Toward the strengthening of enabling technologies in Italy: results of the second survey on procurement 4.0[1]

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Abstract

Purpose of the paper: *This paper presents the results of the second survey on Procurement 4.0 in Italy, focusing on the skills needed for digital transformation.*

Methodology*: The study is conducted through an online questionnaire (CAWI), transmitted by ADACI via email to its members. The results are presented in a comparative format relative to the first survey developed in 2018.*

Results*: The survey suggests that enabling technologies have evolved, at least in the larger companies, from an infancy phase to a real introduction phase with greater involvement of the procurement function, called to act as a gateway for innovation.*

Limitations*: Our second survey has a low participation, though higher than the first. As with the COVID-19 pandemic, the role of enabling technologies in ensuring business continuity has been pushed to the fore, we hope that the third wave of the survey will involve more enterprises.*

Practical implications: *This study provides useful information to researchers, policymakers, and practitioners also suggesting the most appropriate skills to invest in. The findings indicate a strong need for a new training paradigm toward a new integrated mindset.*

Originality of the paper: *The surveys carried out in the framework of this research project are the first to be developed in Italy on Procurement 4.0. The results contribute to illuminating a phenomenon that remains underexplored. Through a university-business partnership, the study can feed decision-making processes at different levels to support the digital transformation of the Italian economic system.*

Key words: enabling technologies; digital transformation; industry 4.0; procurement 4.0; skills; Italy

1. Introduction

The impact of enabling technologies on enterprises and economic systems has been at the forefront of the scientific and institutional debate for almost a decade. The challenge is to promote the establishment of

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hybrid integrated networks (Porter and Heppelmann, 2014) in which the physical and virtual components and know-how of the various players in the supply chain are interconnected and integrated, producing synergistic effects.

The technologies of the Fourth Industrial Revolution seem to be destined to profoundly transform the production paradigms and the methods of managing relations between economic actors. Enabling technologies increase the visibility and transparency of operations and the supply chain through real-time sharing of data, information, and know-how. This will open up the space for an increase in the decentralization of decision-making, which is destined to profoundly transform the humans' role in economic processes and the productive and organizational paradigms that have thus far supported economic development. The transfer of routine and tiring tasks from the humans to the machines that had already began with the Third Industrial Revolution will be strengthened; new abilities of the machines to generate new knowledge autonomously are added by the so-called artificial intelligence. This will allow workers to devote themselves to the more creative and strategic parts of decision-making processes, through which they maintain control of the production systems (Ji *et al.*, 2019).

All business functions are involved in this transformation because with enabling technologies the competitive advantage will strongly depend on the enterprises' ability to manage the processes that cross their functions and their supply chains. Therefore, a holistic approach to supply chain management is needed to acquire and maintain a competitive advantage through enabling technologies.

The procurement function plays a central role in this predominantly cultural transformation as it is called upon to support not only the enterprise but all the enterprises of the supply chain, particularly the suppliers, in the adoption of these technologies. In a Cloud manufacturing context, such as that of the Fourth Industrial Revolution, the procurement function represents a fundamental decision-making centre in which critical information regarding suppliers and supplies is concentrated.

Procurement practitioners need an upskilling process to meet this challenge. New technologies increase the data and information available for decisions, and procurement practitioners need a toolbox to manage them properly (Hughes and Ertel, 2016).

In light of this, the present study aims to contribute to the advancement of this process by supporting policymakers and practitioners in promoting the dissemination of enabling technologies. The study presents the results of the second edition of the first Italian Survey on Procurement 4.0, launched in 2018 in partnership with the University of Genoa and ADACI.

The issue must be addressed urgently as several studies highlight Italy's widening gap with respect to the adoption of enabling technologies compared to other countries, resulting in considerable damage to the competitiveness of the Italian economic system (Probst *et al.*, 2018). Despite the process of adopting enabling technologies having begun, substantial gap is being created in Italy between large enterprises which are catching up, and small-medium enterprises that face various barriers,

such as insufficient capital for the initial investment and inadequate skills. The lack of skills is one of the most important reasons for this gap between large and the small- and medium- sized companies, for which it is also difficult to ascertain the necessary skills to invest in (La Repubblica, 2019; Ambrosetti, 2017). Finally, even if the procurement function plays a central role in the adoption of these technologies, it is not involved in this process in Italy (Zheng *et al.*, 2020).

This study aims to fill these gaps through a descriptive survey of Italian enterprises. We propose the following research questions to understand the diffusion of enabling technologies in Italy in general and in the procurement function, as well as to identify the top skills required for the procurement practitioners require to face changes and challenges in Industry 4.0:

RQ1. What is the adoption level of enabling technologies?

RQ2. What are the main characteristics of the enterprises that adopt enabling technologies (Adopters)?

RQ3. What is the engagement of the procurement function in the adoption of enabling technologies?

RQ4. Which are the skills most required for the procurement function for the digital revolution?

This paper is divided into the following sections. Section 2 describes the diffusion of enabling technologies in Italy, current literature on Procurement 4.0, and procurement skills in digital transformation. Section 3 describes the research methodology with a focus on the research sample. Section 4 presents the main results of the survey, focusing on the Adopters and the skills needed. These results are presented in a comparative format with respect to the analysis conducted in 2018. Section 5 discusses the main results of this study. In Section 6, the managerial implications of the results are discussed, and some conclusions for future research are presented.

2. Background and Literature Review

2.1 Background: The Digital Transformation in Italy

The rapid evolution of new digital or enabling technologies is transforming the production processes of enterprises and the entire industrial system. They are defined as technologies with a high R&D component, rapid innovation cycles, high capital intensity, and highly skilled labor. They enable the innovation of processes, goods, and services in many productive sectors by integrating processes along the entire supply chain (European Commission, 2009).

If adopted correctly, enabling technologies can lead to several benefits, such as greater flexibility and velocity of production and greater integration between processes along the supply chain. Furthermore, the reduction of machinery set-up times and errors increases productivity levels, while the presence of sophisticated sensors that control the production in real-time guarantees high quality (MiSE, 2016).

The COVID-19 pandemic has highlighted the importance of adopting enabling technologies to address supply chain disruptions in a more flexible and resilient way (Deloitte, 2020). During the COVID-19 pandemic, enterprises that adopted enabling technologies were able to react to this external shock: intelligent machinery enabled the quick conversion of production and ensured business continuity; robotics enabled many actions to be carried out automatically or remotely in many fields other than production and logistics, IoT solutions enabled collaborative operations and remote control, 3D printing enabled the quick production of parts that the disrupted supply chain could not provide; and augmented reality systems enabled the real-time use of expertise anywhere to support on-site staff. The pandemic has thus initiated a lively debate on promoting the adoption of enabling technologies which require significant investments by enterprises in a time of crisis (Industria Italiana, 2020a).

In Italy, this phenomenon is still in its infancy. According to a sample survey conducted by the Ministry of Economic Development on 23,700 enterprises between October 2017 and February 2018, 8.4% of respondents use at least one of the Industry 4.0 technologies, 4.7% have planned to invest in the next three years, and 86.9% do not intend to adopt enabling technologies in the near future (MiSE, 2018). Additionally, a study by the University of Padua investigating the presence, impacts, and results of the adoption of Industry 4.0 technologies in Italian SMEs finds that only 18.6% of the 7,293 sample companies declared they had adopted enabling technologies (University of Padua, 2018).

Another survey presented by Cassa Depositi e Prestiti identifies a cluster of "dynamic 4.0 enterprises," representing 11.8% of the 24,000 enterprises analyzed (CDP, 2018). A study by Ernst & Young to assess the digitization of the Italian companies reveals that only 14% of the 150 sample companies have reached an advanced level of digitalization and interconnection, about half (49%) are in the introduction phase and 37% are in the experimental phase. Among those who have already adopted the new technologies, 5% have a structured and automated system for integrating data with suppliers and customers (La Repubblica, 2019).

Compared to the other countries in Europe, the situation in Italy remains immature. The Digital Transformation Scoreboard 2018 evaluates the degree of digital transformation of a country through two pillars and seven dimensions:

- Output pillar: Integration of digital technologies and changes in the start-up environment;
- Enabler pillar: Digital infrastructure, investments and access to finance, supply and demand of digital skills, e-leadership, and entrepreneurial culture;

Two indexes are calculated to measure the output pillar: the Digital Technology Innovation Index (DTII) and the ICT Start-up evolution Index. The Digital Transformation Enablers' Index (DTEI) is calculated to measure the enabler pillar. For DTII and DTEI, Italy scores under the EU averages. Considering the Enabler pillar Italy's score is above the EU average (2%) in just one dimension: investments and access to finance (Probst *et al.*, 2018).

The low maturity stage of the Industry 4.0 Revolution in the context of Italian manufacturing emerges also when considering the results of a descriptive survey conducted in 2017 on 103 manufacturing enterprises of different sizes. According to this survey, 54% of the respondents have adopted one technology, 30% two technologies, 12% three technologies, and 4% more than four technologies (Zheng *et al.*, 2020).

Despite these constraints, enabling technologies have been growing in Italy. According to the 2020 survey of the Industry 4.0 Observatory of the Politecnico of Milan, investments in enabling technologies have increased; in 2019, Industry 4.0 grew by 22% compared to the previous year, reaching 3.9 billion Euros. IoT, Cloud, and supply chain analytics are the technologies that have grown the most (Industria Italiana, 2020b).

Italy is also characterized by a gap between large and small and medium-sized enterprises. This is evident considering the aforementioned MiSE Report (2018), which highlights a positive correlation between propensity toward these technologies and enterprise size. The Ernst & Young study highlights that 70% of the large companies have a 4.0-development plan and have introduced enabling technologies, while SMEs are characterized by a greater weakness (La Repubblica, 2019).

Also according to Zheng *et al.* (2020), the utilization level of enabling technologies depends on the company size. The majority of SMEs in the sample have no projects related to new technologies, while more than half of large and very large companies have adopted at least one technology.

One reason for the Italian delay, which could further widen this gap, lies in the lack of adequate skills. The literature shows that enabling technologies lead to a recomposition of the workforce, increasing the demand for highly skilled workers. Moreover, enabling technologies require the labor force to develop soft skills, such as flexibility, autonomy and responsibility, openness to change, and openness to continuous interdisciplinary learning (Stanton Chase, 2017; Brettel *et al.*, 2014).

In the report "Italia 4.0: are we ready?" (2018), Deloitte stresses the significant gap in Italy with respect to workforce skills compared to other countries. Moreover Ernst and Young's report indicates that it is difficult for enterprises to find and ensure the updating of the skills required for the development of Industry 4.0 (La Repubblica, 2019). Similarly, Ambrosetti's study with SAP (2017) highlights investment in skills as being a priority to meet the challenges posed by digital transformation. It is not only about investing in digital skills, but also in soft skills, such as autonomy, responsibility, problem-solving, creativity, and critical thinking. Thus, investment in skills is a driving force for a broader cultural transformation.

2.2 The Role of Procurement in the Digital Transformation: Procurement 4.0

Although there is abundant literature on the impact of enabling technologies on the management of enterprises and the supply chain, few studies have considered the impact of these technologies on single business functions (Chandrasekara, Vidanagamachchi, and Wickramarachchi, 2020). This is a central theme for the effective and efficient introduction of new technologies into enterprises. Enabling technologies are destined

to impact the operativity of all the business functions and how they relate with the other actors in the supply chain (Bruzzi *et al.*, 2019).

Among the various functions, procurement has received little attention (Kleman, 2016; Bienhaus and Haddudd, 2018; Chandrasekara *et al.*, 2020). In Italy, as highlighted by Zheng *et al.* (2020), the procurement function does not appear involved in enabling technologies to the extent of other business functions such as R&D, production, IT, and direction.

The literature evidences that enabling technologies valorize the role of procurement in the construction and operation of new interconnected and automated supply chain ecosystems (Bienhaus and Haddudd, 2018).

First, procurement contributes to the choice and acquisition of new technologies and the selection of suppliers in a position to guarantee the interconnectivity of activities along the supply chain (Kleemann and Glas, 2017). Moreover, through the application of the enabling technologies, procurement contributes to make more efficient, faster, more flexible, and more transparent all the processes with regard to the enterprise and the entire supply chain (Chandrasekara *et al.*, 2020). Digital technologies can change the way purchases are conducted. The availability of data and information in real-time allowed by enabling technologies such as IoT, artificial intelligence, and Big Data, for example, can improve the effectiveness of market analysis, supplier evaluation, make-or-buy decisions, and inventory management and can improve predictability and thus make the processes of purchasing goods and services more efficient. Moreover, these technologies increase the visibility of processes, illuminate the different stages of the supply chain, and allow procurement functions to intervene in real-time where necessary (Rejeb *et al.*, 2019; Wang *et al.*, 2019; Killpatrick and Barter, 2020). Procurement can assume the role of enabler of a dynamic cooperation between all the actors of the supply chain (Glas and Kleemann, 2016). The literature highlights how the supplier-buyer relationship changes profoundly with enabling technologies. Digital solutions overcome the traditional one-to-one communication between buyers and suppliers in favor of many-to-many communication (Schmock *et al.*, 2007). In digital platforms powered by different enabling technologies, information and data are concentrated, shared, and managed transparently in real-time by all the actors of the integrated supply chain ecosystem (Bienhaus and Haddud, 2018). Procurement has to be adequately equipped to carry out digital transformation to meet the challenges of enabling technologies and to contribute to their effective adoption. Therefore, the issue of skills is vital for the procurement function. Digital innovation disrupts procurement skills, opening new opportunities to rethink value propositions, and optimizing the end-to-end supply chain (Geissbauer *et al.*, 2016).

2.3 Literature Review on Procurement Skills

The skills of the procurement function have not been sufficiently investigated, especially in light of the digital transformation.

The literature dealing with the evolution of the procurement practitioners' skills remains limited, despite its acknowledgment that

procurement within organizations has developed from a tactical to a more strategic role (Giunipero and Pearcy, 2000). Changes have influenced this shift in the economic environment, both from the supply and demand sides, which are strongly interconnected.

Even if the procurement role varies depending on the sector, country, and cultural contexts of the organization, the literature unanimously acknowledges that facing such a dynamic environment requires procurement practitioners to update their traditional skills (Paulraj *et al.*, 2006).

Within the limited literature dealing with this topic, Bals *et al.* (2019) develop a systematic review on procurement and supply management (PSM) competencies. They reviewed 30 articles published during 1987-2017, among which the study proposed by Tassabehji and Moorehouse (2008) stands out (Bals *et al.*, 2019). Tassabehji and Moorehouse (2008) introduce a new taxonomy of procurement skills to consolidate different taxonomies and nomenclatures into a set of five skill categories: technical, interpersonal, internal and external enterprise, and strategic business.

Technical skills, or procurement-specific skills, are basic skills that Tassabehji and Moorehouse consider necessary for the 21st century procurement professional, and they include product knowledge, computer literacy, total quality management, and government legislation.

According to the authors, the other skills are managerial skills that are beneficial for procurement and other functions. Interpersonal skills concern interaction with people in the team and on an individual level, such as conflict resolution, leadership, group dynamics, negotiation and persuasion, and communication. Internal and external enterprise skills concern relations and interactions among organizational functions within the organization and among supply chain actors and stakeholders, respectively. Finally, strategic business skills include procurement skills such as planning, strategic alliances with suppliers, and risk management that can impact the economic value of the organization (Tassabehji and Moorehouse, 2008).

According to this conceptual framework, analyzing 46 qualitative data interviews from 16 companies, Bals *et al.* (2019) identify a list of 65 competencies that are considered currently necessary by procurement professionals and a list of 56 competencies necessary for the future. Through a ranking of competencies, the authors produce a top-10 list of current and future competencies, revealing that the concern for digital and sustainability skills is growing to the detriment of traditional skills such as negotiation, communication, and basic procurement knowledge.

Bals *et al.* (2019) confirm and update the list of skills by Tassabehji and Moorehouse. More specifically, they reveal 17 new skills: four are related to digitization and innovation (automation, Big Data analytics, innovative sourcing, and innovative sourcing approach) that the authors place in the technical skills category, three skills concern the strategic business category: critical thinking, holistic supply chain thinking, and sustainability; and 10 concern interpersonal aspects: curiosity, dealing with ambiguity, humility, mobility, openness, passion, resilience, self-confidence, self-reflection, and self-reliance (Bals *et al.*, 2019).

These studies highlight the growing importance of digital issues for procurement practitioners and the evolution of soft skills, reflecting the emergence of new and more complex needs.

In addition, consultancy firms have highlighted the topic of skills, publishing various reports focused on procurement skills in the digital era. The Deloitte Global Chief Procurement Officer Survey 2019 identifies a crucial issue for Chief Procurement Officers (CPOs) in the ever-increasing complexity that procurement leaders have to contend with: the skills gap of procurement teams and the urgency to recruit new team members with adequate levels of technical, analytical, and professional competencies to address the complexity of this environment. The survey reveals that 54% of respondents were not confident in the ability of their teams to deliver the procurement strategy (against 51% in 2018)[2].

The survey focuses on the urgency of closing this gap, working on three main training areas: technical, digital, and soft skills. Regarding technical skills, according to the results of the report, the top training areas are strategic sourcing/category management, negotiations, project management, evaluations, ethical sourcing, and auctions. The most important soft training areas are business partnering or relationship management, effective management, conflict management, emotional intelligence, and self-awareness. Finally, regarding digital skills, the top training areas are data visualization, predictive analytics, RPA development, artificial intelligence, blockchain, and IoT.

In the face of a strong need for new skills, not limited to the digital area, the procurement function risks not being equipped to support the process of adopting digital technologies. The literature lacks an adequate reflection on this issue in Italy. The survey aims precisely at filling this gap.

3. Research Methodology

3.1 Research Design

The descriptive survey research design has been adopted to provide up-to-date insights into the knowledge and utilization levels of enabling technologies especially for procurement in Italy and contribute to the understanding of skills to be developed to support Procurement 4.0. Accordingly, an online survey was developed, based on a questionnaire (CAWI detection technique - Computer Assisted Web Interviewing), with multiple-choice, numerical, and open-ended questions.

The structure of the questionnaire was based on a survey conducted in 2018 and an in-depth analysis of the national and international literature on skills for Procurement 4.0 for digital transformation (Delesalle and Van Wesemael, 2019; Flynn and Brown, 2020; Tassabehji and Moorehouse, 2008; Bals *et al.*, 2019; Ambrosetti, 2017; University of Padua, 2018).

According to the research objectives, the questionnaire was structured

[2] The results are based on a survey developed with the participation of 481 procurement leaders from 38 countries, representing organizations with a combined annual turnover of US$5 trillion (Deloitte, 2019).

in three sections: the first section, as in the previous survey, focuses on the degree of development and performance of the procurement processes of the respondents; the second section focuses on the issue of skills, to understand the skills required to face the current challenges. We identified 28 critical skills based on the literature, divided into three training areas (Delesalle and Van Wesemael, 2019): technical and technological skills, digital skills, and relational or soft skills. We believe this tripartition is effective, as it can enhance digital skills, which are the focus of our research. Digital skills have a multipurpose and multifunctional nature. Therefore, they must be kept separate from the procurement's technical and technological skills. Additionally, these surveys, which take place during a period of great transformation, aim to raise the enterprises' awareness of specific topics. Since our goal is to promote the dissemination of enabling technologies in the procurement area, it was considered more appropriate to emphasize digital skills.

The questionnaire was tested by procurement practitioners to verify its clarity and consistency with the research objectives. Then, the questionnaire was sent to the Italian Association of Procurement and Supply Management (ADACI) members by email (about a thousand contacts).

The survey was conducted in January 2020 and received 64 responses, of which 57 complete. Our sample mainly comprises respondents with major responsibilities in procurement (72%); 41% of respondents are Chief Officers. This is consistent with the aim of the survey of increasing the commitment of procurement practitioners and executives to the challenges of the digital revolution.

3.2 Empirical Research: The Research Sample

Our sample consists of 64 Italian companies, mainly located in Northern Italy (87%), with a prevalence from Lombardy (26%), Emilia-Romagna (19%), and Veneto (17%). Together, these regions represent 62% of the respondents.

More than half of the companies belong to four sectors: 23% of the respondents work in the manufacturing sector, 14% in the mechanical sector, 9% in food and beverages, and 8% in consulting. Therefore, the industry is more prevalent (85%) than the tertiary (7%) and advanced tertiary sectors (8%).

Over half of the sample consists of large companies: 56% of the respondents have revenues equal to or greater than € 50 million, and 51% have employees equal to or greater than 250 units. Medium-sized companies account for 30% in terms of revenues (revenues between € 10 and 50 million) and 36% in terms of employees (between 50 and 249 employees). Therefore, the data collected in this survey confirms the participation of several medium-large companies, as in the 2018 survey (Bruzzi *et al.*, 2019).

Regarding procurement, companies have many suppliers: 31% have more than 500 suppliers, while 59% have between 51 and 500 suppliers. The supplier base is international: if 100% of respondents have suppliers in Italy, 55% have suppliers in Asia, 53% in Europe, 23% in North America,

and 13% in Central-South America. The purchases to revenue ratio are high: 51% have a ratio over 51% (in 9% of the cases, the ratio is over 70%).

Regarding the procurement processes, for 69% of the respondents they are very formalized (levels 4 and 5 on a Likert scale from 1 = not at all to 5 = completely), and for 47%, these processes are automated (> 50%).

In addition, the degree of satisfaction with the performance level of the procurement processes is high: 86% have expressed a positive opinion (on a Likert scale from 1 = not at all satisfied to 5 = completely satisfied). More precisely, 42% are satisfied (level 3 scale Likert), 39% are very satisfied (level 4 Likert scale) and 5% are completely satisfied (level 5 Likert scale).

Regarding the attitude of the responding enterprises toward enabling technologies, as in the last survey, there is a strong sentiment to this issue, with the statement "Enabling technologies represent a radical innovation that will transform the way of doing business" reaching an average value of 3.96 on a Likert scale from 1 (I totally disagree) to 5 (I totally agree). Furthermore, the degree of awareness of the companies and the procurement function regarding the impact of these technologies is respectively 3.18 and 3.14. However, as in the previous survey, the awareness regarding the role that the procurement function can take on in this digital transformation is lower.

Tab. 1: Sentiment towards the challenges driven by enabling technologies

	Survey 2020	Survey 2018
Enabling technologies represent a radical innovation that will transform the way of doing business	3.96	3.93
In my company there is awareness of the impact that these technologies can have on the way of doing business	3.18	3.05
In my company there is awareness of the role that the Procurement Function can play in the introduction/implementation of enabling technologies	2.58	2.61
In my Procurement Function there is awareness of the impact that these technologies may have on its management/activity	3.14	3

Source: own elaboration

According to the respondents, the introduction of enabling technologies will lead to profound changes in the procurement function. In particular, 70% of the respondents believe that the introduction of enabling technologies will allow more time for different activities such as strategic planning and the scouting of new suppliers. Moreover, the procurement function will become fundamental in the management of the supply chain and the innovation of processes and products (60%); only 2% believe that the enabling technologies will not impact the operations of this function.

This sentiment is also explained by the fact that the sample is primarily composed of enterprises that have adopted or are in the process of adopting enabling technologies or are willing to do so. In fact, 42% of the respondents have already begun their implementation; of these, 17% have already completed the implementation process, 44% are interested

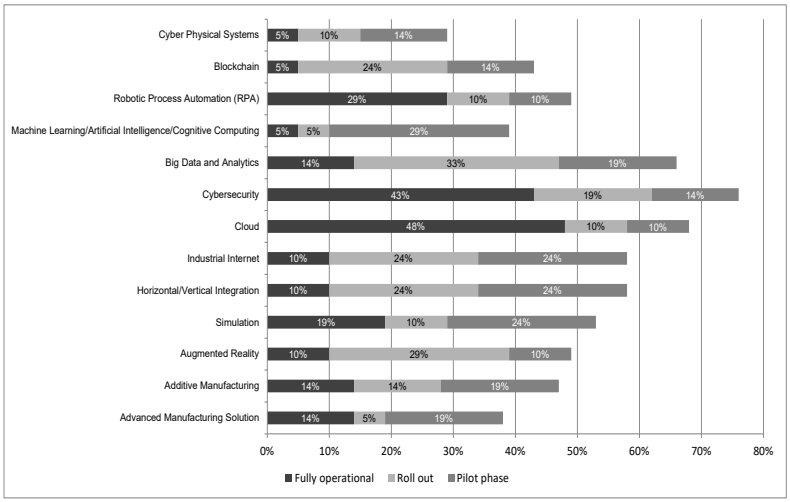
in doing so (of these, 21% are interested and are evaluating the feasibility); 14% do not intend to introduce them in the near future. According to these results, as in the previous study, the sample was divided into three clusters: the Adopters, who are adopting or have already adopted the enabling technologies, the Interested, who are evaluating to introduce them, and the Non-Adopters, who do not plan to make investments in enabling technologies in the near future (Bruzzi *et al.*, 2019).

Compared to the 2018 survey, the percentage of Adopter enterprises increased from 36% to 42% as the percentage of Non-Adopter enterprises, to the detriment of the Interested enterprises. From the research perspective, the participation of Not Non-Adopter enterprises is considered particularly important, first because this study aims to raise the companies' awareness and second as it also aims to understand the reasons behind not-adoption and the needs of these enterprises.

Despite a higher percentage of Non-Adopters, as in the previous survey, the sample is composed of a very high percentage of Adopter and Interested companies (86%). The high percentage of enterprises active in digital transformation makes the survey results particularly valuable because they refer to innovative enterprises that could drive other enterprises in their territory and their supply chains through their experience and good practices.

Regarding the technologies that the Adopters adopt, there is a greater variety, with the most widespread being cybersecurity (76%), Cloud (68%), Big Data and analytics (66%), followed by horizontal or vertical integration and industrial Internet (both 58%) compared to the previous survey, from which one dominant technology, Cloud (63%), emerged. Confirming the evidence that emerged in the first survey, Cloud is the enabling technology that has reached the most advanced level of development (48% of technology is fully used), followed by cybersecurity (43% fully used) and Robot Process Automation (RPA) (29% fully used).

Fig. 1: The most adopted enabling technologies



Source: own elaboration

Among Adopters, 71% have also initiated the process for at least three years, while in the 2018 survey, 62.5% of the respondents started the process the previous year.

In the following paragraphs, the analysis focuses on the main results of the survey, focusing first on the Adopters, to understand if a dominant business model 4.0 is under definition, and then on the skills, to understand the most important ones required to face emerging challenges from the digital transformation.

4. Results

4.1 The Italian Adopters

Adopters are mainly large companies (71%) with an important supplier base (63% have more than 300 suppliers). The degree of internationalization of suppliers is higher than that of other companies: the Adopters have a percentage of non-Italian suppliers higher than the overall sample in Asia (58% vs. 51%), in the EU except Italy (58% vs. 53%), Central and South America (21% vs. 12%), and the Middle East (17% vs. 9%).

Regarding the performance of procurement processes, Adopters have more formalized (83% reach a level of at least 4 on a Likert scale from 1 to 5, against 60% of Interested and 38% of Non-Adopters) and automated processes (67% reach a level of automation of over 50%, against 36% of Interested and 13% of Non-Adopters). Similarly, the degree of satisfaction for the procurement processes' performance is higher for Adopters, with 59% of cases reaching a satisfaction level of at least 4 on a Likert scale from 1 to 5; of these, 13% are completely satisfied (level 5 of the Likert scale). Interested reaches level 4 in 48% of cases and Non-Adopters in 13%. None of the Interested and Non-Adopters achieve a satisfaction level of 5.

Regarding the attitude toward enabling technologies, Adopters represent the cluster that most believes that they constitute a radical innovation destined to transform the manner of doing business (48%) and where awareness of the opportunities they offer is greater (68%). Adopters also have a greater awareness with regard to facing the challenges posed by enabling technologies (63%).

The impact of enabling technologies is significant both at an intra-organizational and inter-organizational level. From the first point of view, the functions most involved in the enabling technologies are procurement (76%), operations (71%), supply chain (67%), and R&D (62%). At the inter-organizational level, enabling technologies impact the other actors of the supply chain and the individual company in 65% of the cases.

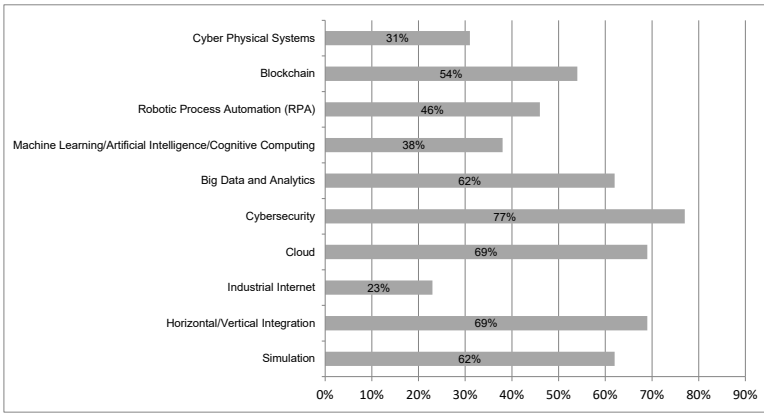
The supply chain plays a crucial role considering the impact. Among the respondents, 48% believe that enabling technologies will impact automation, efficiency, and information sharing at the company level, while at the supply chain level, 43% believe that these technologies will improve efficiency, 38% believe that they will favor greater sharing of information, 33% that they will make relationships safer, and 29% that they will allow improvements in digital integration and responsiveness processes.

From the perspective of the difficulties, the lack of personnel with adequate skills emerges, in addition to those related to compliance with deadlines already highlighted in the first survey, (both 48%). The lack of awareness about the cost or benefit ratio of these investments (43%), the internal resistance to change (33%), which is decreasing compared to the previous survey when it reached 63%, and the infrastructural inadequacy of the other enterprises in the supply chain are also important.

The commitment of the procurement function has increased considerably compared to the 2018 survey. The procurement function is involved from the planning phase in 25% of the cases (against 13% in the 2018 survey) and from the choice of suppliers in 40% of the cases (compared to 31% in the 2018 survey). In 2018, its main task was the evaluation of offers (38% of the respondents). From the perspective of the contribution that the procurement function can make to the purchase and the implementation of enabling technologies, the respondents confirm what was already highlighted in the previous survey: in 70% of cases, they believe that the procurement function can contribute to the risk mitigation and the choice of the most appropriate suppliers; 60% think that it can contribute to managing complex contracts.

Of the respondents, 70% have adopted or are adopting enabling technologies for procurement while 45% initiated the adoption process for over three years. In the case of enabling technologies for procurement, there is a greater variety of enabling technologies adopted than in 2018, when the Cloud, with 64% of the responses, was the dominant technology. In the recent survey, the most adopted or in the process of being adopted enabling technologies are cybersecurity (77% of the respondents), Cloud and horizontal or vertical integration (69%), Big Data and analytics, and simulation (both 62%). Blockchain is also important, which is highlighted by 54% of the respondents.

Fig. 2: Enabling technologies adopted for Procurement



Source: own elaboration

Regarding the objectives pursued, 85% of respondents stated that they aim to simplify internal processes and procedures, 77% want to make business processes and the supply chain more efficient, 54% want to

improve the quality of work, 46% consider enabling technologies consistent with the propensity for innovation and that it aims to reduce costs.

Finally, considering the degree of Adopters' satisfaction with respect to their investments, significant growth is registered compared to the 2018 survey: Levels 3, 4, and 5 of the Likert scale from 1 to 5 are reached in 95% of cases when enabling technologies, in general, are considered (compared to 69% in the 2018 survey). In the case of enabling technologies for procurement, the satisfaction level greater than or equal to 3 is reached in 92% of cases (against 72% in the 2018 survey); 8% are completely satisfied.

4.2 Focus on Skills

Our study confirms the urgency of investing in skills, which has been already highlighted by debate and literature; among the difficulties encountered, the Adopters highlight the lack of human resources with adequate skills.

We investigated the awareness of the great changes that characterize the competitive scenario to address this issue. Accordingly, we focused on risk perception to understand which types of risk are considered the most important and whether companies are confident and prepared to face them. Second, we sought to identify the current priorities of the procurement function. Finally, we focused on the skills, classified into three training areas, to be developed to face the current digital transformation.

Our study registered a high level of awareness: 74% of the respondents believe that the level of risk has increased, with 30% of the opinion that it has increased significantly; 20% believe it remains unchanged, and 6% believe that it has decreased. It emerges that Non-Adopters have a higher perception of risk, with 88% of the opinion that the risk of the procurement function has increased to some extent or significantly, against 71% of Adopters and 68% of Interested respondents.

Regarding the types of risk, those associated with the supply chain (75%) and with suppliers (68.8%) are the most frequently quoted; price volatility (65.6%) and financial risks (64.1%) follow.

Tab. 2: The top risks to be managed (January 2020)

	Adopters	Interested	Non-Adopters	Total
Supply chain risks	58%	76%	100%	75,0%
Suppliers risks	67%	68%	88%	68,8%
Price volatility	58%	72%	63%	65,6%
Financial Risks	71%	56%	63%	64,1%
Legislative changes	29%	36%	25%	31,3%
Tariff policies	33%	28%	0%	28,1%
Cyber Risks	21%	32%	25%	26,6%
Political instability	33%	24%	13%	25,0%
Foreign exchange risk	29%	16%	0%	21,9%
Natural Risks	4%	20%	0%	10,9%
Environmental risks	0%	0%	0%	1,6%

Source: own elaboration

Some differences emerged between the three clusters. Specifically, 100% of Non-Adopters consider supply-chain-related risks a priority, compared to 58% of Adopters and 76% of Interested respondents. Additionally, some risks related to the external environment appear more important for Adopters than for Non-Adopters, such as political instability (33% vs. 13%), risks related to tariff policies (33% vs. 0%), foreign exchange risk (29% vs. 0%), and natural risks (4% vs. 0%).

Cyber risks are considered a priority by only 27% of the respondents. In this regard, it should be noted that 66% of the respondents have already adopted measures to address cyber risks or are in the process of doing so. Of these, 50% have adopted enabling technologies or are introducing them. Therefore, the adoption of measures to address cyber risks appears to be related to the adoption of enabling technologies.

With regard to these risks, 59% of the respondents have expressed their readiness at managing and mitigating them. Among the clusters 79% of Adopters declared themselves ready; the percentage drops to 50% and 38% for the Interested and Non-Adopters, respectively.

Regarding priorities of the procurement function, the respondents highlight the scouting and assessment of suppliers (64%), followed by the traditional savings (58%) and risk management and mitigation (56%). Enhancing skills is also a priority for the respondents. In particular, the enhancement of technical and technological skills is important to 47% of the respondents; 42% give importance to the enhancement of relational skills, while less importance is given to interventions to enhance digital skills, a priority for 33%.

The picture that emerges from the responses concerning the individual skills identified in our study (Fig. 3) highlight a discrepancy in the importance given to the three training areas and that assigned to the individual skills, which requires more thorough analysis.

Fig. 3: The focus on three training areas and 28 skills

Technical & Technological skills	Digital skills	Soft skills
• Risk management • Evaluation of suppliers and supplies • Project management • Global sourcing • Quality management • Technology management • Tenders • Quality assurance • Ethical purchasing • Management of contracts and legal aspects • Emergency management	• **Data analytics and visualization** • **Systems integration** • **Cybersecurity** • **Blockchain** • **Predictive Analytics** • **RPA Systems**	• **Business partnering/relationship management** • **Negotiation skills** • **Conflict management** • **Problem solving** • **Effective management&Leadership** • **Stress tolerance** • **Systems thinking** • **Emotional intelligence** • **Multicultural orientation** • **Self-awareness** • **Creativity**

Source: own elaboration

The most cited skill is predictive analyses, the priority for 84% of the respondents, followed by a soft or relational skill, business partnering or relationship management (75%), and another digital skill, data analytics

and visualization (74%). In fourth place are the technical skills of risk management, and soft skills relating to conflict management and digital systems integration, which are prioritized by 65% of the respondents. These are followed by the evaluation of suppliers and supplies (56%), problem-solving (54%), effective management or leadership (53%), project management (51%), and global sourcing (49%).

Regarding the three clusters, our study highlights the different training needs and interests of Adopters, Interested, and Non-Adopters. In particular, training needs are most expressed by Non-Adopters, with higher demand for many digital and soft skills than the rest of the sample: predictive analysis (100% vs. 84%), systems integration (75% vs. 65%), business partnering/relationship management (100% vs. 75%), conflict management (75% vs. 65%), problem-solving (88% vs. 54%), effective management and leadership (75% vs. 53%), global sourcing (63% vs. 49%), and contract management (64% vs. 46%).

Adopters demonstrate the lowest training needs. The only skills for which Adopters register in significantly higher percentages are stress tolerance, a soft skill that Non-Adopters record the lowest value for (54% vs. 46%), the technical skill of management of contracts and legal aspects (58% vs. 46%), and digital skills related to the blockchain (50% vs. 40%).

In an intermediate position, the Interested cluster exhibits a higher interest in digital skills than the sample except with regard to blockchain (32% vs. 40%). This group also exhibits a higher interest in the relational skills of business partnering/relationship management (84 % vs. 75%) and conflict management (72% vs. 65%). With reference to technical skills, risk management records higher values (72% vs. 65%), while management of contracts and legal aspects registers a significantly lower value (28% vs. 46%) in this cluster.

Tab. 4: The Top 15 Skills

Competences	Adopters	Interested	Non-Adopters	Total
Predictive analytics	75%	88%	100%	84%
Business partnering/relationship management	58%	84%	100%	75%
Data analytics and visualization	75%	76%	63%	74%
Risk management	58%	72%	63%	65%
Systems integration	54%	72%	75%	65%
Conflict management	54%	72%	75%	65%
Evaluation of suppliers and supplies	58%	56%	50%	56%
Problem solving	50%	48%	88%	54%
Effective management & Leadership	42%	56%	75%	53%
Project management	46%	56%	50%	51%
Global sourcing	42%	52%	63%	49%
Cybersecurity	42%	56%	38%	47%
Management of contracts and legal aspects	58%	28%	63%	46%
Stress tolerance	54%	48%	13%	46%
Blockchain	50%	32%	38%	40%

Technical and technological skills

Soft skills

Digital skills

Source: own elaboration

5. Discussion

The results of our survey enable us to respond to our research questions. Regarding the demand related to the dissemination of enabling technologies (RQ1), the percentage of enterprises that have adopted or are willing to adopt enabling technologies is confirmed to be higher than in other studies on the Italian context (MiSE, 2018). In the 2018 survey, the sample was composed of 36% of Adopters, while in the 2020 survey, this figure is 42%. Some responders have also concluded the adoption process. Considering the main characteristics of the enterprises that adopt enabling technologies (RQ2), Adopters are large enterprises and are very interested in enabling technologies, consistent with the results of research by Ernst & Young and Ambrosetti (La Repubblica, 2019; Ambrosetti, 2017). This seems to confirm that in Italy a gap is being created between large and small companies.

These results suggest that, compared to the 2018 survey, the digital maturity of Adopters is increasing, with Adopters involved in digital transformation over several years with various technologies. The number of technologies that are adopted or are being adopted is greater than in the first edition of the survey, where only Cloud was dominant.

Regarding the attitude toward enabling technologies, Adopters represent the cluster that most believes they are a radical innovation where transformation in the manner of conducting business is imminent (48%) and where awareness of the available opportunities is greater (68%). Adopters have greater self-confidence, being able to face challenges posed by enabling technologies (63%).

Additionally, the level of satisfaction for the adoption of enabling technologies has increased significantly, with 95% of the respondents expressing a level of satisfaction of at least 3 for enabling technologies in general (against 69% in 2018).

Regarding the engagement of the procurement function in the adoption of enabling technologies (RQ3), it appears to have a higher digital maturity compared to the 2018 survey. Procurement is more involved in the decision-making processes related to implementing these technologies and makes an important contribution to areas such as risk mitigation, the choice of the appropriate suppliers, and the management of complex contracts. Additionally, various enabling technologies adopted or under adoption emerge after the domination of Cloud in 2018, including cybersecurity, horizontal or vertical integration, Big Data and analytics, simulation, and blockchain.

Adopters show higher confidence in the procurement function's ability to cope with risks: the percentage of enterprises that declare themselves ready to manage and mitigate risks is higher than that recorded by the Deloitte 2019 CPO Survey (79% vs. 45%) (Delesalle and Van Wesemael, 2019). The results of our study suggest the existence of a positive correlation between performances of the procurement function, for example, regarding formalization and automation of processes, and satisfaction with performance levels on the one hand and the adoption of enabling technologies on the other. This could be a research avenue in future.

The maturity and awareness of the respondents is clear, considering the most required skills for the procurement function to face the digital revolution (RQ4). Our results show that investing in new skills is a priority. The respondents' attention to digital skills confirms the validity of our choice to identify a specific training area for them.

However, notably, the respondents do not merely stress the importance of digital technologies, such as predictive analysis, cybersecurity, and data analytics, but also those of technical and technological skills, such as risk management, management of contracts, and the assessment of suppliers and supplies. Soft skills are also very important; business partnering or relationship management, conflict management, problem-solving, effective management, and leadership are at the forefront, followed by stress tolerance, systems thinking, and emotional intelligence. These skills record higher percentages than other more traditional ones, such as negotiation (chosen by 32% of the respondents), which remains among the top soft skills according to the Deloitte CPO Survey 2019.

Tab. 5: A comparison between the main results of the 2018 and 2020 surveys

	First Survey (2018)	Second Survey (2020)
Enabling technologies are being consolidated	None of the Adopters have completed the adoption process	17% of Adopters have completed the adoption process
The variety of enabling technologies adopted is increasing	The main enabling technology adopted is Cloud, followed by the Internet of Things, while the other technologies were adopted by less than a quarter of the sample.	The diffusion of some enabling technologies grows considerably compared to the previous survey, in particular, in addition to Cloud and IoT, Big Data, Cybersecurity, augmented reality and additive manufacturing are growing.
The degree of satisfaction is increasing	Levels of satisfaction 3, 4, and 5 of the Likert scale from 1 to 5 reach 69% in the case of the adoption of enabling technologies in general. In the case of enabling technologies for procurement, a satisfaction level greater than or equal to 3 reaches 72%, with none completely satisfied.	Levels of satisfaction 3, 4, and 5 of the Likert scale from 1 to 5 reach 95% in the case of the adoption of enabling technologies in general. In the case of enabling technologies for procurement, a satisfaction level greater than or equal to 3 reaches 92%, and 8% are completely satisfied.
Procurement involvement is strengthening	The procurement function is involved from the planning phase in 13% of cases. Its main task is the evaluation of offers (38% of respondents).	The procurement function is involved from the planning phase in 25% of cases and the involvement begins from the choice of suppliers in 40%.
Stable the characteristics of the Adopters	Adopters are generally larger and have a greater degree of internationalization, greater formalization and digitalization of procurement processes, and a higher level of satisfaction with the performance of the procurement function.	

Source: own elaboration

6. Conclusions

The results presented in this paper enrich the current insight available to decision-makers, primarily policymakers and practitioners, in a field that remains little explored in Italy.

The data suggest that enabling technologies are transitioning from an infancy phase to a real introduction phase in the largest companies, with much greater involvement of the procurement function.

Regarding managerial implications, our results encourage enterprises to prioritize their investment in enabling technologies, and strengthen the capabilities and tools of the procurement function that can act as the gatekeeper of the new infrastructural investments and an enabler of sound and integrated relationships with the other actors in the supply chain.

Moreover the study's results and discussion indicate there is a strong need for a new training paradigm toward a new integrated mindset. There is a need to strengthen skills in the three areas - technical, digital, and soft - in an integrated and transversal way to manage the risks that enterprises face today in a global and complex contest; this appears to be the *fil rouge* of answers provided by the respondents, who believe that investing in digital skills is not sufficient to meet the challenges of the future. Integration among the different training areas can be achieved through new training paradigms, enhancing the on-the-job experience and adopting a holistic view of economic relations. All the ecosystem players, primarily enterprises and universities, must take up the challenge and become active drivers of change.

Considering soft skills, the survey clearly highlights the need for a new mindset to fully exploit enabling technologies. Companies and experts need to reconsider the skills traditionally drawn on, as well as their relevance and validity. The basic skills, which by their nature today are a *conditio sine qua non* to join and grow in the business world, are complemented by those required by the new paradigms. Typical behavioral and relational areas such as leadership development, problem-solving, conflict management, and negotiation, as well as topics such as business partnering, systemic thinking, and management of complexity should be considered, which encompass areas broader than personal attitudes and related to business management. This "upgrade" of skills requires a very different approach from the one dealing with basic skills. A holistic approach that considers the enterprise as a whole is needed. If they decide to invest in new technologies, they must also invest in people and "re-focus" on the value of human capital. If the classical training paradigm for traditional skills - transfer skills to be "learned" - is sufficient in this new area, it pertains to the adoption of more engaging and riskier approaches capable of "transforming" the participants. In other words, experience-driven training would enable people to understand the true meaning of issues they address. This is challenging because prerequisites such as a high level of engagement and participation are required.

Another policy implication of our study concerns the skills gap between enterprises adopting and those that do not adopt enabling technologies. Policymakers should consider providing enterprises with incentives and

tools that enable Non-Adopters to overcome obstacles to fill this gap. Training initiatives that update skills could contribute to breaking down barriers to innovation.

Additionally, research can play a fundamental role in this cultural revolution. Therefore, we continue to investigate this subject in an attempt to strengthen our results. Similar to the first survey, the second remained characterized by low participation, even though higher. We hope to involve a greater number of companies in the third wave, including Non-Adopters. In this case, the study could increase its cultural impact and produce more robust results through a statistical inferential analysis.

The third survey will take place after the COVID-19 pandemic; this emergency has clearly shown that enabling technologies can make operations and supply chains more resilient and favor business continuity in the event of unpredictable external shocks. This crisis can accelerate the process already underway and therefore draw the attention of enterprises and all actors involved to the advantages that enabling technologies can offer. Our study can strengthen this interest and generate a positive impact on the Italian economic system.

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