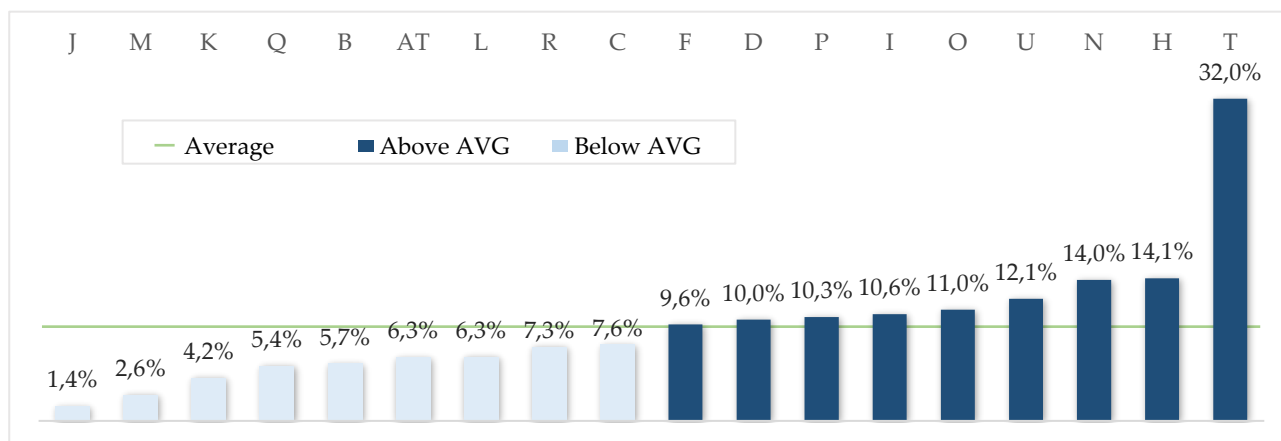


Figure 24 - Incidence of COVID-related costs for goods and services on total costs, 2020

5.2.3 Continuity of activities

In only four universities, out of the 21 that answered to the survey, there was a slowdown of the procurement activity, corresponding to a 19% of the total. Of these, UniA and UniAT are small universities, and UniK and UniF are both large universities. It was also analyzed the adaptation to working from home of the office employees. It was asked to the respondents whether there were previous experiences of smart working in their university or inside of their office. More than half of the respondents (11) answered affirmatively, while the remaining 10 answered that there was no previous experience of smart working. From a deeper

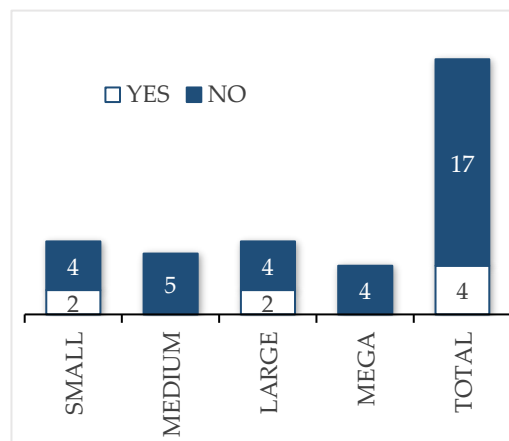


Figure 25 - Interruption or slowdown of procurement activities

analysis, it emerges that only 2 of the small universities answered positively to the question, as well as 2 of the medium-sized universities, and then 4 of the large ones, and 3 mega institutions.

Regarding research activities, all the universities were able to maintain active every project that could not be delayed or interrupted, and every research related to the ongoing pandemic.

On the teaching side, slightly less than half of the universities (9 respondents) interrupted the ongoing semester or postponed its beginning to reschedule didactic activities online. For those that had an interruption, the average time to restart in online modality was of 19,9 days, with a peak of 60 days for UniF, and a minimum of 5 day for UniE, UniQ and UniU which are a medium and two large universities, respectively. Furthermore, all but one respondent declared that the central purchasing office had to purchase materials and services to support professors in didactics from home. For example, these purchases include headphones, digital boards, webcams, laptops, smart pads, and software licenses to stream lessons from home, as well as webinars on how to make online lessons interesting and captivating.

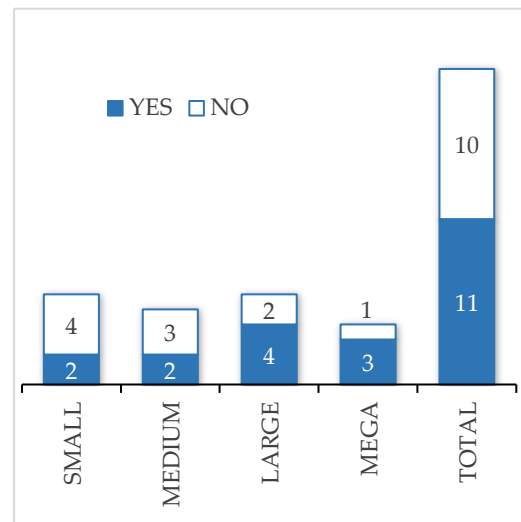


Figure 26 - Smart working experiences prior to the pandemic emergency

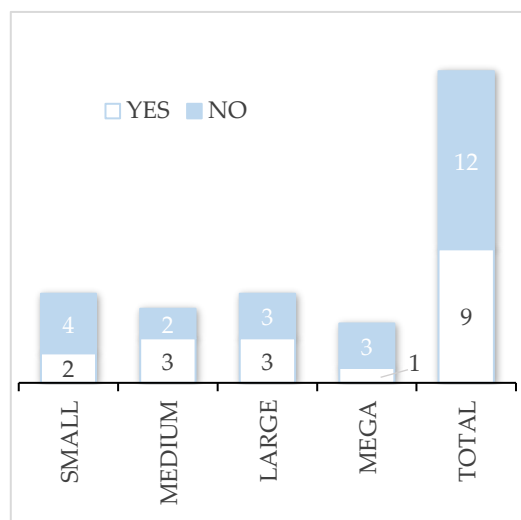
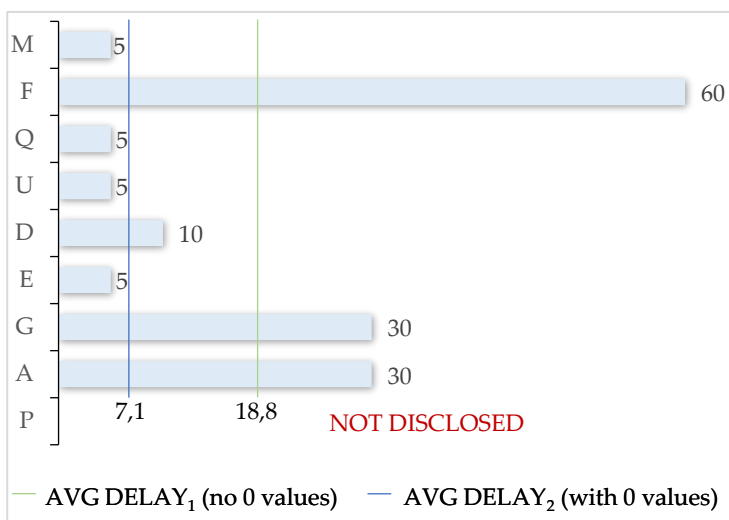


Figure 27 - Days of delay to restart teaching activities (left), and delay to restart teaching activities by university size (right)

Lastly, the government allowed students to return to in-presence lessons at a maximum of 50% of capacity of the classrooms starting from the first semester of the next school year – the 2020/2021 academic year. However, it was in the hands of the single universities to decide whether to organize blended teaching, meaning classes both in presence and synchronously online, or to maintain only online teaching. We remember to the readers that blended learning, in Italy, was allowed only when the region where the institution is located was in a yellow or orange zone – the gravity of the contagions in the Italian regions was

color coded with yellow, orange, and red. When asked whether blended learning was available in the university when the respective region was in yellow or orange zone, 18 respondents out of 21 answered affirmatively.

5.2.4 Qualitative analysis of suppliers of COVID-related goods and donations

The majority of the respondents resorted to new suppliers within the MEPA platform (95%, or 20 out of 21 respondents) for the purchase of COVID-related goods and services. Only one large university, UniF, did not employ new suppliers in MEPA. 18 universities contracted old suppliers in MEPA; 13 institutions purchased also outside of the electronic market from Italian suppliers; only 3 resorted to foreign suppliers outside of MEPA; UniC, UniF and UniO used CPBs; and UniB, UniK and UniM made use of e-commerce platforms or suppliers’ websites and only one answered to have employed an internal marketplace platform. As show in Figure 28, MEPA suppliers, both old and new, represent together more than 60% of the procurement solutions adopted by all sizes of universities, while Italian, non-MEPA supplier were preferred by small universities. No medium university employed any of the remaining categories (Foreign non-MEPA suppliers, CPBs and e-commerce platforms). Out of the total, 13 institutions employed at least one “alternative tool” (so non-MEPA tools) to procure goods and services for the emergency, but only 6 employed more than one “alternative tool” and no university made use of all the available instruments at their disposal.

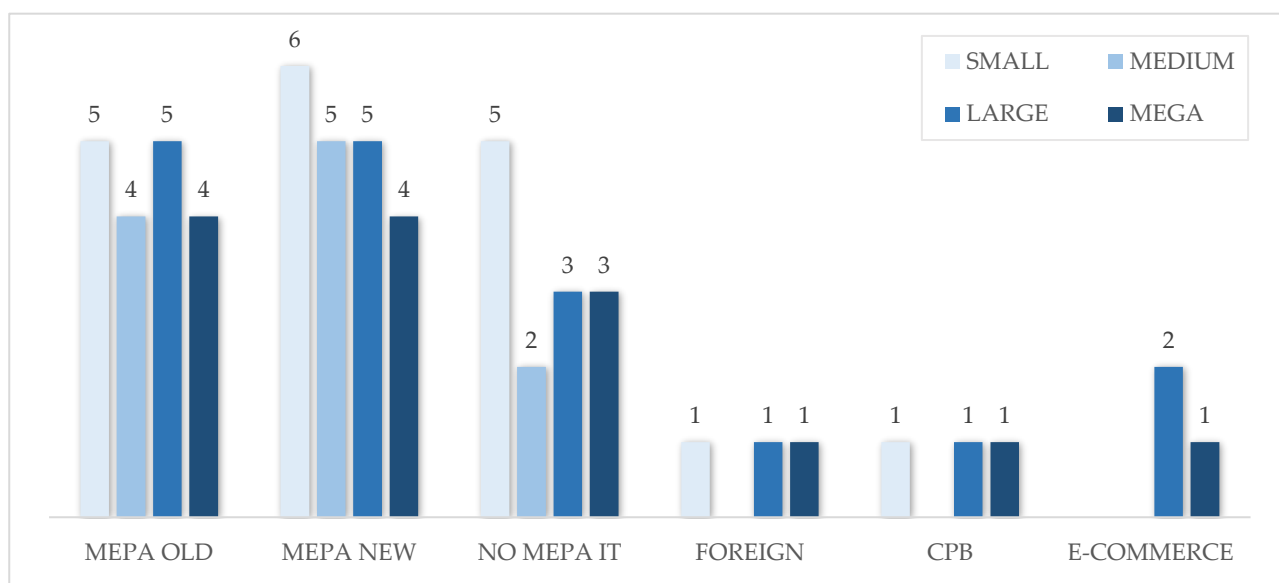


Figure 28 - Types of suppliers used for the purchase of COVID-related goods and services, by university size

It was also asked whether in the procurement office it was present a buyer figure specialized in purchases of medical equipment before the start of the pandemic, and only 2 universities answered affirmatively. Also, 8 universities out of 21 purchased supplies before the start of the pandemic in Italy, considering the news about the spread of COVID-19 arrived from China in January and February 2020.

Apart from purchases, the majority of the respondents received donations, except for 3 small, 2 medium and 2 large universities. However, only 9 out 19 received donations from

foreign countries and on these none was a small university. When asked whether there were delays in the delivery due to logistics problems, including customs clearance time, UniL and UniN, two medium universities, answered positively, as well as UniB, a large one, and all the mega universities. Only UniQ and UniU (both large) did not have issues with the delivery of foreign donations.

5.2.5 Digitalization of the purchasing process: before and during the pandemic

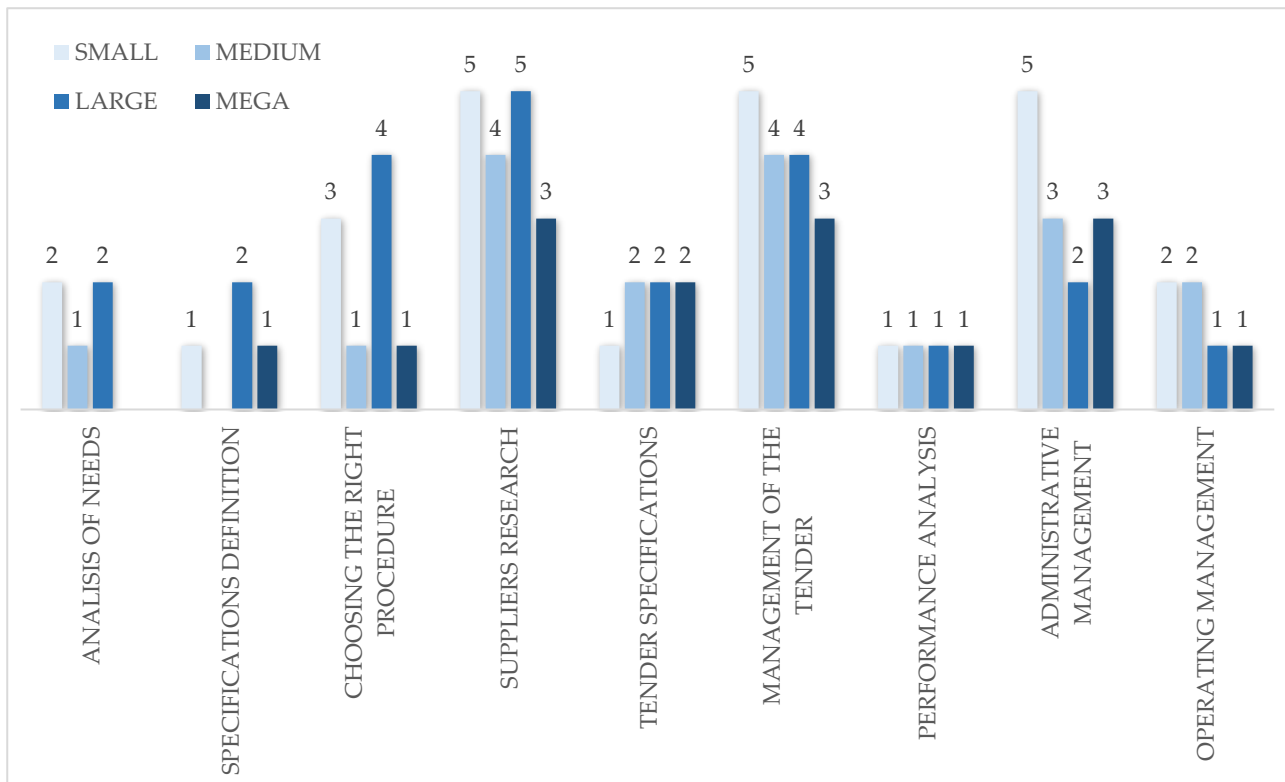


Figure 29 - Phases of the procurement process supported by digital solutions, by university size, 2019

In 2019, digitalization of the procurement process was not strongly widespread. The most digitalized activity was *research of suppliers*, with 17 universities out of 21 respondents digitally supported. The large use of the electronic market also explains why the second most digitalized process is *tender management*, with 16 universities adopting technological solutions to support this step. Follows *administrative management of the contract*, with 13 universities employing a digital tool. All the other steps analyzed are digitalized in 9 or less of the respondents: *selection of procedures* is digitalized in 9 institutions, while in the field of pre-procurement, only 4 universities digitalized *analysis of needs*, and also in the case of *definition of specifications* only 4 universities are digitalized, while in UniA this step of the process is not covered by the procurement office. A similar situation applies to *performance analysis*, which is performed in the procurement office of 16 respondents and digitalized in only 4. Lastly, *operating management of the contract* is supported by ICT solutions in 6 universities out of 20 – in the 21st university *operating management of the contract* is not performed by the procurement office. When analyzing the data by university size (Figure 29), it appears that the digitalization happens homogeneously in most of the phases, except for *analysis of needs*, where, surprisingly, no mega university is digitally enabled, and in

definition of specifics and functionalities, where, in this case, no medium-sized university is ICT-supported.

During the pandemic, not many universities digitalized activities. Only five of the respondents digitalized at least one of the phases mentioned in the survey. Two universities digitalized *definition of specifics and functionalities*, and one of them, UniO, also digitalized *tender management*; one university adopted digital solutions to *choose the right procedure*, and to *define technical specifications*; another digitalized the process of *searching for suppliers*; the last one digitalized the *definition of technical specifications, management of the tender and administrative management of the contract*. Three universities digitalized some other activities: UniL and UniO implemented *digital signature* software and protocols in the procurement department and UniI digitalized *competition sessions*.

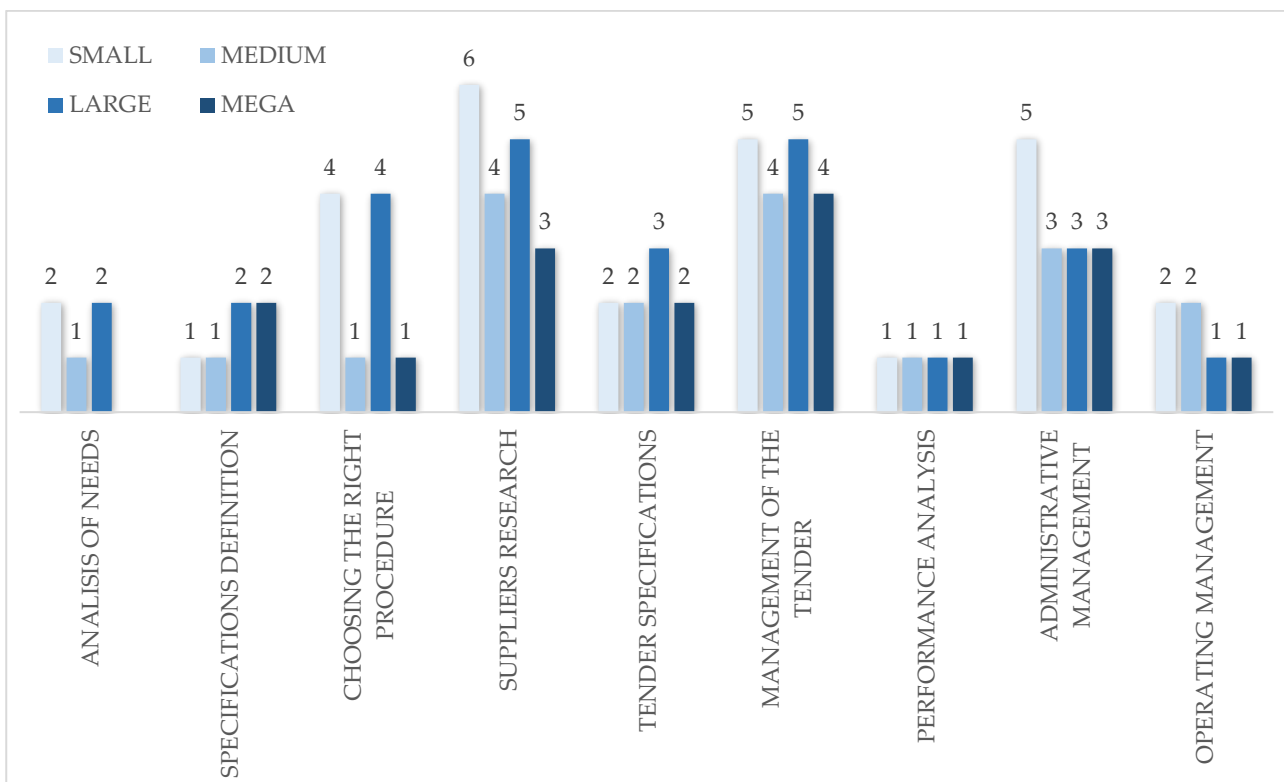


Figure 30 - Phases of the procurement process supported by digital solutions, by university size, 2020

With the addition of these information, there is a shift in the most digitalized activity, which is now *management of the tendering process*, with 18 of the respondents digitalized out of 20 – one is not performing *tender management* in the procurement office. The second is now *search of suppliers* with 18 universities supported out of 21, and third remains *administrative management of the contract*, which raised to 14 universities digitally supported. In Figure 30 it is possible to see the new totals divided by university size. Still no mega university is implementing ICT in performing the *analysis of needs*, but now one medium university is supported in *definition of functionalities and specifics*. In Figure 31 is compared the digitalization of activities in 2019 and 2020.

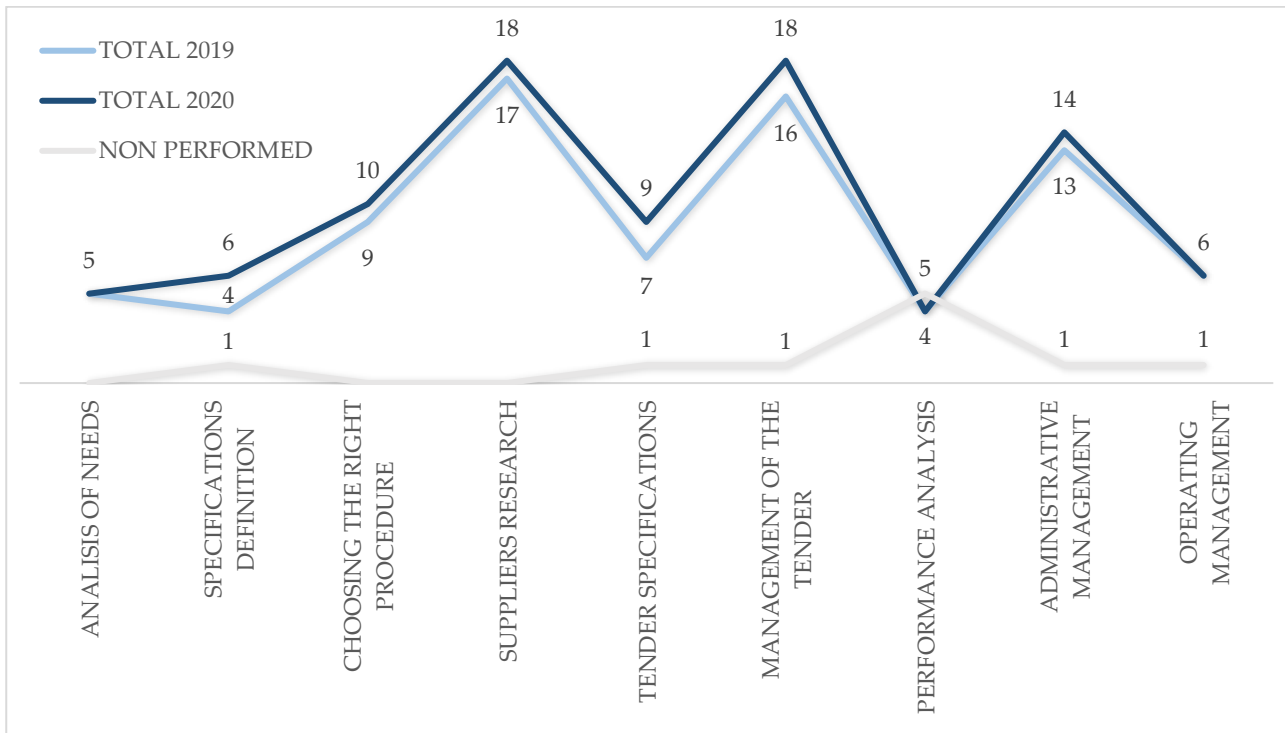


Figure 31 - Phases of the procurement process supported by digital solutions, 2019 and 2020, and phases not performed by the central procurement offices

To conclude the presentation of the results of the survey, in Figure 32 are shown which activities were perceived as more critical by size of university. The activity perceived as most critical was *definition of specifics and functionalities* of new product categories, with 8 respondents affirming so. Then, *analysis of needs*, *suppliers research*, and *operating management of contracts* were seen as most critical to 9 respondents each. All the other steps of the procurement process were perceived as most critical by 7 respondents or less, and only *choosing the right procedure* was never perceived as most critical. Lastly, 5 respondents answered that there was not a most critical activity, but all of them were equally critical in this difficult period.

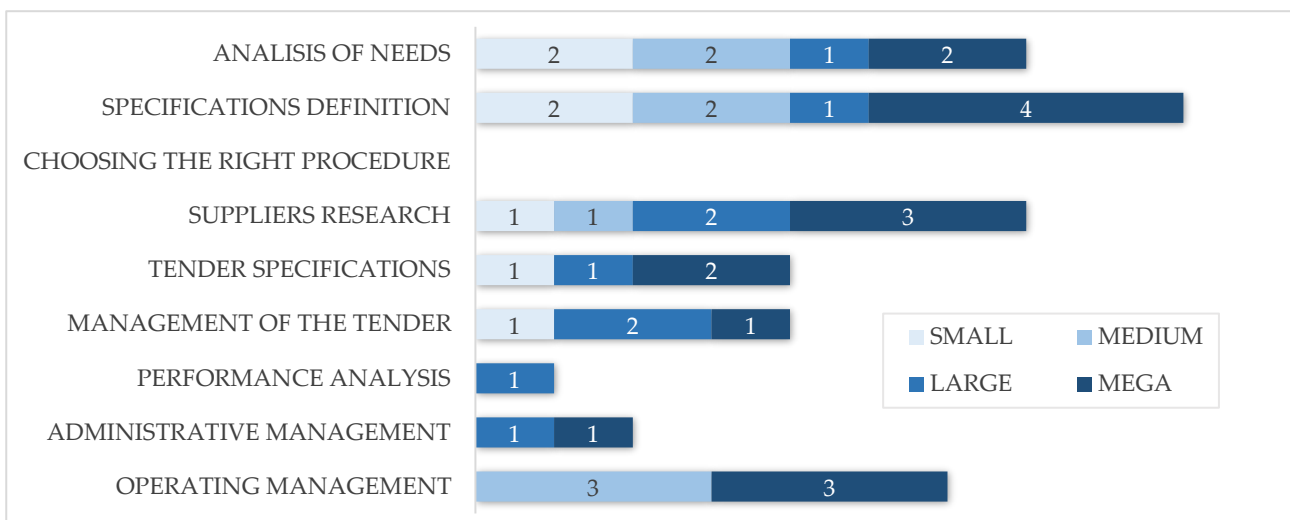


Figure 32 - Phases of the procurement process considered as most critical during the pandemic

5.3 COVID-19 economies and costs: evidence from public reports

- Major reduction in costs for missions and conferences
- Reductions in usage of stationery and paper supplies
- Increase in costs to ensure safety in university facilities and in the purchase of digital devices for the continuation of research and didactics activities

5.3.1 Economies

The emergency caused by the COVID-19 pandemic has impacted the allocation of resources in the 2020 budget. Due to the different way in which institutional activities are carried out, the lack in use of spaces for teaching during the first lockdown, and the consequent organization of smart working and distance teaching, the ability to use the resources allocated in the budget had to be modified.

Through the analysis of the budgets of the universities, the identification of the various economies that could be associated with the COVID-19 emergency was carried out, to verify what effect they had on the work of the procurement office. In that, thanks to the collection of data relating to the economies and, in the next chapter, the costs generated by COVID-19, it is possible to identify the product classes on which the purchasing offices of the universities have had to devote the greatest resources and expertise during the emergency period and which, instead, have generated economies. The analysis of the budgets for 2020 made it possible to collect data relating to the costs of current management of 45 universities out of a total of 67, for the remaining universities it was not possible to carry out the analysis because at the time of carrying out the research the 2020 budget had not yet been published online.

To assess the economies generated by the pandemic, we analyzed each university's 2019 and 2020 budgets to assess in which current operating cost items on the income statement there were a reduction in cost compared to 2019. In addition, the impact of each reduction related to a specific cost item on the total, given by the sum of all reductions in current operating costs, was assessed. The values were then associated with a weight in order to evaluate the weighted average value of the two indicators analyzed. The percentage reduction in the value for a specific cost item in the year 2020, compared to the year 2019, was associated with a low weight, 30%, because, although it is a relevant indicator for analyzing the impact of COVID on the specific cost item, the value does not consider the numerical magnitude of the cost item but only the reduction compared to the previous year. As a result, it is possible to find cost items in which the reduction, while significant in percentage terms, has a low impact on the total savings generated by COVID.

| | $X_{r,y}$ = Reduction of costs [%] | $X_{i,y}$ = Impact on total cost [%] | $X_{v,y}$ = weighted average of X_r and X_i [%] |
|---------|--|--------------------------------------|---|
| Formula | $\frac{cost_{y,t} - cost_{y,t-1}}{cost_{y,t-1}}$ | $\frac{cost_{y,t}}{tot_costs}$ | $X_r * 0,3 + X_i * 0,7$ |

| | | | |
|--------|-----|-----|--|
| Weight | 0,3 | 0,7 | |
|--------|-----|-----|--|

Table 6 - Calculation of X_r , X_i , and X_v for cost item y

A weight of 70% was, on the other hand, associated with the impact of each reduction related to a specific cost item on the total, given by the sum of all reductions in costs of current operations. This indicator is more meaningful with regard to the composition of total economies since it takes into account the numerical magnitude of the reduction in cost items.

From the analysis of the resulting average of the weighted average values ($X_{v,m}$) of each cost item for the year 2020, calculated by taking the arithmetic average across universities of the weighted values ($X_{v,y}$) obtained for each cost item, what emerges is a significant trend. In fact, in all the universities analyzed, the cost item with the highest weighted average value is *missions*, with an average value of 50%. This is caused by the reduction in travel caused by the pandemic, which has led to a considerable reduction in off-site missions. The second cost item, with a weighted average value of 33%, relates to the cost of conferences and events, given the impossibility of organizing events of any kind in presence, first of all due to the lockdown and then to the DMs that have prohibited their holding for the whole of 2020. The next three cost items refer to utilities, in which expenses for electricity, gas, mobile and landline telephony, water are considered, with an $X_{v,m}$ value of 23%, "concierge and surveillance services" with a weighted average value of 13% and "shipping and transport" with an $X_{v,m}$ of 15%. The reductions in these cost items are impacted by the limited use of academic spaces by the entire community, which has generated savings on utilities and the suspension of several graduate concierge and surveillance contracts.

For the item of cost "stationery, paper and printed matter" it is calculated a weighted average value of 12%. Considering only the value relative to the X_r indicator, that is, the reduction of the cost item as a percentage in 2020 with respect to the previous year, there is an average X_r of -34%. With respect to the cost items listed before, the reduction is primarily the physiological result of ministerial regulations that have limited the use of structures and travel, and consequently a return to pre-pandemic cost values is expected once the ordinary regime is restored. However, for the cost item "stationery, paper and printed matter" it will be interesting to analyze during the interview, whether this trend of cost reduction will be maintained in the future as a result of a change in culture or only limited to the pandemic period due to the forced adoption of emergency smart working. Indeed, in order to enable remote working, it was necessary to conduct processes digitally and scan necessary paper documentation. In addition, working from home and having to print with their own peripherals, it is conceivable that employees made use of paper only when strictly necessary for printing, and the rest of the process documentation was saved or shared only in digital form.

5.3.2 COVID-19 costs

This section illustrates the higher costs generated by the COVID 19 epidemic, which, as it was not foreseeable in the 2020 budget, have led to a remodulation of the resources allocated

in the budget to purposes not linked to the emergency. As a result, planned interventions were postponed to subsequent years to cover the need for resources for necessary interventions caused by the pandemic. As illustrated in the preceding section, the reshaping of the budget due to the different manner in which university services are provided has generated savings which have offset, in part, the greater unforeseen costs.

Through the analysis of the budgets of the universities, of which only 7 were found to have detailed descriptions of costs regarding the pandemic emergency, we have analyzed the main sources of funding to cover the majority of unforeseen costs:

- 2020 budget remodeling;
- Unencumbered profits from the 2019 budget;
- Ministerial fund for the emergency needs of the university system, provided for in the Cure Italy and Relaunch decrees;
- Ministerial fund for university building interventions and large equipment, DM 81/2020;
- Regional funds and from private individuals.

For the analysis of costs, 4 categories were considered into which to divide the expenditure made:

- *Extraordinary measures to ensure safety*: in which we include the sanitization services of the premises, the implementation of provisions for spacing such as the adoption of adhesive safety signs in the buildings, the creation of tutorial videos to illustrate the safety rules and signage. Also included are expenses for personal protective equipment, such as disposable masks, sanitizing gel, plexiglass, serological tests and swabs for staff, temperature detectors and thermal cameras.
- *Planning measures for teaching and research activities*: In which are included the purchases of digital devices and equipment for the setting up of mixed teaching, such as the purchase of audio and video systems necessary for the technological adaptation of the classrooms for mixed teaching, the supply of computer equipment, the implementation of software for the reservation of seats in the classroom, tablets for reading the QR code for the management of the entrances to the classroom of students with reservations, acquisition or rental of facilities outside the university to ensure the greatest number of students the possibility of attending classes in presence ensuring the necessary spacing. Also included are purchases of software and hardware to enable distance learning, such as agreements with software houses for distance learning applications, for the management of online exams and cloud services.
- *Measures for continuity of administrative function*: This includes all purchases to ensure continuity of the operation, such as the purchase of notebooks, workstations, webcams for teleworking, headsets with microphones, software such as Titulus for digital signatures and VPN services, SIM-data. Also included are training courses for employees on digital solutions and the new remote working mode.

- *Measures for the support of students*: included are the costs for SIM-data and funding for internet connections, the acquisition of personal computers, tablets for students from the most fragile social classes to reduce the social gap. Also included are the costs for the implementation of the software necessary to guarantee students remote access to the databases and bibliographic resources of the university.

From the analysis of the results of the cost items taken into analysis, it emerges that in five of the seven universities, the item that has the greatest impact on spending due to COVID-19 concerns *planning measures for teaching and research activities* with an average value of 49%, with a minimum peak of 32% of total spending and a maximum value of 63%. The second highest expenditure item, which is also the most impacting in two universities, concerns the total to *ensure safety in facilities* with an average impact of 27% and a high variance, as it has a maximum peak of 53% and a minimum peak of 8% of total costs.

The item *measures to support students* was allocated an average of 14% of the total expenditure, while *measures for continuity for the administrative function* were allocated an average of 10% of the resources invested.

Given that the analysis of the items of expenditure concerns a limited number of universities, since only 7 universities have published details of their expenditure generated in response to the pandemic, it is not possible to draw statistical conclusions regarding the data that emerged. As can be seen from the results, the variance in the results is so high that it is not possible, not only to make a statistical estimate, but also to make assumptions and correlations between the factors that distinguish the various universities and the composition of spending to deal with the emergency.

The results that emerged from this analysis were, in any case, useful, albeit at a qualitative level, for identifying which types of goods and services needed to be purchased in order to overcome the period of crisis; it will then be interesting to verify in the interviews what critical issues emerged in the purchase of these classes of goods.

5.4 Critical analysis of the survey results and public data

5.4.1 Survey and open data (costs) analysis

5.4.1.1 Organization of the procurement office

There are two of the small universities that are adopting full centralization, which can be explained by the fact that full centralization adapts well to organizations small in size and allows for more control on spending and higher aggregation of demand that can allow to have higher purchasing power, which could be an issue if the universities were to use a different organizational model. This can also be of aid in a period of emergency such as the COVID-19 pandemic since the rationalization and aggregation of needs of the departments at the central level would allow, as said before, for a greater purchasing power when it is most needed and for those categories of goods that were difficult to procure in the beginning of March 2020 (i.e. personal protective equipment, safety equipment to enable work in

presence, or technological devices such as laptops). Interestingly, also a large university is adopting full centralization of purchases. This can be of a disadvantage when considering the greater effort to control a larger structure, but it can give a greater reward in terms of planning of purchases and aggregation of demand, even in a period of emergency, but on the other hand, it does not allow for the same level of flexibility that hybrid models give. Indeed, it must be stressed out that, in a period of emergency, the effort needed to coordinate all the purchase at the central level would be higher than with a hybrid structure, which can leave non-emergency and non-strategic purchases in the hands of the departments.

As stated in the previous paragraph, the other small universities are adopting a hybrid structure, which puts together the best advantages of centralization and decentralization. It provides the right amount of control on departments spending, aggregation on common goods, rationalization of the purchasing process throughout the university, without compromising the autonomy of the departments, granting a level of flexibility that can be healthy in a period of emergency. In this way, it is possible to entrust to the central office all the above-threshold purchases, or the procurement of specific categories of goods. As an example, during the pandemic it would be possible to put the central purchasing office in charge of the purchase of PPE for the whole university. This action has different benefits: first, the number of employees that must specialize or learn about certification and requirements of PPE is limited to those in the central purchasing office, which avoids to spend resource on training for all the procurement staff in departments' offices, as mentioned in the Phoenix Framework; second, the purchase at central level implies that the departments would send to the central purchasing office requests for purchase and this can allow to aggregate the different requests, improving purchasing power, as in the fully centralized model. Indeed, as revealed by the survey, the hybrid configuration is the most used not only in small universities, but across all the different dimensional clusters, because, for the reasons stated above and described in the *Literature Review* and in the *Theoretical Framework* chapters, it is a robust organizational model that can provide great advantages and flexibility in ordinary periods, and, in the authors' own opinion, in emergency situations as well.

These considerations also apply to the model of centralization above threshold, which can be considered a type of hybrid structure where large purchases of goods and services, and infrastructure investments are made by the central purchasing office, while smaller purchases are 'left in the hands' of the departments. It is interesting to see that the model is applied in a medium, a large and a mega university, therefore it is possible to assume that the model works in universities of different dimensions, given than the maximum delay in restarting didactics is of 5 days in the medium university, while the others had no delay. During the pandemic this model would allow for large purchases of PPE at the central level, as in the case of a hybrid structure, or investments on equipment and software to enable at first online lectures and then blended-mode classes for the first semester of the 2020/2021 academic year.

Instead, for what concerns the decentralized, only one medium university, UniG, adheres to it. However, this model would probably be less efficient in a crisis scenario, since, in general, decentralization present some drawbacks like low standardization of procedures and processes, and low aggregation of demand at the university level. This organization can reduce the purchasing power of the procurers, and in the worst case, it could lead to departments competing with one another, which might cause cannibalization of supplies.

Successively, it was applied the χ^2 test to understand if there is correlation between the size of a university and the presence of a central office in the public institution. The p-value obtained from this test was around 0,071, lower than the relevance level set at 0,1. This lead to reject the null hypothesis of independence and allowed us to infer that there is dependence between the size of university and the presence of a central purchasing office completely dedicated to procurement. Indeed, with the increase in size of the universities, it is possible to notice an increase of affirmative answers to this question by the respondents. The presence of a dedicated office would indicate that the human resources available in the procurement office work only on procurement activities. This would possibly allow more efficiency during the pandemic, with respect to office with the same number of human resources, but an office that is not dedicated entirely to procurement activities. However, the need for a dedicated office can simply be explained by the fact that larger institutions require more efforts on procurement activities than smaller universities in ordinary times, which would be useful also during emergency periods, so this cannot be taken as indicator of higher efficiency during the pandemic.

Furthermore, also for dedicated offices in the departments there is a similar situation. Even though at the statistical level there seems to be independence between the size of a university and the presence of dedicated office in the departments, since from the application the χ^2 test we obtain a p-value of 0,67, it was shown in Figure 20 that the number of universities that adopt a dedicated office in at least one department increases with the size of the university. It is possible that the statistical test does not show dependence since the data provided is not sufficient. As before, it cannot be said that one university was more efficient than another solely because there is a dedicated office in its departments, but this two information allow for a better understanding of how universities are structured and what configuration they were in when faced with the threat of the global pandemic and the national lockdown.

5.4.1.2 Costs, number of orders and number of suppliers

The pandemic was responsible for stopping for three months all in-presence activities of Italian universities. This is evident when considering the general decrease in expenditure of universities, as it appears from the survey results and the open data collected. Indeed, the decrease in total expenditure is due to the fact that many of the core in presence activities were suspended in favor of online modalities. For example, web-based lectures were made possible by expenditures in digital systems and instruments, but, on the other hand, this meant no need for cleaning and concierge services in faculty buildings and, considering that employees were to work from home with exchange of information in a digital manner, in many cases there was a huge reduction in paper usage. However, there were some

exceptions, which means that in some cases costs to sustain organizational and infrastructural changes due to the pandemic were higher than the reduction in expenses on ordinary activities, but considering the reduced number of these 'exceptions', it is possible to affirm that the trend was the reduction of total costs from 2019 to 2020.

Furthermore, total costs were also analyzed by region of origin of the different universities, or better, by clusters of regions located in the north, center, and south of Italy and by size of the university. It appears that the decrease in cost in universities in northern regions is around 1% less than those in the central regions but 2% higher than the HEIs in the southern regions, which does not lead to any substantial insight, except that the universities in the different areas of Italy seem to have on average the same decrease. However, stronger insights transpire when looking at the universities grouped by size. The average reduction in costs for smaller university is greater than for bigger ones – a 9,95% decrease for small universities, around 8,70% for medium and large universities, and 5,94% for mega universities. This can signify that mega universities had to spend more than other universities, since there is more staff that requires digital and electronic equipment, more classrooms to be adapted to online streaming of lectures (of the first semester of year 2020/2021), and stronger infrastructure are necessary to manage the traffic of data of the didactics service as well as internal communications, that starting from March 2020 were almost exclusively done online.

A decrease in total costs is also explained by an average lower number of orders made by the universities, surfaced from the results of the survey. As said before, this is due to the fact that many activities were shifted online, and employees did not have to make orders for stationary good, and other kind of goods, and furthermore there was lower need for services, like cleaning and catering services. For this reason, also the number of suppliers saw a drop from 2019 to 2020. Again, there are some exceptions to this trend:

- 1 small university (UniA) had a -50% reduction in the number of suppliers but registered a slight 4% increase in cost and roughly the same number of orders in the two years. This can be explained by high-impact purchases on fewer suppliers and many repeated orders, which leads to say that there was low aggregation of purchases.
- Another small university (UniT) registered a reduction in suppliers of -7%, a slight reduction of total costs (-1,6%) and a strong increase in number of orders of 44%. A possible explanation would be a higher number of low-quantity, low-cost purchases with respect to 2019. Furthermore, this university registered the highest impact of COVID-related costs on total costs (31%), so it is possible to infer that many of the new orders were for COVID-related, low-cost purchases.
- A large university (UniF) saw a decrease in the number of orders and in total costs but maintained the same number of suppliers. This can be easily explained since a reduced amount of orders would lead to a reduction in costs if we considered that the cost per order remains on average the same.

- Lastly, of the mega universities responding to the survey, UniR maintained fairly constant the number of suppliers (+1,2%) and the number of orders (+0,1%), but saw a decrease in total cost of -10%, which can lead to the conclusion that COVID-related goods represented a lower expense than what ordinary purchases for the period would have been.

The analysis of the survey only allowed to scratch the surface of costs sustained by the universities in this period. The more detail analysis of public reports and SIOPE data base allowed to find out which are the cost items that influenced more this decrease in total expenditure. For example, the large decrease in missions due to the covid pandemic as well as the decrease for most of the universities in stationary items and paper. The latter is explained by the need to move the procurement office to a remote working setting and is an effect of digitalization, as described in extant literature and previously in the cost analysis.

Successively, an analysis of costs of goods and services related to the pandemic was performed in order to understand whether there was an even utilization of funds. It was necessary to normalize COVID-related costs by the size of the different universities, and this is why COVID-costs over total costs were used as a metric to analyze this data. As before, two analyses were made considering dimension of the institution and macro-region of origin. In terms of regional analysis, as it is possible to see in the previous chapter, the averages are similar and close to the general average of 8,18%. Therefore, we can infer that there was not a variation of the COVID costs based on the region of the universities. On the other hand, the averages by university size are strongly interesting. Small universities' average is of 12,0%, while the average impact of COVID costs on medium universities is 8,5%, and it is 6,3% for large and 5,8% for mega institutions. The percentages decrease with the size of the universities. There is a clear trend which shows that smaller universities had to spend more on emergency purchases than bigger universities. One of the factors that influenced this phenomenon is that the DM n.81 (May 13th, 2020), responsible for providing fundings for digital infrastructure enhancements, had a component of funding which was fixed and equal for all the universities and another that was proportional to the size of the institution, in terms of number of enrolled students. And number of enrolled students is also the criteria that determines the size category of the universities. However, the DMs were designed in such a way that they would allow to give back to the Ministry of Education the fundings in excess, so if there really was a lower need for funding it would transpire from the COVID costs reported on the annual reports and in the calculations made in this dissertation. Indeed, it is also true that smaller universities had a lower aggregation capacity than bigger universities, and prices for the same goods (in terms of category, not quantity) could have been higher, the smaller the institution purchasing them. Therefore, it can be affirmed with a certain degree of certainty that smaller universities incurred in relatively higher costs to contrast the pandemic than larger institutions.

Then, we decided to plot COVID-related costs against three different drivers to understand if there was a certain group of people that would have induced higher spending in COVID-related goods and services in universities. The drivers chosen were the total number of enrolled students, the total number of teaching personnel and research staff, and the total

number of TA employees. These groups were chosen since the population of universities is principally composed of these three groups, and therefore, a higher correlation of cost with one of these three groups could give a general idea of where the funds spent for the pandemic were allocated: on students support and online classes; on professor support, to enable them to stream online lecture and to develop more researches; or on technical-administrative employee in order to allow them to work from home, or in safety inside the university. Figure 33 plots COVID-related costs against enrolled students, while Figure 34 show COVID-related costs against teaching staff (in blue) and TA employees (in orange).

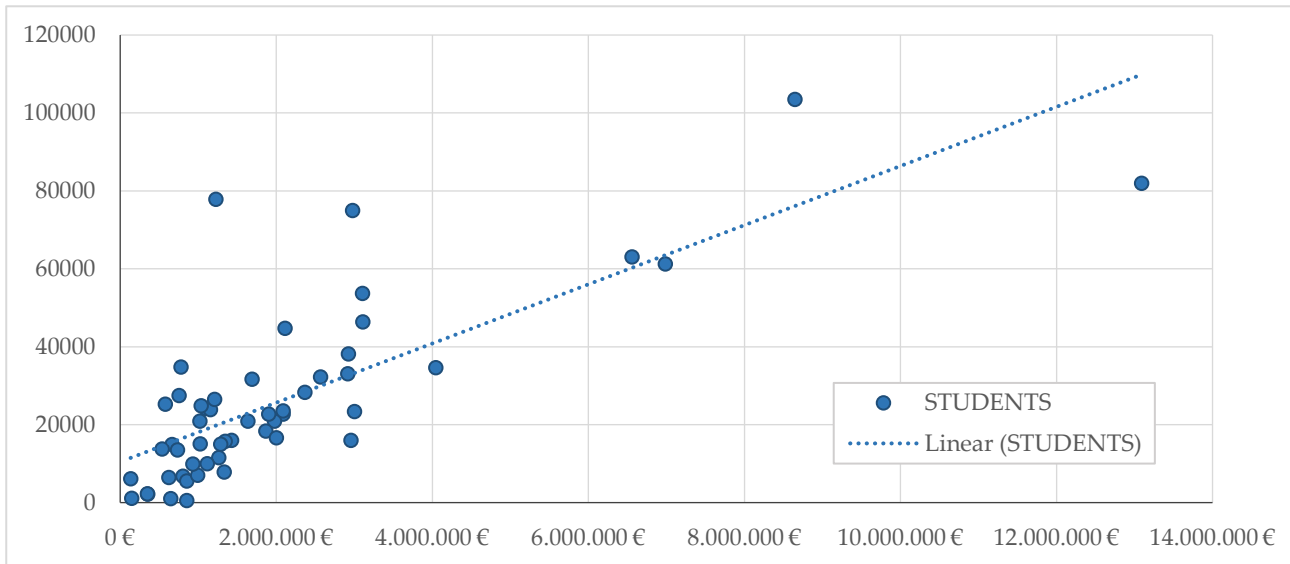


Figure 33 - Relationship between COVID-related costs and students enrolled in 2020

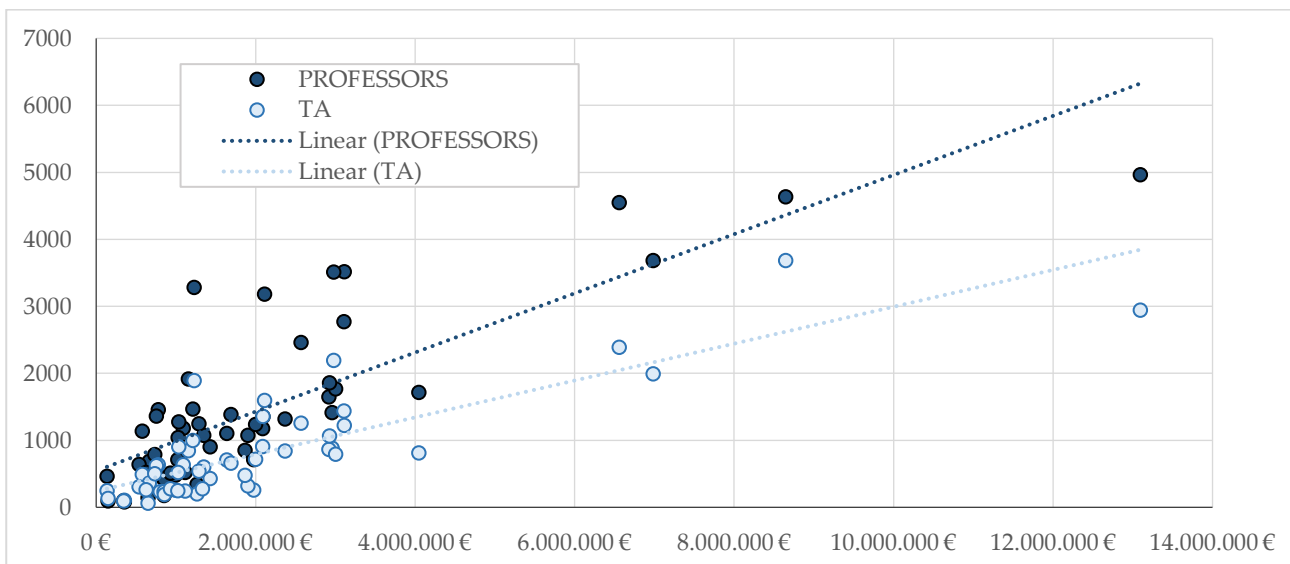


Figure 34 - Relationship between COVID-related costs and teaching staff, TA staff, 2020

It is possible to see that for what concerns number of students, there is high variation of the data from the trendline. Also, the coefficient of determination R^2 of these sets of data is 0,59, meaning that there is medium-to-low correlation between the sets. The coefficient of determination is higher in the case of teaching and research staff, for which it reaches a value of 0,67. The value is still low to say that there is strong correlation between the number of professors and researcher and the amount of COVID-related costs but is a stronger

correlation than the number of students. Instead, in the case of TA personnel, it is possible to see in Figure 34 that most of the data is close to the trendline (orange), which means that there is a pattern of higher spending related to the increase in the number of TA employees. Indeed, the R^2 coefficient is equal to 0,70, meaning that of the three drivers analyzed, this is the most significant. In order to be as thorough as possible, different combinations of the three categories were computed and plotted in order to verify if the coefficient of determination was higher than it was for technical-administrative personnel. When summing TA and teaching personnel and plotting it against COVID-related costs, the coefficient of determination was around 0,70, scoring the same result that was recorded for TA employees alone, meaning that the combination of university employees induced COVID-related spending more than what students did. This can be explained by the fact that in the case of university employees, all the universities had to make investments to enable remote working and teaching, but there was also a component of operational, periodic costs of PPE to allow for them to return to work in safety in the university, after the lockdown period.

5.4.1.3 Continuity of activities

Continuity of procurement was necessary to enable responses of universities to the first weeks of the global pandemic and the results to the survey clearly point out that only a minority of the respondents was affected by delays, nonetheless they did never stop their activities. To understand the reason of a possible delay in the procurement office, we searched for a correlation with previous experiences in smart working activities. The χ^2 test, however, did not point to the conclusion that there was, in fact, a correlation between previous experiences of smart working and no delays in procurement activities. The most probable reason for this result could be that of all the universities that answered not to have had slowdowns in the procurement office, 9 had previous smart working experiences and 8 did not, meaning that there probably is not a correlation between the two responses. Also, of the 4 universities that had delays, UniF and UniAT experienced smart working before the pandemic while the other two did not, which makes it possible to conclude that there is no connection between the two events. Another similar analysis was performed on size of the universities. The three universities that had slowdowns were two small (UniA and UniAT), and two large (UniF and UniK) universities, and a χ^2 test made on these two variables gave a p-value of 0,48, which indicated independence between delays and size of the universities. Since only four universities incurred in delays, there is no way to determine a correlation with other variables to explain said delay.

The fact that all the universities were able to continue research activities does not give space to make any statistical analysis in this regard, but it is reassuring that, in general, the institutions were able to proceed with this activity. It is highly unlikely that the sample of universities is biased since there is a good distribution of university by size and by geographical position. This can be an indicator that every university, independently of size and region of origin, was able to manage efficiently the purchase of protective goods to allow research continuity, and that they were fast in creating or adjourning safety protocols to allow researchers to work in presence.

In terms of teaching delay, there was a significant number of universities that started the semester with at least a week (5 working days) of delay. However, there seems to be no correlation between delays in the didactics field and procurement activities since many of the universities, which had a slowdown in starting lectures, did not have a lack of continuity of procurement activities. Furthermore, not all the universities with delays in procurement saw a delay in didactics as well. When looking at universities by size, there seems to be no particular dimension which suffered definitely more from delays of the didactics service – two small, three medium, three large, and one mega university had a delay in teaching activities. However, one exception captured the attention: UniA had a delay in procurement and a 30-day delay in restarting didactics activities, there was no previous experience of smart working, and there was no purchase of goods made to help professors in need of equipment to stream lectures from home.

Lastly, after the lockdown, the general trend was to allow students to go back to blended lectures when national policies opened this possibility. With the exception of UniI, UniF, and UniJ, which are, respectively, a medium, a large, and a mega university, every institution allowed for a partial return to normality. This was in some cases made only for freshmen and in others for all of the students on a rotation basis or on a reservation modality, but there is no doubt that independently of the size cluster and region of origin, the majority of universities pushed for a return to normality so that people could see universities as a center of aggregation and hope.

5.4.1.4 Qualitative analysis of suppliers of COVID-related goods

During the COVID-19 emergency it was necessary to procure goods of categories that were never purchased before by some universities or were only purchased in medical or similar departments in others. For the universities that were new to the purchase of PPE, in the first weeks of the pandemic it was necessary to find new suppliers, and this is why in the survey almost all the respondents answered that they used new suppliers in the electronic market. Indeed, since there was short supply of protective personal equipment, also universities with established supplies had to find new suppliers. Of course, this is not only due to COVID-19, but also the principle of rotation plays a role in this. The principle of rotation states that universities must always make calls for competition excluding the suppliers of previous calls for three years. This can help small and new suppliers to create a customer base and sell products, but on the other hand, does not allow, especially in this time of need, to purchase multiple times from a supplier that would be able to grant continuous shipments of protective equipment – which during the lockdown was almost impossible to be found. Furthermore, the principle of rotation had another implication: each time that a purchase had to be made, the new awarded supplier would have to be vetted by the procurer to ensure that the protective goods had the right certifications and requirement, which was not always assured. However, some exceptions to this principle can be made if certain conditions are met and the reasons are stated in the tender documentation. For example, if there was no other supplier available, it was possible to return to old suppliers.

The Electronic Market was the first tool employed to try and find new suppliers to respect the principle of rotation, but it can be assumed that the use of MEPA was not always the

best solutions, or that MEPA suppliers alone were not enough. Indeed, more than half of the respondents adopted suppliers outside of MEPA, which were allowed only for purchases under the €5.000 threshold, or in case of sound motivations (for example when prices outside of MEPA are significantly lower than those of suppliers in MEPA or if there is a need for goods that are not available in the Electronic Market) (Legge 145/2018). This could mean that (i) universities acquired in a disaggregated way, (ii) producers outside of MEPA could provide goods and services at better prices than the firms on MEPA. The first affirmation can be regarded as false since, as we saw previously, the majority of the universities are adopting hybrid, fully centralized, or centralized above threshold models, and therefore it would be incoherent not to aggregate purchases. The second opinion instead could be well founded. Indeed, at the start of the pandemic, personal protective equipment was almost unavailable, even for hospitals, which are public administrations as universities and therefore purchase from MEPA. Prices of PPE had risen of around +1700% (Coronavirus, Amuchina, 2020). The fact that more than half of the respondents purchased outside of MEPA can signify that in MEPA prices were higher than in contracting directly with firms, or that on MEPA there was not enough supply to satisfy all the public administrations.

However, this line of enquiry applies to producers outside of MEPA and located in Italy. Foreign producers did not receive the same attention of Italian ones. The reason for this can be the need for timeliness of shipments. Due to customs clearance, public procurers would be less advantaged to purchase from foreign suppliers than from local, maybe near, Italian ones. Indeed, rapidity in deliveries was probably one of the most impacting factors on the selection of suppliers. E-commerce platforms, instead, were expected to receive higher usage since the delivery times are often shorter than on other platforms, but the usage is allowed for small purchases (below the 5.000€ threshold) and therefore it is understandable how they were a less used resource.

5.4.1.5 Digitalization of the procurement process

Digitalization is one of the internal tools, that universities have in their toolset, to reduce the process lead time between manifestation of need and delivery of goods or services. With the pandemic, when all the work of the procurement offices had to be done from home, digitalization of the process with web applications or cloud platforms would have been of huge advantage to manage the disruption. Digitalization can provide strong advantages including reduction of transaction time and costs, increased level of standardization of practices, wider supplier base, increased productivity, simple configuration and scalability of operations, and higher efficiency. Digital systems can automate tedious and time-consuming processes, leaving more time to the employees for other strategical tasks, for example research of right suppliers or understanding new legislation in order to make more efficient changes in the procurement process in accordance with the new changes in legislation, which happened more than once from the start of the pandemic. Additional time could be spent also in acquiring knowledge about the specifications of different PPE and purchase of streaming systems to start the upcoming – or, for some, restart the ongoing – semester as soon as possible. However, even in universities, which represent the source of higher education and are a place where innovations should be promoted more than in other

public institutions, there is not yet strong digitalization of the process, except in few isolated cases. It is interesting to point out that the five universities that are most digitalized (with at least 6 of the 9 phases supported by digital tools) were also some of those who didn't perceive many activities as most critical. More in detail, UniL, with all the procurement process digitalized, did not perceive any phase as most critical; UniC, which is fully digitally enabled as well, perceived only *research of suppliers* as most critical, which is understandable since, as stated earlier, there was short supply of PPE and electronics goods, which in turn increases the efforts to find suppliers of those products; then, UniG, with 7 phases supported does not perceive any most critical phase; instead, UniM perceived *definition of specifics and functionalities* as most critical and has 7 phases digitalized (including *definition of specifics and functionalities*), but this can be explained by the fact that UniM does not have a medical or similar department, and was not used to purchase medical equipment; lastly, UniB, with 6 activities supported, views as most critical *research of suppliers*, as UniC. However, UniB does not perform the last three steps of the process within the procurement office – namely, *performance analysis*, *administrative* and *operating management of the contract* – therefore it can be said that all the process is digitalized for the activities of their competence.

The situation ante-COVID shows that only a small number of institutions is adopting solutions for the phases that precede the tendering process. Even though they are not compulsory, e-sourcing instruments should be given higher consideration, as they allow for enhancements in the *analysis of needs* of the organization and simplify *management of suppliers*. This category of instruments also includes some that can be of help in verifying the certifications of suppliers. Then, the next phases – *choosing the right procedure*, *suppliers research* and *management of the tendering process* – are those that were digitalized the most, since, on the one side, it makes more convenient and efficient the usage of the Electronic Market, and on the other, it has a large impact on the speed of the process, especially in the case of *research of suppliers* and *management of the tender phase*. Also, in the case of *administrative management of the contract*, there is strong usage of electronic instruments to shorten and, in some case even automate, the process of budget approval and other touch points between administration, accounting, and procurement offices. The digitalization, in this case, could have been a huge simplification of the process in this period, as stated in the Phoenix Framework.

During the pandemic, some digitalization occurred to be able to work from home. In particular, the *management of the tender phase* was digitalized by other 4 institutions to guarantee continuity of the procurement activity. Other phases were digitalized during the pandemic but to a lower extent than the previous one. Indeed, it can be said that not all the phases have the same weight in contrasting the disruption of the pandemic. For example, the digitalization of *analysis of needs*, as revealed by the survey results, has a strong impact in facing the pandemic adversities, since the aggregation at the university level of needs of the departments would be highly advantageous in terms of purchasing power. In this phase, one of the best, yet simple, digital instrument would be the implementation of electronic, standardized forms that the departments can fill out with purchase requests. These forms would then be aggregated automatically and delivered instantaneously to the central purchasing office in order to obtain better prices when procuring PPEs for the entire

university. Also, there should be much more emphasis on tools for the search of suppliers with the right certifications, as 6 universities reported it as most critical. This can be supported by the built-in e-catalogue of MEPA, or of other e-marketplaces. However, as a critical activity, *definition of specifics and functionalities* surpasses both research of suppliers and analysis of needs. This can be interpreted in different ways:

- The universities could have had issues in interpreting the norms and laws, making it difficult to clearly define the specifics for PPE when issuing tenders. This can be due to the fact that the Simplification decree and the other decrees issued during the pandemic often apply to specific and particular purchases and, at times, there was no clearness on which types of purchases they apply to.
- The laws were changing rapidly, meaning that it was hard to stay up to date with new standards and regulations and in some cases, contracts already awarded had to be revised or, in the worst case, cancelled. This can put even more pressure on procurers, which have to adapt continuously to new standards and regulations, and in the mean while purchase goods to keep the rest of the university functional.
- There are difficulties on the universities side as PPE was not a frequently purchased category of goods and there is low knowledge and uncertainty about the specifications. This can be solved for universities with medical or similar department by increasing cooperation with said departments. In case there is not this possibility, universities can work together with partners of implement safety task forces with the sole objective of keeping up to date the knowledge about norms and standards of PPE for the university.

Considering that, of the six universities that are digitally supported in the definition of specifics, only two universities reported *definition of specifics* to be one of the most critical activities, it can be assumed that digitalization of the phase is not the problem in itself, but rather there is a greater possibility that the problem of specifics definition is due to one of the three reasons expressed above or a combination of them.

5.4.2 Open data (smart working) analysis

In the pandemic period, the compulsory adoption by all organizations of emergency agile working highlighted the differences between universities in terms of digitization of procedures and IT equipment. From the reports, it emerged that some of the universities that had already started agile work projects in a structured way organized smart working in a more efficient and timely manner during the first lockdown, as they already had an organizational structure for agile work characterized by the following significant elements:

- Regulation through guidelines shared with the Single Guarantee Committee and with the trade unions, information on the general and specific risks associated with the performance of work in agile work;
- Accurate analysis of the possible introduction of agile work in the organization through management models such as SWOT analysis and feasibility studies;
- Mapping of processes and verification of the degree of applicability of agile work, considering the level of digitalization of the process and the digital skills of employees;

- Purchase of IT devices and software to be made available to employees to ensure a high level of productivity;
- Training of all managerial staff on management skills regarding agile working;
- Training of employees on organizational skills specific to agile work and digital skills;
- Scheduling by objectives and performance verification system;
- IT help desk dedicated to agile working;
- Organizational coordination of agile work managed, in general, by the General Director with the support of the office of coordination of managerial functions and in synergy with the steering committee of department directors;
- Applications and databases that can be fully consulted remotely;
- Digital signature.

From the analysis of the reports and results of the POLAs, it is clear that only a minimum number of universities found themselves with an organizational structure of agile work composed of the elements described above and used permanently as one of the flexible modes of work organization. Despite the fact that some universities had already started agile work within the organization, after the approval of Law n. 81 (May 22nd, 2017), which regulates smart working in Italy, it was in most cases a mode limited to a very small number of employees to meet specific needs of the latter, fragile categories or it was part of an experimental project, in which the staff of specific organizational units of the university was involved. As a result, almost all the universities found themselves having to face the enormous problem of guaranteeing the possibility of working from home to all the staff in a short time and without having an experience of agile work within the university that was already widespread.

Fundamental, therefore, has been the IT support from the ICT services area and the provision of basic tools by the procurement offices for the continuation of work from home, avoiding slowdowns in the offices. By comparing the various results from the reports, the following basic resources were identified as necessary to enable work to be carried out in emergency agile mode effectively during the first period of the pandemic:

- Acquisition of laptops for employees;
- Antivirus software extended to private workstations;
- Distribution of data SIM cards to be assigned to facility managers who carry out activities involving frequent telephone contact and distribution of routers to facilitate connectivity;
- Helpdesk service available to employees to support them in case of problems in the use of software and digital devices;
- VPN system to access the university network remotely and be able to use the applications in use;
- Digital signature, a computer security tool that allows you to give legal value to digital documents, digitally signing them as if they were handwritten;

- Collaboration systems (for example, documents in the cloud), agreements with software houses such as Microsoft and Google to allow sharing of documents and to carry out teleconferences and meetings;
- Weekly reporting to constantly monitor the activity carried out by employees in emergency agile work mode.

The information contained in the public reports and in the indicators section of POLA that is connected to digital health shows that 100% of the universities (which submitted data) have promptly equipped themselves and/or were already in possession of VPN and collaboration systems. Moreover, on average, thanks to VPN systems, 96.13% of databases and applications were fully accessible for agile work, while digital signatures were adopted by 71% of universities. From the various evaluations, no university recorded any major slowdown in office activities during the first lockdown, as surfaced also in the survey results.

These data are further confirmed by the results of a Censis research of July 2020, addressed to all Italian universities, to which 61 rectors responded, and which returned "the image of a responsive university system, capable of optimizing human and technical resources, despite the structural deficiencies that have plagued it for years". (Fondazione Censis, 2020)

However, monitoring of the Italian Government Performance Portal showed that the universities that completed the POLA, by the deadline of January the 31st, 2021, were 26 out of 67, or 38.8%. An in-depth analysis of all 2021-23 performance plans submitted by universities and containing the section dedicated to the organized agile work plan shows that of the 26 universities that included the POLA, only 14, or 20.8% of universities, partially or completely filled out the dashboard of performance indicators in the plan. It was required to compile an agile work development program that included 4 dimensions:

- Organizational health;
- Professional health;
- Economic and financial health;
- Digital health.

For each of these dimensions the compilation of the proposed indicators was requested, indicating the status during 2020 and the multi-year targets with reference to the baseline of the plan. The main reason for the compilation of the plan's indicators by only one-fifth of the universities was that it appeared to be a rather ambitious project to be carried out in an emergency period, insofar as it required the compilation of data regarding the state of adoption of agile working, which was time-consuming, especially for organizations that had never used smart working, not even in experimental mode, before the pandemic. As a result, these organizations had never carried out a dedicated process of mapping their processes and the degree of applicability of agile working. Moreover, the time available for compilation was very limited, as the guidelines were presented on December 9, 2020, and the deadline was January the 31st, 2021, therefore less than 2 months, with a holiday within this period.

By analyzing the data for the organizational health dimension of the 14 universities that compiled the POLA performance indicators dashboard, it can be seen that by 2020 only 43% of the responding universities have a system of organizational coordination of smart working, 50% monitor agile work, mainly through standard reporting validated by managers, and only 14% of the universities have an information help desk dedicated to agile work.

The results just presented are not surprising, but they do contextualize with what was previously assumed from the survey results. Even if most universities had smart working experience, this experience was in many cases limited to a restricted group of people or experimented in only one office, while in few others it was extended to the whole university, which allowed to a fast transition to emergency smart working. Therefore, in almost all of the universities there was no organized system of smart working within the organization, but smart working was introduced in a simplified mode to cope with the emergency without a review of organizational models.

5.5 Case studies: insights from the interviews

5.5.1 Case study: Politecnico di Milano

5.5.1.1 Introduction

Politecnico di Milano (called from here onwards PoliMi for simplicity) is a public technologic-scientific university, founded in 1863 and it is based in the North of Italy, more specifically in Milan, with regional campuses in Como, Cremona, Lecco, Mantua, and Piacenza. It has several departments in the fields of engineering, design, and architecture, which together account for a total of around 48.638 students. Of the students, the majority (36.427) is enrolled in engineering disciplines, 7.725 in architecture courses, and 4.486 in design programs. It also accounts for 3.500 professors and assistant professors, and around 1.200 technical-administrative employees.

5.5.1.2 Pre-Covid internal configuration of procurement

PoliMi procurement activities are centralized above threshold, meaning that the purchases above €40.000 are managed through the central purchasing office, while all the other purchases are managed by the single departments, with the exception of only one department that leaves the majority of the purchases, both strategic and non-strategic, to the central office. In addition, the central procurement office gives support to the departments in open procurement procedures. Following the theoretical models proposed, this organizational structure can be associated with a *Supportive Centralized Model*.

The procurement structure is also supported by an advanced digital infrastructure. Indeed, the Request for Purchase process is supported by a fully digital system that digitalizes from the requests of individual end-users (i.e., professors, researchers, and other staff) up to the liquidation of the orders and is interoperable with electronic markets available. In particular, the process digitalizes the *definition of specifics and functionalities, choosing the right procurement procedure, search of suppliers, definition of tender specifications, management of the tender phase, and administrative and operational management of the contracts*. The Request of

Purchase system allows end-user to exchange information about the ongoing requests, monitor progress and control procurement practitioners' workload in real time, with complete control over activities without the need for people in presence. Furthermore, the usage of emails, shared drives and cloud storage is widespread in every department.

These tools allowed for the diffusion of smart working experiences, which were necessary due to the distance between the central purchasing office in Milan and those in the several regional campuses of PoliMi.

5.5.1.3 Reaction to the emergency context

5.5.1.3.1 Internal Configuration

In the first weeks of the pandemic emergency, all the procurement activities were conducted in remote modality since the DMs enacted did not allow for the continuation of activities in presence. Considering the software and applications present in the University before the pandemic, no other procurement activity or phase of the process was digitalized as a reaction to the emergency. Request for orders did not diminish immediately but were stable with previous numbers for a couple of weeks, since it was introduced the purchase of *emergency goods*, to be procured in large quantities given the nature of *emergency purchases* that were required in this period. Indeed, huge quantities of protection devices, plexiglass screens and hand sanitizer were purchased, as well as technological purchases for home streaming and to enable smart working for all the employees, which was a never-seen-before situation. In particular, a task force specialized in the purchase of PPE was created within the central purchasing office. The task force worked on several objectives to cope with the on-going pandemic situation:

- Gather information about PPE specifications and specific tender requirements in that goods class;
- Scout the market for potential suppliers of PPE.

The task force had an essential role since PoliMi does not have any medical or similar department with a register of suppliers of PPE on which to rely. The first objective of the task force was relatively easy, since the purchase of hand sanitizer, face masks and plexiglass shields did not require high technical expertise, but it was of the utmost importance to coordinate with the prevention and safety service of the university, since the authenticity of certifications and knowing which certifications were required by different products was fundamental when looking for potential suppliers. For the second objective, many potential suppliers responded to open procedures with their offers, especially in the periods after the first month of the pandemic, which was a period when PPE were extremely hard to find. Many of these suppliers were new to the business of PPE, attracted by the potential earnings offered by the high demand, and this made it even more important to verify certifications in advance.

PoliMi focused its purchasing efforts on different instruments. MEPA was used for the many purchases of medical and technological nature, including both previously used suppliers (for electronic devices) and new suppliers (both for sanitary equipment and electronic devices). Also, e-commerce platforms were used in the purchases of both

emergency goods classes in the first weeks following the outbreak of COVID-19, to try to ensure fast deliveries of these essential products – electronic devices to start online teaching as soon as possible and limit the delay in starting the new semester.

Another “instrument” that was essential for the continuation of activities was the new work mode adopted, emergency smart working. This work modality allowed for better work-life hours management, and for some employees this was essential for looking after kids, who also were at home due to the lockdown. It also removed transferal times from home to work and vice versa, which allowed to start to set up working material before the working hours, improving productivity. However, there were also some disadvantages due to this new situation. Since every member of the family was at home at the same time, the house was not always the ideal working environment, and, at times, problem solving was easier in presence than it was from home through online video-calls. Furthermore, another issue was the dilation of working hours as an effect of smart working. Some employees worked the usual working hours, but others were to start and finish later, which required both categories of employees to be available for questions and communication also in non-working hours.

5.5.1.3.2 External Enablers

At Politecnico di Milano it was also noticed a strong impact of *external enablers* on procurement activities. The impacts were represented principally by two different sources: changes in bureaucracy and legislation, and the nature of emergency supplies.

First of all, the many changes brought about by the Simplification decree and the many different decrees enacted by the government in the pandemic period had a contrasting effect. On one side, the increase of the purchasing threshold for direct award was positive since it was possible to award directly, following a market analysis, to the suppliers that were considered to have the best value for money, which in this period meant to have fast delivery times and reasonable prices. Another simplification that sped up the procurement procedures was the inversion of awarding evaluations – from administrative evaluation first (certifications and other legal-administrative requirements), to evaluation of the economic parameters first. On the other side, the many decrees increased the interpretative difficulties of the Public Contract Code since many new criteria were left without a clear explanation. For example, it was possible to overrule the *rotation principle* in case of specific situations, but the situations of use and the extent to which these justifications could be adopted were not clear. This made difficult to evaluate when it was possible to re-award certain suppliers that clearly had the best value for money offers, and increased the time spend on research of suppliers and other administrative validations to be sure not to start unlawful contracts.

Secondly, the supply and receipt of emergency goods was strongly influenced by the low worldwide availability of medical products and electronic components necessary for the production of laptops, microphones, and cameras. And even when there was availability from foreign suppliers or foreign donors, the deliveries were blocked at customs for clearance due diligence. This process was made faster by new legislation, which allowed to receive shipments on time, but on the other hand, it required to send to customs the

documentation supporting the deliveries after they were received, making it time consuming for the universities' employees.

5.5.1.4 Evaluation of the response

Politecnico di Milano procurement practitioners limited the effects of the challenges posed by the COVID-19 emergency. Indeed, Politecnico di Milano did not record discontinuities in the procurement activities, and this was made possible by different strategies:

- Usage of MEPA and purchase with open procedures to evaluate different suppliers based on specific criteria elaborated by the task force, described in the previous section, made possible by the new legislation on simplification of procurement procedure;
- Elaboration of open data of previous purchases of medical equipment by other public administrations, made through artificial intelligence tools, to find many potential suppliers in a short period of time to overcome the absence of an internal register of suppliers of medical goods;
- Strong cooperation with ICT services area to enable from one day to the other remote working, and didactics online within a week after the supposed start of the new semester.
- A strong and prepared procurement team, which was already used to working with technological tools and with people in smart working.
- The purchase of safety stock of medical equipment in January, before the pandemic, which was enabled by Chinese partner universities' alerts about the spread of a – at the time – new virus in China.
- Direct contact with the many worldwide university and company partners of Politecnico di Milano allowed to receive a large number of donations of medical equipment in the first period of the pandemic, and direct contact with partnered couriers allowed to shorten the delivery times of these donations.

However, some criticalities arose as a result of the medical emergency. Since Politecnico di Milano does not have a medical school, none of the employees had any knowledge of the requirement of surgical and FFP2 face masks, and which hand sanitizers or ambient sanitizers were more effective than others. This criticality was solved by externalizing some of these competences. The task force was in communication with suppliers of cleaning services to learn about sanitizing solutions for offices and classrooms and was also dedicated in learning other requirements and legislation about protection devices. Another solution implemented in this regard was starting to produce autonomously hand sanitizer, named 'Polichina' after the famous brand of sanitizer. This allowed to reduce the stress on the procurement office to allow to focus more on purchases for remote teaching. Indeed, the first localized lockdown, which blocked the Lombardy region, coincided with the start of the semester at Politecnico di Milano, which made it necessary to find immediate solutions to continue lectures online. Nonetheless, as said before, with the support of the ICT services area and also thanks to fast e-commerce purchases, it was possible to restart the semester

rapidly with no substantial discontinuation of the service and the non-stop continuation of research activities that could not be deferred.

In light of the responses enacted by Politecnico di Milano and the strong internal configuration already present in the university, it is possible to say that Politecnico di Milano responded in an efficient manner to the emergency, considering that it respects the KPIs presented by the Framework for this purpose. Indeed, there were no slowdowns of the purchasing process and of research activities, and minimal delay in restarting the didactics service.

5.5.2 Case study: Politecnico di Torino

5.5.2.1 Introduction

Politecnico di Torino (PoliTo for simplicity) was founded in 1859 as a technical-scientific institute in the City of Turin, in Piedmont. Its main campuses are localized in Turin, where many programs in the fields of engineering, design and architecture are taught, and several regional campuses are distributed in the Piedmont region (Biella, Alessandria, and Cuneo campuses) and in Aosta Valley (in Mondovì). Of the undergraduate programs, 3 are in the architecture area, design, and planning, 19 in the engineering sector, and 1 is a professionalizing bachelor's degree, while for what concerns graduate options, 6 degrees are taught in the architecture area, and 24 in engineering. Furthermore, a wide variety of master's degrees and doctorates are offered. Together, these programs bring to PoliTo around 34.000 students and give work to 1.650 faculty members and 860 technical-administrative employees.

5.5.2.2 Pre-Covid internal configuration of procurement

Procurement activities carried out by PoliTo are done at the central level for purchases above the Italian threshold for direct award of contracts, while those purchases of lower value are done in the respective department that requires them. In particular, in the case of above-threshold contracts, the central office completes procedures up to the awarding and signing of the contracts, then the procedures are followed by the requesting departments' office for what concerns operating and administrative management of the contracts. Only some of the departments have dedicated procurement offices while others have offices merged with other functions, for example with the accounting support, finance, and strategic planning function. Existing theory suggests that PoliTo is adopting a *Supportive Centralized Model*.

Digitalization is present in every step of the procurement process that is managed by the central procurement office. In particular, from the *analysis of needs* to the *management of the tendering phase*, the process is supported by different tools, for example, the entire procedure is managed through Ubuy, a Cineca software that allows to make telematic tenders, which is interoperable with CPBs' instruments as well as the internal ERP and other software of the university. In the departmental offices, the electronic market is continuously used for tendering goods and services. Interoperability and reduction of duplicate or tedious activities is also allowed by digital signatures, which are constantly used for signing every procedure, and are also adopted outside of the procurement office. Even though every

tender is made in digital format, a paper folder with tender documentation is created for every tender and stored in a physical storage.

Furthermore, the central office was already familiar to smart working, as an employee was doing agile work 4 days out of 5, and thanks to the high level of digitalization, there were no issues in executing work activities from home (or other locations).

5.5.2.3 Reaction to the emergency context

5.5.2.3.1 Internal Configuration

With the start of the pandemic and the lockdown, every activity was done online with limited issues. As stated before, the process was fully digitalized before the advent of COVID-19, and every activity could have been done in smart working already. Every tender was executed through MEPA or digital platforms and the few tenders that were not (only two by the central office in 2020) were made with digital means and only with electronic documents. For what concerns departmental procurement offices, the usage of MEPA allows for the digitalization of every procedure and makes them processable from home, and Ubuy was planned to be adopted for procedures of lower cost, that are not processed through MEPA, within the end of 2021. MEPA procedures involved both *emergency purchases* of electronic equipment (home-streaming equipment at first, then utility laptops and PCs for employees and other gear for professors and for classrooms) from new and old suppliers, and medical/protection equipment, mostly from new sources, or, when necessary, re-award of new suppliers. The purchases that were not processed through the electronic market of the public administration were below the threshold for mandatory use of MEPA, and they were made through Italian companies through 'traditional' channels or e-commerce platforms. E-commerce platforms were used especially for the purchase of urgent goods or products that were difficult to find (*emergency goods*).

The purchase of these emergency goods, principally protection equipment like face masks, gloves and hand sanitizer were a new category of goods for PoliTo, which does not have a medical or similar faculty. Before the pandemic, the only medical purchases were for the mandatory medical boxes present in the infirmary and around the campuses. Therefore, the cooperation with the prevention and protection service of the University was fundamental for the procurement office in order to remain up to date with the equipment needed and its certifications, due to the fact that there were several changes in the mandatory equipment that the employees had to wear in the office throughout the pandemic.

Another aspect for which cooperation was fundamental was *administrative management of the contracts*. Indeed, the central purchasing office had to support the departmental offices in temporary suspension of contracts (article n.107 of the New Code of Public Contracts), which was a procedure rarely applied before the pandemic, and for which the central office practitioners' expertise was required.

With the start of smart working, the routine of creating a folder with paper tender documents was abandoned, and was not restarted after the lockdown was over, as this practice was considered futile and a waste of paper, considering that every document could be available in electronic format and signed with a digital signature. Also, the precedent

experiences of smart working within the central office allowed for a smoother transition to smart working for all the employees, even though the majority was not familiar with new communication channels, such as Microsoft Teams. Smart working also allowed for more flexibility on the working schedule and helped in organizing personal and work-related hours better. This also had a negative influence as different employees organize working times differently, which made management and communication more complex. Moreover, it was noticed that the passage to a complete or partial agile modality did not affect the ordinary performances of individual practitioners. It was fundamental in this phase to manage day to day progress and completion of objectives.

A negative impact of the lockdown was for sure the distance of work peers, which affected new as well as well-established teams, who could not enjoy anymore those convivial moments that they shared in presence (for example, the lunch breaks). Indeed, team building is an essential component to efficiency of the office.

Overall, home working was perceived to be a positive working technique, if practiced with moderation. Physical presence is required for team building and better coordination of activities, but a videoconference was perceived as having almost the same impact of a physical one, without the need of moving away from the office (or from home during the lockdown), allowing to reduce travelling times and increase productivity.

5.5.2.3.2 External Enablers

PoliTo did not perceive that the new government decrees issued to sustain public administrations during the pandemic brought any simplification. In particular, in the case of increase of the threshold for direct awarding, at first from 40.000€ to 75.000€ and then to 139.000€, there was no visible simplification since the Code states that direct awarding of contracts must be done with an explanation (which can be an economical motivation). Therefore, direct awarding still means that different producers have to be contacted in order to receive several proposals that can be confronted to determine the supplier to be awarded. However, this is not the only downside. Traditional procurement procedures are made so that awarding of suppliers follows rigorous norms and procedures, that in a certain way are a warranty for both economic operators, purchasing bodies and the public project manager in case of disputes. With direct awarding the evaluation of the supplier to be awarded is sole responsibility of the public project manager. With the increase in threshold, the project manager would now be responsible for choosing the supplier in a higher value contract with respect to the previous direct awarding threshold. This increases the degree of responsibility of the manager, as well as the difficulty of evaluating alone several proposals. This is fundamental when considering that many suppliers of PPE were new to the production of those devices and many project managers were new to this typology of purchase, so it was necessary to pay close attention to certification compliance for safety and cost reasons. Indeed, the university procurement practitioners necessitated to receive guarantees from the suppliers in terms of compliance also considering the large quantities required – non-compliance of one delivery would imply a great loss in terms of money and time to find one or more new suppliers with the same quantities of PPE.

Furthermore, the existing platform for the retrieval of economic operators' certifications and information (i.e., AvcPass) did not help in making the response of the university quicker, since every request would be answered by the authorities with variable time, which varied from a few days to up to even 20 days of wait, if not more.

5.5.2.4 Evaluation of the Response

Overall, Politecnico di Torino internal infrastructure and experience was essential for the correct management of procedures and criticalities during the COVID-19 emergency. First of all, the internal procurement digital system played a huge role in allowing to move every activity in remote modality, making it possible to continue to work with no interruptions and no delays. This was also strategical when considering didactics and research activities, which received no delays due to the rapidity in adaptation to the new situation and immediate purchase of electronic equipment for professors to enable remote streaming of online classes and of medical protection equipment for the research staff working in the faculty buildings. Also fundamental were the purchases of audio-video devices to enable synchronous streaming of classrooms to allow to restart the new semester in September in presence. For this purpose, it was necessary to close many of the accesses of PoliTo's buildings and leave only 2 routes accessible for safety reasons and simplicity of control of potential COVID-19 cases (with thermal cameras). However, it was not always a smooth management. First of all, those decrees issued to simplify procurement during the emergency did not manage to provide real simplifications, and customs clearance in the first period was not sped up, so legislation in that regard arrived later than it should have. Therefore, there was not great synergy provided by the external enablers, which reduced the optimal level of efficiency of the university. Nonetheless, it is possible to say that PoliTo was efficient in overcoming the disadvantages of the pandemic due to its strong internal digitalization and prior smart working experience.

5.5.3 Case study: Università degli Studi di Bergamo

5.5.3.1 Introduction

Università degli Studi di Bergamo (from now on UniBg, for simplicity) is a young higher education institution established in 1968, in Bergamo. It started as a foreign languages and literatures university and with time it added new courses and programs to the available curricula in order to attract more and more students, and in 1992 it became a public university (its original name was Libero Istituto Universitario di Lingue e Letterature Straniere). It has 3 campuses in the province of Bergamo, 8 departments and a total of 41 degrees programs taught. UniBg counts around 22.000 students, with a constant growth rate. Furthermore, it is the place of employment of more than 430 professors and researchers, and more than 260 technical and administrative staff.

5.5.3.2 Pre-Covid internal configuration of procurement

The procurement office of UniBg follows a supportive centralized model of organization. The departments have offices in charge of carrying out purchases for what concerns direct awarding of contract, which require less expertise. For those purchases that require a

procurement procedure different from direct awarding, they lean on the central procurement office.

UniBg sees a low level of digitalization of the procurement processes. First of all, only two phases of the process are supported by digital instruments and software, namely the *research of suppliers* and suppliers analysis, and the *management of the tendering process*, which is made in compliance with legislations through MEPA or other digital platforms, and with the usage of electronic documents. Secondly, the procurement office (as well as the other offices in the university) adopts titulus for the exchange, management, and storage of e-documents. Every employee has its own fixed position in the office, with fixed PCs (not laptop), which are connected to the internal servers of the university.

For what concerns smart working, or more correctly, teleworking, it has been adopted by a restricted number of people in the university, and the adoption was fairly recent. Therefore, teleworking in UniBg is still in an embryonic stage and there are not strong experiences in this modality.

5.5.3.3 Reaction to the emergency context

5.5.3.3.1 Internal Configuration

Bergamo was the Italian epicenter of the pandemic, and it was in lockdown before any other area of Italy. Therefore, UniBg was the first university to have to face such an emergency. The first issue faced by the university was making documents accessible from home. UniBg systems were to be made available in remote, and it was opted to use a remote desktop software to enable this. Remote desktops made available at home every digital instrument already present in the office, with the drawback of having to keep office PCs turned on. Starting from this, which made possible the beginning of emergency smart working, purchases of docking stations and laptops were made to remove fixed drives and fixed office positions, which was necessary due to sanitary reasons and the limitation of capacity of buildings required by law during and after the lockdown.

For what concerns the purchases of PPE, the hybrid organizational structure allowed to spread procurement activities over several structures in the departments. PPE were difficult to retrieve at the beginning of the emergency and often UniBg procurement practitioners found that it was better to partition demand over more smaller suppliers than finding one large supplier that could satisfy all the demand. Furthermore, being at the epicenter of the pandemic, logistics companies would often decline deliveries in the area of Bergamo, making it difficult to receive the goods. More than once it was necessary to set up deliveries outside the area of Bergamo and then go and pick up the PPE with university's vehicles. Apart from delivery issues, processing and managing procedures regarding PPE was not considered a criticality by procurement practitioners. This because, even though a medical department is not present in the university, the purchase of PPE was treated as not different by any other purchase: first of all, buyers became familiar with the certification and standards required for the purchase, especially thanks to the continuous cooperation with the manager of the prevention and safety service of the university; then, thorough market analyses were made for every procedure; and finally, the management and awarding of the contracts was done as for ordinary procedures.

Looking at the people's perspective, the adoption of emergency smart working was a first for the majority of employees in UniBg. Indeed, there were contrasting opinions and effects on personnel. Some positive impacts were:

- More concentration of personnel in some kind of activities (without considering the impact of families at home);
- The reduction of printing and increase in sustainability of procurement and other activities. Now only the necessary documents are printed, while before every document was printed.

But there were also negative effects on teamwork. Coworkers started to confront less with each other and there were strong psychological and social impacts. Indeed, even though there is still the possibility to work from home, while some employees preferred smart working to conciliate better work and family life, the majority of them prefers to stay and work from the office. To monitor the work of employees working from home, the General Director of the university required the completion of office reports on the objectives completed, programmed and short comments on the work completed by single employees. Furthermore, UniBg developed with each worker a personal employment contract which provides for the possibility of working in smart working modality, and it also defines how control of the employee's work is made and the objectives to be reached. To allow for instantaneous communication between coworkers, two time slots were defined, one in the morning and one in the afternoon, in which everyone working for home must be available. Outside of these slots, it is left to the individual employee the choice of when to work.

5.5.3.3.2 External Enablers

Looking at the impact of external forces, UniBg did not perceive strong simplifications from the emergency decrees but saw a strong cooperation and support from companies and other institutions from all over the world.

The main help given by the number of emergency decrees enacted was the increase in direct awarding threshold. This gave the possibility to the departmental procurement practitioners to make purchases above 40.000€ and up to 75.000€. In this way it was possible to spread procedures over more structures, as said before, and reduce the stress on the central procurement office. However, this increase in speed in processing the procedures was contrasted by the general slowness in delivery of the goods due to the non-availability of supplies and components, especially for electronic goods.

On the other hand, private and public companies from around the globe, and Italian public institutions, especially universities from the south of Italy, were more than open to help UniBg in this time of need. Indeed, being Bergamo on the worldwide news as the first city outside of China struck by COVID-19, many third parties made donations of PPE and sanitizer solutions to the university. However, also in this case there were logistics issues at customs. It was difficult to retrieve the materials from customs due to unavailability of couriers, and in the case of sanitizer, the storage in safety of large batches was complex at times. But for sure, the receipt of many donations was considered of strong positive effect for the university.

5.5.3.4 Evaluation of the response

UniBg started the pandemic emergency with a low level of digitalization, which did not immediately support remote working, and this might have caused initial reductions in efficiency. Furthermore, to make remote working possible it was implemented a system, remote desktops, that is not up to date with the latest technological advancement in this area. A stronger impact could have been given by VPN connections, in order to remove dependency on internal PCs and internal connection. A VPN would allow to keep the university's PCs turned off, limiting energy consumption, increasing sustainability, and reducing energy costs. Moreover, the lack of smart working experiences might have worsened the effect of the psychological impact of the lockdown on employees and reduced the overall potential efficiency of the procurement office. Nonetheless, the strong efforts and expertise of the procurement office, as well as the cooperation with ICT to enable remote working, were essential to surpassing the most critical moments of the pandemic emergency.

Moreover, the net effect of external forces had a positive impact of the work of the procurement team. The support of private and public organization helped to relieve some of the stress on the procurement office, generated by the pandemic and general lockdown, although seldom there were issues with managing the logistics of said donations.

In conclusion, given the strong internal communication, procurement expertise, rapid implementation of digital systems, and existing digitalization of the main phases of the procurement process, together with the positive support of external partners, UniBg was able to maintain a good level of efficiency throughout the pandemic period and this is shown by some critical KPIs:

- the absence of delays in the central and departmental procurement offices;
- no slowdowns in non-deferable research activities;
- and a short stop of 5 days in didactics and teaching activities.

5.5.4 Case study: Alma Mater Studiorum – Università di Bologna

5.5.4.1 Introduction

Alma Mater Studiorum Università di Bologna (from now on Alma Mater for simplicity) is the most ancient operating higher education institution in the world, established in 1088 in Bologna, Italy, and it is also among the largest universities in Italy with 87.590 students and 5.778 faculty members, of which 2.842 are teaching staff and 2.936 are technical-administrative employees. The university is divided into 5 'schools' and these schools are then divided in a total of 32 departments. Alma Mater has a total of 5 campuses, of which the main one is located in bologna, and the other 4 in Cesena, Rimini, Forlì, and Ravenna. Its student can pursue 232 different study programs: 93 are bachelor programs, while 125 are masters' degrees and 14 are single cycle degrees.

5.5.4.2 Pre-Covid internal configuration of procurement

Before the start of the COVID-19 pandemic, Alma Mater took advantage of a centralized model for purchases above threshold, in order to support the departments in high-

complexity, high-cost contracts, and leaving simpler contracts in the hands of each department. However, departmental offices are left free in their spending (within budgets), and they are free to choose how to digitalize their processes. According to theory, this can be seen as a centralized *Supportive Procurement Model* with some traits that would make it similar to a hybrid *Silo Procurement Model*, with more complex purchases handled by the central administration, and simpler purchases handled by the single departments where the requests originated, and a high degree of freedom in how departments can make strategical choices regarding the digitalization of the procurement process.

Digitalization of the procurement process is at a fairly low advancement stage, excluding the utilization of the Electronic Market, which is mandatory above 5.000€, and therefore the execution and *management of the tendering phase* happen through a web-based platform and the usage of shared folders for digital documentation. Other than this, a prototype of Request for Orders web application is being implemented by the central procurement office. This application, developed by CESIA (the ICT area of Alma Mater), should allow to collect single end-user's requests for purchases, elaborate them through the procurement office, in order to deliver the required goods or services to the professor or researcher requiring it. Every procedure has its own digital documents concerning the tender, but for signing purposes, paper versions of these are printed and delivered to managers, accounting office, or general director for the required signatures. Every department manages digitalization independently and the majority of them has low digitalization of procurement processes. Also, smart working was not strongly used by employees and there were not a large number of experiences made in this work modality.

5.5.4.3 Reaction to the emergency context

5.5.4.3.1 Internal Configuration

Due to the low digitalization and the necessity to continue procurement procedures from home, CESIA played a key role in enabling a fast digitalization of crucial phases of the process, such as *definition of specifics* and the *management of tenders*, and the Protocol Area was fundamental in creating digital signatures to enable signing of documents remotely. The share of documents was at first done through the use of Microsoft Teams, and within the first week for lockdown internal shared folders were made accessible from remote. Digital signatures was essential because, even though the digitalization of the process was low, it was possible to share digital documents or scan paper ones and sign digitally the scanned versions. Overall, in the central administration, communication is now enabled by digital tools and every document is in PDF format. However, this solution was not implemented in every department, and some continued to print documents to apply signatures and then scan them to make them digital again.

The request of orders system enabled to speed up the purchase of goods and services and its usage will be expanded to every department within the end of 2021, in order to align the digitalization level of departments and central administration procurement offices. However, for purchases above threshold, made by the central office, orders' requests are still managed without an automated or semi-automated system. Each department will

deliver their requests through an excel file, which slow down the process and limits its potential level of efficiency.

For what concerns the typology of purchases, Alma Mater was focused on the purchase of PPE, to allow research work to continue in safety, and electronic devices, to enable remote work of employees without equipment at first, and then to enable blended learning for the upcoming semester (September 2020).

The purchase of PPE was an issue when considering the high number of faculty members that work at Alma Mater. It was difficult to define needs for each department and each campus, but, especially, to find suppliers that could guarantee this huge quantitative of PPE. Those that managed to supply these quantities were asked to make separate deliveries to the campuses in order to simplify the internal logistics and distribution of the equipment. Furthermore, the purchase of these goods was not centralized during the pandemic since Alma Mater has several medical and chemical departments that already purchased these kinds of goods on their own before the pandemic. The central office, which did not have any human resource with knowledge in this area, relied on the Prevention and Safety Service of the university, which was of great help in understanding requirements of face mask and sanitizer, as well as certifications required. During the year, the university dean issued the purchase of washable face mask to increase sustainability and reduce costs of these purchases.

On the side of electronic devices, licenses were bought to enable remote accessibility of shared folders, as well as tools like headsets and internet USBs to enable connection of employees. For some worker, there was also the necessity to purchase laptops and webcams. For what concerns didactics, online teaching was enabled with limited issues using equipment and licenses already owned by the university. As said above the only purchases made for didactics purposes were to enable blended learning, in the second stage of the covid emergency. A software license was acquired to enable asynchronous storage and streaming of lectures and a huge number of digital devices was equipped to the classrooms: around 1.000 touch screen monitors, which is more than the European annual demand, and around 450 microphones, which were purchased with Consip instruments. In particular, for the purchase of microphones it was used a framework agreement, and suppliers were adopted following a 'cascading logic' – the first supplier would provide the amount that it was able to produce and, if not sufficient, a second suppliers would add to the contract to fill the remaining demand, and so on.

In addition to enabling documents sharing in the first week of remote working, the usage of Microsoft Teams also allowed to communicate efficiently from home and start emergency smart working in Alma Mater. Teams helped for sure in managing office work, but it also made easier to make inter-office conferences and meetings, especially considering distant departments and campuses, for which, before the pandemic, travelling was required to have a meeting in the central office. A lot of time is saved, and travel expenses are made more rarely. Furthermore, travelling time is now used to work or to setup all the documents needed to start working, and this allows for an increase in efficiency and productivity of the whole office.

Not only Teams, but the other instruments introduced during the pandemic increased the speed of the process during emergency smart working. Printing became use diffused and sustainability became a cardinal point in the university agenda; problem solving is faster than before because it is possible to call teammates and solve problems from remote; video calls can compensate to a certain extent the lack of physical presence of other colleagues; and managing family and working time became more flexible.

Nonetheless, not all the employees perceived this change as positive. Some of them had difficulties in adapting to the new technology and work mode, showing that there is some digital divide inside the procurement offices. Other employees opted to work in presence even during the lockdown because they did not want to work from home.

But the numbers are encouraging: around 500 employees are now in smart working for different periods of the week, which is around a 16,7% of all the administrative staff members, while before only a minimal number of employees were in smart working.

5.5.4.3.2 External Enablers

The impact of external enablers was not seen as strongly positive by Alma Mater procurement practitioners. The new decrees issued during the pandemic were continuously emanated and revised, which made it difficult to keep up with them. Furthermore, the absence of a unique Code made the matter even more complex. In other words, the Simplification decrees did not give what the name suggests. Due to the revision of processes by Alma Mater procurement practitioners, the decrees did not impact at all the work of the office and some laws were difficultly applicable since they did not consider all the implications they had for the public buyers. The only maneuver that could have given a little of relief on the procurement office was the increase in threshold, but due to the several changes – from 150.000€ in the DL to 75.000€ in the conversion to law, and then again increases at 139.000€ with a second law – the increase in threshold was also considered as an obstacle. Furthermore, direct awards required precise market research and analysis in order to give motivations to the usage of this type of procedure, which made it time consuming and less efficient.

5.5.4.4 Evaluation of the response

Alma Mater Studiorum Università di Bologna was strongly reactive to the emergency period and was able to implement in a short amount of time digital tools that allowed the continuation of activities that were all done in traditional ways before the pandemic. This would not have been possible if the employees did not learn to use these tools from one day to the other. As discussed in the framework, the implementation of digital signature and simple communication and cloud solutions can be extremely effective in allowing to conduct activities as if people were in presence. COVID-19 in this sense was a catalyst for the implementation of digital technology, that by the end of 2021 should be widespread and accepted by the majority of the employees. However, not everyone was satisfied with digital technologies and therefore it is crucial to give training sessions to the employees and try and change the culture about the adoption of technology, which is not an enemy, but a powerful ally that can simplify and support the work of every staff member.

Moreover, a strong impact was given by the already present equipment and services to put every lecture in online mode with no delay. This, on the one side, was essential for maintaining the services for students and allow a smooth, instantaneous transition to online lectures, but it was also important for easing the tension on the central procurement office, that was already submerged with procedures for the purchase of PPE.

In conclusion, considering its initial internal configuration, the response of Alma Mater was stronger than expected, and it did not let external drivers negatively influence its performance by implementing creative procedures when it was possible (for example the purchase of microphones with a 'cascade logic'). Many progresses were made due to the changes brought about by COVID-19 and Università di Bologna will not go back to the old routines but will continue to grow in its digitalization and sustainability of operations.

5.5.5 Case Study: Università Ca' Foscari Venezia

5.5.5.1 Introduction

Università Ca' Foscari Venezia (abbreviated to Ca' Foscari for simplicity) is an Italian public university, founded in 1868 and it is based in the North of Italy, more specifically in Venice, with regional campuses in Treviso and Roncade. It has 8 departments in the fields of Economics, Philosophy, Management, Language studies, Molecular sciences, Environmental sciences, Humanistic sciences, and Asian and Mediterranean African studies. The university accounts for a total of around 20.888 students, 1.105 professors and assistant professors, and around 706 technical and administrative employees.

5.5.5.2 Pre-Covid Internal Configuration of procurement

Ca' Foscari procurement activities are centralized above threshold, meaning that the purchases above €40.000 are managed through the central purchasing office, while all the other purchases are managed by the autonomous spending centers (ASIT, University Library System, Departments) that make purchases autonomously, using the support, when necessary, of the central purchasing office. Consequently, the central purchasing office also performs a support function for the autonomous purchasing centers. For the management of purchases above the direct awarding threshold, each autonomous purchasing center is required to compile the biennial planning, which are then collected by the central purchasing office, which draws up the biennial planning of the University. For purchases below the thresholds, each autonomous purchasing center has complete managerial and accounting autonomy, while the central purchasing office intervenes only for purchases of certain strategic product categories, making available, to the autonomous purchasing centers, framework agreements for the supply of paper, stationery, airline tickets, catering services and coffee breaks. Following the theoretical models proposed, this organizational structure can be associated with a supportive centralized model.

The procurement structure is supported by the digitalization of only an activity of the process, the *search of suppliers*. This activity of the process is the only one in which Ca' Foscari utilizes digital solutions, together with the use of MEPA, which is mandatory for all PAs for every purchase above the threshold of € 5.000. Furthermore, recent investments of the university on VPN systems allow to access all the internal databases from the internet.

5.5.5.3 Reaction to the emergency context

5.5.5.3.1 *Internal Configuration*

In the first weeks of the pandemic emergency, all the activities of the purchasing office were carried out remotely, following the issuing of DMs in March 2020, which established a nationwide lockdown. None of the purchasing process steps were digitized as a result of the pandemic and even though the access to internal databases was guaranteed with the systems available to the procurement office, it was still necessary to always keep some personnel in presence to allow for the scanning of documents stored in the traditional paper archives. For the management of the personal protective equipment purchasing process, there was maximum collaboration with the prevention and protection office, as there was no specialist in health care purchasing within the purchasing offices. Suppliers were asked to provide certification of the equipment, which was then forwarded to the prevention and protection service, which carried out a conformity check and, only after their approval, was the purchase made by the procurement office.

Considering the national lockdown, it made necessary to start working remotely as soon as possible. The experience of smart working within the procurement office began with the pandemic, before which there had never been widespread nor circumscribed experience of it. The employees of the central procurement office in Ca' Foscari perceived that the adoption of smart working allowed an increase in flexibility. For example, if an employee had a medical appointment, previously he or she would have to take a leave for a whole day, while with smart working there was the possibility to manage autonomously working time and personal time during the day. Another advantage was related to the reduction of home-work transfer times, especially for those who live far from the institution, and this time saved could be used by the employees to prepare work materials and documents, with positive effects on office productivity and efficiency.

The main disadvantage was related to availability, as carrying out the work of the purchasing office necessitated continuous relationships and communication with other offices and among the employees of the office itself. Leaving it up to individual employees to manage their own working hours during the day made it difficult for employees to relate with each other, because each one had a different working schedule. The perception was that smart working could not be a viable way forward for the purchasing department, but it only worked for project work, in which everyone could work to deadlines and in complete autonomy. For the purchasing offices, since availability is fundamental in carrying out activities, the optimal solution would be remote working, with the same service hours as in-person work.

5.5.5.3.2 *External Enablers*

Also external forces had an impact on the process of purchase for Ca' Foscari, in particular the decrees emitted in the emergency period and the difficulty in procuring emergency goods given from the insufficient offer. For what concerns the legislation, on the one side, the increase in threshold for direct awarding has simplified and sped up the process. On the other hand, the fact that the principle of rotation has remained in force even for emergency

purchases has meant that the advantages deriving from raising the threshold for direct purchases could not have been fully exploited. For example, if you wanted to purchase from a supplier already 'vetted' by the procurement office and who guaranteed promptness and security in delivery, but from whom you have already purchased in the recent period, you could not use it and would have to look for another supplier who could guarantee the same conditions. During the emergency period, it would have been desirable to suspend the principle of rotation, as it was extremely difficult to find reliable and punctual suppliers. In this way, it would have been possible to purchase directly from the supplier who guaranteed the level of service required, instead of having to make a Request for Order on MEPA with unknown suppliers. Making purchases on MEPA did not guarantee the reliability of the suppliers, as the suppliers present on the platform are enabled to sell on the basis of a self-certification. In the initial period of the emergency, on MEPA there were suppliers of face masks completely unprepared. As there was a huge business opportunity in the market of PPE, many suppliers who previously dealt with the sale of completely different classes of goods have readjusted to selling PPE, in order to take advantage of the high demand for sanitary material but were not knowledgeable in this new category of goods.

Secondly, the purchasing process of *emergency goods* has been strongly influenced by the low availability of medical products and electronic equipment such as computers and printers. Indeed, the Italian suppliers of medical goods were often the second link in a chain that started from abroad producers. Long customs clearance times were to be waited for the Italian distributors to receive the goods, and this increase the time waited by Ca' Foscari to receive the requested goods.

Overall, there have even been great difficulties with Consip orders. Suppliers awarded with Consip tenders were struggling in satisfying the demand, especially for IT products. The suppliers, beyond not respecting the time deadlines, were not in a position, in many cases, to estimate the length of the delay in delivery.

5.5.5.4 Evaluation of the response

It is fundamental to analyze which elements influenced the process of reaction to the emergency period by Ca' Foscari University:

- Investments already made in digital technologies, as almost the entirety of the purchasing office could work remotely with the available hardware devices, which allowed to access all the university databases from anywhere.
- Strong cooperation with the prevention and protection office allowed the best management of the purchase of PPE devices.

However, among the critical points faced is the fact that there has never been any experience, not even experimental, of smart working within the purchasing office. Given that within the office the enabling technologies for smart working were already available, having already experimented with this mode of work would have made it less difficult to manage remote work in the first period of the pandemic, as employees would have been more confident in using the necessary tools. A second criticality was given by the lack of technical-scientific departments, which eliminated the possibility of self-production of

sanitizing solutions and similar products which were necessary during the first emergency period and whose availability on the market was scarce. Moreover, given the lack of medical departments, within the purchasing office none of the employees had any knowledge of the requirements of surgical and FFP2 face masks, as this category of goods had never been requested for purchase. This criticality was partially solved by strong teamwork between the purchasing department and the prevention and protection office, which made it possible to overcome the difficulties arose from the purchase of this category of goods, demonstrating how the establishment of task forces and close collaboration between the offices of the same organization are an essential requirement for responding to an emergency.

5.5.6 Case Study: Università di Camerino

5.5.6.1 Introduction

Università di Camerino (from here on called UniCam) is a public university, founded in 1336 and it is based in the Center of Italy, more precisely in Camerino, in the Marche region, with other regional campuses in Ascoli Piceno, Matelica and San Benedetto del Tronto. It has 5 departments in the fields of Architecture and Design, Veterinary Medicine, Technology and Science, Pharmaceutical Science, and Law, which together account for a total of 6.492 students. It also accounts for 519 professors, assistant professors, and researchers, and around 263 technical-administrative employees.

5.5.6.2 Pre-Covid internal configuration of procurement

UniCam procurement activities are centralized, meaning that the central purchasing office manages all of the University's purchases, including purchases for departments, both above and below the direct awarding threshold (€40.000). The centralization of all purchases of the University has been adopted in recent years, as previously each department managed its own purchases under threshold independently. The motivation which led to this strategic choice was to make the purchasing procedures more homogeneous within the university, with the aim of making the process less fragmented and more efficient by programming all the procurement activities in a single structure. Unfortunately, the achievement of this objective has been severely hampered by the consequences resulting from the earthquake of August 24, 2016, which caused the unavailability of many structures of the university for safety reasons. The direct consequence of the uninhabitability of many facilities is the impossibility of stockpiling, making it difficult to aggregate demand and purchase massive quantities of goods. Indeed, the greater part of the orders (92%) that have been carried out were under 5.000€, rendering therefore vain the advantages, described in the theoretical literature, deriving from the centralization of purchasing activities. Following the theoretical models proposed, this organizational structure can be associated with an Authoritative Procurement model.

Within the purchasing office, following the emergency caused by the 2016 earthquake, remote working had already been experimented in order to guarantee the continuity of operations during that crisis. At the beginning of 2020 a seminar was held, called by the former Director General, with the aim of presenting an agile work plan for the university.

Moreover, digitalization of the procurement processes is present for procedures above threshold through the UBuy platform, and the request for orders of single end-users is made through a dedicated mailbox of the procurement office.

5.5.6.3 Reaction to the emergency context

5.5.6.3.1 Internal Configuration

Request for orders in 2020 decreased by 21.6% compared to the previous year, with a drastic drop in the first half of 2020 of about 400 orders, which equals to about one third of total orders for that year. Starting from August 2020, the number of order requests returned to nearly the same as in FY 2019, demonstrating that the decline seen in the first half of 2020 was entirely attributable to the lockdown period that significantly impacted research activities in the first half of the year. In order to manage the pandemic crisis, a working group was created in early March that included a small team from university governance, including the Director General.

From that working group, a task force, including the purchasing manager and the head of the logistics and prevention office, was created to manage the emergency purchases that were required during this period. In particular, the task force had the aim of understanding the specifications and tender criteria for the purchase of PPE and good in the same category. The task force had an essential role since UniCam does not have any person in charge of the purchase of health goods within the purchasing department. The objective of the task force was to unite the skills of the purchasing office and the logistics and prevention office and compare notes on the management of the purchase of face masks, sanitizer, and other required medical goods, which changed many times during the lockdown period. This type of purchases did not require any particular technical expertise; the difficulty was in verifying the authenticity of the certificates associated with the PPE. It was decided to proceed to make emergency purchases using the channels that would guarantee the shortest delivery time and a guarantee of receiving the goods. Therefore, MEPA was used for the many purchases of medical and technological nature, with a percentage of 50% among new suppliers and 50% among suppliers already used.

Of great importance was the previous experience of smart working, built during the previous emergency faced by UniCam. Moreover, having an agile work plan introduced at the beginning of 2020 made it possible to be more reactive in the management of remote work during the first period of the emergency, and guaranteed legal protection for employees, since agile work was regulated by the plan. Smart working guaranteed more flexibility, as it allowed the employees to carry out their own personal tasks, and organize the working day autonomously, based on their own needs. However, not all of the office activities could be carried out in complete organizational autonomy since, without the definition of appropriate on-call time slots, the interactions between the various offices that are necessary in carrying out the daily activities would be lost. In the light of this, UniCam defined two on-call periods for the activities carried out in agile working mode, between 10.00 and 12.30 and between 15.00 and 16.00 (for days in which the afternoon shift is scheduled).

5.5.6.3.2 External Enablers

The reaction to the emergency context by UniCam, in addition to the *Internal Configuration*, is strongly impacted by *External Variable*, which directly influenced the university's ability to react. The main factor taken into consideration is the change of legislation to support the public sector in responding to the emergency period.

However, the decrees were expected to introduce a more concrete simplification; raising the threshold for direct awarding has certainly speeded up the purchasing process, but it was not enough on its own. The advantage brought about by raising the threshold is the ability to entrust directly to a supplier, justifying the uniqueness of the products, thus avoiding the need to search the market for similar solutions. However, justifying a supplier was not always a fast task and, especially for common goods, there was the need to search the market for similar products in order to justify that one supplier had the best possible offer. Instead, the simplification UniCam hoped for was the introduction of a national database to verify supplier certifications required by contracting authorities. With the actual system (AvcPass), the response times of the various public authorities are very variable and often long, thus lengthening the time needed for the purchase process. With the introduction of a single national database, the verification times of the certificates would be cut down and, consequently, the time of the procurement process would no longer be influenced by the response times of the various public bodies, as they are an external factor that greatly influences the process.

5.5.6.4 Evaluation of the response

Even though UniCam has not yet fully recovered from the difficulties generated by the crisis of the earthquake in 2016, the university was able to overcome the adversities caused by the new COVID-19 emergency through:

- the establishment of the task force composed of the head of the purchasing office and the head of the logistics and prevention office. This cooperation ensured a more efficient management of emergency purchases and allowed the university staff to return to presence as early as May 2020, with all facilities with the necessary safety protocols;
- the extension of Cineca's U-buy application for the management of below-threshold tenders. This application interfaces with Cineca's applications, U-Gov and U-Budget, already in use in the organization;
- a strong and prepared procurement team, which already had experience in emergency remote work, gained after the 2016 earthquake;
- the purchase of safety stock of medical equipment in January, before the pandemic, which was enabled by the expertise and insight of researchers from the department of bioscience and technology, working on infectious diseases such as malaria;
- an improved document flow system between offices, which has reduced the use of printing by more than 50%, making the processes more sustainable;

- a system for distance learning already widely tested and known by students and professors, as it had been used following the emergency caused by the earthquake. This made it possible to start distance learning, following the lockdown, without causing days of interruption to classes.

UniCam has been able to reduce the problems caused by COVID-19, since in recent years it had to face another sudden emergency. This dramatic event meant that within the university a process of digitalization of processes and teaching activities was already underway. However, for the management of purchases of medical equipment, during COVID-19, UniCam did not have, within the university, departments of medicine or similar, and therefore had no previous experience in the purchase of this type of goods. This criticality has been partially resolved by the institution of the emergency task force within the university, which has enabled a more targeted and efficient management of purchases.

As far as the digitalization of the purchasing process is concerned, during the emergency period the computer system in use for the management of orders has made it possible to carry out activities remotely without any particular issue.

It is advisable, as per the University program, to provide for the purchase of a software for the management of order requests, since, as of 2021, the requests are delivered to the procurement office through a dedicated email box, and the applicants do not have visibility on the process, consequently they cannot verify the status of their pending requests. A software that interacts with the applications in use for the other phases of the process would guarantee a greater speed of management of the requests and the possibility for the users to know in real time the status of the order.

5.5.7 Cross-Case Analysis

5.5.7.1 Pre-Covid internal levers

The public universities investigated within the case studies all share a similar organizational structure, that is the centralization of procedures above the direct award threshold. Università di Camerino is the only university with full centralization of procurement activities, which can be explained by the fact that it is a small university. Centralization for its 5 departments would not be complex to manage, if accompanied by digitalization of the process, which would then guarantee standardization of procedures, rationalization and aggregation of purchases, and overall better efficiency of the procurement function. For what concerns Politecnico di Torino, Università di Bergamo, and Università di Bologna, they adopt a model that is centralized for purchases above the 40.000€ threshold, but also their models reflect some similarities with hybrid organizational structures, in the sense that they leave more autonomy to the departments in the adoption of technology and the execution of procedures. Instead, Ca' Foscari is a clear example of centralization above threshold and Supportive procurement since it helps the departments in the procedures below threshold, and at the same time the central office is responsible for those above it. At the organization level, Politecnico di Milano stands out from the group with centralization above threshold and a strong digitalization of the whole procurement chain, that allows for standardization of procedures within the central and departmental offices. Indeed, its

Request for Orders systems allows to manage almost automatically every departmental request with a maximum degree of standardization and almost inexistent possibility of maverick purchases.

For what concerns the remaining universities, only Politecnico di Torino is comparable to Politecnico di Milano in terms of digitalization of the procurement process. Indeed, every step of the process is managed through a digital tool, for example U-Buy for tendering procedures and up to the payment of the goods or services received. Also, it implements digital signatures to avoid duplication of activities. The digital signature was also implemented by Università di Bergamo, Politecnico di Milano, and Ca' Foscari, with the exceptions of Università di Bologna and Università di Camerino. Furthermore, the digital infrastructure of Politecnico di Milano, Politecnico di Torino, Università di Camerino and Ca' Foscari allowed them to start activities in remote whenever it was needed since they have a VPN system. On the other hand, Università di Bergamo, and Università di Bologna were not ready to start immediately activities from home. However, Università di Bologna is interesting because before the pandemic it was already starting to test a Request of Purchase system like that of Politecnico di Milano, but in such a large university, the extension of this system to every department would require a long time.

Also previous experiences of smart working highlight the differences between the six universities under observation: Politecnico di Torino, Politecnico di Milano and Università di Camerino already had a strong experience of smart working, of course for different reasons, but this does not remove the fact that they were ready to start emergency smart working due to this experience made; on the other hand, Università di Bologna and Università di Bergamo had small experience before the pandemic, only a small number of employees experienced working in agile modality and for limited time periods; and Ca' Foscari experienced smart working for the first time during the national lockdown. Both in the case of Politecnico di Torino and Politecnico di Milano, it was the strong digitalization of the process and outside the procurement offices that enables this experience and also fostered the diffusion of such experiences in other areas of the university. Instead, Università di Camerino built its experience during the earthquake of 2016, which caused the closure of many university buildings and made it necessary to work from home.

5.5.7.2 Response to the pandemic

5.5.7.2.1 Procurement internal levers

At the beginning of the pandemic, all the universities were able to start working from home with relative ease. Some did not need to adapt their processes and systems to the new modality, like Politecnico di Torino and Politecnico di Milano, Università di Camerino and Ca' Foscari, while others needed to implement systems that could enable working from home, like Università di Bergamo with the adoption of Remote Desktop software, and Università di Bologna with the implementation of digital signature, to reduce printing at a minimum and speed up order approval process, and a VPN connection, to make files on the internal servers available from home. Even though Università di Camerino was already digitally enabled, it took the opportunity to revise its processes to remove redundancies and

make them more efficient and suited to the new work modality, and it extended their procurement platform, U-Buy, to purchases below the direct awarding threshold.

Adapting to emergency smart working was essential to begin to procure emergency goods that were needed to keep the services of the university alive (research and didactics). All the universities resorted to the continuous search of possible suppliers on MEPA, and Politecnico di Torino as well as Politecnico di Milano were the only two out of the six university to point out the use of e-commerce platforms to secure fast and reliable purchases in the beginning of the emergency, when timeliness was a critical issue. Politecnico di Milano also thought about purchasing PPE and sanitizing solution in January, before the beginning of the pandemic, due to the news received from Chinese partners about the virus's fast spread. In the same way, Università di Camerino decided to purchase protective equipment in advance, but their reason was the expertise of researchers on malaria and other infectious diseases in their institution. The remaining four universities did not make any purchase in advance and saw difficulties in finding suppliers, since every university agrees that there were low quantities of PPE available on the market during this critical period. Politecnico di Milano and Università di Camerino were also able to produce hand sanitizer solution in-house, but Università di Camerino, after the initial phase of the pandemic, decided to terminate the production within its laboratories for safety reasons (to avoid starting outbreaks).

All the universities' central procurement offices cooperated strongly with the "prevention and safety service" – the official name changes slightly for each university, but for simplicity it will be addressed as "prevention and safety service" for every institution – of the respective university, due to the fact that in the central procurement offices no one had expertise in the purchase of PPE before. Here, it is interesting to consider the experience of Università di Bologna, which among the six is the only one with medical departments. Università di Bologna decided that the purchase of PPE would not be done at the central level since its medical departments were capable of purchasing PPE and other medical equipment on their own. In this way, the central purchasing office, which at the beginning of the pandemic was inexperienced in this field, was not submerged with request for orders of PPE from every department, but only those with no expertise would partially rely on them, without a complete overload of the capability of the office. Also, Università di Bergamo made a choice similar to Università di Bologna, in that it spread the purchase of PPE also on departmental offices, in order to reduce the stress on the central procurement office and allow for the purchase of other goods and give assistance to the departments if needed. Furthermore, both Politecnico di Milano and Università di Camerino created task forces with the purpose of understanding better certifications and requirements of this new goods class, as well as finding possible suppliers. Politecnico di Milano was the only one which adopted AI tools to scan old tenders of these goods in order to find possible suppliers, and instead of using direct awarding, they decided to make open procedures in order to compare more offers and make background checks, to evaluate the trustworthiness of the possible suppliers.

Moving on from the purchases regarding PPE, also for the purchase of electronic devices, both at the beginning of the pandemic and before the start of the first semester of the academic year 2020/2021, there was a general lack of availability of products and of raw materials to produce those goods. Apart from the delay in deliveries, there were no internal difficulties reported by any of the universities for the purchase of these goods.

Also, the adoption of smart working does not see all the universities of the same opinion. First of all, it has to be considered that, as said before, some were advantaged by their previous experiences in this area, like Politecnico di Milano, Politecnico di Torino and Università di Camerino, while, for example, Università di Bergamo, that had a reduced experience, saw its employees almost rejecting smart working. However, the existing experience is only one component. Università di Bologna started the pandemic period with limited, if none, smart working experience, but it has perceived it as a change of pace with respect to regular work in a positive way. The introduction of technology, like the digital signature, enabled by smart working, was seen as a great improvement in the process and in its performances. This point was also brought up by Università di Bergamo, Politecnico di Torino, and Università di Camerino. Another positive result of the introduction of digital signature was the reduction in printing, and with this a higher level of sustainability of the procurement process. In this case, all the other universities agree with this consideration of Università di Bologna. Università di Bergamo also saw an increase in concentration and productivity in the first period as well as the other Universities.

Moreover, all the universities are positive that the introduction of smart working cancelled travelling times (from home to work and from work to home) and, in the case of Università di Bologna and Politecnico di Milano, video-calls simplified meetings for which before it was necessary to move from one regional campus to the other. Except for Università di Bergamo, all the HEIs agree that emergency smart working allowed for more flexibility of the working hours and better management of family and working time.

Nonetheless, the increase flexibility was also a source of increased complexity. Sharing opinions and communicating with coworkers was made more difficult since employees were working in different moments of the day. Università di Bergamo and Politecnico di Torino saw that communication and sharing opinions between coworkers decreases also due to the lack of physical presence and daily convivial moments that can only happen when working in the office. Politecnico di Milano reported that for the employees the house was not always an ideal workplace, especially during the lockdown when everyone was at home. In Università di Bologna, some of the employees had difficulties in adapting to the technology required to work from home, as well as in Politecnico di Torino, where practitioners in the departmental offices were not so used to digital tools as they were those from the central procurement office.

On the basis of these pros and cons, Università di Camerino, and Università di Bergamo established morning and afternoon time slots for smart working as soon as possible in order to guarantee time were all the employees can communicate with each other, and also Politecnico di Torino and Ca' Foscari agree that this configuration would be the best for continuing smart working in the future, even though all the universities agree that smart

working cannot be the only way of working in procurement, but it has to be used with moderation.

5.5.7.2.2 *External variables*

For what concerns the analysis of the external factors that most impacted the effectiveness of emergency response by universities, common findings emerge across the case studies. The most impactful factors can be classified into two categories:

- Nature of the emergency supplies;
- And Legislation.

Firstly, the procedures for the purchase of the commodity classes necessary for the management of the first pandemic phase, such as PPE and hardware devices, necessary to ensure the continuation of the activities of the offices remotely, were strongly influenced by the lack of availability, as introduced in the previous paragraph. All universities experienced problems with the procurement of emergency supplies, given the general unavailability of products from suppliers. The outbreak of the pandemic led to an exponential and sudden growth in demand for specific commodity classes, which exceeded the production capacity. The suppliers, like declared from Università Ca' Foscari, beyond not respecting the time deadlines, were not in a position to estimate the days of delay of the deliveries. The instability in deliveries had a huge impact on the activities of the universities as it did not allow them to draw up a timeline of the actions to be taken to cope with the emergency. Ca' Foscari also highlighted the fact that often on MEPA, quantities reported available were incorrect and this also was a cause of delay. And even when the universities were able to find a supplier with actual availability of the required products, international shipments were blocked by customs for clearance due diligence.

In addition to supply difficulties, Politecnico di Torino pointed out a further risk factor for emergency supplies, linked to the suppliers on the market. Indeed, given the enormous demand for emergency supplies, a high number of new suppliers appeared on the market completely unprepared for the type of material they were selling. In particular, for the purchase of personal protective equipment, such as FFP2 face masks, for which the presentation of certificates was required, several universities have found cases of suppliers with non-compliant products or with missing certifications. This problem has had the greatest impact on universities where there was no department of medicine, or similar, for which the purchase of such material was entirely new and there was no previous knowledge about the necessary certifications, in addition to not having relationships with suppliers of medical equipment. Politecnico di Milano was one of the universities interviewed that had never, prior to the pandemic, had the need to purchase medical equipment. Politecnico di Milano has managed to cope with the absence of an internal register of suppliers of medical goods, through the elaboration of open data of previous purchases of medical equipment by other public administrations.

Secondly, the impact found by universities from the decrees enacted during the pandemic to simplify the procurement process was tested. Raising the threshold for direct awarding of contracts elicited mixed opinions from the universities interviewed. For Università di Camerino, Università di Bergamo and Politecnico di Milano, the decree-law was perceived

as a positive intervention, or potentially positive, in that it made it possible to award higher value contracts directly, speeding up the purchasing process. The importance of guaranteeing fast purchases for certain essential goods was an essential condition for guaranteeing the continuity of operations in the lockdown period and planning the safe return of students and employees to their facilities.

The universities that have declared less satisfaction with the raising of the threshold for direct contracting are Politecnico di Torino, Università Ca' Foscari, and Università di Bologna. The first two universities agree that raising the threshold does not entail any simplification of the purchasing process, insofar as the other criteria for awarding remain in force, for example the rotation principle. The non-application of the rotation principle is justified only in particular exceptional circumstances, the justification for which remains a subjective factor, even after the divulgation of the emergency decrees.

Moreover, as pointed out by Politecnico di Torino, the decree-law did not speed up the purchasing process as it provided that direct awarding ought to be done with an explanation. In order to be able to declare which have been the objective reasons for the selection of a specific supplier it is necessary to carry out a market analysis to justifying the best offer of a supplier which, especially of common goods, is not an easy task. Through an analysis of the market, they have contacted various suppliers in order to receive several offers to be able to compare and to justify the choice of the supplier with the best offer. For Università di Bologna, another major problem has been the continuous issuing and revision of decree-laws during the emergency, which, instead of simplifying, have caused the opposite effect, adding more confusion to an already complex and fragmented legislation. Even the decree for raising the threshold for direct awarding has undergone several changes, from €150,000 in the DL to €75,000 in the conversion to law, and then again increases to €139,000 with a second law, becoming more of an obstacle than an advantage.

Università di Camerino, although in favor of raising the threshold, was expecting a reform that would introduce a more concrete simplification. An implementation measure that the universities hope can be introduced as soon as possible and would bring real simplification as well as speed up of the process is the introduction of the national BDOE, to contract the time required to verify suppliers' certifications required by contracting authorities. As emphasized from Politecnico di Torino and Università di Camerino, through the BDOE, the answer times from public authorities for the verification of the suppliers' certifications would receive a significant cut. The advantage is that the times of the purchasing processes would not be influenced anymore by public authorities, which nowadays are strongly dilating the time to complete a procedure.

5.5.7.3 Evaluation of the Response

Each university reacted to the emergency with peculiar differences that made their cases unique, and every university was able to guarantee the necessary efficiency to overcome this difficult period. Politecnico di Milano was able to leverage on its existing digital infrastructure in order to activate promptly emergency smart working, it used data analysis techniques to find suppliers for emergency goods and was able to take advantage of the partnerships it has worldwide to overcome the emergency. In the same way, Politecnico di

Torino was able to move to remote modality immediately thanks to its digitalization level and saw issues mainly due to external forces. Also impacted by external variables was Università di Bergamo, especially donors of PPE from all over the world since Bergamo was all over the news due to its situation. The usage of Remote Desktop software was sufficient to work from home, but the implementation of a VPN, as the other universities, would have been probably more sustainable and less reliant of the internal computers, which have to remain turned on for the usage of Remote Desktop. Nonetheless, the cooperation of employees of Università di Bergamo and their hard work was fundamental in surpassing the critical phase of the pandemic. Università di Bologna was more than able to catch up with digitalization, which was not strongly present before the pandemic, and is now on the path of digitalizing more and more steps of the procurement process, starting from the extension of the Request for Orders system to all the departments and continuing in the long term with the adoption of an ERP system. Università di Camerino, even though it is still suffering from the previous emergency it had to face, managed to surpass efficiently the pandemic thanks to the expertise of its research staff, that had the intuition about making safety stock for PPE, but also thanks to the already tested online teaching system, and the smart working experiences of its procurement team. And finally, Ca' Foscari was also able to work efficiently through the pandemic thanks to its investments in digital systems, such as the VPN and the establishment of a task force to collaborate on the purchase of protective equipment. The efficiency that the universities had, that is represented by no slowdowns in the procurement offices, the continuation without interruption of research activities in all universities, and the continuation of didactics activities with no delays in Università di Camerino, Università di Bologna and Politecnico di Torino, and 5 days of delay in Università di Bergamo, Politecnico di Milano and Ca' Foscari, was merit of the internal resources of the universities. For all the universities, the impact that the emergency decrees had in their operation was considered minimal and only the maneuver to increase the direct awarding threshold can be considered to have had an impact. However, Politecnico di Torino pointed out how the simplification given by the increase in threshold is contrasted by the necessity to make market analyses and ask for several offers in order to justify the direct award of contracts; Ca' Foscari is critical with the increase due to the principle of rotation, which made in more time consuming to find new suppliers than the effective time saved in not making open procedures; and Università di Bologna was not impacted by the decrees and the increase in threshold since the various modifications of the threshold were only of obstacle to the procurement practitioners.

5.6 Data triangulation: cross-methods analysis

5.6.1 Introduction

This chapter will focus on the comparison of all the analyses with the methods seen until now in the dissertation, in particular the survey analysis, reports and open data analysis and case studies. The objective of this chapter is to verify the consistency of the information collected through different data collection modalities in order to capture better and jointly the peculiarities of the subjects analyzed. This will also serve to better define and revise the authors' made Theoretical Framework, since it was possible to verify on field the

applicability of the Framework and possible initial misconceptions about internal and external dynamics of public universities.

5.6.2 Organization

Both from the survey results and the case studies emerged that the usage of hybrid models and centralization above threshold is favored by universities since they provide great benefits in ordinary times and give flexibility in procurement management during an emergency period. In particular, these configurations allowed in some cases the purchase by the central office of emergency goods for all the university in order to limit the amount of time spent on training and learning the requirements for the purchase of medical equipment. While in other instances, for example in Università di Bologna and Università di Bergamo, the flexibility of their configuration allowed for a distribution across different structures of the purchases in order to limit the stress on the central procurement offices, and also allowed for the standardization of these procedures and better communication between different offices and different functions.

The case study of Università di Camerino also confirmed how the usage of a fully centralized structure is suitable to a small university, considering that it has to serve a smaller number of departments.

One difference that emerged during the case studies was thinking that a higher purchasing power would guarantee the purchase of more PPE or the purchase at a lower price. It was revealed that during the pandemic, especially during the lockdown period, the purchases related to PPE were characterized by the ability of suppliers to supply only relatively small quantities due to the unavailability of raw materials and supplies.

Therefore, for what concerns the organizational structure of the universities, the framework is consistent with what was seen across the different analyses. Indeed, it is important to point out that the hybrid and centralized above threshold models are the best models to be adopted during an emergency – and full centralization in the case of smaller HEIs. However, the importance that was given to high purchase power has to be reduced in favor of the importance of flexibility of these models. Each university with these structures should then consider what strategy is best to be followed based on their internal capabilities: (i) to procure all emergency products inside the central office if there is enough capability or (ii) to spread purchases on different offices to avoid putting too much pressure on the central office or in the case some departments are already familiar with the categories of emergency purchases for the emergency considered.

5.6.3 Emergency Purchases

5.6.3.1 Costs

We noticed consistency throughout the reports that, due to the pandemic, “missions and conferences” was the activity that was most impacted by the pandemic, but the impact will be limited to the emergency situation, due to the fact that the pandemic itself was limiting movements of people. As written in the report analysis, it was also considered the reduction in costs of paper supplies and the possible continuation of this trend. The case studies confirm that there was a decrease in the usage of paper supplies and support the thesis that

this trend will continue even after the lockdown period due to the digitalization and change in culture that happened thanks to the emergency, and it is also possible to assume that it will continue after the end of the COVID-19 pandemic. Universities already digitalized that used paper folders as an old routine stopped this process since it was futile, and universities with a lower degree of digitalization, as a consequence of digitalization due to the pandemic, saw a wide reduction in paper usage that will proceed after the pandemic thanks to the digital enablers that are now part of the ordinary procurement process.

5.6.3.2 Suppliers

From the analysis of the survey results it appeared that MEPA was the most used tool on which to purchase emergency goods, both for new and old suppliers. However, it was noticed that many universities had used outside of MEPA solutions, and it was speculated how this could be due to the lower prices and faster delivery times of other solutions with respect to MEPA suppliers, and not due to universities purchasing in a disaggregated way. The case studies support but also contradict this information. First of all, the case studies allowed to go more in depth in this analysis. They showed that purchases outside of MEPA usually regarded a small quantity of goods or purchases of limited costs. For those universities within the case studies that used outside-of-MEPA suppliers, for example e-commerce platforms, it is indeed true that it was to allow for higher speed of the deliveries, especially at the beginning of the pandemic, but the fact that these purchases had lower prices was not confirmed. Secondly, not in every case study the universities acquired goods by aggregating through the central procurement office, but in the case of Università di Bergamo and Università di Bologna the purchases were not aggregated at the central level. This choice was made, as said in the previous paragraphs, to repartition the work of procuring emergency goods on more procurement offices with the objective of maintaining the workload of each office balanced and to avoid an overload of the central office.

The case studies also confirm what was originally affirmed about purchases and donations from abroad. Custom clearance was an obstacle to the deliveries from foreign organizations and this is the reason why a large number of public higher education institutions did not deal with foreign companies. However, there were some cases in which Italian suppliers were actually distributors of foreign producers and this would generate customs clearance issues as well, as reported by Ca' Foscari.

In this evaluation, the case studies were essential to complement and correct assumptions that were initially elaborated from the survey results. It is possible to say that the Framework is in line with this evaluation and that priority should be given to timeliness of procurement practices especially in the beginning of an emergency.

5.6.4 Continuity of the processes and smart working

The survey analysis highlighted how it was not possible to find correlation between past smart working experience and the slowdowns in the procurement process, research, and didactics activities. And the case studies were essential to understand that the line of questioning of the survey for what concerns this topic was too superficial. Indeed, from the case studies it emerged how universities with circumscribed smart working experience

answered to have had experience in the survey and led to believe that smart working did not influence slowdowns. However, from the cases of Politecnico di Milano, Politecnico di Torino and Università di Camerino, which had a strong smart working experience and digital infrastructure, it was evident that the passage from office to remote work modality was instantaneous and the perception of change was minimal, while in the cases of Università di Bergamo and Università di Bologna, with low experience in agile work, the passage was enabled by the substantial effort of coordination with ICT services, necessary only to a lower extent for the first three universities.

It is then obvious how the past experiences in smart working are one of the factors influencing the continuity of operations, but thanks to the strong collaboration with ICT services it is possible to implement the necessary digital tools that can guarantee a satisfying level of performance while working remotely. Digital tools can be powerful and provide large benefits in terms of reduction of time to complete the procurement of goods and service, necessary now more than ever. For example, digital signature, which is a simple yet effective tool, was not adopted by Università di Bologna before the pandemic, and its implementation was possible in a short period of time and brought immediate simplifications to the process of signing procedures and giving access to documents only to the people allowed. But more than this, the implementation of a VPN was necessary to access to internal servers and continue to work from remote, like in the case of Università di Bergamo (which adopted a 'predecessor' of VPNs). The topic of digital enablers was not captured within the survey, which mainly focused on the digitalization of the procurement process but was investigated thoroughly through the case studies and is in line with the theoretical framework presented. Indeed, digital enabling tools are necessary and sufficient to start emergency smart working in a short period of time, which can guarantee continuity in operations. However, as it was previously addressed in Chapter 2.6, *emergency smart working* cannot be considered smart working as it was only working from home, which is remote working or teleworking. To enable smart working, both digital tools and digitalization of the process are necessary.

5.6.5 Digitalization

From the survey results we evince how digitalization of different phases of the process can impact the efficiency in remote working differently. For instance, the digitalization of *analysis of needs* would have a lower impact since there are not historical data to support the analysis for medical goods, which are only purchased in universities with medical or similar departments. The case study of Università di Bologna enhances this position, since the university was not able to define the quantities needed for the purchase of PPE as such a situation was a novelty even in a university with a department of Medicine.

The new situation was also complicating one of the subsequent phases of the procurement process, which is the *research of suppliers*. Compared to *analysis of needs*, the *research of suppliers* is a high-impact phase of the process in an emergency, and its digitalization is already defined by legislation. Indeed, the usage of MEPA as an e-catalogue allows to compare different suppliers' offers in order to find the best available ones. However, this works when the procurement practitioners are competent about the category of goods for

which the suppliers are researched. Furthermore, it is useful for categories of goods that do not require particular certifications or standards. The emergency goods needed during the pandemic, such as PPE, did not fit these criteria. From the case study of Politecnico di Milano, an innovative solution was adopted to solve these issues. Politecnico di Milano, which does not have a medical school, was not prepared in the purchase of medical devices, and adopted artificial intelligence analytics techniques on previous purchases of other PAs for medical goods to create a supplier base, as described before. This technological innovation was proved by Politecnico di Milano to provide a substantial help and overcome the absence of competences in this field.

Given the importance of this innovation, which could be adopted with low effects, it was decided to include it in the theoretical framework as a method to overcome criticalities in the *research of suppliers*. Indeed, whatever the category of emergency goods, artificial intelligence analytics can be applied to old tenders in order to obtain information about the service level and professionalism of previous suppliers of other public organizations.

Another important solution that was highlighted in the case studies was the presence of a request for orders systems, which can make the process automated, smooth and allow continuous tracking of the completion of ongoing orders. Without an automated, tracked system, the requesting staff would not be able to see the status of their order and would continuously ask for information to the procurement office. In turn, this would increase the amount of work of the buyers, which are already under a lot of stress due to the state of emergency. Furthermore, the introduction of such a system would be more efficient than excel files or dedicated mailboxes, since they do not require to be updated manually, eliminating a repetition of activities.

As verified in the case studies, in accordance with the theoretical framework, the presence of a suite that allows to manage the process digitally from the presentation of a need to the payment of the orders would be the best solution available to universities, as in the case of Politecnico di Milano, or Università di Camerino, which implements the procure-to-pay suite U-Buy and is going to implement an interoperable request for orders systems of the same producer. Of course, having a suite that allows to manage all the process allows to have interoperability between the phases of the procurement process, but it must also guarantee interoperability with other platforms and touch points with the processes of other offices, for example the accounting office. Interoperability is therefore the first and most important aspect when considering the digitalization of the procurement process.

Finally, the analysis of critical activities in the survey was concluded by saying that *definition of specifics* could have been considered critical for a plurality of reasons, which are the difficulty in interpreting the new legislation, the difficulty in understanding the certification of new products categories to be purchased or the rapidly changing regulations. Through the case studies it was possible to confirm the initial hypothesis elaborated in the survey about why they were perceived as critical. Indeed, the subjects of the case studies reported how the legislation was frequently changed regarding the goods required to work in presence during the first period of the pandemic and, combined to the novelty of the purchases to be made, this brought confusion in the procurement offices. It can be confirmed

that *definition of specifics* was not perceived as most critical due to the lack of digitalization in that phase of the process, but it was mostly due to external factors, namely the legal framework.

6 Conclusions

6.1 Answers to the research questions

After this long journey it is now time to give an answer to the research questions we posed at the beginning of this thesis. To recap the questions for the readers, the purpose of this publication was to investigate the following issues:

- How did the digitalization of procurement processes of Italian public universities affect their capability to respond to the disruption generated by an emergency situation?
- How did the pandemic emergency have a role in the digitalization of procurement processes and activities and what are the implications of this phenomenon?

First of all, through our analyses it was possible to understand that the level of digitalization of the Italian public universities is highly heterogeneous and the scenarios of digitalization vary from universities that are fully digitalized to universities with the minimal, mandatory level of digitalization. For the purpose of this research, such a context allowed to compare the effect of different levels of digitalization across the universities and formulate a better answer to our questions. Indeed, we verified that the response to the COVID-19 pandemic, and more in general, to an emergency situation, is impacted differently by the digitalization of the process.

It can be said that those universities completely digitalized were able to adapt to the situation by effectively and efficiently moving activities in remote with minimal issues. Digitalization was fundamental in guaranteeing the continuity of operations and processes from remote and to ensure the continuation of the main services provided by the universities such as didactics and research. Not only this, full digitalization allows to maintain the same performance level of the office also in remote modality, as well as to go in smart working modality when needed, even after the lockdown period.

For what concerns universities with a medium level of digitalization, which refers to an average level of digitalization of procedures, but no tools that allow to access internal services and databases from remote, it was seen that the simple implementation of such tools enabled the whole office to work remotely with low losses in efficiency. This was possible since digital tools like digital signature and VPN are of simple implementation and do not require long procedures to set up if the right digitalization is already present in the office, which is almost always guaranteed by the presence of the electronic market and the mandatory execution of procedures above 5.000€ through it. The implementation of this tools can allow universities with an average level of digitalization to go in agile work modality if needed.

Secondly, in the case of low digitalization of the procurement process, it can be said that digitalization is not a route that can be walked during an emergency, but the pandemic worked as an accelerator towards digitalization of the processes. Digitalization is a complex, long and demanding process that necessitates training of the employees on the technologies and digital systems to be used, time to select the right platforms and tools to be implemented, which have to guarantee interoperability of the different new and existing

systems, and at least a minimum level of experience in agile working. The context of the pandemic emergency, which is very demanding on the procurement office in terms of time and effort to sustain the whole university, does not allow to focus also on the adoption of new platforms and training to use them, which would contribute with an additional factor of uncertainty on the procurement practitioners and the procurement process. What can be done is to take advantage of digital enablers. Digital enablers require low digital skills and are commonly used in day-to-day activities – smartphones, shared folders, video chatting services – and can be used in order to allow for the continuation of activities from remote, but not in smart working, which would again require a certain level of digitalization of the process. This would be useful to surpass the period of emergency with a discrete efficiency level comparable to that of regular office work, but not comparable with full digitalization. It has to be stressed out that the efficiency was maintained because with the emergency, ordinary activities were postponed in favor of emergency purchases, therefore there was actually a decrease in the overall number of tasks and contracts executed by the procurement office. The difficulty faced was the novelty of many purchases and the new work modality. Moreover, digital enablers gave a brief “introduction” to the world of digital tools and digitalization of the process and started a process of digital change for when the emergency is surpassed. This digital change will lead to the mapping and re-engineering of internal processes so that the universities can proceed with real digitalization in the medium to long term. This was confirmed through the survey responses, which show that even in the cases of less digitalized universities the time of delay was fairly low, and also through the case studies, since the universities with a low digitalization, for example Università di Bologna, viewed the pandemic as a catalyst to digital innovation that will change forever the way of working inside the procurement office.

The emergency also had an important role concerning the external variables, and most of all in the action of the government to try and sustain public organizations in this period. First of all, legislation was made to sustain the procurement process and try to simplify public tendering, but as we saw from the case studies this was not perceived as sufficient.

Fundamental was, for the universities that adopted it, the POLA. The government’s objective was to give an instrument that could be used as compass to guide the PA towards a digital transformation and in the transition to agile work, making possible to monitor and evaluate the performance achieved with remote working and considering the contexts inside and outside the organizations. As said before, POLA was adopted by 38.8% of the public universities, an important result considering the short deadline for its completion and that it could be delivered on a voluntary basis. Moreover, public universities had a higher percentage of adoption of POLA than the average adoption rate of all the public administrations. With the new plan, PIAO, which is mandatory, it will be possible to receive more insights about the digitalization state of the art of public administration and which steps are programmed to digitalize more of the processes, including the procurement process.

6.2 Implications

The answers to the research questions allowed to define several implications, both managerial (internal) and at policy level(external), which are summarized in Table 7.

| Managerial Implications | Policy Implications |
|---|--|
| Importance in supporting coordination (internal and external) | Legislation that give real support to procurement practitioners and speed up procurement processes |
| Give more relevance to emergency action plans | |
| Change management: digital culture and digital skills | CPBs and central infrastructure to sustain procurement |
| Mapping processes and process reengineering | |
| Importance of the organizational structure | Importance of recovery funds to invest in digitalization |

Table 7 – Research implications. Authors’ work

6.2.1 Managerial implications

At the managerial level, it is fundamental to enable internal and external communication and cooperation. **Internal cooperation** must happen between departments and offices with different functions to ensure **fast responses** and guarantee **optimal efficiency**. As it was seen in the pandemic management, the coordination between central procurement, prevention and safety, and departmental offices was fundamental to ensure that every facility was up to date with legislation and certifications required for the purchase of PPE. Furthermore, **external coordination** is necessary to improve the efficiency in response of all the institutions. This can be done through the diffusion of **best practices** and internal policies to also sustain those public universities with lower competences in digital tools and in emergency goods. Moreover, **competences** should also be exchanged between universities and other public administration that might have more knowledge in certain fields that are helpful to face an ongoing emergency.

Secondly, cooperation and communication should be used as a **prevention** tool, even before being a reaction one. The diffusion of knowledge and best practices for digitalization of the processes should be used to create **emergency action plans** to be enacted in the advent of a crisis. Action plans should be detailed and about different possible scenarios so that they can help in managing risks and allow continuity of operations without issues. The plans should also define prevention strategies such as the **level of digitalization** to be reached to face emergencies with the best possible internal setting. Therefore, emergency plans would

also influence public institutions in ordinary times, and they would also become promoters of **digital innovation**.

However, digital innovation cannot happen if managers are not the firsts to sustain digitalization of the processes and digital initiatives. The process of digitalization is not fast, and different people adapt to digitalization differently, so it is important that managers involve every employee in **training and workshops** about digital tools to **raise digital awareness** and improve the overall digital skills. Digital tools are easily scalable and modular, and therefore it is possible to digitalize progressively in order to give the right amount of time to practitioners and other staff to **adapt to digital change**, rather than to avoid or refuse it.

To support this process, management should also promote mapping of the internal processes of the public institution, so that it will be possible to find best fit digital solutions and **remove redundant activities** through automatization. The next phase to mapping the processes is indeed process reengineering.

Lastly, it was noticed how the organizational structure of a public university impacts the efficiency and ability to respond to an emergency. A thorough revision of the **organizational structure** should be made to analyze whether a different setting could provide more optimal efficiency in ordinary times, as well as in case of an emergency. It has to be considered that, of course, emergencies are extraordinary events, and the configuration of an organization should not be focused on being efficiency only during emergencies. But it should be known that **hybrid** structures and **centralization above threshold** can provide the right level of flexibility during an emergency and adapt to the needs of the public universities, based on their capability. In ordinary periods they are also efficient as they combines the strengths as well as avoid some of the weaknesses that full centralization and full decentralization would have alone.

6.2.2 Policy implications

The case studies shed light on the influence that **legislation** has in the procurement process efficiency and, in particular, it showed how the emergency decrees issued during the COVID-19 pandemic were not perceived to have provided enough simplifications. It is fundamental for legislators to consider the opinions of public procurement practitioners when issuing laws and decrees. A way in which this can be achieved is the **involvement of procurement practitioners** in the decision-making process that leads to the drafting of decrees, since practitioners would make the right questions to understand the implications of a certain draft. Changing the draft of a decree before it is issued should avoid the confusion that is generated from making changes afterwards. More than this, it is clear how a thorough **simplification of procurement regulations** is needed to reduce the time to complete procedures and increase the flexibility of the procurement system during ordinary times first, so that they can be fast and reactive in emergency periods as well. With this objective in mind, it is important to restructure the Public Contracts Code so that it is truly simpler and clearer than its precedent version, maybe through the strict implementation of European directives and of actuation laws only when the directives are not fully applicable as laws.

Moreover, it is important that the **governmental infrastructures** that sustain public procurement are efficient as well. The average time to complete a public contract is heavily reliant on external factors, such as the retrieval of certifications and background checks on economic operators. The digitalization of tendering procedures through the electronic market is not sufficient to improve performances since it is only one of the touch points between internal procurement management and external agents. Indeed, it should be given much relevance to the creation of a single **BDOE** from which public universities, as well as other public institutions, can retrieve, with a single operation and instantaneously, data about an economic operator. The creation of this database was also included in the New Code of Public Contract but was never implemented. The COVID-19 pandemic showed the importance of having such a system in place, because it highlighted the importance of fast procurement procedures.

European **recovery funds** will allow for the creation of this database and other digital innovations. Indeed, the PNRR, created to manage these funds, in an opportunity to relaunch Italian public administration in the direction of digitalization, starting from the DBOE and following with innovation at the national and single administration level. Indeed, digital fundings are the third and last policy implication that emerged from the dissertation, and they are a necessary push for improving Italy's DESI index. Fortunately, thanks to the pandemic emergency, that showed to the world the importance of digitalization, there was also a push to provide more fundings in this direction and more concrete plans to bring digitalization. Indeed, the first mission statement of the PNRR was dedicated to digitalization and the decree n.81 on construction and heavy equipment for universities, in 2020, was dedicated to the digitalization of the infrastructures in universities.

6.3 Limitations of the study and possible research developments

As this dissertation is an exploratory study, the research presents some limitations and gives opportunities for future developments that, in the authors' opinions, should be pursued.

First of all, the focus on public universities will not make it possible to generalize the findings and the theoretical framework elaborated in this dissertation to the entire public administration sector, since different public administrations might differ from one another. It will be possible, in future research, to continue exploring the public sector and understand the extent of the applicability of our framework to other public administrations, or to corroborate a new and more generalized version that is, in fact, applicable to all the PA, since universities are generally more advanced in terms of digitalization with respect to the rest of the public administration.

Moreover, even though a mixed-methods research can be stronger in investigating various aspects of a phenomena, it may lead to a reduction in the depth of analysis in the sense that it tries to combine qualitative and quantitative analyses, without strictly focusing on one or the other. Future research could focus on the usage on a single type of analysis to better capture the essence of numerical data, for what concerns quantitative analyses, or

interviews answers, if a qualitative approach is chosen. Therefore, a different method of investigation could be used in order to confirm our results.

Furthermore, the definition of the theoretical framework, the analysis, and the successive implications we derived are based on the COVID-19 pandemic, which is a very specific and peculiar emergency, and this could limit the applicability of this research to other emergencies. The COVID-19 emergency was chosen since it is the largest emergency faced by the whole world in recent history, and consequently it affected every institution, public and private. The development of future literature regarding digitalization of procurement in an emergency period could be about more localized emergencies, like an earthquake or a flood, that could affect only a smaller number of institutions, without an effect on external factors, and would also affect the institutions in a different manner with respect to COVID-19. For example, an earthquake could lock out of internet connection an entire area, therefore, the main enabler in our framework would be missing. An alternative solution to enable connectivity and continuity should be investigated in future studies.

Lastly, the survey and interviews were conducted in Italian and are regarding the Italian context. Since external factors, such as the legal framework of a nation, are part of the framework, it is possible that the theoretical framework is dependent on such context. We believe that our framework could be easily adapted to other contexts, and researchers from all over the world should be encouraged to replicate our study to verify our framework's applicability to their national context and highlight potential adjustments to be made.

7 Bibliography

- Aboelazm, K., & Afandy, A. (2019). Centralization and decentralization of public procurement: Analysis for the role of General Authority for Governmental Services (GAGS) in Egypt. *Journal of Advances in Management Research*, 16(3), 262-276. doi:10.1108/JAMR-05-2018-0049
- Action 4 - The legal framework of responsible and innovative procurement put into practice. (2020, May 8). Retrieved from European Commission: Futurium: Urban Agenda for the EU: futurium.ec.europa.eu/en/urban-agenda/public-procurement/library/action-4-legal-framework-responsible-and-innovative-procurement-put-practice
- Agasisti, T., & Soncin, M. (2021). Higher education in troubled times: on the impact of COVID-19 in Italy. *Studies in Higher Education*, 46(1), 86-95. doi:10.1080/03075079.2020.1859689
- Agenzia Nazionale Anticorruzione. (2019). *Relazione Annuale 2018*. Rome: Camera dei Deputati.
- Agenzia per l'Italia Digitale. (n.d.). *E-Procurement*. Retrieved from Agenzia per l'Italia Digitale: www.agid.gov.it/it/piattaforme/procurement
- Angeles, R., & Nath, R. (2007). Business-to-business e-procurement: success factors and challenges to implementation. *Supply Chain Management: An International Journal*, 12(2), 104-115. doi:10.1108/13598540710737299
- Azanlerigu, J. A., & Akay, E. (2015). Prospects and Challenges of E-Procurement in Some Selected Public Institutions in Ghana. *European Journal of Business and Management*, 7(29), 61-76. Retrieved from <https://www.iiste.org/Journals/index.php/EJBM/article/view/26295>
- Bassan, V., Simonetta, B., & Salvioli, L. (2021, July 23). Cose che noi umani. (L. Salvioli, Ed.) *Il Sole 24 Ore*. Retrieved from lab24.ilsole24ore.com/storia-coronavirus/
- Bertezzaghi, E., & Kalchschmidt, M. (2004). La gestione e l'organizzazione degli acquisti delle Università: un'indagine su un campione di atenei. In G. Catalano (Ed.), *L'organizzazione e la gestione degli acquisti di beni e servizi nelle università* (p. 105). Bologna: Il Mulino.
- Bettacchi Roberto. (2021, April 13). *Gare telematiche, soluzioni per un'ottimizzazione delle procedure*. Retrieved from ForumPA: <https://webinar2021.eventifpa.it/it/event-details/?id=10032#>
- Boyne, G. A. (2002). Public and priva management: What's the difference? *Journal of Management Studies*, 39(1), 97-122. doi:10.1111/1467-6486.00284
- Burt, D. N., Norquist, W. E., & Anklesaria, J. (1990). *Zero Base Pricing: Achieving World Class Competitiveness Through Reduced All-In-Costs* (1 ed.). Chicago, IL: Probus Professional Pub.

- Capoferro, P. (2022, February 9). *Smart Working: che cos'è, a cosa serve, perché è importante per il business*. Retrieved from Network Digital 360: www.digital4.biz/hr/smart-working/smart-working-che-cos-e-a-cosa-serve-e-perche-e-cosi-importante-per-il-business/
- Centro di Ricerca sul Valore Pubblico, Università degli Studi di Ferrara, Dipartimento della Funzione Pubblica. (2021). *Monitoraggio della Qualità dei POLA 2021-2023*. Retrieved from www.funzionepubblica.gov.it/sites/funzionepubblica.gov.it/files/Infografica_indpol_a.pdf
- CIPS & NIGP. (2016). *Global Procurement Best Practices: Specifications*. Retrieved from CAPPO Inc.: https://www.cappo.org/page/BestPractices?&hhsearchterms=%22specifications%22&#rescol_4223732
- Consip S.p.A. (2021). *Bilancio Consip relativo all'Esercizio 2020*. Retrieved from www.consip.it/sites/consip.it/files/CONSIP_Bilancio2020_WEB.pdf
- Consortium for Global Electronic Commerce. (2002). *Measuring and Improving Value of E-procurement Initiatives*. Madison, WI.
- Coronavirus, Amuchina a prezzi stellari, mascherine a 40 Euro. Consumatori: "Speculazione vergognosa". (2020, February 24). *La Repubblica*. Retrieved from www.repubblica.it/cronaca/2020/02/23/news/coronavirus_amuchina_mascherine-249358877/
- Corriere Comunicazioni: Dl Reclutamento, ok del Senato: nasce la "Linkedin" della PA*. (2021, July 30). Retrieved from Network Digital 360: <https://www.corrierecomunicazioni.it/pa-digitale/dl-reclutamento-ok-del-senato-nasce-la-linkedin-della-pa/>
- Corso, M., Naddeo, A., & Deidda Gagliardo, E. (2021, July 20). *Le prospettive per lo smart working per il post-pandemia: oltre il POLA verso il "Piano Unico" della PA*. Retrieved from ForumPA: www.forumpa.it/riforma-pa/smart-working/le-prospettive-per-lo-smart-working-per-il-post-pandemia-oltre-il-pola-verso-il-piano-unico-della-pa/
- Croom, S. (2000). The Impact of Web-Based Procurement on the Management of Operating Resources Supply. *The Journal of Supply Chain Management*, 36(1), 4-13. doi:10.1111/j.1745-493X.2000.tb00065.x
- Croom, S., & Brandon-Jones, A. (2007, December). Impact of e-procurement: Experiences from implementation in the UK public sector. *Journal of Purchasing and Supply Management*, 13(4), 294-303. doi:10.1016/j.pursup.2007.09.015
- Croom, S., & Johnston, R. (2003). E-Service: Enhancing internal customer service through e-procurement. *International Journal of Service Industries Management*, 14(5), 539-555. doi:10.1108/09564230310500219
- De Boer, L., Harink, J., & Heijboer, G. (2002). A conceptual model for assessing the impact of electronic procurement. *European Journal of Purchasing & Supply Management*, 8(1), 25-33. doi:10.1016/S0969-7012(01)00015-6

- Dimitri, N., Dini, F., & Piga, G. (2006). When should procurement be centralized? In N. Dimitri, G. Piga, & G. Spagnolo, *Handbook of Procurement* (pp. 47-81). Cambridge University Press. doi:10.1017/CBO9780511492556.004
- Donato, L., Mariconda, M., & Mirrione, M. (2020). La digitalizzazione possibile degli appalti pubblici. L'analisi della Banca d'Italia per l'Anac sulle prospettive dell'e-procurement. Retrieved from https://www.researchgate.net/publication/341398475_La_digitalizzazione_possibile_degli_appalti_pubblici_L'analisi_della_Banca_d'Italia_per_l'Anac_sulle_prospettive_dell'e-procurement
- Dooley, K., & Purchase, S. (2006). Factors influencing E- procurement usage. *Journal of Public Procurement*, 6(1/2), 28-45. doi:10.1108/JOPP-06-01-02-2006-B002
- Ellram, L. M. (1995). Total cost of ownership: an analysis approach for purchasing. *International Journal of Physical Distribution & Logistics Management*, 25(8), 4-23. doi:10.1108/09600039510099928
- Essig, M., & Arnold, U. (2006, April 5). Electronic Procurement in Supply Chain Management: An Information Economics-Based Analysis of Electronic Markets. *Journal of Supply Chain Management*, 37(3), 43-49. doi:10.1111/j.1745-493X.2001.tb00112.x
- European Commission. (2008, February 14). *The Public Electronic Procurement (eProcurement) and related topics*. Retrieved from JoinUp: <https://joinup.ec.europa.eu/collection/eprocurement/document/public-electronic-procurement-eprocurement-and-related-topics>
- European Commission. (2021). *Recovery and Resilience Facility - Performance*. Retrieved from European Commission: https://ec.europa.eu/info/strategy/eu-budget/performance-and-reporting/programmes-performance/recovery-and-resilience-facility-performance_en
- European Commission. (n.d.-a). *Public procurement*. Retrieved from Internal Market, Industry, Entrepreneurship and SMEs: ec.europa.eu/growth/single-market/public-procurement_en
- European Commission. (n.d.-b). *Recovery plan for Europe*. Retrieved from European Commission: ec.europa.eu/info/strategy/recovery-plan-europe_en
- European Commission, Directorate-General for Communications Networks, Content and Technology. (n.d.). *The Digital Economy and Society Index (DESI)*. Retrieved from Shaping Europe's digital future: <https://digital-strategy.ec.europa.eu/en/policies/desi>
- European Commission, Directorate-General for Regional and Urban Policy. (2018). *Public procurement : guidance for practitioners on the avoidance of the most common errors in projects funded by the European Structural and Investment Funds*. Publications Office. doi:10.2776/886010

- European Commission, Directorate-General for the Internal Market and Services, Sadée, C., Lifonti, R., & Bardellini, M. (2016). *Study on e-procurement measurement and benchmarking Markt 2011/097/C : Lot 1 : public procurement performance indicators : D4 final study report*. European Commission. Retrieved from <https://data.europa.eu/doi/10.2780/94897>
- Filho, W., Skouloudis, A., Brandli, L., Salvia, A., Avila, L., & Rayman-Bacchus, L. (2019). Sustainability and procurement practices in higher education institutions: Barriers and drivers. *Journal of Cleaner Production*, 231, 1267-1280. doi:10.1016/j.jclepro.2019.05.202
- Flynn, A. (2018). Measuring procurement performance in Europe. *Journal of Public Procurement*, 18(1), 2-13. doi:10.1108/JOPP-03-2018-001
- Fondazione Censis. (2020). *La classifica Censis delle Università Italiane (Edizione 2020/2021)*. Rome. Retrieved from www.censis.it/sites/default/files/downloads/classifica_universit%C3%A0_2020_2021.pdf
- ForumPA, Editorial Board. (2020, June 3). *Smart working: il 94% dei dipendenti pubblici proseguirebbe anche nel post-emergenza*. Retrieved from ForumPA: www.forumpa.it/riforma-pa/smart-working/smart-working-il-94-dei-dipendenti-pubblici-proseguirebbe-anche-nel-post-emergenza/
- Gangai, A. (2021, January 28). *Come gestire lo Smart Working: ruolo dei manager e sistemi di monitoraggio*. Retrieved from Osservatori.net: https://blog.osservatori.net/it_it/gestione-smart-working?hsLang=it-it
- Gardenal, F. (2010). Public e-Procurement: define, measure and optimize organizational benefits. *4th International Public Procurement Conference*, (pp. 26-28). Seoul. Retrieved from www.ippa.org/IPPC4/Proceedings/05e-Procurement/Paper5-1.pdf
- Glock, C. H., & Broens, M. G. (2013). Size and structure in the purchasing function: Evidence from German municipalities. *Journal of Public Procurement*, 13(1), 1-38. doi:10.1108/JOPP-13-01-2013-B001
- Government of South Australia. (2012). *Writing procurement specifications guideline*. Government of South Australia, Department for Education. Retrieved from www.education.sa.gov.au/sites/default/files/writing-procurement-specifications-guideline.pdf?v=1564979949
- Haigh, N., & Griffiths, A. (2007). The natural environment as a primary stakeholder: the case of climate change. *Business Strategy and the Environment*, 18(6), 347-359. doi:10.1002/bse.602
- Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our Competitive Edge: Competing Through Manufacturing*. New York, NY: John Wiley & Sons.
- Instituut voor Bouwrecht. (2020). *Proportionality Guide - 2nd Revision*. The Hague: IBR Publications. Retrieved from www.pianoo.nl/en/legal-framework/proportionality-guide-2nd-

- Osservatorio Agenda Digitale. (2020b). *Procurement ed eprocurement in ambito pubblico*. Politecnico di Milano, School of Management. Retrieved from www.osservatori.net/it/prodotti/formato/report/procurement-eprocurement-ambito-pubblico-report
- Osservatorio eProcurement nella PA. (2006). *L'eProcurement nella Pubblica Amministrazione italiana: innovare la gestione degli acquisti*. Politecnico di Milano, School of Management. Retrieved from www.osservatori.net/it/prodotti/formato/report/l-eprocurement-nella-pubblica-amministrazione-italiana-innovare-la-gestione-degli-acquisti
- Osservatorio Smart Working. (2013). *Smart Working: la competitività passa da qui!* Politecnico di Milano, School of Management. Retrieved from www.osservatori.net/it/prodotti/formato/report/smart-working-la-competitivita-passa-da-qui-2
- Oxford College of Procurement & Supply. (2014, August 7). *The Benefits of E-Procurement*. Retrieved from Oxford College of Procurement & Supply: www.oxfordcollegeofprocurementandsupply.com/the-benefits-of-e-procurement/
- Parlamento Italiano. (2021). *Piano Nazionale di Ripresa e Resilienza*. Rome: Governo Italiano. Retrieved from www.governo.it/sites/governo.it/files/PNRR.pdf
- Patrucco, A. S., Luzzini, D., Ronchi, S., & Walker, H. (2016). Organizational Configurations for Local Government Procurement. *Proceedings. 2016*. Academy of Management. doi:10.5465/ambpp.2016.12151abstract
- Patrucco, A. S., Luzzini, D., Ronchi, S., Essig, M., Amann, M., & Glas, A. H. (2017). Designing a public procurement strategy: lessons from local governments. *Public Money & Management, 37*(4), 269-276. doi:10.1080/09540962.2017.1295727
- Patrucco, A. S., Walker, H., Luzzini, D., & Ronchi, S. (2019). Which shape fits best? Designing the organizational form of local government procurement. *Journal of Purchasing and Supply Management, 25*(3), 100504. doi:10.1016/j.pursup.2018.06.003
- Pennings, J. M. (1992). Structural contingency theory: A re-appraisal. In B. M. Staw, & L. L. Cummings (Eds.), *Research in Organization Behavior, XIV* (pp. 267-309). Greenwich, CT: JAI Press.
- Picho, E. O. (2017). Institutional legal environment and public procurement performance in tertiary institutions in West Nile Sub Region of Uganda. *Global Journal of Commerce & Management Perspective, 6*(3), 1-15. doi:10.24105/gjcmp.6.3.1701
- Prometeia (Ed.). (2019, July 10). Pmi, quanto conta in Italia il 92% delle aziende attive sul territorio? *Il Sole 24 Ore*. Retrieved from www.infodata.ilsole24ore.com/2019/07/10/40229/?refresh_ce=1
- Rai, A., Tang, X., Brown, P., & Keil, M. (2006). Assimilation patterns in the use of electronic procurement innovations: A cluster analysis. *Information & Management, 43*(3), 336-349. doi:10.1016/j.im.2005.08.005

- Reunis, M. R., & Raaij, E. M. (2006). Scale Development for E-Procurement (EP) Adoption Influence Tactics. *15th IPSERA conference*. IPSERA. Retrieved from resolver.tudelft.nl/uuid:6c1c7e9d-c6f9-455b-b811-22411680b5e7
- Rowley, J. (2011). e-Government stakeholders—Who are they and what do they want? *International Journal of Information Management*, 31(1), 53-62. doi:10.1016/j.ijinfomgt.2010.05.005
- Scuttari, A., & Agasisti, T. (2016). *Gli acquisti nelle università*. Bologna, Italy: Il Mulino.
- Šerpytis, K., Vengrauskas, V., & Gineitienė, Z. (2011). Evaluation of financial effects of public procurement centralisation. *Ekonomika*, 90(3), 104-119. doi:10.15388/Ekon.2011.0.932
- Stagno, G. (2019, April 10). *Smart Working: l'importanza di riprogettare gli spazi lavorativi*. Retrieved from ForumPA: www.forumpa.it/riforma-pa/smart-working-limportanza-di-riprogettare-gli-spazi-lavorativi/
- Stentella, M. (2021, December 3). *Smart working: cos'è, come funziona, la normativa e i vantaggi per le PA*. Retrieved from ForumPA: <https://www.forumpa.it/riforma-pa/smart-working/smart-working-cos-e-come-funziona-la-normativa-e-i-vantaggi-per-le-pa/>
- Supply Chain Process Improvement, Inc. (n.d.). *SCOR Metrics*. Retrieved from Supply Chain Process Improvement, Inc.: <https://www.scpiteam.com/SCOR%20Metrics.htm>
- Thai, K. V. (2009). International Public Procurement: Concepts and Practices. In K. V. Thai (Ed.), *International Handbook of Public Procurement* (1st ed., pp. 1-24). New York: Routledge. doi:10.4324/9781315092539
- Thai, K. V. (2015). International Public Procurement: Innovation and Knowledge Sharing. In K. V. Thai (Ed.), *International Public Procurement* (Vol. 14, pp. 1-10). Cham, Switzerland: Springer. doi:10.1007/978-3-319-13434-5_1
- Thai, K. V. (2016). Global Public Procurement Theories and Practices: An Introduction. In K. V. Thai (Ed.), *Global Public Procurement Theories and Practices* (Vol. 18, pp. 1-14). Cham, Switzerland: Springer. doi:10.1007/978-3-319-49280-3_1
- University of Wisconsin Whitewater. (2021, October 8 [updated]). *Communication Sciences & Disorders: Researching the Literature: Step 3: Reference Mining & Citation Searching*. Retrieved from University of Wisconsin Whitewater: <https://libguides.uww.edu/comdis-lit-review>
- Vaidya, K., Sajeev, A., & Callender, G. (2006). Critical factors that influence e-procurement implementation success in the public sector. *Journal of Public Procurement*, 6(1/2), 70-99. doi:10.1108/JOPP-06-01-02-2006-B004
- Williams College. (2021, February 11). *Citation Searching : Forward Citation Searching*. Retrieved from Williams College: <https://libguides.williams.edu/citationsearching/forward>
- Wyld, D. C. (2002). The electric company: how the supply chain is being reinvented through the rapid application of e-procurement processes in the business-to-business arena. *Management Research News*, 25(12), 22-53. doi:10.1108/01409170210783269

- Yin, R. K. (2017). *Case Study Research and Applications: Design and Methods* (6th ed.). Los Angeles, CA: SAGE.
- Young, S., Nagpal, S., & Adams, C. A. (2016). Sustainable Procurement in Australian and UK Universities. *Public Management Review*, 18(7), 993-1016. doi:10.1080/14719037.2015.1051575

8 Laws, Directives and Decrees

The laws, directives and decrees are listed in chronological order.

- D.L. March 30, 2001, n.165, “Norme generali sull'ordinamento del lavoro alle dipendenze delle amministrazioni pubbliche”. (2001, 9 May) (Italy). *Gazzetta Ufficiale*, (106), Ordinary Supplement, (112).
<https://www.gazzettaufficiale.it/eli/id/2001/05/09/001G0219/sg>
- Directive 2004/17/EC. *Coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors*. European Parliament, Council of the European Union. <http://data.europa.eu/eli/dir/2004/17/oj>
- Directive 2004/18/EC. *On the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts*. European Parliament, Council of the European Union. <http://data.europa.eu/eli/dir/2004/17/oj>
- Directive 2004/25/EC. *On takeover bids*. European Parliament, Council of the European Union. <http://data.europa.eu/eli/dir/2004/25/oj>
- Directive 2014/23/EU. *On the Award of Concession Contracts*. European Parliament, Council of the European Union. <http://data.europa.eu/eli/dir/2014/23/oj>
- Directive 2014/24/EU. *On Public Procurement and repealing Directive 2004/18/EC*. European Parliament, Council of the European Union. <http://data.europa.eu/eli/dir/2014/24/oj>
- Directive 2014/25/EU. *On Procurement by Entities operating in the Water, Energy, Transport and Postal Services Sectors and repealing Directive 2004/17/EC*. European Parliament, Council of the European Union. <http://data.europa.eu/eli/dir/2014/25/oj>
- Legge August 7, 2015, n.124, “Deleghe al Governo in materia di riorganizzazione delle amministrazioni pubbliche” (August 13, 2015) (Italy). *Gazzetta Ufficiale*, (187).
<https://www.gazzettaufficiale.it/eli/id/2015/08/13/15G00138/sg>
- D.L. April 18, 2016, n.50, “Attuazione delle direttive 2014/23/UE, 2014/24/UE e 2014/25/UE sull'aggiudicazione dei contratti di concessione, sugli appalti pubblici e sulle procedure d'appalto degli enti erogatori nei settori dell'acqua, dell'energia, dei trasporti e dei servizi postali, nonche' per il riordino della disciplina vigente in materia di contratti pubblici relativi a lavori, servizi e forniture” (2016, 19 April) (Italy). *Gazzetta Ufficiale*, (91), Ordinary Supplement, (10).
https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2016-04-19&atto.codiceRedazionale=16G00062
- Legge May 22, 2017, n.81. “Misure per la tutela del lavoro autonomo non imprenditoriale e misure volte a favorire l'articolazione flessibile nei tempi e nei luoghi del lavoro subordinato” (2017, 13 June) (Italy). *Gazzetta Ufficiale*, (135), 1-20.
<https://www.gazzettaufficiale.it/eli/id/2017/06/13/17G00096/sg>
- Legge December 30, 2018, n.145, “Bilancio di previsione dello Stato per l'anno finanziario 2019 e bilancio pluriennale per il triennio 2019-2021” (2018, 31 December) (Italy).

Gazzetta Ufficiale, (302), Ordinary Supplement, (62).
<https://www.gazzettaufficiale.it/eli/id/2018/12/31/18G00172/sg>

Ordinanza February 28, 2020, n.641, "Ulteriori interventi urgenti di protezione civile in relazione all'emergenza relativa al rischio sanitario connesso all'insorgenza di patologie derivanti da agenti virali trasmissibili" (2020, February 28) (Italy). *Gazzetta Ufficiale*, (50). <https://www.gazzettaufficiale.it/eli/id/2020/02/28/20A01349/sg>

Direttiva March 13, 2020, n.2, "Indicazioni in materia di contenimento e gestione dell'emergenza epidemiologica da COVID-19 nelle pubbliche amministrazioni di cui all'articolo 1, comma 2, del decreto legislativo 30 marzo 2001, n. 165". (2020, 13 March) (Italy). *Ministero della PA*.
<https://www.funzionepubblica.gov.it/articolo/dipartimento/12-03-2020/direttiva-n2-del-2020>

D.L. March 17, 2020, n.18, "Misure di potenziamento del Servizio sanitario nazionale e di sostegno economico per famiglie, lavoratori e imprese connesse all'emergenza epidemiologica da COVID-19" (2020, 17 March) (Italy). *Gazzetta Ufficiale*, (70).
<https://www.gazzettaufficiale.it/eli/id/2020/03/17/20G00034/sg>

D.L. April 8, 2020, n.22, "Misure urgenti sulla regolare conclusione e l'ordinato avvio dell'anno scolastico e sullo svolgimento degli esami di Stato" (2020, April 8) (Italy).
Gazzetta Ufficiale, (93).
<https://www.gazzettaufficiale.it/eli/id/2020/04/08/20G00042/sg#:~:text=Misure%20urgenti%20sulla%20regolare%20conclusione,del%2008%2D04%2D2020>

D.L. April 8, 2020, n.23, "Misure urgenti in materia di accesso al credito e di adempimenti fiscali per le imprese, di poteri speciali nei settori strategici, nonche' interventi in materia di salute e lavoro, di proroga di termini amministrativi e processuali".(2020, April 8) (Italy). *Gazzetta Ufficiale*, (94).
<https://www.gazzettaufficiale.it/eli/id/2020/04/08/20G00043/s>

D.M. May 13, 2020, n.81, "Criteri di riparto del Fondo per l'edilizia universitaria e le grandi attrezzature 2020 – interventi di potenziamento delle infrastrutture tecnologiche" (2020, May 22) (Italy). *Corte dei Conti*, (1353). <https://www.miur.gov.it/-/decreto-ministeriale-n-81-del-13-maggio-2020-criteri-di-riparto-del-fondo-per-l-edilizia-universitaria-e-le-grandi-attrezzature-2020-interventi-di-pot>

D.L. May 19, 2020, n.34, "Misure urgenti in materia di salute, sostegno al lavoro e all'economia, nonche' di politiche sociali connesse all'emergenza epidemiologica da COVID-19" (2020, May 19) (Italy). *Gazzetta Ufficiale*, (128), Ordinary Supplement, (21). <https://www.gazzettaufficiale.it/eli/id/2020/05/19/20G00052/sg>

D.L. May 31, 2021, n.77, "Governance del Piano nazionale di ripresa e resilienza e prime misure di rafforzamento delle strutture amministrative e di accelerazione e snellimento delle procedure" (2021, May 31) (Italy). *Gazzetta Ufficiale*, (129).
<https://www.gazzettaufficiale.it/eli/id/2021/05/31/21G00087/sg>

- D.L. June 9, 2021, n.80, “Misure urgenti per il rafforzamento della capacita' amministrativa delle pubbliche amministrazioni funzionale all'attuazione del Piano nazionale di ripresa e resilienza (PNRR) e per l'efficienza della giustizia” (2021, June 9) (Italy). *Gazzetta Ufficiale*, (136).
<https://www.gazzettaufficiale.it/eli/id/2021/06/09/21G00093/SG>
- D.M. July 14, 2020, “Criteri di riparto del Fondo per le esigenze emergenziali delle Università, delle istituzioni AFAM e degli enti di ricerca” (2020, July 16) (Italy). *Corte dei Conti*, (1604). <https://www.miur.gov.it/-/decreto-ministeriale-n-294-del-14-07-2020-fondo-per-le-esigenze-emergenziali-del-sistema-dell-universita-delle-istituzioni-di-alta-formazione-artistic>
- D.L. July 16, 2020, n.76, “Misure urgenti per la semplificazione e l'innovazione digitale” (2020, July 16) (Italy). *Gazzetta Ufficiale*, (178), Ordinary Supplement, (24).
<https://www.gazzettaufficiale.it/eli/id/2020/07/16/20G00096/sg>
- Legge July 17, 2020, n.77, “Conversione in legge, con modificazioni, del decreto-legge 19 maggio 2020, n. 34, recante misure urgenti in materia di salute, sostegno al lavoro e all'economia, nonche' di politiche sociali connesse all'emergenza epidemiologica da COVID-19” (2020, 18 July) (Italy). *Gazzetta Ufficiale*, (180), Ordinary Supplement, (25).
<https://www.gazzettaufficiale.it/eli/id/2020/07/18/20G00095/sg>
- D.P.C.M. October 13, 2020, “Ulteriori disposizioni attuative del decreto-legge 25 marzo 2020, n. 19, convertito, con modificazioni, dalla legge 25 maggio 2020, n. 35, recante «Misure urgenti per fronteggiare l'emergenza epidemiologica da COVID-19», e del decreto-legge 16 maggio 2020, n. 33, convertito, con modificazioni, dalla legge 14 luglio 2020, n. 74, recante «Ulteriori misure urgenti per fronteggiare l'emergenza epidemiologica da COVID-19»” (2020, October 13) (Italy). *Gazzetta Ufficiale*, (253).
<https://www.gazzettaufficiale.it/eli/id/2020/10/13/20A05563/sg>
- D.P.C.M. October 18, 2020, “Ulteriori disposizioni attuative del decreto-legge 25 marzo 2020, n. 19, convertito, con modificazioni, dalla legge 25 maggio 2020, n. 35, recante «Misure urgenti per fronteggiare l'emergenza epidemiologica da COVID-19», e del decreto-legge 16 maggio 2020, n. 33, convertito, con modificazioni, dalla legge 14 luglio 2020, n. 74, recante «Ulteriori misure urgenti per fronteggiare l'emergenza epidemiologica da COVID-19»” (2020, October 18) (Italy). *Gazzetta Ufficiale*, (258).
<https://www.gazzettaufficiale.it/eli/id/2020/10/18/20A05727/sg>
- D.M. October 19, 2020, “Misure per il lavoro agile nella pubblica amministrazione nel periodo emergenziale” (2020, 28 October) (Italy). *Gazzetta Ufficiale*, (268), 50-53.
<https://www.gazzettaufficiale.it/eli/id/2020/10/29/20A05834/sg>
- Ordinanza October 26, 2020, “Ulteriori misure per la prevenzione e gestione dell'emergenza epidemiologica da COVID-19” (2020, October 27) (Italy). *Gazzetta Ufficiale*, (267).
<https://www.gazzettaufficiale.it/eli/id/2020/10/27/20A05916/sg>

A Appendix A

Thesis Survey questions: Purchases in Public Universities during an emergency period

Since the survey was developed and shared in Italian, below it will be presented translated in English.

***Mandatory answer**

1. Email: *
-

Introductory Questions

2. Insert the complete name of your Institution: *
-

3. In your Institution, how are procurement processes organized? *

Choose only one

Centrally

Autonomously by each department

Other organizational structure: _____

4. Is there an office entirely dedicated to procurement activities in the central administration? *

Choose only one

Yes

No

5. Is there an office entirely dedicated to procurement activities in the central administration? *

Choose only one

Yes

No

Other (only in some): _____

With respect to total purchase (made in 2019) indicate:

6. Total spend: *
-

7. Total spend managed by the central procurement office: *

8. Number of active suppliers: *

9. Number of purchase contracts issued: *

With respect to total purchase (made in 2020) indicate:

10. Total spend: *

11. Total spend managed by the central procurement office: *

12. Number of active suppliers: *

13. Number of purchase contracts issued: *

14. Purchases made to face the COVID-19 emergency: (in particular the total cost and the estimated percentage of the total costs managed by the central purchasing office) *

Questions related to the management of didactics activities during the pandemic

15. With regard to didactics activities of your Institution, when was the beginning of the February/March semester (or trimester) scheduled?

Example: 7 January 2020

16. Did the semester/trimester receive an interruption or delay due to the necessity to organize distance learning?

Choose only one

Yes

No

Skip to question 18

17. How long was the delay?

18. When the region with your Institution's headquarters was categorized as 'yellow' or 'orange', did the Institution allow for blended learning (partially in presence didactics activities)?

Choose only one

Yes

No

19. Considering the first national lockdown, was there the necessity to buy electronic materials for professors to support didactics from home?

Choose only one

Yes

No

20. Considering the first national lockdown, were research activities always guaranteed?

Choose only one

Yes

No

Skip to question 22

21. How long was the interruption?

Questions related to the purchasing process during the pandemic

22. With reference to the purchase of goods for the COVID-19 emergency, which purchasing channels have been used? *

Choose all the applicable items

Suppliers on MEPA, already used before

Suppliers on MEPA, never used before

Suppliers outside of MEPA, located in Italy

Suppliers outside of MEPA, from foreign countries

Others:

23. If, to the above question, it was answered 'Suppliers outside of MEPA, located in Italy', 'Suppliers outside of MEPA, from foreign countries', and/or 'Others', please explain more in detail the type of supplier (e-commerce platform, direct contact, other CPB, etc.):

24. Regarding medical and protection equipment, on the basis of the information coming from China in January/February regarding the newly COVID-19, did the procurement office purchase supplies in advance with the objective of being prepared to a possible spread of the virus to Italy? *

Choose only one

Yes

No

25. Before the beginning of the pandemic emergency, was there a buyer figure with competences in the purchase of medical materials? *

Choose only one

Yes

No

26. Did your Institution receive any donations from third parties (partnered universities, companies, or privates)? *

Choose only one

Yes

No

Skip to question 28

27. Regarding international purchases and/or donations, were there logistics issues related to the receipt of these goods/donations? *

Choose only one

Yes

No

The Institution did not make/receive international purchases/donations

Questions related to digitalization and smart working within the procurement office

28. Is there an office entirely dedicated to procurement activities in the central administration? *

Choose only one

Yes

No

Other: _____

29. For what concerns the phases of the purchasing process and procurement office activities, please indicate which are supported by digital solutions (i.e., software for managing of a specific phase of the process) (with respect to 2019): *

Choose only one item in each row

| | Si | No | Phase not executed by the procurement office |
|--|-----------------------|-----------------------|--|
| Analysis of needs | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Definition of specifics and functionalities | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Selection of procedures | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Research of suppliers | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Definition of tender specifications | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Management of the tendering phase | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Analysis of procurement process performances | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Administrative management of contracts | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Operating management of contracts | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

30. For what concerns the phases cited above, which were digitalized during to the COVID-19 emergency? *

Choose all the applicable items

- Analysis of needs
 Definition of specifics and functionalities
 Selection of procedures
 Research of suppliers
 Definition of tender specifications
 Management of the tendering phase
 Analysis of procurement process performances
 Administrative management of contracts
 Operating management of contracts
 None of the Above
 Others:

31. Did employees in the Institution experience smart working modality before the COVID-19 emergency? *

Choose only one

Yes

No

32. For what concerns the phases of the purchasing process and procurement office activities, during the national lockdown (March to April 2020), which were the most critical activities that allowed the correct functioning of the activities of your Institution? *

Choose all the applicable items

Analysis of needs

Definition of specifics and functionalities

Selection of procedures

Research of suppliers

Definition of tender specifications

Management of the tendering phase

Analysis of procurement process performances

Administrative management of contracts

Operating management of contracts

None of the Above

Others:

33. Within the central procurement office, are there one or more buyer figures with knowledge of the English language? *

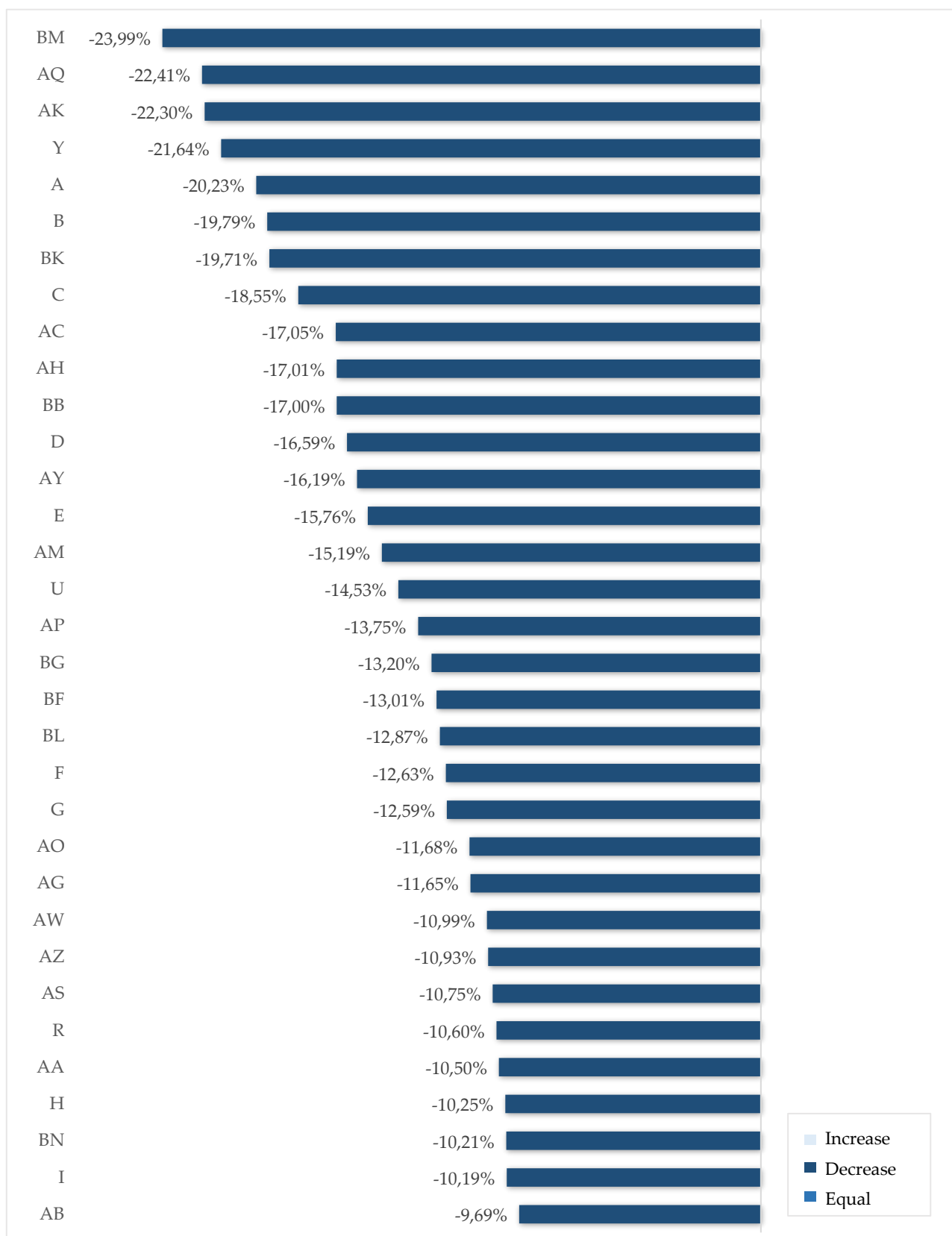
Choose only one

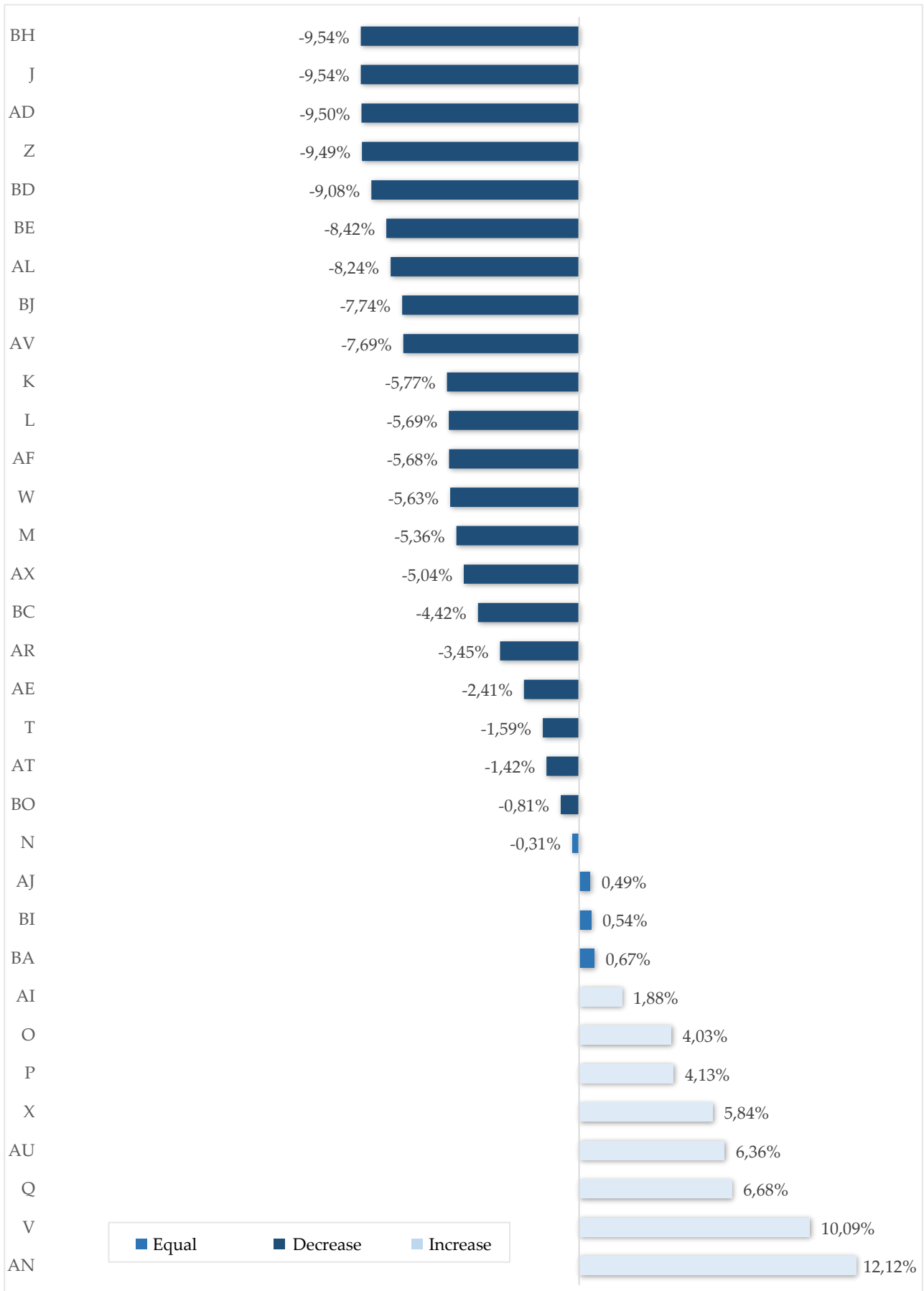
Yes

No

B Appendix B

Variation of total costs of Public Universities, from 2019 to 2020





C Appendix C

Impact of COVID-related costs on the total for Public Universities, 2020

