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Managerial Challenges of Industry 4.0

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Preface

According to Paul Schneider (2018, p. 803) "the increasing intelligence of products and systems, their intra-company cross-linking and their cross-company integration into value creation networks is referred to as Industry 4.0". Additionally, to BCG (2020) Industry 4.0 "is a transformation that makes it possible to gather and analyze data across machines, enabling faster, more flexible and more efficient processes to produce higher-quality goods at reduced costs". Indeed, Industry 4.0 contributing to the increase of productivity, foster industrial growth, and change the workforce profile, emerges as a natural way to increase competitiveness through digital technologies. These technologies have a critical role in our lives, implying, its evolution, changes and disruptions in the knowing courses as well as in the way people live. In what concern jobs, the impact in jobs number is too critic in Industry 4.0 era. If from one side, many argue that Industry 4.0 is an excellent opportunity to develop new jobs, on the other hand, others share the opinion that the labor force will be replace and many of the jobs will disappear. The need to develop and improve the employees' competences and abilities is a consequence of job creation that require higher qualifications. Another challenge originated by Industry 4.0 in the work field concerns the interaction between man and machine. As a result, both the work nature, the workers' profile and the organizational structure observe deep changes. Ecological and social challenges, such as resource efficiency and environmental protection, are also addressed by Industry 4.0. Take into account the high level of implications caused by the emergence of industry 4.0, it is important to know and understand the managerial challenges that nowadays organizations are facing, and more than that, what kind of answers are them developing, in order to maintain and improve their competitiveness indexes. Conscious of these implications and huge relevance, this present book seeks to gather the contributions that experts and researchers have been making as a result of the most diverse research that have been developed all over the world.

Organized in seven chapters, *Managerial Challenges of Industry 4.0* looks to focus in chapter 1 "*Herd Behavior in the Adoption of Artificial Intelligence: Exploration of Drivers and Potential Consequences*"; while chapter 2 covers "*Seeking truer reality: Quark influence on the Transhuman future*". Chapter 3 discusses "*Managerial*

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challenges of Industry 4.0: A case study in the Portuguese footwear sector"; chapter 4 speaks about "*When the wind makes the structure tremble. Excess-based resilience and the role of organizational slack*"; chapter 5 deals with "*E-leadership and new leadership skills for effective leaders in the public sector within contexts of telework – A Delphi method study*"; chapter 6 analysis "*Challenges of European organisations in the VUCA world and the emergence of the Bani world*"; and finally chapter 7 looks to discuss about "*Telework in times of technological transformation and pandemic and the impact on the work-family relationship: Spillover and boundary control*".

Managerial Challenges of Industry 4.0 can be used by a variety of potential stakeholders, including academics/researchers, managers, engineers, practitioners and other professionals in the different areas of business and management, who are dealing with the effects of Industry 4.0. It constitutes a fundamental support capable of providing a focused and current view about the key challenges, trends, implications, strategies and ways of overcoming, underlying industry 4.0, that dynamic, and competitive organizations are facing today and increasingly in the near future.

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Chapter 1

Herd Behavior in the Adoption of Artificial Intelligence: Exploration of Drivers and Potential Consequences

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Abstract

Artificial intelligence (AI) causes radical changes in the business landscape. Despite its promise, many companies fail in AI initiatives. One potential reason is that the decision to adopt AI is not always driven by business needs but instead by herd behavior. This is when the hype around AI increases common interest in AI systems, and managers are vulnerable to mimicking competitors, causing them to make quick adoption decisions without a solid understanding of how AI works and how it can create business benefits. This study explores the herd behavior phenomenon by conducting interviews with knowledgeable AI experts and managers. The key findings provide evidence of herd behavior in AI adoption and identify its key drivers and potential consequences. The findings show that firms need adequate technical knowledge of AI to avoid herd behavior based on overstated benefits and competitive pressure. The findings also imply that while herd behavior may decrease the risk of adoption failure, it may also decrease the likelihood of innovative solutions emerging to help develop sustainable competitive advantages.

Keywords: Artificial intelligence, Herd behavior, Technology adoption, Business studies

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1.1 Introduction

Artificial intelligence (AI) is predicted to "double annual economic growth rates by 2035 by changing the nature of work and spawning a new relationship between man and machine" (Accenture, 2016). Businesses are undergoing radical transformation due to AI because this technology provides numerous use cases that can lead to business benefits. Various data sources enable managers to generate more accurate results for a variety of tasks, such as customer segmentation, profiling, product reputation management, pricing strategies, competitor analysis, promotions, recommender systems, and community dynamic analysis (Fan *et al.*, 2015). Information from online platforms, such as tweets, Google Trends, Wikipedia, texts, images, audio, video, and *Huffington Post* news, if carefully analyzed, can predict consumer behavioral intentions (Liu *et al.*, 2016).

Despite its benefits, AI is still overpromising and underdelivering business results, leading to failures and disappointments (Forbes, 2021). However, trust in the promise of AI has remained steady. For example, most chief marketing officers worldwide think that "AI will transform the marketing landscape even more than social media has, and nearly six in 10 believe that companies will need to compete in the AI space to succeed" (Adobe, 2020). This perception is also reflected in budget allocation and marketing investment decisions. For example, advertisers in the US will spend nearly $60 billion USD on AI-based programmatic display advertising in 2019 (IAB, 2019).

We propose that managers' overconfidence in AI investments stems from herd behavior (*i.e.*, herding), which refers to a situation in which many people do what others are doing (Banerjee, 1992). In the online environment, the literature has identified herd behavior in the online loan market, digital accusations, and online bidding behavior (Ding and Li, 2019; Herzenstein *et al.*, 2011; Chen, 2008; Simonsohn and Ariely, 2008; Huang and Chen, 2006; Dholakia *et al.*, 2002). In a similar vein, managers are likely to be influenced by success stories and the general hype around AI which increases their fear of missing out and encourages them to mimic other companies' AI adoption decisions. Nevertheless, research has neither thoroughly investigated how herding behavior is manifested in AI-related adoption decisions nor determined its key drivers.

Against this backdrop, this study investigates managers' herd behavior associated with the adoption of AI technologies through qualitative interviews (N = 13) with AI industry experts, CEOs, data scientists, entrepreneurs, and consultants from the USA, the UK, Peru, Switzerland, and Finland. This study contributes to the existing literature by providing evidence of herding in AI adoption decisions and outlining its key drivers and potential consequences. From a managerial perspective, this study implies that it is imperative to understand what AI is, what it can do for a business, and how it can be employed to reach business objectives instead of imitating competitors' AI initiatives.

1.2 Literature Review

1.2.1 AI Use Cases in Business Research

Many studies from technical backgrounds have used AI and machine learning techniques to solve marketing problems. Jarrahi (2018) stated that AI-induced machines and humans can work together to solve business problems; he concluded that "AI can extend humans' cognition when addressing complexity, whereas humans offer a more holistic, intuitive approach in dealing with uncertainty and equivocality in organizational decision making". Nair *et al.* (2017) presented a framework that leverages a company's customer database to build models of consumer behavior for better targeting. Shankar (2018) discussed AI applications in retailing, arguing that AI can be used to understand and anticipate shopper behavior, make product recommendations, oversee sales management, and customer service, among other issues.

Liu *et al.* (2016) discussed a garment recommender system by tracing customers' movements with a camera in a retail store. This system analyzes the data and recommends a suitable garment based on the collected data. Liu *et al.* (2016) contrasted the volume of sentiments in tweets, which resulted in the information content of tweets and their timeliness significantly improving forecasting accuracy. Ku *et al.* (2019) constructed a framework to integrate visual analytics and machine learning techniques to investigate how hotel managers respond to positive and negative reviews, with the goal of developing an approach to deep learning that prioritizes responses.

It is important to determine whether companies have organizational structures that can successfully support AI initiatives. Less than half of firms have an AI strategy in place; only one out of five have incorporated AI in their offerings and processes; and a mere 5% have extensively incorporated AI (Ransbotham *et al.*, 2017). Turchin (2019) states that "current computer hardware and neural net development imply that potentially dangerous AI could be created in the coming decade."

1.2.2 Extant Knowledge of Herd Behavior

Herd behavior occurs when "decisions by early movers provide additional information to later movers, giving them an incentive to imitate even when their private signals suggest otherwise" (Khanna and Mathews, 2011). In the IT industry, herding is particularly prominent because managers are known for following one another when making investment decisions (Kauffman and Li, 2003). Notably, few studies have explored herding in IT adoption that stems from corporate decision makers' investment decisions. However, Duan *et al.* (2009) indicated two types of herding that are seen in the IT industry: network externalities, which is when an increase in other users adopting software increases the utility for existing users (Katz and Shapiro, 1985), and the lesser-known informational cascade, which refers to

following "the behavior of the preceding individual without regard to his own information" (Bikhchandani *et al.*, 1992, p. 994). Table 1.1 presents herding and related terms that are often used in the academic literature on finance, marketing, investing, psychology, and IT.

Tab. 1.1 – The concept of herding and related constructs.

Concepts	Understanding
Herding	In the cognitive science literature, herding is defined as "a form of convergent social behavior that can be broadly defined as the alignment of the thoughts or behaviors of individuals in a group (herd) through local interaction and without centralized coordination" (Langley *et al.*, 2014). In simple terms, herding is everyone doing what everyone else is doing (Banerjee, 1992)
Rational herding	Rational herding happens as a result of observational learning among lenders or other stakeholders (Croson and Shang, 2008)
Irrational herding	Irrational herding occurs when lenders passively mimic others' choices, refer to others' decisions as a descriptive social norm, or follow well-funded and hence salient listings (Croson and Shang, 2008)
Informational cascades	An informational cascade occurs when it is optimal for an individual, having observed the actions of those ahead of him/her, to follow the behavior of the preceding individual without regard to his/her own information (Bikhchandani *et al.*, 1992)
Observational learning	Observational learning has primarily focused on quality uncertainty and how a consumer makes quality conclusions through observing others' actions (*e.g.*, restaurants that maintain a sizable waiting list are often perceived to be of high quality) (Zhang, 2010; Bikhchandani *et al.*, 1992)

Herding has often been studied from the perspective of digital marketing and other online solutions. For example, "herding effects are offset significantly by negative comments from others" in digital settings (Huang and Chen, 2006). Lenders (investors) in the online loan market typically follow herding behavior (Zhang and Liu, 2012; Herzenstein *et al.*, 2011). Previous research has shown that buyers at digital auctions are susceptible to herding bias (Dholakia *et al.*, 2002). Additionally, online book choices are guided by sales of the book and readers' star ratings (Chen, 2008). Ding and Li (2019) found a strong presence of rational herding in both digital book consumption and purchases on websites.

Herding can also have some positive aspects. Regarding initial decisions, Khanna and Mathews (2011) showed that herding could result in superior aggregate information and improve subsequent decisions. Altogether, the literature has identified herd behavior in several contexts and has found both positive and negative implications. However, the research lacks insights into herd behavior and its key drivers in the context of AI adoption.

1.3 Research Method

Understanding herd behavior in the AI context is in the early phases of development. Therefore, we adopted an exploratory research strategy and qualitative methodology suitable for developing a rich understanding of a novel phenomenon in its context (Miles and Huberman, 1994). In terms of data collection, we conducted in-depth interviews (N = 13) with managers, CEOs, entrepreneurs, and consultants (table 1.2). Specifically, we followed purposeful sampling (Patton, 2002) and selected interviewees who were particularly knowledgeable and experienced in the AI field.

Tab. 1.2 – Interview participants.

Code	Country	Title	Type	Duration
I-1	Finland	CEO	Face-to-face	28 min
I-2	Finland	CEO	Telephone	52 min
I-3	Finland	Director, Analytics	Telephone (with I4)	46 min
I-4	Finland	CEO	Telephone (with I3)	46 min
I-5	Finland	Founder and Chairman	Telephone	37 min
I-6	Finland	Head of Data	Telephone	49 min
I-7	Finland	Chief Growth Officer	Telephone	36 min
I-8	Finland	Lead Data Scientist	Telephone	24 min
I-9	Finland	CEO	Telephone	38 min
I-10	Bulgaria	CEO and Co-Founder	Telephone	51 min
I-11	Switzerland	AI Expert	Telephone	55 min
I-12	UK	CEO	Telephone	39 min
I-13	US	AI Industry Expert	Telephone	62 min

We divided the interview into two parts: (1) the drivers of herding in the context of AI adoption (*i.e.*, why herding occurs) and (2) the manifestations of herding in the context of AI adoption (*i.e.*, how herding occurs). Furthermore, we asked the interviewees to elaborate and offer examples/additional details on potentially important issues. The average interview duration was 43 min, and all interviews were recorded and transcribed. On the basis of the transcriptions, we divided the material into (1) the drivers of herding and (2) the manifestations and potential consequences of herding. Thereafter, we conducted a thematic analysis by identifying sub-themes from the interview data that were raised by multiple study participants. Figure 1.1 presents our research process.

1.4 Findings

The main findings demonstrated evidence of herd behavior in managers' AI adoption on two decision-making levels: the decision to adopt AI in general, and the decision to select specific AI use cases. Herd behavior was found to be largely driven

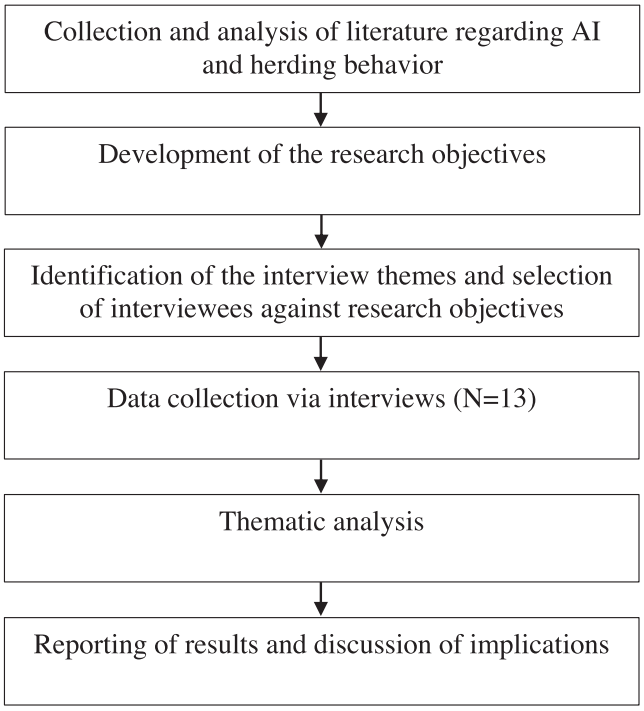

FIG. 1.1 – Research process.

by (a) a lack of technical knowledge of AI usage, (b) exaggeration of AI benefits by media and AI vendors, and (c) competitive pressure and fear of missing out. These three drivers are interrelated: when managers have a limited understanding of how AI works and see their competitors adopting systems, they are more easily persuaded by the exaggerated promises presented in the media and vendors' sales presentations. Finally, our results imply that herd behavior has both negative and positive aspects. While it decreases the risk of failure in AI adoption, imitating existing use cases may lead to a lack of innovation and decrease the likelihood of turning AI usage into a sustainable competitive advantage. Figure 1.2 illustrates the key findings elaborated on in the following subsections.

1.4.1 Drivers of Herd Behavior in AI Adoption

The data revealed several drivers of herd behavior, the most important being a lack of AI technical knowledge. The interviewees stated that this lack of knowledge created a lack of clarity about the business benefits and concrete use cases. Therefore, the widespread interest in and stated benefits of AI make companies eager to explore it and build capabilities for using it, even if they are unsure of its purpose.

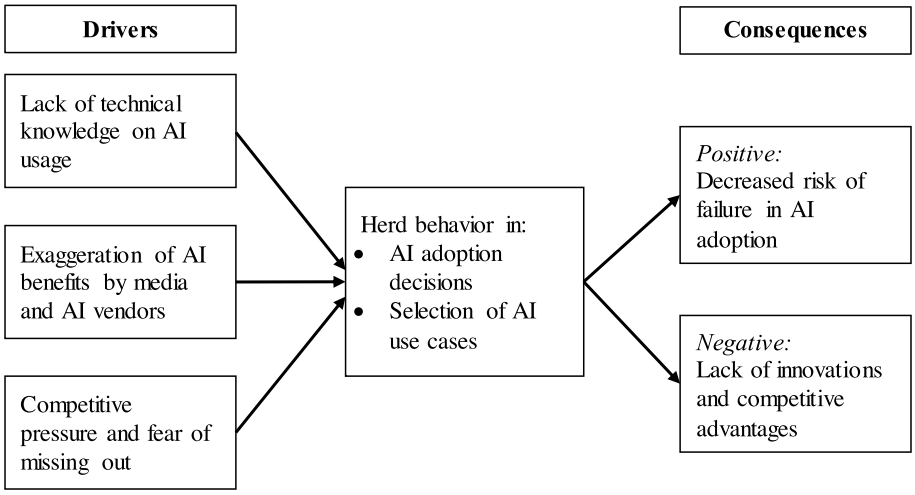

FIG. 1.2 – Drivers and consequences of herd behavior in AI adoption.

"Everybody is talking about machine learning and AI without properly understanding machine learning and AI, yet they [still] think that it will yield business benefits. But how could that happen? It is like walking in the forest without a map; you just end up somewhere. You need to have a business direction. You need to have business goals. You have to understand what you are trying to accomplish, and then you select the tools. And in that case, machine learning can be a crucial part [of] some points of the business process. But thinking that AI will somehow revolutionize everything [without those processes is incorrect]. You will still need business ideas. That is a little bit unwise, at least in Finland, because many old industrial companies do not understand this fact, and that is the reason they are losing a lot of money" (I-2, CEO).

"The technology [AI] will be spreading gradually because it is difficult to define what product or solution the company needs. So, it is better to have those skills for your business and company, and then you will utilize them for the company" (I-4, CEO).

The second driver of herding stems from the role of media and AI vendors. The media tends to highlight the revolutionary aspects of AI. Such viewpoints often ignore the related challenges in AI adoption, creating misunderstandings and drawing an unrealistic picture of AI benefits for an average firm.

"I think that AI is a big topic, and there is a lot of talk about it. [The] media covers AI, and it's for the people who are not dealing with AI in daily business. It must be very confusing because there are a lot of these threatening discussions [in which] people are afraid of AI because of all these ethical topics. [Yet], there are these positive topics, so people are very mixed" (I-3, Director, Digital Analytics).

"Yes, people do think it [AI] [is] a flash in [the] pan, [but that is] purely because of media speculation, hype, and the misunderstanding of what it can actually do. A lot of people I talk to [initially] think [that] AI has something [to do] with robots" (I-12, CEO).

"Well, yes, AI can be misunderstood. You only get to look at the adverts on television, and they oversimplify AI. It is not really AI; it is analytics of data providing meaningful outcomes. True AI is something completely different. It is complete automation using machine learning codes and algorithms, not just something that gives you an outcome by analyzing data" (I-12, CEO).

In addition to the media, some interviewees noted that marketers and sales representatives of AI vendors exploit managers' limited understanding of AI by overstating its business potential and expected benefits.

"Let's imagine a situation where there are actual facts about AI and its abilities. Already there [is] a person who does not understand the basics of AI [who] might be confused. And this is a very optimal situation. And now, let's go to the real world, where you have different marketers [and] salespeople selling fully bogus ideas of what AI is capable of. And then you have, again, the ethical concerns. It [is no] wonder that there are quite a few snake-oil salespeople around" (I-7, Chief Growth Officer).

The third driver found to contribute to herding in AI adoption was competitive pressure. Any sized company (big or small) knows that AI is already being used in different businesses and use cases (*e.g.*, recommender systems, targeting in advertising, content personalization, etc.). They know that their competition is also contemplating AI adoption, which results in increased fear of missing out. Thus, many managers feel that they need to adopt AI quickly to stay ahead of or keep up with their competitors.

"I think the changes in the market [include] big publications, big vendors, companies like Amazon and Alibaba investing in these solutions (AI), [and] data becoming more available; those conditions [signaled] when more companies and researchers started to talk about this more. People herd around these technologies because they think [that] now they can solve new problems [that] they didn't have solutions for before" (I-9, CEO).

"In the coming years, it [pressure] will increase—within five years for sure. Pressure is [always] there; it took 21 years for Amazon to surpass Walmart in market value, 14 years for Tesla to beat GM in market value, and 7 years for Uber to beat Tesla in market value. And that's exponential technologies, so they're feeling the pressure" (I-9, CEO).

1.4.2 Herd Behavior in AI Adoption and Its Potential Consequences

The data presented evidence of herding behavior in AI adoption. The interviewees did not consider AI a management fad, but they noted that adoption decisions were affected widespread interest in AI. The managers felt that it was difficult to avoid herding. There is a need to be interested in AI because everyone else is interested in AI, which contributes to managers' decisions to adopt AI systems.

> *"I would say that, yes [there is herding behavior], because organizations are in a way social structures; thus, people are herding toward certain things at certain times. So, when big data was a hot topic, and I am not saying big data and AI are analog, but a few years ago, if you asked any chief information officer if they were interested in big data, you could not be serious and say, 'I am not interested in big data.' So, it is absolutely herding behavior, and when it comes to AI, I do not see AI as a buzzword. I mean, yes, it has been a buzzword, but it is something that is here to stay. But, to answer your question on herding, absolutely, yes" (I-7, Chief Growth Officer).*

> *"Herding is there, at least to the extent that people and organizations can contact us and tell us more about AI and its possibilities because everybody is talking about that. So, in that sense, I would say that this is herding behavior—that they feel the need to learn more and understand more because it's a factor that everybody is talking about" (I-8, Lead Data Scientist).*

> *"Absolutely there is herding behavior. But there is a difference if you see blockchain; it has come and gone. AI is another one of these trends ... I don't think it's going to go away" (I-12, CEO).*

Besides herding's effects on AI adoption decisions, a few interviewees pointed out that managers also imitate other firms' AI use cases. Herd behavior may have both positive and negative consequences.

> *"Yes, many times, because obviously you hear what others have done, you feel like this is what you need to be doing, like propensities and journey models. Everybody does those, and it's kind of a must, in a sense. But, there have not been that many cases, at least publicly available, for something completely different or something completely unique, but that might also be [because] companies don't want to share this kind of information" (I-6, Head of Data).*

> *"I think it's good, in a sense, that you don't need to [re]invent the wheel. But on the other hand, if you only stick to that and follow what others have done, you are always one step behind, and you don't really build your own capabilities. You don't really [get the full] benefit of the AI opportunities, so then you are the follower and not the leader" (I-6, Head of Data).*

1.5 Discussion

This chapter focused on herd behavior in the adoption of AI and explored its drivers and consequences. The study was conducted *via* interviews with knowledgeable AI experts and managers, and the data were analyzed *via* thematic analysis. The results show that herd behavior in AI adoption is driven by (1) a lack of technical knowledge of AI, (2) exaggeration of AI benefits by media and AI vendors, and (3) competitive pressure and fear of missing out. Notably, we found that the first driver, the lack of technical knowledge of AI, was the fundamental reason why companies herd regarding AI adoption decisions. This lack of knowledge makes managers vulnerable to competitive pressure and AI stories that exaggerate the expected benefits.

Herding was found to occur in both AI adoption decisions and the selection of AI use cases, and it was associated with both negative and positive consequences. In brief, herding may lead managers to imitate competitors to keep up with them rather than fostering innovation to stay ahead of the competition. However, herding may also decrease the risk of failure in AI adoption, leading to more predictable business outcomes. These findings have important implications for both researchers and managers.

Due to the mixed potential consequences, our findings foster the idea of *rational herding* that results from observational learning from stakeholders (Croson and Shang, 2008). Rational herding requires managers to have a grounded approach to AI adoption that is supported by a business needs assessment. In other words, to comprehensively capitalize on AI, managers need to ask basic questions to determine whether AI is truly needed and in which use cases it can be applied to obtain the best results. As a first step, managers must determine whether AI can improve their existing processes or replace them with new and smarter processes. When making incremental changes to existing processes, we presume that herding is particularly valuable because the changes impose only minor changes to existing routines. Instead, when AI adoption leads to the replacement of existing processes, herding in use cases might be riskier because it requires the transformation of existing routines and structures of the focal organization (Mero *et al.*, 2022). Therefore, imitating competitors in transformations may result in adopting AI systems that do not fit the resources and business needs of the organization in question. Once the business needs and resources for the adoption of AI are determined, firms can join the herd with a more rational approach and imitate the use cases that fit the business strategy.

AI will change business as we know it. It can mimic human intelligence and automate processes that were previously time- and labor-intensive pursuits. Our results revealed that it is crucial for managers to understand what AI is, how it can be employed in their business, and what results to expect. Therefore, understanding AI from a technical perspective goes beyond understanding complicated algorithms and includes defining business goals. Incomplete, contradictory information will force individuals to herd in one direction.

Companies might realize some benefits from herding, but in the long term, they will need a clearly articulated AI strategy. To this end, companies should develop AI learning initiatives within their organizations to fuel the debate. We also recommend further and continuing AI training within organizations. To improve productivity with AI, it is imperative to train the human workforce at an early stage. Therefore, employees should continually learn new skills, and universities should take the lead in training the future workforce.

It is not feasible for every company to use an AI-based autonomous system. However, the herding effect tends to push companies away from their traditional structures to try new things. This journey will comprise failures and successes, which will include a phase during which the company must decide whether the failures warrant developing a better strategy; they must learn from the process. Given that encountering inefficiencies and spending money with no results will stress the organization, companies must be convinced that AI is meant to help people and not

replace them. There will be organization-wide issues between managers and data scientists because the latter group is likely to be less informed in the business domain, and the former group is likely to have less understanding of how these algorithms work. Thus, inter-organizational collaboration in AI adoption is likely to lead to more streamlined adoption processes. Success will follow those who are interested in learning about and understanding AI. Relying on unfounded claims can lead to failure. The key to remember is that AI adoption must be justified in terms of business needs rather than speculation of its revolutionary power.

Due to their exploratory nature, the results must be interpreted in light of obvious limitations. Our data were collected from 13 informants, and although they represented knowledgeable AI experts, the results cannot be generalized beyond the sample of this study. Thus, future research is needed to confirm, extend, and potentially challenge the findings of this study. Specifically, future research could investigate the contextual factors that affect herd behavior in AI adoption and its impact on business outcomes. Additionally, as our findings imply that herd behavior may have both negative and positive consequences, more research is needed to investigate the circumstances under which herd behavior is associated with negative and positive consequences. We also presume that our dataset was limited to identifying all possible drivers and consequences of herd behavior. Therefore, more research is needed to draw a holistic picture of this novel phenomenon in the business field.

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Chapter 2

Seeking Truer Reality: Quark Influence on the Transhuman Future

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Abstract

This chapter aims to demonstrate that technology and humans are inherently linked and how this impacts the organisation. The chapter further highlights the harmony between human beings and technology which arises from the mutually integrative essence of both humanity and technology. A review of extant literature reveals that the nature of humans has been in a state of constant flux and this continues to be the norm. Furthermore, individuals and organisations embrace the various changes from metahuman to transhuman coupled with the various managerial challenges. Organisations thrive in longevity and are sustainable when individuals are able to work with dignity and are neither hunted through managerialism nor reliant on efficiency within the broader context of the post-constructivism approach. Technology has a significant core that permeates the essence of human beings as well as the prevailing character of those societies wherein this logic makes sense. This argument allows technology to be defined as a distinct branch of humanistic reflection. Moreover, the fundamental elements to achieve sustainability entail mindfulness, soft skills embracing technology as the main conduit.

Keywords: Humanism, Mindfulness, Social constructivism, Technology

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2.1 Introduction

This chapter presents a critique wherein Feenberg (1999, 2002) postulates the nexus between society-technology. Society can be perceived by its context in a local environment. The chapter will put forward the debate surrounding the assumption that technology is neutral in nature which is based on the works of Max Weber (1964), Martin Heidegger (1977), Jacques Ellul (1965), George Grant (1969), and Albert Borgmann (1984). According to this view, technology holds a substantial essence that deeply penetrates the profound significance of human beings as well as the prevailing character of the societies wherein this logic makes sense. This issue allows technology to be defined as a distinct branch of humanistic reflection. On the other hand, substantivism is based on a determined logic that carries with it not only the needs of societies but also our very subjectivity and our being. According to this school of thought, based on the works of Weber (1964) and Heidegger (1977), the results of technology reveal the logic and the essence of technology, which can be considered as rational instrumentalism that includes the logic of standardisation, homogenisation, as well as deep knowledge about the nature of society. Using technology implies using people which means producing a particular type of person and a particular type of society. All technological results have the same logic, meaning that it is not possible to distinguish between good and bad results – there is a dominant logic in instrumental rational and efficient technology. The substantivist philosophy of technology is based on the hermeneutical issue surrounding the essence – the meaning of technology and not on what technology does. A discussion ensues on managers and managerialism as viewed by Fayol which are diametrically opposed to Follett's views. The chapter also puts forward the views of Follett regarding managers who she considered as being those individuals who were in 'the space between' which is generally understood to be the middle area – middle management. According to Follett, management should provide direction, be inclusive, shared, and non-hierarchical quite the opposite of management which provides direction, controls, and commands. The chapter will further expound on the nexus between self-actualisation related to metahumanism; how the constant flux in human existence within society has led to transhumanism. The notion of transhumanism proposes a particular interpretation of the human being which is associated with the improved and enhanced human being. In this study, the notion of quarks is an analogy to depict the power espoused by Follett, the constructionist approach of technology, espoused by Feenberg, as well as the smallest elements, such as mindfulness.

2.2 Technology and Its Dialectical Nature

Feenberg (1999) has been instrumental in supporting the realm of information science as a right on its own. In the current information and technology era, an intangible leap has led to the catapulting of organisational effectiveness. The origins of social constructivism lie in the sociological and historical works of Thomas Kuhn (1962),

Paul Feyerabend (1975), and Sandra Harding (1991). Constructivism emerged from contemporary social theory which highlights the importance of social actors that behave as influential groups in constructing technology. Furthermore, constructivism is related to specific social factors which, in turn, are related to the history of individual cases. Social constructivism interrogates the essence of the substantivism within technology which ignores that human agency that is without direction or course of action. Technological results are a product of complex interactions between social, political, economic, cultural, and technological factors.

The school of thought of Wieber Bijker (1995), advocates that technology interacts with its context and its artefacts as well as their usage thus producing new paths and artefacts. The heterogenous nature of society may lead to the inference that technological usage and its results can also be heterogenous. In accordance with the social constructivism approach, technology, with its usage and results, should be considered as an articulation between local factors, such as sociocultural, political, and economic conditions within specific contexts and technological dimensions at hand. Constructivism emphasises *who* produces technology, *how* and *why*.

The theoretical foundation of the critical approach in technology is based on the Marxist theories and on the capitalist rationalism view of production (Feenberg, 1999) which lead to the fact that the constructionist approach in technology was at the base of contemporary technological essentialism. This aforementioned approach views technology as a social construct. In this way, technology is stripped of its independent power and strength. According to social constructivism, creating and developing technology is subject to contingent factors, social in nature, and which analyse individuals and groups that create various technologies.

Feenberg (1999) developed the dialectical approach to technology which perceives its positive and negative usage and effects. According to this perspective, technology can always be counterargued and allows for a rebuttal that can be reconstructed to serve human needs and objectives. Elichirigoity (2000) is of the opinion that human nature is made up of two facets – a technical and a natural, according to which there is no dichotomy between human beings and technology due to the mutually constituent nature of humanity and technology. This study, therefore, is set against the background of this school of thought, namely, of social constructionism which stresses the fact that technology co-emerges with the people who are, in turn, imbued with experiences arising from the economic, social, and cultural domains in which they live.

Technology is essentially artificial in nature and is usually linked to the exploitation, domination, and subjugation of nature, especially, that of human nature. According to Grant (1969), technology incorporates and reinforces a particular way of being in the world, as well as a particular perception and understanding of human relations. Weber (1964) was of the opinion that technology is a prison and the inmates are specialists without soul or spirit. These specialists are rational and without emotions. According to Heidegger (1977), technology performs the role of the context. The essence of technology is based on the characteristics of both human and non-human nature which is served by the demands arising from the limited resources that are available to be explored. For Grant (1969), technology represents a way of looking at the world. Moreover, Feenberg is of the opinion that

technological development transforms the meaning of being human. The central assumption within social constructivism resides in the fact that the outcomes are devalued and neglected by the very essence of the technology in question, and in turn, these outcomes are formed through the interaction between technology and social relations, or the environment in which the technology is placed (Pinch e Bijker, 1987).

The critical approach to technology is also built on the rational capitalistic theories of production which Foucault (1977) designates as a prison and Habermas (1992) terms as the social space. According to the critical approach to technology, as posited by Marx, technology is viewed as rational and biased, which in turn, is related to the constructivist notion of subjugation. Barney (2004) classified technological theories into three categories, namely, instrumentalism, substantivism, and social constructivism. Instrumentalism advocates that technology is neutral; it is essentially a tool used by people and reflects on the values, objectives, problems, and limitations of society. In accordance with this optimistic view, technology can only be judged by its efficiency. Negative results that technology yields, are not viewed as a consequence of the actual technology but instead, from the inappropriate *use* of technology.

Feenberg (1996) postulates that technology has become an important theme in the current era. Therefore, technology can be considered a fundamental ingredient for society because it is intimately related to politics, economy, culture, and all aspects of life. While theorising about technology Feenberg's critiques ranged from technological determinism to existential theories. Technological determinism follows a similar logic to that of economic determinism and both have pernicious implications philosophical and political in nature. If individuals understand the market and economy as a quasi-natural organism, subject to its own laws and autonomy, attempts to manage or control technology have to necessarily be rejected, as being perceived to interfere with its fundamental nature. By the same token, if individuals consider technology as an autonomous force and one which political control cannot penetrate, attempts to manage or recreate become an absurd initiative.

Technological determinism theories emerged after WWII, on the one hand, to celebrate the characteristics of modernised technology, and on the other hand to blame technology for the crisis that western civilisation faced (Heidegger, 1977; Ellul, 1965). Unfortunately, the current global context portrays quite a different reality. Deterministic theories transformed into essentialism, negative and positive in nature. Heidegger (1977) and Ellul (1965) assigned a negative meaning to technology which was based on a force of authority and totalitarianism. This perspective considers technology as an autonomous force that is irresistible and immune to democratic control or human reconstruction and one which usurps the modern world. Technology was considered a frame or 'Gestell' (Heidegger, 1977) which forms the structure of the modern world and the lived experience. This dystopic and technophobic essentialism is contrasted with the technophile essentialism in which technology is characterised favourably as a sensible control over nature and as an efficient force of rationality and progress. "Apparently neutral technological rationality is enlisted in support of a hegemony through the bias it acquires in the process of technical development" (Feenberg, 1999, p. 87). Additionally, Feenberg (1999) posits that

technological essentialism promotes a vision of constructionism in the contemporary era; the latter views technology as being socially constructed and thereby depleting it of its force and independent power.

Feenberg (1999) postulates that the critical theory of technology is based on two approaches, namely, substantivism and social constructivism. According to the lens of social constructivism, creating and developing technology are considered simultaneously the subject and the object of socially dependent contingent decisions whereby those groups and individuals responsible for creating technologies, are analysed. Furthermore, social constructivism takes into account the background inherent in the interests pertinent to the different social groups which create technology, notwithstanding its micro-descriptive and empirical dimensions which may at times lead to social imperatives and political interests which are essential in nature. Again, the current COVID-19 is evidenced because this can be related to what Feenberg (1999, p. 103) opposes as "hegemonic technological rationality".

The substantivist philosophy emerged from the technological philosophy and its basic assumptions lie in the debate that technology is autonomous and biased towards domination. This is based on the Frankfurt School with Heidegger (1977) and Ellul (1965). These theorists argue that technology develops according to its own intrinsic logic without taking into consideration any democratic and humanitarian values. Whilst substantivism which is related to the general consequences of technology conveys social consequences in the realm of contemporary life. This approach is vehemently against the philosophical theories of modernity. Moreover, the substantivist approach gives rise to the foundations which lead to social constructionism and can be understood as a critical approach to a modern technological society. The critical theory maintains that theories within the substantivist approach are deterministic in nature and deny human agency. The substantivist paradigm is linked to instrumental rationalism as well as to standardisation and homogeneity and it prioritises masterliness over and above the nature of humanity. The social constructivism theories make a clear distinction between other theories on society and are biased towards an empirical description of specific technologies. These theories conceptualise technology as the key element in contemporary society. The notion of technology can become compromised due to its defining characteristics and main effects. Notwithstanding the fact that constructivist sociology has placed specific technologies at the forefront of the agenda for new trajectories, namely, the basic issues of modernity, around the general debate on technology, issues which in turn, have already been debated by previous generations of theorists and which are nowadays no longer discussed nor debated.

Feenberg (1999) debates the approach to constructionism with the view of technology which is systemic and which is social and critical in nature, which is in alignment with those views held by Marcuse (1964) and Foucault (1977, 1980). These theorists analyse the links between technology and power; how technology can serve the interests of social domination and pave the path for a debate on the alternative views regarding technology. Feenberg (1999) links this theory with social philosophy in an attempt to eliminate those unilateral approaches which debase and reduce the value of technology or which have reduced it to social facts. In this way, Feenberg (1999) attempts to mediate between the substantivism perspective and the

social constructivist theories by critiquing the philosophies of Heidegger (1977), Ellul (1965), and Habermas (1971) who view technology as being reductionist and deterministic and excessively abstract. Moreover, Feenberg also critiques the constructivist perspective which considers technology as a neutral instrument, that in turn, proposes a descriptive narrative around specific technology in disparate historical contexts that challenge those philosophically wide and all-encompassing perspectives and critiques. Feenberg developed a dialectical perspective of technology which considers the negative and positive usage and effects of technology. He views technology as an area that can always be questioned and which can be reconstructed to serve human needs and objectives. For this reason, Feenberg develops a stance that is characterised as neither an ingenuous optimistic view of technology nor rigid technological and technophobic determinism. Feenberg rejects the dystopic views which could simply repudiate technology and instead, argues that it is more productive to focus on its reconstruction instead of its denial. This would be in alignment with the notion that "transhumanists regard the enhancement of cognitive capacities as one of the decisive enablers for other techno progressive goals" (Roden, 2014, p. 166).

Designing technology is subjective and affected by political forces. Abraham Maslow postulated the term 'metahuman' which referred to the changes that individuals could be subjected to, in seeking to attain self-actualisation. Since the 1950s, when Huxley postulated the term 'transhumanism', human existence has been exposed to enormous changes and fluctuations in all contextual spheres, namely, economic, political, sociological, and especially technological. Follett viewed managers as those individuals who are in 'the space between' which is generally understood to be the middle area – middle management. According to Follett, management should provide direction, be inclusive, shared and non-hierarchical which is quite the opposite of management which provides direction, controls, and commands.

The continuous questioning of technology by the general public, which in turn, incessantly demands change and in some way, change is continuously taking place, this has made technology much more flexible and transformative towards the debate and democratic reconstruction as opposed to what previous theories indicated. Nevertheless, with the onset of COVID-19, it seems that Feenberg was rather too optimistic. The fundamental point in Feenberg's view highlights integrating the development of philosophical approaches, based on concrete studies of the current construction and reconstruction of technologies, based on studies related to the creation and recreation of outstanding technologies as well as with proposals of the design and utilisation of these technologies – this is a matter of public debate and political democracy.

2.3 The Critical Theory of Technology

The debate centered against the essentialist approach to technology tends to reduce technology to the 'instrumentalisation', technique, Gestell, and efficiency. Feenberg however argues in favour of an approach that will furnish an array of systemic socio-cultural variables and which will allow for the diversification of its historical realisations. Feenberg (1999) posits that primary and secondary analysis of

'instrumentalisation' highlights dilemmas linked with the philosophical theories of technology which focus on developing universal analyses of nature and the role of technology in the life of humans. One can question whether the critical theory of technology should focus specifically on the historical lens when analysing technology in a specific era with special emphasis being placed on the current circumstances instead of providing universal perspectives on technology. In *Questioning Technology,* the seminal work of Feenberg (1999), the theorist emphasises a more historical stance and puts forward a concluding perspective that encompasses a philosophical turn aiming at the development of a universal analysis to view technology that conceptualises the analysis of its unchanging characteristics.

Constructivism focuses on *who, how and why* technology is developed. Feenberg (1999) proposes a framework with two levels to handle the substantive and constructive questions and answers. Both approaches are reconcilable *via* a common approach designated as the 'instrumentalisation' theory. According to this theory, technology can be analysed on two levels, namely, (i) at the original functional level in relation to its reality, as well as (ii) at the technological design level and its implementation. This 'instrumentalisation' theory examines the substantive lens of hermeneutical questions pertaining to the meaning of technology in relation to modern life (and not that which technology produces) as well as the constructivist questions about who produces technology and why. Substantive philosophies of technology focus attention on the *hermeneutical* question associated with the meaning of technology instead of *what* it does. This question allows the philosophy of technology to be defined as a distinct branch of humanistic reflection. Therefore, the theory of 'instrumentalisation' endeavours to understand technology as a phenomenon, both pre-modern (non-rational) and also modern in order to distinguish between primary and secondary 'instrumentalisation'.

The essence of technology encompasses two aspects, firstly related to the functional composition of objects and technical subjects which Feenberg designates as primary 'instrumentalisation'. The second aspect – secondary 'instrumentalisation' – focuses on the creation of subjects and objects composed of networks and technical devices. 'instrumentalisation' supplies unique knowledge about primary 'instrumentalisation' because its functions are separate from daily life. This functional 'instrumentalisation' relates to technical relationships in society which entail the act of decontextualisation because objects are removed from their lifeworld and reduced to things with useful albeit limited properties. Secondary 'instrumentalisation' refers to the act of re-contextualising a new technical grouping within a particular lifeworld, which is integrated into particular practices which become codified artefacts.

Elichirigoity (2000) is of the opinion that humans are beings with both natural and technological characteristics and therefore, no dichotomy exists between human beings and technology due to the humanity-technological nature which is mutually embodied. In the current global post-humanist world, humans live in a universal nation with a global communication space wherein humans concurrently embody and emerge with technology and nature. Critical posthumanists concur with Michel Foucault who doubts that the human body exhibits forms that are discursive or transcendental because the individual is present in a context, packed in a whole which entails a world that is interconnected with other bodily masses, perceived as a

"transversal force that cuts across and reconnects previously segregated species, categories and domains" (Braidotti, 2013, p. 193).

Kellner (n/d) doubts the concept of 'instrumentalisation' and the distinction between 'primary and secondary instrumentalisation' that Feenberg (1999) theorises in order to appropriately characterise technology in all its diverse configurations and constellations. It is also not clear whether the concept of 'instrumentalisation' is adequate to describe the nature and function of technology through history. Whilst the instrumental use of technology undoubtedly describes modern society, it may be that pre-modern society may have had more ritualised, aesthetic, religious, or social notions about technology. Moreover, Kellner (n/d) is not certain whether the concept of 'secondary instrumentalisation' is the correct term for the substantive analysis of aesthetic and ethical meanings and qualities, democratic reconstructions of technology, and usage that integrate technology within specific contexts that Feenberg (1999) endeavours to characterise in order to distinguish specific uses of technology from a conceptualisation that is more instrumental in nature. Additionally, Kellner (n/d) postulated that the concept of 'instrumentalisation' appears to be associated with the dominant construct of technology against that which Feenberg endeavours to polarise in order to maintain a link with the critical theory that Lukàcs posits as well as other critics of the instrumental rationale which theorise technology as a distinct characteristic of modern capitalism that is opposed by the substantive notion of democracy. According to this perspective, technology is viewed as an instrument, a term that cannot grasp the robust and vast range of elements that Feenberg wishes to embody in the concepts of integration (of technology within daily life) and realisation (of values and aesthetic qualities) including democratisation (of design, use, and reconstruction). Above all, the distinction between primary and secondary instrumentalisation is highly enabling towards the vision that Feenberg opposes and also suggests that the primary dimension of technology is the instrumental or functional nature. The other characteristics of the technology are secondary in nature and repeat the dialectic between primary and secondary qualities prevailing in the history of philosophy.

Kellner (n/d) corroborates that Feenberg could argue the instrumental and multidimensional qualities of technology are primeval relating to the concept that Heidegger posited. Additionally, the design, usage, meaning, function, construction, and realisation are all imbued with equal importance in the creation of current experiences and the use of technology in the social life of humans. Above all, the distinction between instrumentalisation and the concept of democratic rationalisation, that Feenberg (1999) proposes, to substitute its distinction of primary *versus* secondary, would enable all discrimination which Feenberg intends, and would provide continuity to the criticism of the Frankfurt School of instrumental reasoning; this would further give rise to a critical point of view to critique other theories of technology as well as that usage which is essentially instrumentalist, thus abstracting the environmental context, values, meaning and democratisation. This instrumental, decontextualised, deductive, autonomist, and determinist approach which Feenberg endeavours to distinguish from the approach which considers technology as being contextualised, mediating, multidimensional, reflexive, democratic, and concrete. The latter view could provide daily life with a motive for agency, values, and meaning as well as afford technology with the wealth that Feenberg intends to value.

2.4 Collaborative Management and Mindfulness

Fayol was excessively fascinated with managerialism and the functions of management; in his 1916 seminal work *General and Industrial Management*, the unity of command and the workers are controlled by one boss in a hierarchical organisational structure. Fayol and Taylor buttressed the manager's entitlement to manage. Taylor lived by the dictum that managers are expected to manage and workers are expected to work. This viewpoint is linked to the debasement of the very essence of being human. Thus, managerialism is viewed as being authoritative and oppressive. Follett (1941), on the other hand, was fascinated with the notion of power-with instead of power-over. This form of power is according to democratic ideals where the collaborative development of power arises from the community and organisational members. The authors of this book chapter are of the opinion that the views of Taylor and Fayol are responsible for the endemic situation of workplace stress and other work-related ailments which have surfaced during the last few decades. This situation has been exacerbated by the overuse of IT and with the onset of COVID-19 where the boundaries of work and home have become blurred to non-existent. However, those organisations which follow a more humanised and Folletian perspective where employees are treated with dignity and respect should reduce workplace ailments. In this regard, the concept of mindfulness should be nurtured within organisations. Mindfulness can be defined as the "state of conscious awareness in which the individual is implicitly aware of the context and content of information" (Langer, 1992, p. 289). The concept of mindfulness refers to a heightened state of awareness and employee involvement (Langer, 1989, 2000). Extant literature shows that mindfulness programmes within organisations lead to increased job satisfaction and organisational performance. The concept of mindfulness can be brought in here due to it being aligned with the notion that when an individual is aware of the circumstances, then the individual is not behaving mechanically and thus engages with full awareness and making use of the mental processes (Glomb *et al.*, 2012).

The most cited definition of mindfulness is that of Brown *et al.* (2007, p. 212) and this is "a receptive attention to and awareness of present moment events and experiences". The majority of definitions of mindfulness state that it is a present-moment awareness of the "here and now" (Herndon, 2008, p. 32). According to Dane (2011), mindfulness is present-focused consciousness, which requires "giving full attention to the present" (Thondup, 1996, p. 48). When individuals are constantly thinking about the past or only musing about the future, they are not demonstrating mindfulness (Brown and Ryan, 2003). Mindfulness entails concentrating on internal and external occurrences (Dane, 2011; Brown and Ryan, 2003). Mindfulness also requires that individuals view these phenomena with an open mindset "without imposing judgments, memories, or other self-relevant cognitive manipulations on them" (Glomb *et al.*, 2012, p. 119). The literature is in agreement with defining mindfulness as an individual construct that can enhance physiological, cognitive, and psychological activity. One of the major benefits of mindfulness is self-regulation (Glomb *et al.*, 2012). Individuals who engage in mindfulness never

think or behave in mechanical or mindless ways; this is because these individuals are constantly disrupting the automatised mental processes (Chaiken, 1980).

Mindfulness leads to the opportunity for engagement in order not to be caught in automatic thought patterns and instead "experience what is instead of a commentary or story about what is" (Shapiro *et al.*, 2006, p. 379). Mindfulness allows for a heightened level of psychological flexibility (Bond *et al.*, 2006). Moreover, mindfulness allows the individual to make choices that are tinged by personal culture and aspirations rather than by private fears or contextual demands (Hayes *et al.*, 2004).

Several studies reveal the transition linked with the desired group of skills inherent in information systems to focus on the soft skills as demonstrated in table 2.1 below which presents a classification of the IS skills (Lee *et al.*, 2002; Richards *et al.*, 1998; Lee *et al.*, 1995). These soft skills include interpersonal skills and problem-solving skills, organisational skills include teamwork, communication, and leadership, among other skills.

Tab. 2.1 – Classification of IS abilities/knowledge/skills[a].

Authors	Categories
Ashenhurst (1972)	People, models, systems, computers, organizations, society
Couger *et al.* (1995)	Communication, computer applications systems, information technology and tools, interpersonal relationships, management, problem solving, systems development methodologies, systems theory and concepts, professionalism
Lee *et al.* (2001)	Business functional knowledge (H), interpersonal and management skills (H), technology management knowledge (M), Technical specialty knowledge (L)
Leitheiser (1992)	*Developer skills:* interpersonal (H), analysis and design (M), programming (M), business (M), environment (L), programming language (L), specific application (L) *Specialist skills:* database and data communication (1), software (2), hardware (3), advanced applications (4)
Nelson (1991)	Organizational knowledge, organizational skills, organizational unit, general IS knowledge, technical skills, IS product
Todd *et al.* (1995)	Hardware, software, business, management, social, problem solving, development methodology
Young and Lee (1996)	Interpersonal skills (H), programming languages (M), development and management of applications (M), operating systems (M), network and communications (L), personal computer tools (L)

Source: Adapted from Lee *et al.* (2002, p. 53).

Earl and Feeny (2000) opine that those individuals who are considered as being successful top managers do not always possess IT literacy; however, they do focus on IT and the knowledge inherent to IT. Moreover, these successful top managers are becoming sensitised to the importance that soft skills have in the workplace in order to explore and understand new technologies and in so doing create an IT-driven vision

about the future of the organisation. Additionally, these managers create the foundations for IT and place it at the centre of the organisational strategy and its processes. Information systems professionals tend to dedicate more time to monitoring new trends associated with technology in order to better understand the specific business functions as well as the organisational environment. Therefore, soft skills are vitally associated with the realm of information systems to create the vision which harnesses the sustainable competitive environment for organisations to thrive (Lee *et al.*, 2001).

2.5 Conclusion

If the organisations adopt the Folletian view of collaboration and power-with instead of the Fayol notions of bureaucracy and power-over, then the human element and mindfulness prevail which enable individuals to be productive. This organisational context is fundamental so that technology can be part and parcel of daily organisational life and not be regarded as a controlling mechanism in spite of its pervasiveness. The stance that this study espouses is that technology should be put into perspective, democratic, conciliating, multifaceted, reflexive, and unambiguous – all these enable the performance of the individuals to grow and serve as the conduit for the organisation to achieve sustainability.

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Chapter 3

Managerial Challenges of Industry 4.0: A Case Study in the Portuguese Footwear Sector

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Abstract

In the manufacturing industry, the increasing intelligence of products and systems, their intra-company cross-linking, and their cross-company integration into value creation networks are referred to as Industry 4.0 (I4.0). Academics and practitioners largely agree that I4.0 offers far-reaching opportunities while having a presumably disruptive impact on today's markets, business models, supply chains, and the world of work in general. In line with the above trend, academic contributions dealing with I4.0 have increased dramatically within the last few years. This chapter strives to establish I4.0 as a challenging but promising field for management research and aims to assist scholars in engaging with the topic. First, we gather and analyse extant contributions through a systematic literature review on the topic and then, we present empirical research, conducted on the Portuguese footwear industry. On this basis, we derive managerial challenges in this industry and present an empirically backed research agenda, and suggest fruitful avenues for future research.

Keywords: Industry 4.0, Footwear industry, Disruption, Smart production
JEL Classification: M19, O39

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3.1 Introduction

Industrial revolutions were all triggered by technical innovations: The introduction of water and steam-powered mechanical manufacturing, at the end of the 18th century (1st revolution); the division of labour, at the beginning of the 20th century (2nd revolution), and the introduction of Programmable Logic Controllers (PLC) for automation purposes in manufacturing, in the 1970s (3rd revolution) (Schuh *et al.*, 2015). The 4th Industrial Revolution paradigm relates to the creation of Smart Factories through Industry 4.0 (I4.0) technologies (Bag *et al.*, 2021).

In recent years, the business world has been stepping into I4.0. I4.0 is characterized by the fast development of various disruptive technologies namely blockchain, big data, and AI (Chauhan *et al.*, 2021; Schneider, 2018). It is commonly accepted that I4.0 is a collective term for the broad range of current digital technologies related to the value chain organization. This concept aims to introduce technical advances such as Wireless Network Systems (WNS), Cyber-Physical Systems (CPS), Internet of Things (IoT), and Cloud Computing (CC) (Satoglu *et al.*, 2018). These disruptive technologies have reshaped the entire business environment to encompass such recent technological and managerial advances (Siqin *et al.*, 2022; Chauhan *et al.*, 2021).

I4.0 technology principles comprise interoperability, virtual applications, decentralised systems, real-time capabilities, orientation for service, and modular production. According to Chen and Tsai (2016) interoperability is "*the ability of two systems to understand each other and to use the functionality of one another.*" It represents the capability of two systems to exchange data and share information and knowledge (Lu, 2017). These principles, along with empowering technologies, possess the potential for the improvement of firms' operations as they focus on process, product, and business models (Chauhan *et al.*, 2021).

Academics and practitioners, largely agreeing on the global importance of this proclaimed industrial revolution, have published many contributions on the topic. Research, however, is rather focused on investigating single technologies in quite specific application domains and largely neglects the profound managerial challenges underlying I4.0. Given the recent plea for a more active contribution from the management science community, this chapter strives to establish I4.0 as a challenging but promising field for management research and aims to assist scholars in engaging with the topic.

The chapter is organized as follows. First, we introduce the main the 4th Industrial Revolution, the I4.0 concept and technologies, as well as its benefits and challenges. Then, we introduce research conducted in the Portuguese Footwear Industry – the challenges and opportunities, as well as an analysis of the impact of I4.0 on that sector. Finally, we present the managerial insights about I4.0, based on a qualitative investigation carried out based on in-depth interviews with various relevant actors and experts of the Portuguese footwear cluster.

3.2 Literature Review

Industrial Revolution, in modern history, is the process of change from an agrarian and handicraft economy to one dominated by industry and machine manufacturing (Schwab, 2017). These technological changes introduced novel ways of working and living and fundamentally transformed society. This process began in Britain in the 18th century and from there spread to other parts of the world (Schwab, 2017). Although used earlier by French writers, the term Industrial Revolution was first popularized by the English economic historian Arnold Toynbee (1852–83) to describe Britain's economic development from 1760 to 1840. Since Toynbee's time, the term has been more broadly applied as a process of economic transformation than as a period in a particular setting (Schwab, 2017). This explains why some areas, such as China and India, did not begin their first industrial revolutions until the 20th century, while others, such as the United States and western Europe, began undergoing "second" industrial revolutions by the late 19th century (Schwab, 2017).

3.2.1 The 4th Industrial Revolution

The 4th Industrial Revolution paradigm relates to the creation of Smart Factories. I4.0 is considered a new industrial stage in which vertical and horizontal manufacturing processes integration and product connectivity can help companies to achieve higher industrial performance. In this sense, I4.0 can be understood because of the growing digitization of companies, especially regarding manufacturing processes. The key element that characterizes this new industrial stage is the deep change in the manufacturing systems connectivity due to the integration of Information and Communication Technologies (ICT), IoT and CPS (Schwab, 2017; Kagermann, 2015).

Since it was first mentioned in the Hannover fair event, in 2011, the I4.0 term is currently one of the most popular manufacturing topics among industry and academia in the world and has also been considered as the new industrial revolution with extreme impacts on manufacturing in the future (Rojko, 2017). With the rise of this 4th industrial revolution, the paradigm of the companies has shifted and will continuously change throughout the upcoming years (Nagy *et al.*, 2018).

In this chapter, firstly, we will provide a clear definition of I4.0, clearly differentiating it from Digitalization and Computer Integrated Manufacturing (CIM). Secondly, we will provide an overview of the major I4.0 technologies. Finally, we will make a brief overview of the main benefits and challenges brought by this revolution.

3.2.2 Industry 4.0: Differentiation from Similar Terms

While the popular and increasingly used term I4.0 still lacks a generally accepted definition (Bierer *et al.*, 2016; Oesterreich and Teuteberg, 2016), the meaning of the neologism seems clear: the first part reflects the common definition of industry and the second part, 4.0, refers to the fourth stage of the industrialization process. Based on this conception of networking as the key aspect of I4.0, we aim to investigate the

foundations of I4.0. For this purpose, as Schneider (2018), we describe the underlying vision of I4.0 as differentiated from Digitalization and CIM.

I4.0 is sometimes described as digitalization. However, I4.0 seems to go beyond pure digitization or computerization. Firstly, digitalization refers, by definition, to essentially all areas of social life. In contrast, the key promoters of I4.0, while emphasizing that the topic ought to be developed in an interdisciplinary rather than an isolated manner and that further progress should be made in exchange with other application Fields, explicitly focus on the manufacturing industry (Schneider, 2018). Secondly, compared to the phenomenon of digitization, I4.0 highlights a specific technology bundle as its key enabler. Despite rather broad conceptions of the technology base enabling I4.0 in some application-oriented contributions (Bechtold *et al.*, 2014), the so-called CPS is acknowledged as the technological driver of I4.0, both by industry experts and in large parts of the academic literature (Brettel *et al.*, 2014). A CPS interconnects distributed, embedded systems (Klötzer and Pflaum, 2015) that are integrated into physical objects and that possess extensive communication functionalities and computing capabilities (Miorandi *et al.*, 2012).

I4.0 is sometimes described as "the computerization of the manufacturing industry" (Haddara and Elragal, 2015). Computer-Integrated Manufacturing (CIM) envisioned a deserted factory (Haddara and Elragal, 2015). On the contrary, the literature assumes that substantial potentials of I4.0 arise from an improved human-machine interaction based on a new generation of collaborative, fast-learning industrial robots and sophisticated, CPS-based assistance systems (de Gea Fernández *et al.*, 2017; Quint *et al.*, 2015; Blümel, 2013). Given such a human-centred perspective on I4.0, the topic may be of utmost importance for leadership, human resources, and change management. Additionally, networking in the context of I4.0 is not limited to the entity means of production and networking may particularly be geared towards inter-organizational integration. In contrast, in the vision of CIM, networking only takes place vertically across the various products and Information Technology (IT) systems of a manufacturing company and explicitly focuses on intra-organizational integration (Kumar *et al.*, 2005).

3.2.3 Industry 4.0 Technologies

I4.0 is characterized by the fast development of various disruptive technologies namely blockchain, big data, and AI (Chauhan *et al.*, 2021; Schneider, 2018). The technological stream constitutes an important field concerning I4.0, and a combination of digital and manufacturing technologies can enable vertical integration of an organisation's systems, horizontal integration in collaborative networks, and end-to-end solutions across the value chain (Zheng *et al.*, 2021).

It is commonly accepted that I4.0 is a collective term for the broad range of current digital technologies related to the value chain organization. As previously mentioned, this concept aims to introduce technical advances such as WNS, CPS, IoT, and CC (Satoglu *et al.*, 2018). These disruptive technologies have reshaped the entire business environment (Siqin *et al.*, 2022; Chauhan *et al.*, 2021). Table 3.1 presents a summary of the principal I4.0 technologies.

TAB. 3.1 – Summary of I4.0 technologies (Zheng *et al.*, 2021).

Technology	Description
CPS	CPS is a collection of transformative technologies that connect the operations of physical assets and computational capabilities. The main aim is to monitor physical systems while creating a virtual copy
IoT	Information network of physical objects (sensors, machines, cars, buildings, and other items) that enables the collection and exchange of data, allowing interaction and cooperation of these objects
Big data and analytics	Collection and analysis of a large amount of available data using a series of techniques to filter, capture and report insights, where data are processed in higher volumes, with higher velocities, and in a greater variety
CC technology	System for the provision of online storage services for all applications, programmes, and data in a virtual server, without requiring any installation
AI	A system that thinks humanly and rationally according to six main disciplines, including natural language processing, knowledge representation, automated reasoning, machine learning, computer vision and robotics
Blockchain	A database that creates a distributed and tamper-proof digital ledger of transactions, including timestamps of blocks maintained by every participating node
Simulation and modelling	Technologies that mirror the physical world data such as machines, products, and humans in a virtual world, aim for simplification and affordability of the design, creation, testing, and live operation of the systems

3.2.4 Managerial Benefits of Industry 4.0

I4.0 is based on technological developments relevant to the physical, digital, and biological spaces across industries. In this sense, advances in Artificial Intelligence (AI), Nanotechnology, Quantum Computing, Synthetic Biology, and Robotics will rapidly substitute for the production technologies of the past sixty years. The I4.0 revolution creates better prospects in today's production process, including mass customization, flexible production, increased production speed, higher product quality, decreased error rates, optimized efficiency, and better customer proximity. Therefore, the use of I4.0 technologies may compromise several benefits to the firms, namely:

i. *Higher Customization and Low Production Volume*

I4.0 allows individual, customer-specific criteria to be included in all the phases of production which include design, configuration, ordering, planning, manufacture, and operation. Due to the end-to-end integration of all the stakeholders, I4.0

technology made it possible to make last-minute changes and incorporate them into the products without generating any extra costs. Additionally, I4.0 technologies made it possible to meet individual customer requirements and to produce one-off items or have very low production volumes whilst still making a profit (Rüßmann *et al.*, 2015).

ii. *Higher Flexibility*

CPS-based *ad hoc* networking enables dynamic configuration of different aspects of business processes, such as quality, time, risk, robustness, price, and eco-friendliness, increasing the flexibility of production. This also means that engineering processes can be made more agile and manufacturing processes can be changed in a short space of time (Kagermann, 2015). Besides, the highest flexibility allows firms to meet the growing need of employees to strike a better balance between their work and their private lives and between personal development and continuing professional development (Rüßmann *et al.*, 2015).

iii. *Process Optimization and Innovation*

I4.0 technologies allow the optimization of manufacturing processes on a case-by-case basis across the entire value network. Additionally, I4.0 technologies also provide the opportunity to optimize the systems during production in terms of their resource and energy consumption or reduce their emissions, without having to stop the machines (Schuh *et al.*, 2017). Moreover, I4.0 technologies stimulate the creation of new services and product opportunities, especially for SMEs and Startups, that aim to develop new B2B technological services (Rüßmann *et al.*, 2015).

iv. *Higher Integration and Transparency*

I4.0 technology provides end-to-end integration and transparency in real time. This allows firms to have an early verification of any design or process changes. Moreover, I4.0 technologies enable interconnections. This is, to strengthen the link between partners, customers, employees, and systems to accelerate business performance and create new opportunities by collaborating on a shared platform (Ervural and Ervural, 2018).

3.2.5 Managerial Challenges of Industry 4.0

As promising as the idea of a self-prophesying 4th Industrial Revolution may sound, at first sight, it is essential to remark that there is a multitude of managerial challenges, risks and barriers concerning its implementation, including scientific, technological, and economic challenges as well as social problems, and political issues. According to Schneider (2018), there are six interrelated clusters of managerial challenges: Analysis & Strategy, Planning & Implementation, Cooperation & Networks, Business Models, Human Resources and Change & Leadership (see figure 3.1).

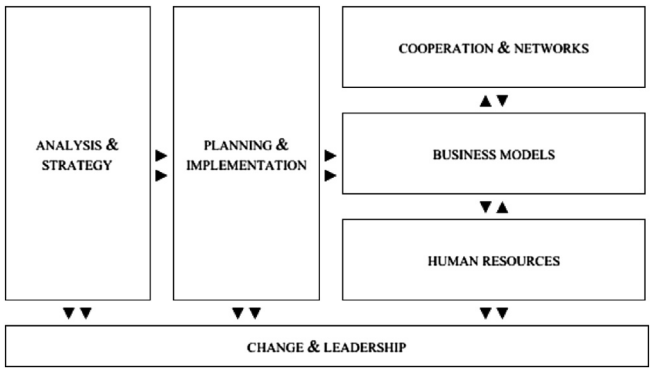

FIG. 3.1 – Six interrelated clusters of managerial challenges of I4.0 (Schneider, 2018).

The main challenges across the six clusters are following described.

i. *Analysis & Strategy*

This cluster refers to strategic managerial challenges that companies must discuss to be able to make an informed decision on how to approach and deal with I4.0 in general terms (Schneider, 2018). Namely:

- *Evaluation of the impact on markets and competition:* Understanding the essential drivers of change, anticipating the impact on industry structure, market boundaries, rules of competition and power relations, and assessing the disruptive potential of I4.0 (Schneider, 2018).
- *Determination of a general strategic approach:* Determining whether the company acts as a creative innovator, a fast adaptor, or an observant laggard (Schneider, 2018).
- *Development of a strategic transformation path:* Develop a rough strategic plan in terms of a staged model that specifies the general strategic approach by structuring the transformation in single phases and by describing the activities to be carried out (Schneider, 2018).

ii. *Planning & Implementation*

This cluster refers to managerial challenges underlying the need to reflect on more specific aspects, termed planning, and implementation of I4.0 technology (Schneider, 2018). Namely:

- *Identification and development of specific use cases:* Transferring the general potential of I4.0 into specific projects, initiatives and implementations that aim to improve (Schneider, 2018).
- *Conduction of cost-benefit analyses and making investment decisions:* Estimating, the ex-ante uncertainty and the prospective added value of various use cases considering both monetary and non-monetary effects, to decide to what extent investments are justified and when to invest in the continuously evolving technology base (Schneider, 2018).

- *Planning of migration paths for implementation:* Planning how new technologies and systems could be integrated into the existing technological and organizational infrastructure assets immediately or without interfering with functioning workflows (Schneider, 2018).

iii. *Cooperation & Networks*

This cluster refers to the managerial challenges in terms of the need to face faster and more intensive competition through continuous I4.0 technological innovations (Schneider, 2018). Namely:

- *Assessment of the meaning of inter-organizational collaboration:* Developing an awareness of the possibilities and risks of a strengthened organization concerning cooperation and networks and deriving implications for the specific company (Schneider, 2018).
- *Decisions on make-or-buy respectively cooperative value creation:* Deciding on integration or disintegration and determining which activities should be outsourced, be pursued cooperatively, or be performed by the company (Schneider, 2018).
- *Identification and selection of suitable collaboration forms as well as a partner:* Building up knowledge about possible forms of collaboration, assessing the respective opportunities and risks, and making informed decisions (Schneider, 2018).

iv. *Business Models*

This cluster refers to managerial challenges underlying the interface between business model innovation and I4.0 (Schneider, 2018). Namely:

- *Derivation of implications for the business model:* Understanding general characteristics as well as influencing factors that, in the context of I4.0, trigger and enable the adaptation and innovation of business models and applying this knowledge to the own business model (Schneider, 2018).
- *Development of new business models:* Designing innovative, coherent, and sustainable business models given the technological possibilities and drivers of I4.0 that are completely new or represent small adaptations to the current business model (Schneider, 2018).
- *Decisions on business model innovation:* Deciding whether an adaptation to the business model is necessary and to what extent the current business model should change, be complemented by a simultaneously developed business model and/or be replaced by a completely new business model (Schneider, 2018).

v. *Human Resources*

This cluster refers to a profound understanding of I4.0's impacts on the workplace of the future, qualifying employees and building digital capabilities (Schneider, 2018). Namely:

- *Evaluation of the impact on working life:* Comprehending the impact of I4.0 on the working world and the role of humans in it, and anticipating for the own company how task range, task depth and task content may change in general (Schneider, 2018).
- *Designing the workplace of the future and qualifying employees:* Determining necessary competencies and abilities, defining altered requirements regarding education and training, implementing the technological and organizational possibilities that have been improved by I4.0 and using them to qualify employees (Schneider, 2018).
- *Building digital capabilities at the level of the firm:* Enabling the company to gather large amounts of data, store them securely, transmit and process them efficiently, and use and analyse them intelligently (Schneider, 2018).

vi. *Change & Leadership*

This cluster refers to managerial challenges triggered by organizational and cultural change, which needs to be governed and controlled by managers, considering potential acceptance problems and inertia tendencies (Schneider, 2018). Namely:

- *Govern, control and coordinate the transformation process:* Defining approaches for management control and change management, implementing specific responsibilities and dedicated management units, and managing the overall process of change (Schneider, 2018).
- *Creation of acceptance for change and counteract organizational inertia:* Overcoming scepticism and fear of top managers, executives and blue-collar workers, counteracting inertia tendencies at the firm, business unit and individual level, resolving potential conflicts and motivating employees to actively shape and participate in the transformation (Schneider, 2018).
- *Establishment of a culture of experimentation, risk-taking and collaboration:* Increasing the willingness to experiment, take risks and cooperate beyond area boundaries in a company, business unit and individual level (Schneider, 2018).

3.2.5.1 Extrinsic and Intrinsic Barriers to Industry 4.0

In addition to the managerial challenges already described, there are several barriers to the adoption of I4.0. Chauhan *et al.* (2021) have highlighted the existence of extrinsic and intrinsic barriers to the adoption of I4.0. These are exhibited in figures 3.2 and 3.3, respectively.

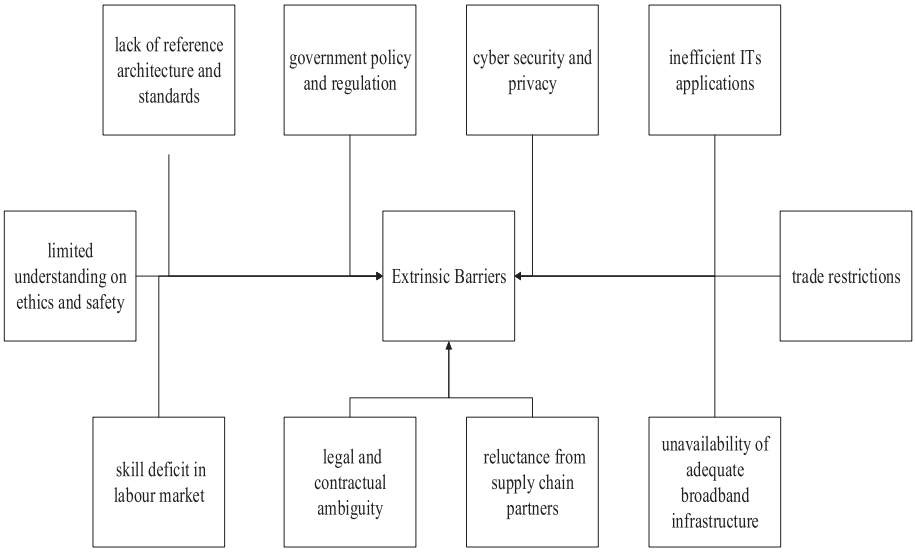

FIG. 3.2 – Extrinsic barriers (Chauhan *et al.*, 2021).

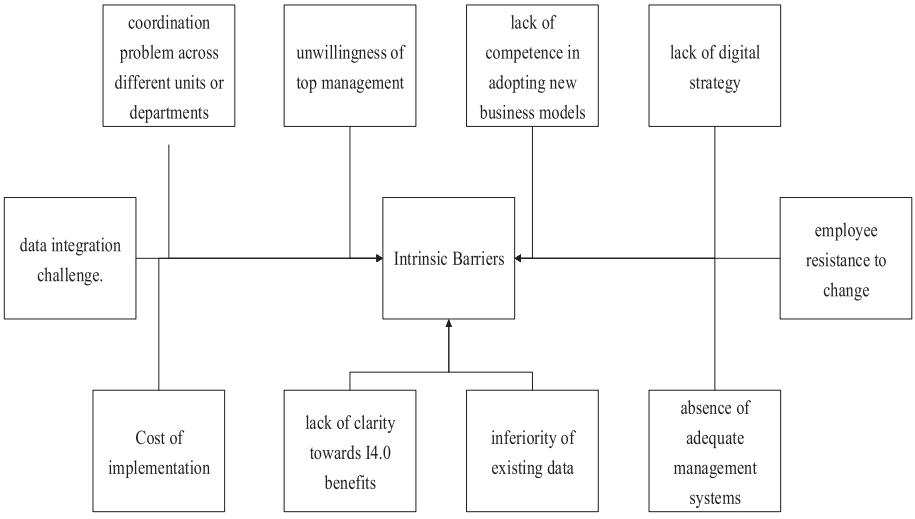

FIG. 3.3 – Intrinsic barriers (Chauhan *et al.*, 2021).

3.3 The Portuguese Footwear Industry

The Footwear Industry is one of the most profitable markets in the world. According to Statista (2022) revenue in the Footwear market amounts to US$2,602m in 2022. The market is expected to grow annually by 3.40% (CAGR 2022–2025) and the

average purchase volume per person in the Footwear market is expected to amount to 4.48 pairs in 2022.

Nowadays, Portuguese companies are known worldwide not only for the quality of their footwear but also for the excellence of their service, and the ability to deliver small series, always based on a quick response to the market needs and requirements (www.worldfootwear.com). The Portuguese footwear industry has displayed, throughout the last six years, a remarkable performance in several economic and competitive indicators. Leather shoes are the main category of footwear products manufactured in Portugal, being that the country is the 10th World Exporter of Leather Shoes (Marques *et al.*, 2017). According to APICCAPS (2018), based on the last information available, footwear products are essentially traded to South Korea, Russia and Chile – see figure 3.4.

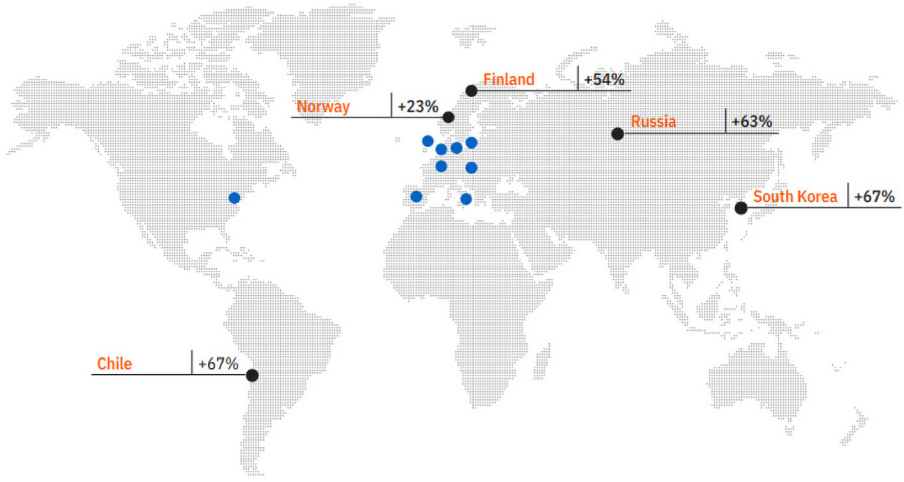

Fig. 3.4 – Main dynamic markets in 2017 (APICCAPS, 2018).

3.3.1 Exports: Benefits, Challenges, and Threats

In 2017, Portugal consolidated its position in most of the countries of the European Union, where its traditional business partners are mainly located, being the destination for 86% of its footwear exports. While continuing to consolidate its position in its most important markets, the Portuguese footwear industry also ventured into new ones, overcoming the constraints of the international markets and the uncertainty that has dominated the world economy (APICCAPS, 2019).

Despite facing challenges within national and international macroeconomic frameworks, the Portuguese footwear industry is expanding, which suggests that it is implementing appropriate strategies (APICCAPS, 2019). In the last 3 years, there has been a global slowdown in economic growth and a deep recession in the

eurozone, with gross domestic products contracting in 2012 and 2013. For a highly export-oriented industry such as footwear, with exports mostly directed towards Europe, the crisis imposed an extremely unfavourable environment for further external expansion (APICCAPS, 2019).

In these unpromising circumstances, the industry asserted itself, yet again, as a mainstay of the Portuguese economy (APICCAPS, 2019). Between 2010 and 2012, contrary to the national recession, the sector managed to increase both its employment and output significantly: 10 and 20%, respectively, according to its employers' association (APICCAPS, 2019). There are 1354 footwear firms with a total of 35 355 employees, suggesting that, on average, the bulk of these firms are small rather than medium-sized (Marques *et al.*, 2016).

In 2016, the footwear cluster carried on in a moderately favourable economic climate, not differing greatly from the previous year. The political events of the year, however, particularly the United Kingdom's "Brexit" and the results of the United States elections, had their effect on economic agents and were reflected in a downturn, although slight, in the growth rate of GDP, both worldwide and the Euro Zone (APICCAPS, 2019).

In the same year, Portugal exported more than 81.6 million pairs of shoes with a total value of more than 1.9 billion euros. This performance represents a growth rate of 3.2% over 2015 and the seventh consecutive year of growth in sales to foreign markets. In this short period, the Portuguese footwear industry has presented an outstanding growth dynamic, increasing its export revenue by roughly 50%. This is a particularly positive performance considering the instability felt in foreign markets and the uncertainty impacting important footwear consumer markets (www.worldfootwear.com).

3.3.2 Technological Enhancement: A New Era of Modernization

At the beginning of 2017, the Portuguese government worked together with different companies to develop a strategy and a set of measures to help Portuguese companies to start their adaptation processes toward the I4.0. Since then, the Portuguese footwear industry has undergone a rapid and intensive transformation. During this time, the Footwear Technological Center of Portugal (CTCP) has also invested in the application and sharing of know-how amongst specialized workers, through different projects such as *Step2Footure* – a project that aimed to transfer to the sectors of materials, components, footwear and leather goods, advanced technological knowledge, developed in R&DT projects, for the design, prototyping and functionalization of the product.

Portuguese footwear companies embraced the challenge to modernize their facilities and production methods and started investing in the less tangible aspects that gave them a competitive edge. As a result, a new wave of start-up companies and new services, that took advantage of I4.0 technologies emerged. Examples were the use of Apps and photos to build a 3D model of the person's feet to better advise the customer on which shoe fits better; the performance of customized shoes for

brides; the use of online stores to sell customized shoes, where the client can choose every aspect of the shoe, from the material, colour and shape (Pinto, 2017).

Another good example is the company Timberland. Due to the increasing pressure to turn the marketer's vision and the consumer's taste quickly and affordably into a reality that performs well, feels good and looks great, the company adopted a 3D printing system to produce their prototypes. This system has enabled Timberland to compress its typical design cycle from three to two weeks (3D Systems, 2018). According to Toby Ringdahl, computer-aided design manager of the company, the Colour Jet printers have allowed compressing the design cycles, lowering the costs, and helping to produce better products for the customers.

3.3.3 Challenges and Opportunities for the Portuguese Footwear Industry

Portuguese Footwear companies are known worldwide not only for the quality of their work but also for the excellence of their service, and the ability to deliver small series, always based on a quick response to the market needs and requirements. The topic of I4.0 is very complex and complete. As one of the main components of I4.0, the future factory is going to involve a new integrative, where not only all manufacturing resources (sensors, actuators, machines, robots, conveyors, etc.) are connected and exchange information automatically, but also the factory will become conscious and intelligent enough to predict and maintain the machines; to control the production process, and to manage the factory system.

For the footwear manufacturing sector, I4.0 can mean more flexibility and effectiveness in responding to the market thanks to the possibility to access a vast quantity of information and process data that can help to increase efficiency. But it also can mean finding the right balance, thanks to I4.0 technologies, between knowledge, artisanal skills, and automation in new production settings, which also enable Italian businesses to bring back phases of production that were transferred abroad long ago and a shortening of production chains through a return of delocalised production. The entire chain of the footwear manufacturing sector, from producers to their suppliers, from manufacturers of machinery and developers of process technologies to the final consumers.

Despite all the advantages, I4.0 can be brought to the sector that is still a long way to run. According to the Digital Economy & Society Index 2016 from European Commission (2016), nowadays. Portugal has a great position in terms of digital competitiveness. Nonetheless, there is no specific law regarding the I4.0 already. Therefore, in the second part of this chapter, we conducted a study to analyse the effect that the I4.0 revolution had, in the Portuguese footwear cluster and at a factory level, being able to get a more realistic overview of the actual impacts of I4.0 technologies in the Portuguese footwear industry. By doing so we aim to:

- have an idea of the degree of knowledge that the Portuguese manufacturers have regarding I4.0;
- have a clearer notion of the dissemination of this topic among Portuguese manufacturers;

- analyse the degree of digitization of the Portuguese footwear industry;
- have an idea of the implementation of I4.0 technologies in the Portuguese footwear industry;
- analyse the perceived benefits that come with I4.0 among Portuguese manufacturers;
- analyse the perceived challenges that come with I4.0 among Portuguese manufacturers;
- identify the main drivers for the implementation of these technologies in the Portuguese footwear sector;
- have an idea of the impacts that the implementation of I4.0 technologies might bring to the Portuguese manufacturer's workforce.

3.4 Methodology

Adapted from Stremersch and van Dyck (2009) and Schneider (2018), our methodology consists of two essential steps: a literature review on the managerial challenges of I4.0 (section 3.2) followed by triangulation of the data employing interviews and direct observation that allows us to perform a qualitative investigation of exploratory nature in terms of the practical importance of each one of the managerial challenges and future research need. Figure 3.5 depicts our methodological approach for the second part of the work. The steps are following described.

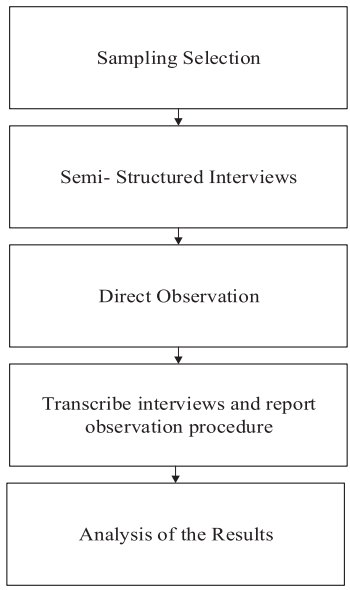

Fig. 3.5 – Methodological steps.

3.4.1 Sampling Selection

The fundamental basis of this study is based on personal opinions which are constructed having into consideration the academic and scientific state of the art and the application of the different study tools. We selected relevant persons of the Portuguese footwear: 10 internal and 3 external informants, for the interviews. Internal informants included top and middle managers that were listened to get acquainted with the firms' history, culture, strategy, and the way they perceive and react to environmental changes. External informants included industry experts. The role of these experts was critical in two key stages of the research: the design of the questionnaire and the interpretation of some results.

In the selection of the informants, we used purposive sampling, a non-probability sampling in which researchers rely on their judgment for choosing members of the population to participate in their interviews (Palinkas *et al.*, 2015). This technique is widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest (Palinkas *et al.*, 2015).

3.4.2 Semi-Structured Interviews

We performed twelve semi-structured interviews with significant stakeholders of Portuguese footwear (Kallio *et al.*, 2016). The interviews consisted of a series of open and closed questions related to the themes: degree of knowledge regarding I4.0, degree of implementation of I4.0 technologies, perceived benefits of I4.0, perceived challenges of I4.0, main drivers for the implementation of I4.0, and impacts of I4.0 technologies among workforces. In addition to the interviewees' opinion/knowledge regarding the questions, we performed questions about their experience, feeling, background and sensory questions, as recommended by Patton (2002).

A general interview guide was used to keep the interactions focused while allowing individual perspectives and experiences to emerge. Interviews lasted for about one hour. All interviews were conducted face-to-face, except for one, which was carried out over the phone. The interviewees allowed us to record the audio of the conversation for future transcription.

3.4.3 Direct Observation

The direct observation took place throughout the visits to the sample firms (same period as the interviews). Direct observation is the collection of information using the senses (Rolfe, 2020). By performing direct observation, we document activities, and behaviour, without having to depend on peoples' willingness or ability to respond accurately to questions (Rolfe, 2020).

The visits had an average duration of one hour, allowing the observation of behaviours displayed by managers, designers, and production workers. In some cases, participant observation was conducted while working alongside the production workers and gaining an in-depth understanding of the activities involved in the production process.

3.4.4 Transcription and Report

After the visits to the firms and the interviews, we performed the transcription by using NVivo Software (NVivo, 2018). An interview transcript is a written record of a completed oral interview. The interview transcription process documents the conversation. This process was done from the audio recording. Additionally, we reported the insights that were collected through direct observation.

3.5 Results

3.5.1 Sample Description

The sample used in this investigation can be separated into two main groups: Internal and External Informants.

Internal informants (firms' managers) were divided into two main clusters, based on two of the most relevant Portuguese footwear ecosystems: São João da Madeira and Felgueiras. The two main clusters (Felgueiras and São João da Madeira) were composed of 4 companies each. The selected companies operated in the shoe manufacturing sector. Additionally, two extra interviews were conducted, outside these two clusters, to have a more complete sample for the investigation concerning the Portuguese footwear sector: one in Guimarães and another one in a company in Vila Nova de Gaia.

São João da Madeira is known as the Portuguese "shoe capital" since this was the place wherein 1483 was registered as the first shoe factory in Portugal. The production in São João da Madeira is typically focused on high-end quality shoes and is a complex type of production that requires more labour-intensive activities. Felgueiras, on the other hand, is known for having a larger production capacity and producing higher volumes of the same design, which in the early years, was linked to lower quality products, but nowadays, due to the technological advances in the machinery and processes, these factories are more able to produce large volumes while maintaining high-quality standards.

External informants included industry experts. In this group, to have a better understanding of the Portuguese footwear sector, we conducted one interview with the manager of the CTCP (Portuguese Footwear Technological Centre) and two interviews with managers of the Portuguese Association of the Shoe Industry and Substitute Leather Products (APICCAPS).

The following subsections will focus on the exhibition of feedback from internal informants. Since the external informants' role was more critical in the design of the questionnaire and the interpretation of some results (rather than in the insights). Table 3.2 lists the general characteristics of the internal informants. For anonymous reasons, companies are identified with numbers.

Tab. 3.2 – Interviewees' company descriptions.

Company	Interviewed	Location	No. of employees	Daily production	Main export markets
Company 1	Interviewee 1 (Manager)	Felgueiras	100	800 pairs	Spain, Netherlands, Sweden, Germany
Company 2	Interviewee 2 (COO)	Felgueiras	86	600 pairs	Germany, Russia, Canada, UK
Company 3	Interviewee 3 (Owner)	Felgueiras	44	300 pairs	Germany, Netherlands, USA, Chile
Company 4	Interviewee 4 (Commercial Director)	Felgueiras	92	750 pairs	France, Netherlands, UK
Company 5	Interviewee 5 (Manager)	S. João da Madeira	38	200 pairs	France, Switzerland, Belgium, Germany
Company 6	Interviewee 6 (Owner)	S. João da Madeira	15	100 pairs	France, Scandinavia, USA
Company 7	Interviewee 7 (Financial Manager)	S. João da Madeira	58	200 pairs	France, Netherlands, Denmark
Company 8	Interviewee 8 (Owner)	S. João da Madeira	16	130 pairs	France, Belgium, Denmark
Company 9	Interviewee 9 (Production Manager)	Pedroso, Vila Nova de Gaia	400	1000 pairs	France, Germany, Netherlands, USA, Canada, Turkey
Company 10	Interviewee 10 (Plant manager)	Guimarães	140	–	Portugal, Spain, France, Netherlands, UK, Switzerland, Sweden, Germany, Austria, USA, Canada, Chile, Uruguay, Australia

3.5.2 Portuguese Footwear Industry: Insights

The next subsections detail the findings for the Portuguese Footwear Industry, in a set of different areas: degree of knowledge regarding I4.0, degree of implementation of I4.0 technologies, perceived benefits of I4.0, perceived challenges of I4.0, main drivers for the implementation of I4.0, impacts of I4.0 technologies among workforces and future investment in I4.0. We carried out an iterative and reciprocal approach for analysing and synthesizing the respective contributions.

3.5.2.1 Degree of Digitization

When analysing the degree of knowledge those Portuguese manufacturers have regarding I4.0, it is possible to conclude that the producers are well informed on what refers to new technologies that are already being used in the industry and new technologies that are being released. Concerning the degree of digitization of the footwear industry, these manufacturers believe that the industry has already some tools that allow for the automation of some processes. As stated by one of the operational managers: "*There have been many technological advances in the footwear sector which allows for higher quality as the products come out more perfect and more fluidly. Companies produce more and in less time*".

Nonetheless, all interviewees refer that the Footwear Industry is a sector that is still very dependent on human labour and that nowadays the related technologies have not evolved enough to allow full process automation scenarios. The interviewees also stated that currently, it is not easy to effectively implement the I4.0 paradigm in current work scenarios as, according to Zhou *et al.* (2016), it is likely to take ten or more years to realize it. Informants were invited to classify the degree of digitalization from 1 – very low to 5 – very high. Most internal informants answered 3 (medium level).

3.5.2.2 I4.0 Technologies

Concerning such implementation of I4.0 technologies in the Portuguese footwear industry, it was possible to notice that the technologies with the highest degree of implementation were the automatic cutting machines, followed by an integrated management system (IMS) and Digital footwear monitoring in real-time (QR codes; RFID tags). Table 3.3 presents the I4.0 technologies adopted per internal informant.

3.5.2.3 Benefits of I4.0 Technologies

Regarding the benefits that arise from the implementation of Industry s 4.0 technologies, the benefits most recurrently mentioned were: (i) the lower degree of dependency on human labour, (ii) improvements regarding flexibility of processes, especially due to the automatic cutting machines, (iii) the faster production and (iv) the higher efficiency. These benefits can also come from suppliers that implement I4.0 technologies. As stated by one of the operational managers: "*In recent years, I have been amazed at the technologies that have emerged. The value of 3D and*

Tab. 3.3 – I4.0 Technologies per company.

Company	Automatic cutting machine	Automatic sewing machines	Automatic assembling machines	Automatic storage	Additive manufacturing and 3D printing for sampling	IMS	Digital footwear monitoring in real-time (QR codes; RFID tags)
Company 1	X			X		X	x
Company 2	X	X				X	
Company 3		X					
Company 4	X		X			X	X
Company 5	X					X	X
Company 6							
Company 7	X						
Company 8							
Company 9	X	X	X			X	X
Company 10	X	X	X		X	X	X

shape digitization. Our stakeholders already use very advanced systems. For example, our last supplier already works with technologies that allow the digitization of shoe lasts and already sends me the work done in a very automatic way which ends up benefiting my business because it makes everything much faster and more perfect. Directly, I do not use these technologies, but my business partners already benefit from these technologies which end up benefiting me as well and making it easier for me to work. It makes everything faster, with more quality and more efficient. For me to build a shoe it is required a large list of suppliers, who already work with more advanced technologies that end up benefitting me".

3.5.2.4 Challenges of I4.0 Technologies

On what refers to the main challenges of I4.0, internal informants highlighted: (i) the lack of skilled human labour to work with I4.0 technologies and (ii) the huge investment in machinery. It is also highlighted, the lack of personnel in corporate management able to put into practice I4.0 technologies. As stated by one of the operational managers: "*A very large gap that I want to mention is the fact that there is a shortage of competent personnel in the corporate management of the companies, that is, the positions are occupied by people who have been working in the footwear industry for many years but do not have the competencies for the position in question. In many companies in Felgueiras and even in São João da Madeira there is not even a production director, there is no planning. Another obstacle is the lack of internal communication within companies. Lack of technical skills. In production, we will soon be lacking people because there are fewer and fewer people wanting to work in the factory. In this context, it makes sense to replace people with machines, but today there are still no machines available to replace people*".

3.5.2.5 Drivers of I4.0 Technologies

On what regards the main drivers of the implementation of I4.0 technologies, it is highlighted (i) the training of the employees to keep up with the I4.0 technological advances and (ii) the government support through the applied fiscal policy, to enable a lighter tax burden. Another thing that was highlighted was the partnership with universities. As stated by one of the operational managers: "*Partnerships with universities play a very important role because of the technical capacity they have within universities. Bringing the talent and know-how of young people inside companies is very important. The support that comes from the government is also very important to boost the entry of these people into the labour market*".

3.5.2.6 Workforce and I4.0 Technologies

Concerning the implications in the workforce, most of the internal informants do not believe that the implementation of I4.0 technologies will cause drastic job losses. Most informants consider that routine tasks are already being automatized, with the tendency for more tasks to follow this path and new job positions are emerging because of it. Also, operations managers see that the problem is finding people that

are willing to work on production, rather than training them. As stated by one of the operational managers: "*It is necessary to train the workers so that they can deal and work with these new technologies and I do not know if the Training Center is training workers for this purpose. I do not think it is. You will find it hard to find qualified people. Also, the people who have been working for many years in the footwear industry may be reluctant to learn new things. What happens in my factory and even in other factories around here is that there is a great difficulty in finding people to work there, and our workers are already in a higher age range which can be problematic for us as manufacturers*".

3.5.2.7 Investment in I4.0 Technologies

Finally, when asked about the intention of investing in new I4.0-related technologies in the future, seven out of ten of the internal informants claim to have the intention to invest either in machinery, improving their management system or selecting technologies that allow for better communications and interactions with their customers. All agree that the future passes to increasingly lower human intervention.

3.6 Discussion of Results

Academics and practitioners, largely agreeing on the global importance of I4.0, have published many contributions on the topic. Considering that I4.0 is still an emerging topic and publications may thus not always be found in highly ranked journals, we aimed to increase the confidence in our findings and triangulated our data by conducting semi-structured interviews with industry experts and managers that allow us to identify and have a perception of the weight of the challenges already identified on the literature, in terms of managerial importance and future research needed.

When analysing the degree of knowledge Portuguese manufacturers have regarding I4.0 it is possible to conclude that the producers are well-informed regarding new technologies that are already being used in the industry and new technologies that are being released. It was possible to notice that the manufacturers have a proactive attitude when it comes to researching ways of improving their businesses and keeping in touch with the latest innovations. CTCP and APICCAPS play a huge role in the dissemination of this type of information and novelties that come up in the market.

Different types of information channels are used such as email, news on their websites, events and presentations related to new technologies. Also, it is very common for manufacturers to attend various tradeshows, not just for footwear but also for technologies and materials. This gathering of knowledge and up-to-date information might impact the decisions made regarding the different partnerships established with the stakeholders. While some of the interviewees were not aware of the term "I4.0" nor the implications behind it, they are aware of the technologies that could be useful for their specific production sites.

Concerning the degree of digitization of the footwear industry, it is possible to notice that Portugal is receiving a lot of attention due to its new positioning and marketing campaigns that claim that the Portuguese footwear industry is "the sexiest industry in Europe". This campaign has a significant focus on the marketing aspects of the industry which is not the main concern of the manufacturers in this investigation, especially since eight out of ten are manufacturers, who don't have their brands and develop their business activities within the B2B segment. The manufacturers believe that the industry has already some tools that allow for the automation of some processes but all of them also say that this is a sector that is still very dependent on human labour and that the technologies have not evolved enough to allow full process automation. In conclusion, the industry is evolving and improving but it still has a long way to go in terms of automation and the establishment of processes.

There are many technologies available in the market, and it is not objective to assume that one is better than the other. It all depends on the type of product, client, and which are the goals of a specific company. Having these aspects under consideration, each company decides which technologies are the best fit to produce an answer to their needs. In this investigation, it was very common to hear the manufacturers say that they would like to produce more automatically, without having to rely so much on human labour but, at the same time, they also need to be flexible to respond to clients' demands. Bearing this in mind it is important to refer that not all technologies provide the much-needed flexibility that manufacturers require. Technologies, such as automatic sewing machines and automatic assembling machines, require set-up processes that aren't very cost/time efficient yet. The automatic lines are profitable when the production is focused on large volumes of the same design. Each time that is required to make changes, the set-up times and re-programming of production lines end up being highly time-consuming and requiring costly adjustments.

Other technologies, such as automatic cutting machines, have been used for decades and are constantly improving. This is the type of technology that presents the highest degree of implementation in the companies that were part of this study. This is because, because this technology has evolved over the years, it allows for more automatic, quick, and flexible production, with the manufacturers being more familiar with the overall functionality and requirements of the equipment.

Another important aspect that must be highlighted is that, particularly in leather production, since this is a very specific raw material, there are still many operations that are not automated, as it requires the application of highly technical procedures by a professional employee. Having this in consideration it is possible to assume that in the future, it will be expected that these technologies will allow for more flexible production which will increase the degree of interest of Portuguese manufacturers.

Regarding the benefits that arise from the implementation of Industry 4.0 technologies, it is important to conclude that the most recurrently mentioned was the fact that the automatization of processes allows a lower degree of dependency on human labour. Also, improvements regarding the flexibility of processes, especially due to the automatic cutting machines, faster production and more efficiency were

very common topics in the answers of the interviewees. Some of the advantages named by the interviewees are in line with the authors.

On the other hand, observing the present overall setting, the main challenges identified in the current research were the lack of skilled human labour to work with these new technologies and machines. This problem was identified both from the preliminary interviews and from the opinions collected from manufacturers. There is a common consensus regarding the difficulty in finding people that are willing to work on the shop floor in the factories and that have the proper training to perform more technical activities. These problems were already identified in the literature by Hofmann and Rüsch (2017), who argued that defining appropriate infrastructures and standards, ensuring data security, and educating employees are among the issues that need to be addressed on the road to I4.0. There is also general discontent regarding the courses given by the local vocational school and the CTCP.

Some other important constraints are the high cost of the machinery and the fact that orders from clients are not as homogeneous. According to Bartodziej (2017), the tendencies of the 21st century such as cycles of products being shorter while consumers demand more complex, unique products in larger quantities – pose many challenges to production and it was one of the main constraints identified by the manufacturers. In today's market, the orders are increasingly more diversified, which means that clients needless quantities of a higher number of designs. To be able to respond to this demand, the manufacturers must find ways to increase their production flexibility and also have a better communicational flow with their clients to understand their needs.

Concerning the implications for the local workforce, it is possible to conclude that most of the interviewees do not believe that the implementation of these technologies will cause drastic job losses. The common belief is that some more routine tasks are already automatized, with the tendency of more tasks following this route. The same workers that performed manual procedures are being trained and requalified to learn how to cope with the new technologies.

According to Hofmann and Rüsch (2017), the automated and self-regulatory nature of Smart Factories might cause severe job destruction since most routine tasks will be done by machines, creating opportunities for humans to be in charge of more creative and intellectual activities, which might not please everyone. Having this in mind, it is imperative that competent entities such as the local vocational school and the CTCP, invest in training and developing courses that can slowly but surely integrate the former and new workers into this new mindset, also giving them the specific tools to be able to work with the new equipment and resources that are available. It is also the responsibility of factories' managers to be aware of the importance that these formation programs represent, not only in requalifying the employees but also in giving them motivation and incentives to learn new processes and techniques.

Finally, when asked about the intention of investing in new technologies in the future, seven out of ten manufacturers say that are going to invest in more technology in the near future. The three that said that are not going to invest, justify this decision in the high costs that come along with these investments and the fact that some of the automatic equipment is not in line with the production flexibility

that is demanded from the clients. All the other manufacturers claim that they have the intention to invest either in machinery, improving their management system or upgrading their technologies to have a better relationship with their clients.

3.7 Conclusions

This chapter offers practitioners an overview of the relevant managerial challenges of I4.0 and may utilize the synthesized information when making decisions concerning the specific I4.0 issues discussed. Accordingly, scholars will not only benefit from a comprehensive and synthesized picture of the state of research in this challenging yet promising management research field but also find a good starting point for deciding on and engaging in their research projects on the topic of I4.0.

Since all identified challenges seem to be of practical importance and considering the various, highlighted interdependencies between them, a study of exploratory nature was conducted in the Footwear Portuguese Industry. The companies in this sector are known worldwide not only for the quality of their footwear but also for the excellence of their service, and the ability to deliver small series, always based on a quick response to the market needs and requirements (www.worldfootwear.com).

In the interviews conducted, we could see that manufacturers believe that the industry has already some tools that allow for the automation of some processes but all of them also say that this is a sector that is still very dependent on human labour and that the technologies have not evolved enough to allow full process automation. Despite the perceived benefits that I4.0 technology offer regarding the flexibility of processes, there are still many challenges to face. Especially the one concerning the lack of skilled human labour to work with these new technologies and machines. This problem was identified both from the preliminary interviews and from the opinions collected from manufacturers. Thus, the path through the specialization of workers and proper training seems to be undoubtedly important.

3.7.1 Research Limitations

The study conducted has some limitations. Firstly, it is important to refer that I4.0 is a broad subject that encompasses many different technologies and affects several departments in a company. In this study, especially due to time constraints, the focus was only directed to some of the technologies used, mostly at the shop level, with the intent of portraying the most realistic scenario possible regarding the companies present in the Portuguese footwear production clusters.

Secondly, the sample used in this study was also limited and the investigation could be more complete if there had been more companies involved. This limitation had to do with the time constraint for the development of the study and scheduling incompatibilities with the interviewees.

Concerning the interviews, some difficulties were experienced since some companies were not willing to participate in the present investigation. It is important to refer that some of the potential interviewees were not willing to reveal any

information regarding their factories and business, which was a major setback in terms of data collection and ended up imposing the exclusion of some interviews and the necessity to find other companies to proceed with the investigation.

3.7.2 Recommendations for Future Studies

In this study, the focus was only on some subtopics of the main topic regarding Smart Manufacturing. It might be interesting to explore other subtopics such as quick and flexible production which encompasses the advanced planning of footwear production for fashion, and automatic machines that allow a more efficient and faster production.

Another important aspect that was mentioned in the product development and efficient prototyping includes the development of new flexible production equipment with customization capacity and 3D additive manufacturing in sample production. Lastly, it briefly analysed the business intelligence and digitization caused by the increasing automation of the factory using IoT, production monitoring for virtual monitoring in real-time and the increased business intelligence of footwear companies.

This strategic plan is extremely well developed and has a complete overview regarding which are the implications of the implementation of I4.0 technologies in the different departments of a footwear factory. In the axis of Smart Manufacturing, there are still many topics that can be addressed to have a full understanding of how these technologies are impacting the Portuguese footwear sector. One of the suggestions lies in the development of a study based on the Footwear value chain and sustainability.

I4.0 technologies could be beneficial in several aspects of manufacturing, and one of the major implementations is 3D Printing which, now, is more used in the printing of components such as shoe soles. This technology allows for a quicker and better time of response from the soles manufacturers to the shoe manufacturer, which ends up benefiting the entire shoe value chain. This is just an example of how the technologies can have a positive impact on all the different stakeholders and that could be studied more profoundly.

Another very important aspect, that could be developed, is the digital marketing actions that are being more and more developed in the Portuguese manufacturers, with a special focus on the ones that do have their brand and that would benefit in large scale of well-designed digital marketing campaigns which is another important strand for the potential of I4.0.

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List of Abbreviations

AI – Artificial Intelligence
APICCAPS – Portuguese Association of the Shoe Industry and Substitute Leather Products
CC – Cloud Computing

CIM – Computer Integrated Manufacturing
CPS – Cyber-Physical Systems
CTCP – Footwear Technological Center of Portugal
I4.0 – Industry 4.0
IMS – Integrated management system
IoT – Internet of Things
WNS – Wireless Network Systems

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Chapter 4

When the Wind Makes the Structure Tremble. Excess-Based Resilience and the Role of Organizational Slack

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Abstract

We use publications on slack resources extracted from academic journals to explore how holding excess capacity enhances organizational resilience. By doing so, we answer the call for further research on resilience as a key attribute for firms to thrive in highly complex contexts. Through the integration of organizational resilience and slack resources, we attempt to present a clear response on reducing supply chain disruptions, stakeholder conflict, adverse effects from economic dropdowns, and the impact of high-risk environments. Our integration shows a close relationship between organizational slack and resilience; in particular, the first can be a fertile ground for the second one to thrive. Nevertheless, studies have only explored a partial nexus between slack resources and organizational challenges. Therefore, we focus on correlations rooted in the literature on slack and resilience. Overall, we found a mostly positive relationship but qualified by some contradictory results. The information presented in this chapter invigorates the conjunct path of resilience and slack resources and strengthens the basis for decision-making.

Keywords: Organizational resilience, Organizational slack, Supply chain disruption, Economic dropdown, Risk management

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"So he huffed, and he puffed, and he puffed, and he huffed, and at last he blew the house down, and he ate the little pig. The third little pig met a man with a load of bricks, and said: "Please, man, ***give me those bricks to build a house with.****"*

So the man gave him the bricks, and ***he built his house with them.*** *So the wolf came, as he did to the other little pigs, and said: "Little pig, little pig, let me come in."*

"No, no, by the hair of my chinny chin chin."

"Then I'll huff, and I'll puff, and I'll blow your house in."

Well, he huffed, and he puffed, and he huffed and he puffed, and he puffed and huffed; but ***he could not blow the house down.****"* (Jacobs, 1890)

4.1 Introduction

Organizational resilience is a prominent concept in a variety of disciplines with distinct conceptualizations and operationalizations, as academics and decision-makers are interested in how to tolerate environmental shifts. Within the management literature, and to comprehend what resilience involves, we apply the definition proposed by Ortiz-de-Mandojana and Bansal (2016) as "the incremental capacity of an organization to anticipate and adjust to the environment." The concept has grown in importance across management and operations management fields (Van Der Vegt *et al.*, 2015). Resilient behavior allows a buffer against the continuous increase in environmental complexity and stakeholder pressures. For instance, the COVID-19 pandemic and the Ukrainian international crisis represent some of the challenges that lead to an unprecedented scenario with resilience and risk management at the highest priority level. Therefore, in a context of high pressure and growing complexity, organizations must be prepared to face controllable and uncontrollable risks (Buckley *et al.*, 2018).

Researchers have largely tackled the concept of resilience in the literature on management, but its conceptualization and attributes need to be discussed (Linnenluecke, 2017). Thus, for this chapter, we base our analysis on the combination of the above-mentioned definitions (Ortiz-de-Mandojana and Bansal, 2016), and a body of empirical and review articles that provide a rich understanding of the assumptions and implications attributed to organizational resilience (Hillmann and Guenther, 2021; Linnenluecke, 2017). Then, we take a step beyond by combining the understanding of organizational resilience with the conjunct of strategic resources conceptualized as organizational slack (the positive gap between the resources required to maintain coalition and those available), as they seem to be a significant source of resilience (Pal *et al.*, 2014).

The concept of organizational slack or "resources in excess" appears to be fundamental as fuel for strategic resilience (Välikangas and Romme, 2013), as slack represents a buffer for external pressures and a fertile ground for adjustments and strategic change (Lin and Wang, 2021; Bentley and Kehoe, 2020; Tseng *et al.*, 2007). The strategic importance of holding resources in excess has been widely addressed in the organizational literature, as "strategic inefficiencies" can enhance the formation of more resilient and risk-tolerant organizations.

Cyert and March (1963) first specifically conceptualized organizational slack in their foundational work on the Behavioral Theory of the Firm (RBF); Bourgeois (1981) then defined slack as "*that cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures... or to external pressures for changes in policy, as well as to initiate changes in strategy with respect to the external environment.*" After academics noticed the importance of "back-up" resources in complex environments, literature on both resilience and slack developed with a variety of intersections. Nevertheless, academic discussion of the positive value of organizational slack is still open, as neoclassical and agency theorists see the possession of slack resources as waste (Jensen and Meckling, 1976). However, researchers have recently supported the value of organizational slack as an instrument to buffer risk and sustain performance in highly complex environments (Buyl *et al.*, 2019; Pierce and Aguinis, 2013).

Even when the reasons for combining organizational slack and resilience appear self-explanatory, fewer studies have focused on it. Therefore, we provide an integrative perspective of organizational slack and resilience, considering the role of slack as a resource provider for resilient behavior. Conjugating organizational slack and resilience is challenging and interesting at the same time; both theoretical concepts have a significant level of complexity and increasingly strategic importance for decision-makers. Nonetheless, this combination of complexity and strategic relevance invites us to formulate integrative knowledge and recommendations.

We structure this chapter as follows: in the subsequent section, we address the concept of organizational resilience in more depth, and we superficially describe its contact points with organizational slack. In section 4.2, we specifically develop the concept of organizational slack with its typologies, and we explain its linkage to organizational resilience at a conceptual level. In section 4.3, we tackle the specific associations between slack types and organizational challenges normally found in resilience literature, like economic dropdowns, internal and external conflict, supply chain disruptions and pressures from nature and sustainability (Hillmann and Guenther, 2021). Then, in section 4.4, we explain how combining different slack resources can work as fertile ground for achieving resilience. Finally, in section 4.5, we present an overall analysis and description of the relationship between slack and resilience, with proposals for decision-makers. In this chapter, we aim to help decision-makers build strong "houses" that can resist the corrosive blows of the environment, and even more, that can take advantage of them.

4.2 Theoretical Frame: Organizational Slack for Resilience

This section introduces the main theoretical concepts of organizational resilience, elaborating on its role as a diffuse but strategically valuable concept. We also address organizational slack by explaining its manifestations within and outside the organization. Across the subsequent subsections (4.2.1 and 4.2.2), we begin to construct the bridges that connect organizational slack and resilience to set the stage

for sections 4.3 and 4.4, where we explore the association between slack and resilience more deeply.

4.2.1 What is the Relation Between Resilience and Excess?

The appearance of resilience as a scientific concept is a result of the interest that natural scientists have in the resistance of ecosystems to external pressures and threats (Linnenluecke, 2017). After decades of scientific production, social and natural scientists have adopted resilience as a significant concept with diverse meanings and approaches. In the management field, researchers have mainly studied organizational resilience at two levels of analysis: first, at an individual level, in which a particular subgroup of units (employees, directors, etc.) are analyzed; second, at an aggregate level, where the organization is studied as a complex system composed of a number of subunits, recognizing that the organization as an ecosystem is more than the sum of its parts (Shin *et al.*, 2012).

The literature on organizational resilience still has plenty of room for development; there is no clear consensus on the conceptualization of resilience, nor on its operationalization, as Linnenluecke (2017) has recognized. Moreover, resilience can be addressed in several ways; for instance, as an organizational outcome, a capacity or an ability (Hillmann and Guenther, 2021). Even when its conceptualization is still under development, the importance of creating organizations that can tolerate change, pressures and threatening shocks is relatively clear and deeply rooted in the conventional wisdom of management. In this particular case, we will not be focusing on the theoretical debate around resilience, but on its relevance to the performance and survival of organizations. Despite the academic debate around the conceptualization of resilience, we can approximate relative agreement on resilience as the ability of a company to maintain its core activities, particularly in times of economic, social and natural crises. In this sense, "excess resources" or organizational slack can represent sufficient organizational resources for resilient behavior and, consequently, for protecting the core activities of the organization when facing complex contexts (Linnenluecke, 2017; Meyer, 1982).

Previous researchers have associated organizational resilience with keeping the house standing against supply chain disruptions, internal conflicts, economic shortfalls and external, uncontrollable threats—for instance, terrorist attacks, natural crises, and religious conflicts. In basic terms, the analysis of organizational resilience has been strongly linked to particular phenomena or challenges. In that sense, the resilience of an organization is related to the dangers that the organization must face (Linnenluecke, 2017). Rather than entering into the theoretical debate about how we should address organizational resilience, we analyze the various conceptions, themes and approaches to organizational resilience. In that sense, the major topics and approaches that resilience literature introduces are intimately related to organizational slack, as excess capacity is an enabler for flexibility and a substantial buffer against internal and external pressures. Mithani *et al.* (2021) highlight the essentiality of slack resources for organizational resilience. Even more, despite the classification that academics give to resilience (outcome, capability,

capacity or ability), slack resources will be intimately correlated to it, as they share fundamental goals such as (Bowen, 2002)

(a) conflict reduction;
(b) risk tolerance;
(c) enabling innovation and technological implementation;
(d) maintaining firm performance under diverse contexts.

4.2.2 Getting to Know the Bricks for Building a Resilient Organization

As stated in the previous section, the concept of resilience is particularly old. Researchers in several scientific fields have studied it as a significant attribute to tolerate and adapt to constantly changing environments, thereby awakening tremendous interest throughout the literature on management. However, for organizations, achieving resilience is still an open debate. For instance, to get an individual to be resilient is a significantly challenging task, but to get an organization to be resilient is even more complex, as it requires the preparation of a system composed of a wide variety of resources and subsystems for adapting to uncertain threats (Kahn *et al.*, 2018). Therefore, we attempt to identify which resources or "bricks" make organizations ready to tolerate uncertainty. This is where slack resources come in, as resources which can create the best conditions for resilient behavior, and moreover, increase the ease with which managers can improvise, a capacity that, as Suarez and Montes (2020) state, is critical in developing organizational resilience.

In recent decades, leanness and efficiency have become major productive paradigms; however, organizations seeking maximum leanness and efficiency can face adverse effects of limited capacity to respond to highly complex and unstable situations. It is interesting to refer to the too-much-of-a-good-thing effect as Pierce and Aguinis (2013) propose to explain that almost every association between variables reaches a certain point at which the correlation becomes negative. In basic terms, the pursuit of lean and fast-paced productive systems in a context full of "blowing wolves" or environmental shifts can diminish the resilience of an organization.

To present a holistic understanding of the relationship between slack and resilience, we tackle organizational slack through a three partite approach based on (a) the presence of strategic excess within and outside the organization as a buffer for external pressures (tolerance); (b) as a substantial element for strategic change and decision-making (adjustment); and (c) as an indicator for declining performance. Therefore, we elaborate on the different types of slack, categorizing them as effective and ineffective "bricks" for building resilience.

Organizational slack is categorized in several ways. However, we based our categorization on well-founded typologies that serve the purpose of comprehending how slack can affect resilience. Hence, we divide organizational slack into available, recoverable and potential slack (Bourgeois and Singh, 1983; Bourgeois, 1981). Available slack is the theoretical representation of resources in excess that have not

been assigned to a particular task and are free to be relatively easily and quickly deployed. On the contrary, recoverable resources are those resources in excess that have already been assigned to a particular task and that must be transformed or recovered to be reallocated, resulting in a relatively more complex and slow redeployment. There is a third category of slack, interesting in fast-paced and changing environments—potential slack. Potential slack is the excess capacity of an organization to acquire debt from public or private sources—resources that come from external sources. It is the only type of slack that requires interest payments, as it basically represents unborrowed capacity. In basic terms, slack resources can come from internal or external sources and differ in the ease with which they can be deployed (Xu *et al.*, 2015; Bourgeois and Singh, 1983; Bourgeois, 1981). In this sense, and to present a more detailed description of organizational slack resources, authors have cataloged them as financial, human resource, operational and relational (see table 4.1). In particular, financial, human and operational resources in excess can play a central role in achieving resilience (Wiengarten *et al.*, 2017).

Tab. 4.1 – Organizational slack typology.

Organizational slack typology	
Type of slack	Conceptualization
Unabsorbed, available or discretionary	*excess of cash and financial assets that will be transformed into cash within a year* (Bourgeois, 1981)
Absorbed, recoverable or low discretionary	*organizational resources that have already been assigned to particular tasks, also denominated as recoverable slack* (Bourgeois, 1981)
Potential or unborrowed	*excess debt capacity of the company* (Bourgeois and Singh, 1983)
Financial	*excess of cash and financial assets* (Yang *et al.*, 2021)*
Human resources	*overabundance of employees for what is required in exploitation and exploration activities to maintain the required operation level* (Lecuona and Reitzig, 2014)
Relational slack	*surplus of resources committed to the organization by stakeholders, normally by suppliers, shareholders, donors and clients* (Voss *et al.*, 2008)
Operational slack	*excess of operational resources, commonly divided into supply chain, inventory, and capacity slack* (Baghersad and Zobel, 2021; Kovach *et al.*, 2015)

*Financial slack can also be found as a synonym for unabsorbed slack, or as the excess of financial resources allocated to a particular organizational subunit.

In the first instance, financial slack is defined as the excess of cash and financial assets (Yang *et al.*, 2021), and it is the most studied type of slack. It can be mainly related to organizational resilience as it is an expression of available slack, being a source of power to feed improvisation. In the second instance, academics

differentiate human resource slack as the overabundance of employees for what is required in exploitation and exploration activities to maintain the required level of operation (Lecuona and Reitzig, 2014). Finally, studies specify the existence of operational slack, which is the excess of operational resources and is commonly divided into supply chain slack, inventory slack and capacity slack (Kovach *et al.*, 2015). It is relevant to highlight that human resources are separated from operational resources because their level of complexity requires differentiated treatment. Furthermore, as operational slack is particularly suitable in preventing supply chain disruptions, we develop its subdivisions.

Operational slack is generally divided into strategic stock excess, operative redundancies and supply chain overabundance (operative elements, suppliers and partners). The three expressions of operational slack tend to have an inverted curvilinear relation with organizational performance, and they are instrumental in unstable contexts (Kovach *et al.*, 2015). Decision makers must be aware of the level of operational slack within the organization and at the supply chain level, as these redundancies can have a protagonist role in preventing disruptions and risk.

Once we understand the importance of these "bricks" to build a more resilient organization, we must address the relevance of each type of resource for diverse organizational phenomena. In that sense, not every resource works as a buffer against supply chain disruptions, as there are specific slack resources that will enable a firm to face economic shortfalls.

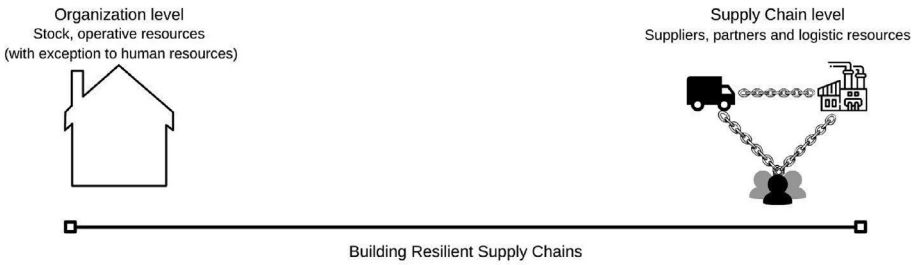

FIG. 4.1 – Operational slack for a resilient supply chain – source: own elaboration.

4.3 The Appropriate Bricks for Each Blow: Slack Resources Type Per Resilience Challenge

Managers must face diverse scenarios and challenges daily to make their organizations able to thrive and survive. Nonetheless, not every organizational resource has the same effectiveness in buffering pressures. In that sense, organizational slack is particularly relevant for organizations that have to face highly competitive, immature, innovative and dynamic sectors. Even more, if

organizations are under institutional frames that present significant pressures, the usefulness of slack resources can be even greater.

As an answer to the call for more resilient organizations, we have prepared a view of which slack resources are strategic to each pressure and which environmental conditions maximize the added value of strategic inefficiencies in creating resilience. Therefore, this section divides organizational threats into five main themes and further examines their relationship with organizational slack (see table 4.2).

4.3.1 Navigating Through Economic Shortfalls

Economic crises or shortfalls represent one of the main threats organizations face because they act as an uncontrollable risk that usually affects the entire organization and its daily activities. Therefore, reducing the impact of economic and performance shortfalls, and enhancing recovery from them is one of the natural aspects that managers have to consider to build resilient organizations. In this sense, financial and relational slack appear to be essential resources to reach a certain level of endurance and capacity for recovery. Moreover, Välikangas and Romme (2013) state that organizational slack resources are key to converting crises and threats into opportunities.

In the first instance, managers and subunit directors should be aware of how to anticipate economic shortfalls through organizational slack. In this sense, previous academic findings suggest that the level of financial slack within an organization can be implemented as one of the predictors of decline. Therefore, the constant reduction of financial slack can be related to performance decline and economic shortfalls; then, managers can use the level of financial slack to anticipate fluctuations and risks. In the second instance, financial slack resources can be implemented as a buffer for pressures and a fuel for recovery. Buyl *et al.* (2019) propose that the possession of financial slack can significantly reduce the impact of economic shortfalls on organizational performance, which is a significant component of tolerance and adjustment to environmental changes. Additionally, Kuusela *et al.* (2017) suggest that the possession of slack resources can impact strategic decision-making, particularly when confronting economic shortfalls through resource-freeing or resource-consuming actions.

Even when maintaining resources in excess can represent a trade-off in current operations, as it represents an opportunity cost for the organization, holding a certain amount of financial slack can be a fundamental "brick" in the design of resilient organizations. Furthermore, studies in this perspective propose that organizational slack has a dual role as a buffer for economic dropdowns and a recovery enhancer by providing the necessary means to take counteractions against negative backgrounds. However, even more interesting, this effect seems independent of institutional contexts (Bamiatzi *et al.*, 2016).

Apart from the above-mentioned attributes, the scientific community has produced insights on the role of slack resources in firm recovery, slack obtained thanks to the existence of highly trained teams (Kim and Ployhart, 2014). In basic terms, highly trained and capable teams are supposed to be better at handling economic

shortfalls or crises, mainly due to their higher preparation and capacity to detect solutions and opportunities. Nonetheless, highly trained teams require a significant amount of resources to convert their ideas into actions; the possession of financial slack plays a significant part in making that process possible in a resource-constrained environment.

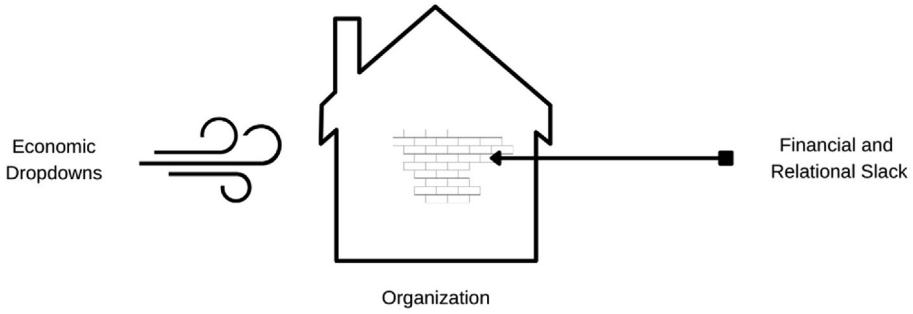

Fig. 4.2 – Available slack as a buffer of economic dropdowns – source: own elaboration.

Another pillar of organizational slack is the debt capacity that a company has in excess. On average, there is a certain level of debt that companies acquire to pursue their normal operations, and this so-called average varies across industrial sectors. The difference between the intersectoral average of indebtedness or debt-free capacity and the unborrowed capacity of an organization is conceptualized as potential slack. This type of resource is beneficial in the recovery from economic shortfalls; however, its employment will be better or worse depending on the economic history and context of the country. Recent management literature has shown how the availability of potential slack increases the tendency of entering markets with high levels of uncontrollable risk (Buckley *et al.*, 2018), as it reduces the specific weight of risk and enables higher levels of tolerance. Moreover, Carnes *et al.* (2019) propose that the effect of organizational slack (where potential slack plays a major role) is particularly strong when firms have high levels of competitive complexity. This can be attributed to the discretionary properties of slack resources as they can be deployed in various actions and without compromising firm performance.

Therefore, awareness of the level of indebtedness of the organization is not only important for current operations and accounting, but also as a differentiator in extremely uncertain or complex environments or strategic paths. In this sense, it is relevant to highlight that the need for resilience can come from internal and external factors. For instance, companies with particularly aggressive or complex strategies need to be more careful of internal or sectoral difficulties or dropdowns, requiring slack resources to (a) hold the search for competitive advantages without hurting firm performance, and (b) to maintain a certain level of resilience against internal or external shifts.

4.3.2 Resisting Natural Disasters and Pressures for Green Development

Organizations must cope with pressures from different sources, some from nature and others from social structure. Despite the differences in origin, natural and social pressures can be interconnected, as with the need for more sustainable development. In this sense, organizations must be resilient enough to tolerate the onslaught of nature and man, keeping essential activities protected even in peak-pressure scenarios. In line with this need for resilience, studies on slack resources address how maintaining excess capacity can protect core activities and help sustain the coalition during critical times.

On the one hand, organizational slack should reduce goal conflict, thus reducing the relative cost of trade-offs related to corporate greening. Furthermore, organizations with a certain level of slack will face fewer dropdowns in their financial performance when investing in implementing and functioning of green processes and innovation (Endrikat *et al.*, 2014). On the other hand, companies do not only have to support the pressure of their boards, employees and institutional frameworks; pressure also derives from competitiveness within a particular industrial sector. In this sense, the possession of financially unabsorbed and potential slack positively moderates the sectoral pressures while taking the necessary trade-offs to improve environmental performance (Chen *et al.*, 2017). In specific terms, financial slack can be a fertile ground for green innovation because the availability of resources in excess positively moderates the correlation between a CEO's predisposition and actual environmental innovation (Arena *et al.*, 2018). Moreover, Hasan and Habib (2017) mention how slack resources can affect a firm's behavior toward corporate social responsibility practices.

The logic behind the arguments that link organizational slack with an easier balance of green and economic goals in complex environments is based on the idea that the availability of resources modifies the perception of the costs derived from the implementation and maintenance of green practices and facilitates tending to the inducements required to maintain the coalition with stakeholders.

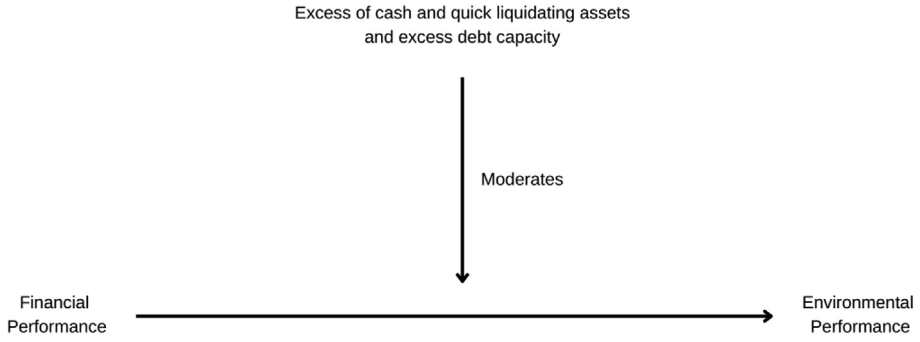

Fig. 4.3 – Moderating the role of organizational slack in the prevention, tolerance and adaptive capacity for natural pressures – source: own elaboration.

This rationality also works under volatile natural contexts as excess capacity can fuel recovery from natural disasters or disruptions. Natural disasters and disruptions are two of the basic concepts that academics relate to resilience, and they are two of the few that are not associated with social phenomena. This is the case for natural catastrophes that can affect the business as usual of an organization. In this sense, organizational slack can act as a source of recovery by allowing quick investment in countermeasures (available slack), and as an enabler for alternative supply channels or productive capacity (recoverable slack). In this sense, organizations with abundant suppliers located in diverse geographic regions will have to face more costs in the short term but can build a more resilient supply chain in the long term. In that sense, Chopra and Sodhi (2014) propose that excess capacity within the supply chain can reduce the appearance of supply chain disruptions. For instance, organizations located in proximity to regions with frequent volcanic activity, earthquakes or tsunamis may require more excess capacity to temper the abruptness of nature.

4.3.3 Addressing Risk Through Technology, Turning a Threat into a Strength

As Linnenluecke (2017) suggests, there is a growing tendency in resilience literature to focus on the ability to predict or detect changes in market tendencies, thereby being better prepared to face adversity. Moreover, it seems that organizations can only be relatively prepared to tackle environmental shifts by going through controlled risk. Therefore, by deploying and starting projects that are considered risky, organizations can be better ready to deal with risk and comprehend it completely. This is particularly interesting as it puts resilience as a capacity strengthened by doing.

In this sense, organizational slack plays an essential role, as companies with slack can apply new technologies, diversify their projects and dedicate resources to exploration activities that can help detect risk. Moreover, while not ideal, organizations with slack can allocate resources to high-risk projects without affecting their day-to-day resource allocation and performance.

In terms of resources and capacity, studies on organizational slack have significantly recognized its value as a critical element for different types of exploratory activities and innovation (Katz-Gerro and Lopez Sintas, 2019). This is relevant as slack may provide the resources for exploratory activities without diminishing firm performance. This is particularly important for sectors with high levels of instability and competitiveness, as slack not only affects how companies explore but also keeps their performance at an acceptable level. This relationship between slack and exploration works not only as an enabler for risk detection and traditional innovation but also as a fertile ground to achieve radical innovation to prevent radical changes in the market by producing them (Troilo *et al.*, 2014). Thus, slack resources not only affect how companies may detect and navigate risky situations but can also affect the tendency in the actions taken as responses to recover from such situations.

In addition to its material role, organizational slack plays a part in the cognitive processes within the organization. For instance, managers may be more inclined to pursue their motivations in the presence of slack (Arena *et al.*, 2018). Furthermore, companies with excess capacity may evaluate risk differently and navigate it with lower levels of stress because knowing that the organization has buffers against disruptions not only affects the material impact of threats but can change how they are perceived.

4.3.4 Supply Chain Disruptions and How to Build Resilience

Since the times of the Roman Empire, civilizations have attempted to create vast commercial routes creating and increasing global commercial interdependence. As time progressed, commercial relations between regions, countries and companies became more intense, up to the point where organizations are today. Interdependence appears to be an acceptable term to describe the stage where organizations do business and conduct their core and peripheral activities. In an interdependent, international economic and political system, managers must face challenges created around the globe, as exhibited by the container crisis that originated in China. This crisis led to several systematic supply chain disruptions and the exponential rise in prices, which pose a financial threat to most world organizations. In this scenario, resilient organizations not only have more capacity to tolerate such difficulties but can also take advantage of this critical context. For that purpose, slack resources can be strategically important. Organizational slack can prevent supply chain disruptions and help to achieve recovery when facing them. Unabsorbed slack is an instrument to recover supply chain performance after a dropdown. Meanwhile, the overabundance of suppliers and strategically valuable stock may prevent supply chain disruptions or at least reduce their impact. For instance, an organization with a net of national and international suppliers can be more resilient in the long term, even when it can mean sacrificing supply chain performance in the short term.

To completely understand the role and coverage of organizational slack at the supply chain level, we need to degloss operational slack, as it represents a variety of "strategic excess." Operational slack denotes stock over those materials or products which are significant to core production; operative redundancies that help to attend variations at the supply chain and demand level; and the overabundance of elements and actors within the supply chain, as they can be a higher level of suppliers than is strictly required. Understanding the multiple manifestations of operational slack can help academics and managers to understand why slack resources are relevant to preventing several internal and external risks.

In the case of external risks, Chopra and Sodhi (2014) state that an excess capacity in the supply chain can be relatively detrimental to short-term performance. Nonetheless, these logistical chains are significantly better at avoiding disruptions in the long term. Kovach *et al.* (2015) state that financial and operational slack within the firm and at the supply chain level can enhance organizational and

supply chain performance in unstable environments. Therefore, a certain level of excess at the operational level when operating in volatile environments can help to prevent disruptions and consolidate a competitive advantage against organizations that might suffer from supply chain disruptions. In addition, Modi and Mishra (2011) showed that permanently seeking efficiency at the operative level, or in basic terms, looking for the extinction of operative slack can be positive for firm performance, but only up to a certain point. Thus, it becomes clear that the predominant paradigm of maximum efficiency and the complete elimination of waste managers can lead to underestimating the positive effects of certain operative redundancies, resulting in a reduced response capacity to fluctuations at supply and demand levels.

As for internal risks, academics have studied the role of operative redundancies in the prevention of inconveniences such as harm to workers and halts to production. In that sense, Wiengarten *et al.* (2017) propose that a certain level of operational redundancies (more slack) can catalyze workers' safety, as redundancies within the supply chain and at the production level can reduce stress on the system, thereby reducing the level of pressure that is put over workers. Moreover, this positive relation is moderated by financial slack, as this type of slack facilitates the search and acquisition process of operative instruments during times of higher productive needs.

Last, at the supply chain level, redundancies are particularly useful as they prevent ruptures in the supply process. More importantly, they also enable organizations to take advantage of opportunities created by instabilities and disruptions in the international logistical system. On the one hand, an overabundance of strategic resources at the supply chain level can permit organizations with slack from maintaining operations at a relatively acceptable cost. In contrast, other organizations can be obliged to look for new providers in record time, which can be more complex and more expensive. Moreover, supplier redundancies in geographic proximities can significantly reduce the impact of international supply chain crises. Thus, operational slack can represent a competitive advantage that enables a company to gain market share that is not available to organizations more affected by fluctuations in the supply system. On the other hand, holding resources in excess can indeed be relatively detrimental to firm performance in the short term; therefore, managers should be aware of the trade-offs that operational slack represents. Azadegan *et al.* (2013) state that the valuation of the trade-offs involved in owning slack will depend on the instability of the sector. In this sense owning operational slack in contexts of high instability will tend to reduce the tendency to fail.

Nevertheless, the discussion about when and under what conditions it is better to hold operational slack remains partially unclear, mainly due to the fact that several academics evaluate slack resources as a manifestation of waste. On the contrary, in a many specialized studies, academics recognize the added value of a certain operational slack because organizational slack can work as a buffer against political, social, economic and natural disturbances.

4.3.5 The Role of Slack in Conflict Reduction and Resolution

Hillmann and Guenther (2021) highlight how organizational resilience relates to maintaining certain core and essential business activities during critical times and recovering from disruptions or dropdowns and to a positive mindset during these times. In this sense, resilience and slack are intimately related to organizational slack, according to the Resource Based View and the Behavioral Theory of the Firm. The two concepts are a primary source of conflict reduction, even when the availability of resources might lead to higher tensions regarding their distribution. Cyert and March (1963) were some of the first to theorize that excess can be particularly beneficial to reducing stakeholder conflict because an organization that does not suffer from resource constraints may tend to its inducements without suffering, even during critical times. As slack resources work as a conflict resolution instrument within the organization, and conflict tends to increase during internal or external crises, organizational slack acts as a vital strategic resource to achieve and maximize resilience.

Slack resources work as an internal and external instrument for conflict resolution at three distinguishable levels. First, organizational slack works as a source of conflict reduction in the relationship that organizations maintain with their stakeholders. The availability of excess capacity allows them to pursue their inducements and attain particular pressures without losing performance. This is particularly relevant if resources are scarce, as companies without organizational slack may be unable to fulfill the increasing demands of their stakeholders, creating an additional source of tension to the already stressed system. Meanwhile, organizations with slack —especially available slack and unborrowed capacity—will be more likely to tend to stakeholders' demands successfully.

Second, conflict within the organization is almost unavoidable; nevertheless, companies with slack can tend to disputes faster and without harming firm performance. This works not only at an organizational level but also at the subunit level. Tensions across subunits have mainly been recognized, especially in the Behavioral Theory of the Firm. Therefore, possessing a strategic resource that alleviates the tensions among subunits in times of resource constraints or performance shortfall can be beneficial to the organization's functioning. Third, going from macro to micro units, organizational slack acts as a conflict reducer inside the different subunits. In that sense, it is important to maintain control over the levels in which slack works because holding slack resources can present no benefits or even be detrimental to performance if it is not correctly located.

In line with this, the capacity for financial excess has also been linked with the ability to reduce internal conflict within the organization, and under certain conditions, to firm survival (Amezcua *et al.*, 2013). Reducing internal conflict is particularly relevant in high-pressure settings as the organization has fewer resources to tend to its inducements, and the organizational subunits keep working with fewer resources. Thus, the existence of a capacity for financial excess alleviates the pressure imposed by the economic context.

TAB. 4.2 – Summary of slack types or "bricks" with positive associations per resilience challenge founded in the last decade of scientific production.

Organizational threat	Suggested effective type of slack
Economic dropdowns, performance shortfalls and economically complex/unstable environments	• *Available slack* possession of cash and quick financial assets convertible to cash within a year, above the intersectoral average (Bourgeois and Singh, 1983; Bourgeois, 1981) • *Potential slack* excess debt capacity of the company or unborrowed capacity above the intersectoral expected level (Bourgeois and Singh, 1983) • *Operational slack* excess of operational resources commonly divided into supply chain slack, inventory slack and capacity slack (Baghersad and Zobel, 2021; Kovach *et al.*, 2015)
Conflict reduction and resolution	• *Available slack* possession of cash and quick financial assets convertible to cash within a year, above the intersectoral average (Bourgeois and Singh, 1983; Bourgeois, 1981) • *Potential slack* excess debt capacity of the company or unborrowed capacity above the intersectoral expected level (Bourgeois and Singh, 1983)
Supply chain disruptions	• *Available slack* possession of cash and quick financial assets convertible to cash within a year, above the intersectoral average (Bourgeois and Singh, 1983; Bourgeois, 1981) • *Operational slack* excess of operational resources commonly divided into supply chain slack, inventory slack and capacity slack (Baghersad and Zobel, 2021; Kovach *et al.*, 2015) • *Recoverable slack* organizational resources that have already been assigned to particular tasks, also denominated recoverable slack (Bourgeois, 1981)
Natural disasters and environmental pressures	• *Available slack* possession of cash and quick financial assets convertible to cash within a year, above the intersectoral average (Bourgeois and Singh, 1983; Bourgeois, 1981) • *Potential slack* excess debt capacity of the company or unborrowed capacity above the

Tab. 4.2 – (continued).

Organizational threat	Suggested effective type of slack
	expected intersectoral level (Bourgeois and Singh, 1983) • *Recoverable slack* organizational resources that have already been assigned to particular tasks, also denominated recoverable slack (Bourgeois, 1981)
Risk through technology	• *Available slack* possession of cash and quick financial assets convertible to cash within a year, above the intersectoral average (Bourgeois and Singh, 1983; Bourgeois, 1981) • *Recoverable slack* organizational resources that have been already assigned to particular tasks, also denominated recoverable slack (Bourgeois, 1981) • *Potential slack* excess debt capacity of the company or unborrowed capacity above the expected intersectoral level (Bourgeois and Singh, 1983) • *Human resource slack* overabundance of employees for what is required in exploitation and exploration activities to maintain the required level of operation (Lecuona and Reitzig, 2014) • *Operational slack* excess of operational resources commonly divided into supply-chain slack, inventory slack and capacity slack (Baghersad and Zobel, 2021; Kovach *et al.*, 2015)

4.4 Organizational Architectural Design: Accommodating Every Slack for Greater Resilience

We have explained the strategic role of organizational slack in building resilience. Therefore, in this section, we will complement the basic information we have presented by describing how organizational slack resources can work together and be located for resilient behavior.

As we pointed out in the previous section, available and potential slack resources can be fundamental to addressing organizational threats up to a certain point where excessive possession of slack can result in lower performance (Pierce and Aguinis, 2013). Therefore, combining both types of slack can help deal with almost any organizational threat and can be a significant instrument for achieving resilience.

However, institutional and contextual factors will change the effectiveness of each type of slack. In this sense, we can suppose a more positive role of potential slack when (a) interest rates are low, (b) debt can be accessed smoothly, and (c) the valuation of the financial system in which the organization is operating is positive. Additionally, we suppose a significantly positive role for available slack in nearly any context, with the exception of mature and highly stable industrial sectors in which changes are lower. Furthermore, we understand that organizations producing and commercializing low-elastic products will have a reduced positive effect on financial slack in economically critical contexts. They will have less pressure to search for alternative solutions to maintain the sales level.

In the case of recoverable and operational slack, both are particularly effective at preventing supply chain disruptions in a volatile environment. It is important to know that recoverable slack and operational slack can overlap. Therefore, we degloss them into the already budget, human resources, operative capacity, supply chain capacity and stock. As the literature suggests, the combination of these types of slack can reduce the tendency for supply chain disruptions (Mohammaddust *et al.*, 2017; Kovach *et al.*, 2015; Chopra and Sodhi, 2014), and this effect can be catalyzed by the existence of available slack. Nevertheless, it is substantial to present the double-edged-sword dilemma presented by Azadegan *et al.* (2013), which means that the possession of organizational slack (operational in this case) can buffer the pressures of instability and carries significant costs that can be diminishing to firm performance.

In addition, we have analyzed how slack can reactively and proactively facilitate risk reduction through technology and innovation. For this particular attribute, we suggest that available slack, potential slack and relational slack are the most effective types. The literature on slack states that all three types of organizational slack can change how organizations approach technological investment, diversification and innovation.

In basic terms, organizational slack types are not independent; in fact, studies suggest that they have a moderating effect on each other (Wiengarten *et al.*, 2017). Hence, the existence of various types of slack in a relatively reduced amount can enhance resilient behavior and even potentiate organizational performance. Still, these will depend on the characteristics of the context and the characteristics of the firm.

4.5 Conclusion

Organizations face increasing external and internal threats for which most are unprepared. Thus, through the Behavioral Theory and a Resource Based View, of the firm we attempted to integrate slack resources and organizational resilience to collaborate in consolidating a common theoretical groundwork for resilience. A holistic understanding of organizational resilience and slack can assist in designing resilient organizations better prepared for unstable environments and increasing pressure. This chapter has suggested different combinations of available, potential

and recoverable slack to identify, buffer and surpass significant organizational challenges. Perhaps more importantly, we have sought to collaborate in constructing a theoretical and empirical body that consolidates organizational slack as an essential aspect of organizational resilience.

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Chapter 5

E-Leadership and New Leadership Skills for Effective Leaders in the Public Sector Within Contexts of Telework – A Delphi Method Study

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Abstract

Through an investigation based on the Delphi method, we seek to identify key skills for virtual leadership, within the context of telework.

Two enquiries were applied, over two rounds, to management and leadership experts, resulting in a consensus centered on nine key competencies for effective leadership: the capacity to problem solve and take on responsibilities, empowering, the capacity to manage change, creativity and innovation, ethical and rigorous behavior, emotional intelligence, communication, capacity to ensure cohesion and delegation.

Keywords: Public sector, E-leadership, Competences, Delphi method

5.1 Introduction

The Covid-19 pandemic, which took over the world in March 2020, had an unquestionable effect on organizations, forcing them to adapt to new ways of organizing labor, with telework and its many means of virtual team management

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standing out. The most convenient way of managing teams assumes frequent in-person interactions.

In the case of telework, these interactions do not often happen in person. This context forced leaders to reshape the current models of labor, given that the way the workers communicate, collaborate and use technology changed, creating new challenges in leading both individuals and teams.

Due to its importance, leadership is one of the most studied areas by academics and professionals, with the goal of producing knowledge that is useful to the organization's survival and sustainability. Although leadership is one of the most studied themes in what concerns organizational behavior, research on e-leadership, by comparison, started being developed in the first decade of the 21st century (Avolio *et al.*, 2014), and only recently did it earn considerable attention by researchers through advancements in AIT (Advanced Information Technology) and by the appropriation over all realms of organizations and societies overall.

Advanced Information Technology in this context is defined as "tools, techniques, and knowledge that enable multiparty participation in organizational and inter-organizational activities through the sophisticated collection, processing, management, retrieval, transmission, and display of data and knowledge" (DeSanctis and Poole, 1994, cit in Avolio *et al.*, 2000, p. 616).

As far as public administration is concerned, there have been many studies on the effects of the ongoing digital revolution at the macro level and in different contexts, such as the interaction of the government and the public (e-participation) and the administrative structures (e-administration) (Van Wart *et al.*, 2019), however, the studies of e-leadership within the public sector have been little and the development of skill models and identification of relevant skills for virtual leaders in public administration have been practically nonexistent.

The main goal we propose is to characterize the means of leadership in situations of partial or full telework, considering the skills that most need to be mobilized in public administration in Portugal, and looking towards fulfilling the existent literature gap.

This research integrates three main aspects: first, a literature review focusing on leadership, e-leadership, leadership and telework models, discussing the current definition of e-leadership by enlarging and suggesting a more concrete definition for the purpose of this research.

A second aspect makes explicit the methodological aspects of both the construction of a Delphi questionnaire and how it is put into practice to pursue the treatment of data. Lastly, we present and discuss the results and propose a skillset model for public administration leaders that may serve as a base for further investigations.

In terms of methodology, through the literature review on leadership and e-leadership, 20 specific skills are identified. Afterwards, a Delphi questionnaire was constructed with a *likert* scale of six points in the different skills we identified and we then invited, fifteen management and leadership experts with recognized good practices of leadership from municipalities of the Setúbal region, in order to rank, in two or three rounds, the most relevant skills.

5.2 From Leadership to E-Leadership – Concept Development and Main Theoretical Perspectives

5.2.1 Leadership – Concept Development and Main Theoretical Perspectives

Leadership has not been understood consensually, with the emergence of multiple approaches and definitions. It is considered one of the most complex and multi-faceted concepts within organizational studies. However, there is consensual agreement that leadership is connected to someone's skill to influence in any given way the behavior of an individual or a group, regardless of the goals.

Leadership can be defined as the skill to coordinate a team, strongly contributing to its motivation in accomplishing an objective. Leadership, within organizational contexts, may be considered as a process of influencing others to achieve organizational goals, *i.e.* the skill to guide and orient a group's activities in such a way that the group's objectives are achieved (Sarnin, 2016, cit in Santos *et al.*, 2020).

The leadership process is thus intimately connected to the intentional influence exerted by the leader over those who are led, which drives Yukl (2013) to state that influence is the essence of leadership. Leadership, despite being difficult to define, is easily recognized.

There is a range of studies that research leadership from the perspectives of different theories which explain leadership styles from individual characteristics or as a process, amongst which trait theory, behavioral theory, contingency and situational theory became the most relevant (Yukl, 2013).

Leadership style results from the articulation between skills and behaviors used by the leader in interactions with their team members (Sahay and Baul, 2015).

From these traditional theories that defined leadership as one-directional, drawing a strong line between leaders and followers, there are now new leadership theories "new leaderships" that have supported ongoing globalization, technological innovation and fast social transformations.

New leadership, which emerged in the 1980s puts an emphasis on charismatic, affective, visionary, and inspiring elements which are oriented towards values and change, with new approaches such as charismatic leadership, transformational, transactional, shared, service-based, authentic and level 5 leadership (Benmira and Agboola, 2021).

Charismatic leadership (House, 1977) is one of the first models in which the leader stops being seen as an individual who has certain skills, to be seen instead within interactions, in a dynamic process, where the team and change in attitude and beliefs of each element gain special relevance.

The charismatic leader is the product of the leaders' traits and behaviours, the context of a given situation as well as the individual and collective needs of the followers.

Followers believe and trust the leaders' convictions and vision, following them unquestionably, feel emotionally involved in their contribution to the success of the

organizational mission that they embody and defend and feel motivated to establish ambitious objectives, internalizing their attitudes, beliefs and values.

On the other hand, charismatic leader presents strong self-confidence and a need for power and domination. Often, they create conviction amongst followers, of greater skill and success than non-charismatic leaders and transmits high expectation and trust in followers, leading them to believe that they can achieve great things even amidst adversity (Mhathre and Riggio, 2014).

Transformational leadership emerged from Bass's work (1985), Burns's concept (1978) and House's work (1977) on charismatic leadership.

Burns's transformational leadership is a process which is settled on change and on deep individual transformation in what comes to followers' values, ethics and long-term goals, through fulfilling their needs. Burns (1978) distinguishes between transactional and transformational leadership: transactional leadership is based on the attribution of rewards by the leader as if it was all about a transaction: the performance of the followers is evaluated and they obtain in exchange an appropriate tangible reward.

On this, transformational leadership is about the leader's ability to motivate team elements to develop extra efforts, increasing and enlarging the level of awareness regarding the importance of the goals to be achieved, attracting ideas and values such as freedom, justice and equality, motivating collaborators to go beyond personal interest in favor of the team or organization, making the leader and/or organization's aspirations compatible with the team members, leading them to better performance and increasing satisfaction and efficacy.

Bass and Avolio (Avolio, 1999; Bass and Avolio, 1994; Bass, 1985, 1990), build their approach on transactional and transformational leadership not as separate processes but as complementaries, where both can be effective in distinct situations within the life of the organization, opposing Burns's perspective (1978).

Bass (1985) places a distinction between charismatic and transformational leadership, stating that charisma is a necessary ingredient, if not the most important, of transformational leadership although by itself might not give a leader transformational leadership skills.

The operationalization of Bass and Avolio's (1994) leadership model, with followers of transformational leadership, reveals that within this type of leadership, there are three key components: inspiring change, individual regard and intellectual stimulation whilst transactional leadership's key components would be: management my reward and management by exception.

Charismatic characteristics of transformational leaders activate strong emotions in their followers, instilling optimism and enthusiasm, generating inspiration and motivation towards the achievement of group objectives and teamwork, with a performance level that goes beyond expectations.

Consideration for the individual is focused on changing the attitudes, beliefs and values of the collaborators, seeing them as people who are seeking to achieve their own needs, self-development and fulfillment, promoting self-confidence and self-efficacy.

The leader intellectually stimulates the followers and evokes performance levels that transcend those of a team under transactional leadership. The transactional

leaders' characteristics appeal to management by rewards and management by exception, as motivational instruments, not needing to influence subordinates. It becomes necessary to monitor the followers' performance and reorient tasks to the patterns establishment, clarifying what needs to be done to be rewarded for their effort.

Authentic Leadership, is one of the most recent approaches to leaderships originating in Kernis's work (2003) and assumes authenticity is practised by leaders and recognized by those who are leaders and by the organization (Gardner *et al.*, 2021). It is based on the leader's moral character, their care for others and the congruence of their ethical values and their actions (Gardner *et al.*, 2011). These leaders foster a positive environment and manage the business in an ethically and socially responsible way (Iszatt-White and Kempster, 2019).

To be authentic means to be "loyal to oneself" (Avolio and Gardner, 2005). Authentic leadership has been connected to positive behaviors and attitudes in which the leader supports and promotes positive psychological skills in their followers, in particular the development of skills such as optimism, resilience, confidence and hope, influencing the subordinates through positive emotional and social relationship (Avolio *et al.*, 2004).

Leadership has been understood as a single individual occupying a position of leadership, in the meantime, there is evidence that leadership can be shared (Pearce, 2004, cit in Lopes and Baioa, 2011). As a result, the focus shifts from the person who influences to a dynamic and interactive process of influence, carried by a set of individuals that can collaborate to an overall process of leadership.

Shared leadership involved the maximization of human resources within the organization in order to conduct the group to achieve the expected results (Ligh *et al.*, 2006) and has been recognized as an important drive for team efficacy (Wang *et al.*, 2014).

Leadership can then be conceptualized as a relational phenomenon that emerges out of the interpersonal relationship that one or more individuals (leaders) take on leadership and responsibility roles over several team members while others (followers) are willing to recognize and accept that process of influence (Siangchokyoo and Klinger, 2022).

Team leadership can be understood as a process of facilitating or directing the creative efforts of team members towards a common goal (Sousa and Monteiro, 2017).

Servant leadership is prominent among moral and ethical approaches to leadership. This approach is focused on leaders that have the natural drive to want to serve first, transcending personal interest and expressing genuine care and concern with their subordinates (Eva *et al.*, 2019), as well as always trying to act in their best interests.

These leaders behave ethically and have skills such as listening, empathy, healing, awareness, persuasion, conceptualization, foresight, stewardship, commitment, and building community (Spears, 2004, cit in Avolio *et al.*, 2009).

Other authors (*e.g.* Parris and Peachey, 2013) added salient characteristics of servant leadership as communication, credibility, competence, visibility, influence,

encouragement, teaching, delegation and relational development of followers and emulation of leaders' service orientation.

Collins (2007) in his research, identified levers that speed up the transformational process within organizations from good to great – this corresponds to a leader designated "level 5 leader", which presents a set of specific characteristics, namely "ambition for the company and the preparation of competent successors" (Collins, 2007).

Level 5 leadership refers to a process of accumulation of knowledge by accumulation within the organization and corresponds to "the highest level in the hierarchy of executive capacities", promoting lasting excellent performance through "a paradoxical mix of personal humbleness and drive" (Collins, 2007, p. 44).

Level 5 leadership is not the single factor of transformation of an organization from good to great, there is a set of other factors such as a disciplined culture, but they are supported by the level 5 leader.

In summary, the different approaches to leadership are complementary to each other since none of them isolatedly integrates the complexity of leadership or is completely functional in all organizational situations. The field of leadership is thus not restricted to the positions of leader or followers and is integrated into a broader field which includes didactic, shared, relational, strategic and global models.

5.2.2 E-Leadership

In the XXIst century with the exponential growth of advanced information technology that catalyzed the globalization process on a global scale, organizations started to have new demands, both in terms of quick adaptation to new realities and the update of technology and information means as well as the preparation of human means who are capable of using and taking full advantage of those means. Public Administration used means of information and technology as a primary instrument to modernize, reform and transform the administration since the late 20th century (Xavier and Escaleira, 2015).

The implementation of an electronic government (e-Gov), resulted in the informatization of internal activities and facilitated public service access by the public sector, promoting citizen participation and transparency in what comes to decision-making on public policies (Van Wart *et al.*, 2017).

The existence of an electronic public administration with increasingly advanced information technologies has been making possible the concentration and availability of information, facilitating business and answering crescent citizen demands. Public workers started to need new competencies, particularly regarding information technologies to advance modernization and support the economic and social development of local, national, public and private economic sectors.

In light of all these global changes, spurred by information and communication technologies and particularly by advanced information technologies, organizational leaders are faced with new models of management where both leaders and those who are led need new technological competencies for their organizational activities, adequate to new global and virtual realities. Leaders with low information and

communication technology skills not only limit their options as well as are seen as less effective (Van Wart *et al.*, 2017).

It is in this context that a new paradigm emerges: e-Leadership. Several authors who define e-Leadership connect it with advanced information technologies (AIT) and show how the technology itself influences leadership competency.

AIT is not limited to messaging and communication systems, they also involve knowledge management systems and collaborative management in relationships with clients and supply chains and management systems. These technologies can support leaders in planning, deciding, spreading, managing information, controlling and leading virtual teams.

Avolio *et al.* (2000), chose "e-Leadership" to name this concept to include this new context when approaching leadership. In the seminal article they state that "past leadership research has not focused on issues confronting the leadership in organizations where work is mediated by AIT" (Avolio *et al.*, 2000, p. 615).

Avolio and Kahai (2003) stress how traditional leadership theories are not enough to explain successful leadership practices within organizations under this context, they consider Information and Communication Technology (ICT) a microcosmos of potential effects that might occur in the leadership processes with groups and individuals as well as a multilevel processes involving individuals, groups, within organizations and inter-organizationally.

These authors define e-Leadership as a social influence process that involves advanced information technologies and electronic interactions both one-to-one and one-to-many, that might occur at any hierarchical level within the organization, with the goal of achieving a change in attitude, sentiment, behavior and performance from individuals, groups or organizations (Kerfoot, 2010; Avolio *et al.*, 2000, p. 617) and might also be associated with one or several individuals being in different locations and time zones.

This leadership style thus comes about as an alternative to "traditional" leadership, which is mediated by in-person communication (speaking and listening) and its rich non-verbal communication and suggestions of physical presence, as well as physical and low technology spread of materials.

E-Leadership emerges tightly connected to the triangular relationship between e-Leadership, e-Teams and ICT, with stress on time and space dimensions that makes leaders have to know how to manage the two interconnected axis (i) global dispersal of subordinates; and (ii) the technological advance of information and communication systems which drives to the constant need to know how to manage virtual teams, geographically spread (Hyppönen, 2017).

Leading virtual teams using technology for management stresses the role of organizational practices that are embodied in individual relationships as well as large group relationships, dispersed in a range of degrees, in different geographical areas, all of which the e-leader must be apt to intervene.

E-Leadership is a research field established within the literature surrounding e-Teams. As Gilson *et al.* (2015) state, leaders can hold a central role in the functioning of virtual teams, particularly because they influence how a team faces obstacles and adapts to challenges.

The case of the current Covid-19 pandemic reaffirmed the need for efficient leadership.

Reports by Deloitte, amongst others, explicitly stated some of the challenges faced by traditional leaders who had to pivot to electronic leadership with virtual teams and that include the promotion of a new style of electronic leadership, the management of the professional boundaries and the guarantee of the well-being of team members under teleworking circumstances (Deloitte, 2020).

New means of management, increasingly flexible leadership styles and the restructuring of company culture and trust in workers are the backbones of the successful implementation of virtual teams under telework (Aderaldo *et al.*, 2017, cit in Figueiredo *et al.*, 2021).

5.2.2.1 Specific Skill Set Models for E-Leaders and Desired Characteristics for Leadership and E-Leadership

The current moment made many organizations develop new practices that tie into e-Leadership with teleworking teams. As such, within months the means of work organization shifted in such a way that telework became highlighted (Contreras *et al.*, 2020) and leadership was increasingly replaced by e-Leadership (Pei and Piaw, 2018), with demands for new competency models.

Within this frame, several explanatory models have emerged that associate e-leadership with several of the competencies, assets or groups of organised behaviours and motivations and knowledge required for effective performance (Pedro, 2014; Burns *et al.*, 2012).

A selection of the specific virtual leadership competencies is discussed below:

Capacity to manage change – as Fernandez and Rainey mention (2006, cit in Van Wart *et al.*, 2017), change in the public sector includes: establishing the need for change, providing a plan, building internal support, ensuring support to top management tiers, organizing external support, providing resources and institutionalize change.

Managing change corresponds to a proactive attitude that requires knowledge about top technological solutions that respond to organizational challenges, implementing these technologies whenever justified and resisting them when they have no substantial benefits to the organizations (Van Wart *et al.*, 2017).

Change management skills have a positive effect on decision-making when it comes to the introduction of ICT.

Capacity to problem solve and take on responsibilities – for Van Wart *et al.* (2017) skills such as the drive to continuous learning, environmental digitalization and strong technical skills increase an e-leader's capacities.

In order to overcome challenges connected to digital transformations, leaders have to develop digital and human skills, especially in what comes to efficient communication within a digitalized context, the creation of cohesion amongst followers who are spread geographically and fostering a sense of initiative and change in attitudes, managing to solve complex problems in a timely manner (Cortellazzo *et al.*, 2019).

Capacity to innovate and be creative – as referred by Cortellazzo *et al.* (2019) citing Kodama (2007), managers can foster innovation at any level beyond the formal organization, in order to create real or virtual networks between internal and/or external communities.

These practice communities allow for responsiveness to change, promoting the free flow of information and allowing managers and all their teams the possibility of integration while transforming and stimulating knowledge that spurs innovation.

Thus, information and communication technology allows for the creation of shared information pools in which the workers from the entire organization contribute to a collaborative and dynamic process of generating ideas.

Emotional intelligence – as per Bryant (2013, cit in Alward and Phelps, 2019) emotional intelligence for an e-leader has significant importance as well as different aspects of communication and trust.

To reinforce virtual group cohesion leaders have to establish a high level of emotional intelligence. This can be achieved by exploring virtual communication channels and building trusting relationships.

Proximity management – the capacity to manage proximity has been mentioned in literature as a skill that is even more relevant in e-leadership, given the challenge to emotional human relationships that information technologies imply (*e.g.* Kissler, 2001).

The capacity to manage proximity increases organizational commitment and the co-creation of strategies and solutions and it avoids long-term risks such as isolation and lower performance, increases turnover as well as family-work and work-family conflict (Contreras *et al.*, 2020).

Teamwork support/life-work balance – e-leaders should understand new technologies to satisfy the workers' needs and build relationships, supporting them in finding the balance between professional and family life because it is a crucial matter for each employee, in particular millennial employees (Wolor *et al.*, 2020).

Personal development – managing and developing people is a fundamental part of daily life within organizations with virtual work environments, although there may be difficulties from "e-leaders in managing and developing people a younger workforce that is often technologically superior" (Kissler, 2001, p. 129).

The E-leader is oriented towards the professional development of workers, investing in their skills and potential, providing clear and honest feedback, and supporting teams for success.

Communication – communication is an important skill to consider in e-Leadership studies since it's a differentiating factor in the efficiency of virtual teams. Leaders use strategies to achieve complex communication objectives – in other words, to manage that the work done promotes an informal and collegial exchange, creating a sense of real instead of virtual communication among team members (Darics, 2020).

Managers have to learn new communication skills to avoid workers feeling isolated.

Leaders should provide continuous feedback, communicate effectively and regularly and provide a clear picture of tasks, to foster the feeling that virtual

employees are part of the organization and to reinforce their ties to the organization (Leonard, 2011).

Besides this, leaders must learn how to effectively drive video conferences, audio conferences and a balanced use of e-mail, voicemail and face-to-face tools of communication (Cascio, 2000) taking into consideration privacy and safety.

Focusing on results instead of execution times – virtual leaders should adopt a leadership strategy in which the team is focused in achieving results by presenting goals and explaining the ways in which the team's work facilitates goal achievement, supporting the ongoing development of the team (Berry, 2011; Cascio, 2000).

They manage the team's results, align tasks with technology and control activities by their results rather than their execution times.

Empowering – virtual leaders promote empowerment through the services and areas they are responsible for, in such a way that people can be responsible, committed and autonomous in fulfilling their work (Cortellazzo *et al.*, 2019; Walvoord *et al.*, 2008).

Delegation – e-leaders should show an ability to delegate tasks, setting clear commitments to control results and evaluate performances as well as promote the personal and professional development of subordinates (Zhang *et al.*, 2012).

Capacity to use technology to cooperate – e-leaders should be knowledgeable and capable of using Information and Communication Technology (digital competencies) as well as digital platforms to execute tasks, problem solve, communicate and collaborate with the team efficiently, manage information, collaborate, create and share contents and produce knowledge adequately and efficiently, respecting ethical principles (Ferrari, 2012; Avolio *et al.*, 2000).

Sharing of vision and mission – e-leaders should demonstrate their ability to manage people create and maintain team identity, promote the mission, vision and values of the organization, defining workflow and the needed processes to stay productive within the virtual environment (Darics, 2020).

Ethical and rigorous behavior – e-leaders should be able to stand in as models for organization members in it comes to using technology solely for the ends that are expected, acting with ethics, rigor and mutual respect (Cortellazzo *et al.*, 2019).

5.3 Telework, Risks and Opportunities

5.3.1 Concept of Telework

Before deepening the analysis of the impacts of telework, it is important to first define what is understood by telework.

While there is no universally accepted definition, it can be described as a kind of work and/or service provision that happens remotely, remotely and online, using computer and telematic technologies (Belzunegui-Eraso and Erro-Garcés, 2020).

For the International Work Organization (OIT, 2017, cit in Belzunegui-Eraso and Erro-Garcés, 2020), telework is defined as the use of Information and Communication Technology ICT, such as smartphones, tablets, laptops and/or desktop computers to perform work outside of the employer's headquarters.

In other words, telework implies work performed with the support of ICT outside of the employer's quarters with all implications that might bring about within both the organization and the interactions between workers and leadership (Belzunegui-Eraso and Erro-Garcés, 2020).

Even though telework had been an atypical way of organizing work, corresponding to greater flexibility both in the productive tissue and the work market (Fiolhais, 2007), it has been emerging particularly in the tertiary sector between 2020 and 21, as a result of the global pandemic situation.

Even though for many functions it cannot be put into practice and for others it is only viable as a mixed regime that is complemented with in-person work, the fact is that many organizations, even without a previously laid out plan, ended up having to organize work in this manner.

Work flexibilization has been greatly developed over the past years and includes flexibility both in terms of schedule and in terms of place of work and how work is performed, pointing to telework once again (Leite *et al.*, 2019; Fiolhais, 2007).

Telework gained significance with the Covid-19 pandemic of the past few years, affecting a high number of both private and public sector workers in Portugal.

Regardless, the literature defends telework touches on a set of personal and context-based variables that interfere when choosing teleworkers and it is not adequate for all worker profiles (Figueiredo *et al.*, 2021).

As a result, between March and December of 2020, according to INE data, telework included 23.1% of workers in the second trimester, 13.4% in the third 11.6% in the fourth trimester, hitting a never seen dimension and varying in numerical terms between about one million and one hundred thousand to about five hundred thousand and five thousand individuals (INE, 2020, 2021 referred by Santos, 2021).

5.3.2 Impacts of Telework

Relevant literature identifies the impacts of implementing telework in the teleworker, the organization and in society itself (Leite *et al.*, 2019).

Both literature review and empirical studies mention telework consequences as including workers' life-work balance, their personal satisfaction and their well-being (Rodríguez-Modroño and López-Igual, 2021). These impacts depend on the degree of telework and characteristics of different types of telework and can manifest as positive or negative (Rodríguez-Modroño and López-Igual, 2021).

Telework can be analyzed taking into account both these perspectives (Rodríguez-Modroño and López-Igual, 2021).

On one hand, the use of Information and ICT allows for gains in flexibility and further autonomy leaving workers some possibility of deciding where, when and how to work: on the other hand teleworking might make the separation between work life and personal life more challenging, leading to higher work demands and the

depersonalization of working relationships and lack of clarity regarding work functions as well as adverse effects on teleworkers' individual well-being.

Gajendran e Harrison (2007), referred by Fonner and Roloff (2010) explains that telework affects individual results positively and negatively, namely in what comes to work-related satisfaction.

The model the authors used analyzes several variables in three aspects: interface management between home and work, psychological in what connects to autonomy as well as potential isolation and relational impoverishment.

Amongst sensitive aspects connected to telework management, due to the physical distance of the worker which difficulties the coordination and motivation and mitigates hierarchies and demands redefining leadership models and a special attention to communication, it stands out (Fiolhais, 2007): (i) the technology used which depends on the functional characteristics of the telework; (ii) teleworkers' profiles, in which self-discipline and self motivation are recommended as well as initiative, ability to produce results without need for supervision, experience and given proof; (iii) organizational dimension and the required physical space to perform telework which might happen at home, at a telecenter or be mobile (under the current circumstances spurred by the pandemic, working from home has been the most prominent one); (iv) teleworker isolation which becomes more critical when work is performed at home; (v) questions connected to the difficulties of control and supervision; (vi) duration of work and break periodsa; (vii) salary policies which in this modality should priviledge results; (viii) professional training, since training on the job becomes more difficult; (ix) the maintenance of health and safety at work, especially given that telework is pointed at as a cause of mental health issues due to isolation, fatigue, stress and psychosomatic problems due to increased screen exposure; (x) the legal framing.

It is equally worth noting the economic and behavioral changes spurred by telework have contributed to a global reduction in energy consumption, thus relating to environmental sustainability (Horner *et al.*, 2016; De Graff, 2004, cit in Hook *et al.*, 2020).

5.3.2.1 Risks of Telework

Among the risks that are associated with telework, isolation stands out. Social isolation of team members has increasing consequences in what comes to connecting to the organization, less motivation and long term it drives to worse performance and might create conflicts between family members and increase incompatibilities between private and professional life (Contreras *et al.*, 2020).

One of the physiological functions that can be affected by teleworking is sleep. In this case, due to greater flexibility of schedules, we witness a loss of socio-professional references. Sedentarism and decreased exposure to natural light are some of the causes of sleep problems (Afonso, 2021, p. 241).

On the other hand, the isolation that is embedded in telework might harm mental health (Afonso, 2021). With the Covid-19 pandemic, telework substantially increased in Portugal and worldwide and its characteristics promote a higher risk for

mental health problems given that teleworkers no longer establish social work relationships with their colleagues and human beings need these social relationships.

As a result, it is justified to place more attention on the mental health consequences of telework (Afonso, 2021).

Telework is a psychosocial phenomenon given work is a central component of life that contributes to individuals' identities. Initially emerging as a means to sustain families, it corresponds today to much more than that in people's individual pyramids (Costa, 2021).

This is now a new focus of daily motivations and objects of satisfaction and personal fulfillment, emerging as a promoter of interpersonal relationships, changing life projects, motivated by new ambitions, career progress, new experiences and better salaries (Costa, 2021).

There is a connection between personal and professional life and any change in one of the sides of the connection will impact the other as a consequence (Costa, 2021).

5.3.2.2 Telework Opportunities

Telework brings about a set of very positive aspects. Several studies point to improved performance and satisfaction and decreased stress besides the improvement of balancing work and family life (Fonner and Roloff, 2010).

Thus, telework brings several opportunities in balancing professional and personal life while simultaneously generating higher performance and increased satisfaction (Fonner and Roloff, 2010).

Putting telework in place allows for the reduction of costs connected to the physical use of spaces such as rental and maintenance of workspaces as well as the costs of using varied resources (Giovanis, 2018, cit in Amorim *et al.*, 2021).

It is also worth noting an increase in efficiency due to commuting times between home and workplace being reduced and so there are no longer or much fewer delays Amorim *et al.* refer (2021) quoting Yu *et al.* (2019).

5.4 Telework and New Leadership Challenges

With the emergence of telework, especially amidst public administration and municipalities, leaders have had to shift to new means of interacting with their team, prioritizing online meetings using Teams, Colibri Zoom, etc., rather than face-to-face interactions.

Despite there not being consensus in team leadership and remote work, questions related to the clarity of communication and regular feedback and the need for time to obtain clear results have ample consensus as referred by Carvalho *et al.* (2021) quoting Larson and Makarius (2018) and Neely (2020).

Virtual leadership is thus emerging, has a wide scope and there is no literature consensus, with several possibilities of performance and full awareness that e-leadership and telework came to stay even if not exactly in the same ways that they have been taken up in pandemic years (Rodrigues, 2020, quoted by Carvalho *et al.*, 2021).

5.5 Methodology

5.5.1 DELPHI Procedure

The Delphi method was initially used during the fifties in a research study for the American air force and has since continued to be used in social sciences as a qualitative research method (Azeredo, 2019). It's a perspective technique that aims at obtaining consensus through interactive questionnaires applied to experts through several rounds (Azeredo, 2019; Santos and Saragoça, 2017).

The Delphi method is adequate and fit for reaching a consensus where there are diverging opinions in fields of knowledge that are in the process of being developed. This anonymous tool allows participants to express their position and option without being influenced by others (Fialho *et al.*, 2020; Santos and Saragoça, 2017; Christie and Barela, 2005; Listone and Turoff, 1975; Dalkey, 1969).

A group of experts is chosen to participate and respond to a series of questions through several rounds, allowing them to redefine and refine their opinion to arrive closer to a consensus (Azeredo, 2019).

The experts receive feedback from investigators that provide information about the group's perspective, with the objective to clarify or change their opinions, providing them with statistical information regarding the group's opinions in quantitative terms (Santos and Saragoça, 2017; Balasubramanian and Agarwal, 2012; Skulmoski *et al.*, 2007; Landeta, 2006; Rowe and Wright, 1999; Shields *et al.*, 1987; Dalkey, 1969).

Other fundamental aspects of the Delphi method are the connection of the questionnaire and the number of rounds that the questionnaire is sent out, connected to the dimension of the expert panel, their characteristics and the answer rate (Fialho *et al.*, 2020).

In general, two or three rounds are adequate although there can be as many rounds as needed to reach a consensus with clear and specific topics and an appropriate choice of experts, two rounds are usually enough (Azeredo, 2019).

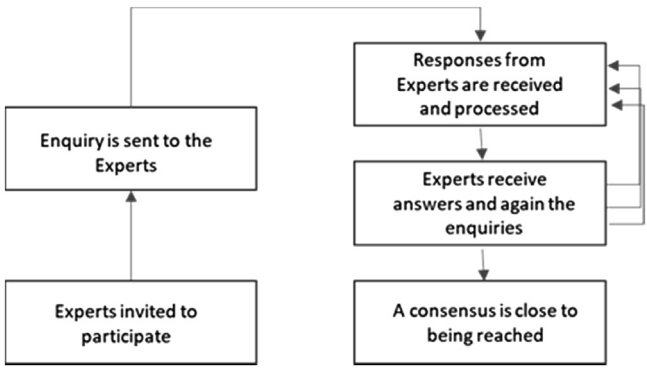

Fig. 5.1 – Delphi method.

E-delphi or online Delphi is an evolution under the light of new contexts (Azeredo, 2019) and is very important in current times, especially in the context of the pandemic which places difficulties in operationalizing the classic version.

5.5.2 Criteria Used for Constructing This E-Delphi and Selecting Experts

In this research, it was decided to perform two rounds given that the number of respondents allowed for the existence of at least two rounds as a repetitive process to arrive at a consensus which according to some authors (Azeredo, 2019; Christie and Barela, 2005; Mullen, 2003; Gallagher *et al.*, 1996; Butterworth and Bishop, 1995) allows for feedback and the revision of answers. Since the objective is to understand the nuances of participants' perspectives, as referred to, two rounds were found to be adequate (Skulmoski *et al.*, 2007), which confirmed itself and also allowed the participation and continuity of the panel (Landeta, 2006).

When choosing study experts their level of experience in management and leadership positions in municipalities of a specific administrative region in Portugal as well as their knowledge of leadership in public organizations and virtual teams and capacity to communicate efficiently were the factors that were taken into account (Skulmoski *et al.*, 2007; Adler and Ziglio, 1996) as well as their own interest in participating, which reinforces the reliability and validity of results (Kittell-Limerick, 2005; Rowe and Wright, 1999; Adler and Ziglio, 1996).

There were twenty chosen experts that accepted to participate in the research and twenty answers were obtained for the first round of the study and fifteen for the second round of the study.

The number of respondents fits into what is considered habitual for Delphi studies which are between seven and thirty (Dalkey, 2003; Mullen, 2003; Phillips, 2000; Armstrong, 1985; Cavalli-Sforza and Ortolano, 1984; Turoff, 1970), even though there is no consensus and it depends on the specific theme being researched and controversies connected to the theme.

Many authors consider the ideal number to be between fifteen and twenty (Azeredo, 2019) with the possibility that it shifts depending on disciplines and participants' interest in taking part (Mason and Alamdari, 2007).

In the current case, respondents formed a fairly homogeneous group, performing similar functions within the institutions they are a part of, which made the answers produce sufficient results (Skulmoski *et al.*, 2007) and ensure their validity (Listone and Turoff, 1975).

5.5.2.1 First Round

Questionnaires were sent to experts by email, with a link inviting them to participate and answer online.

Over the first round, respondents received a structured questionnaire with a set of fourteen competencies (as indicated in table 5.1) that were considered desirable by a leader within virtual work contexts which had been mapped in several

TAB. 5.1 – Results of the first round.

	(5) + (6) %	Mean	Median	Mode	Standard deviation	Percentile 25	Percentile 75
Capacity to problem solve and take on responsibilities	100.0%	5.7	6	6	0.47	5	6
Empowering	100.0%	5.65	6	6	0.49	5	6
Emotional intelligence	90.0%	5.65	6	6	0.67	5.5	6
Ethical and rigorous behavior (R)	100.0%	5.64	6	6	0.56	5	6
Change management	95.0%	5.55	6	6	0.6	5	6
Proximity management	90.0%	5.45	6	6	0.69	5	6
Personal development	90.0%	5.35	5	5[a]	0.67	5	6
Delegation	90.0%	5.35	5	5[a]	0.67	5	6
Teamwork support/life-work balance	85.0%	5.35	5.5	6	0.75	5	6
Communication	90.0%	5.3	5	5	0.66	5	6
Sharing of vision and mission	85.0%	5.25	5	5	0.72	5	6
Innovation and creativity	85.0%	5.15	5	5	0.81	5	6
Capacity to use technology to cooperate	60.0%	4.8	5	4[a]	0.77	4	5
Focusing on results instead of execution times	65.0%	4.8	5	5	0.83	4	5

[a]There are several modes. Lowest values are shown.

e-leadership studies (Contreras *et al.*, 2020; Darics, 2020; Jarrell, 2020; Alward and Phelps, 2019; Cortellazzo *et al.*, 2019; Alsharo *et al.*, 2017; Schaubroeck and Yu, 2017; Van Wart *et al.*, 2017; Ferrari, 2012; Zhang *et al.*, 2012; Avolio *et al.*, 2009; Kissler, 2001; Avolio *et al.*, 2000; Cascio, 2000).

Researchers provided a detailed description of the fourteen competencies and established a Likert scale to attribute the level of agreement, on a six-point scale in which 1 – Completely disagree and 6 – Completely agree (Christie and Barela, 2005).

Besides classifying the desirable skills through the Likert scales, experts were welcomed to present suggestions on what comes to the skills and behaviors with which they disagree or propose improvements in how they are described.

The questionnaire also foresaw the sorting of ten competencies for efficient leadership, by order of importance.

Results of the first round of questionnaires were analyzed through descriptive statistics, using the 28 SPSS version.

5.5.2.2 Second Round

The second round happened three weeks after receiving the answers to the first round of questionnaires and, just like for the first round, two weeks were given for the experts to answer. It was not possible for all experts who had participated in the first round to answer in the second round.

The same methodology for sending the questionnaires to the experts, with a set of modified information, particularly in what comes to the descriptions of skills and behaviors, which was based on the comments the experts made over the first round; there was also the additional of a new competency suggested by panel members, (as indicated in table 5.2).

Problem-Solving and Empowering obtained a consensus immediately on the first round (higher mean, smaller standard deviation and frequency of 5–6 are 100%) so they were not included in the second questionnaire. For each competency, the means and standard deviation results of the first round were added to this second-round questionnaire.

In this last and second round, each Delphi panel expert was invited to review their answers, answering again using the same classification scale and adding comments to their answers.

The answers to this questionnaire allowed for a general consensus in what comes to the most relevant competencies for leaders of virtual teams and to narrow the differences in expert opinions. The replies for each round were enough to perform a deepened and profound analysis and interpretation and the second round results were used to answer the research question.

As a result, nine competencies were identified as the most consensual for e-leadership. These nine elements are developed in the coming section when the results are discussed.

To obtain a consensus by analyzing the data, mean, median, upper and lower quartiles, median and frequency distribution can be used (Azeredo, 2019) with standard deviation also being of great importance.

TAB. 5.2 – Results of the second round.

	(5) + (6) %	Mean	Median	Mode	Standard deviation	Percentile 25	Percentile 75
Change management	100.0%	5.67	6	6	0.49	5	6
Innovation and creativity	100.0%	5.6	6	6	0.51	5	6
Ethical and rigorous behavior	100.0%	5.6	6	6	0.51	5	6
Emotional intelligence	93.3%	5.53	6	6	0.64	5	6
Proximity management	86.7%	5.47	6	6	0.74	5	6
Communication	100.0%	5.47	5	5	0.52	5	6
Teamwork support/life-work balance	86.7%	5.33	5	6	0.72	5	6
Personal development	80.0%	5.33	6	6	0.82	5	6
Capacity to ensure team cohesion	93.3%	5.27	5	5	0.59	5	6
Delegation	93.3%	5.2	5	5	0.56	5	6
Sharing of vision and mission	80.0%	5.07	5	5	0.7	5	6
Capacity to use technology to cooperate	73.3%	5	5	5	0.76	4	6
Focusing on results	73.3%	4.8	5	5	0.56	4	5

In the second round, seven competencies have percentages higher than 90% of Very and Extremely important categories; twelve competencies have a mean higher than five points and all competencies have a median and the mode superior to five.

Twelve competencies have an interquartile range equal to 1 and a standard deviation inferior to 0.8.

For one item classified as five or higher (on a Likert six-point scale) at least 75% of experts follow criteria that make it considerable.

This acceptance criterion was used in several Delphi studies (*e.g.*, Al-Muallem *et al.*, 2016; Arbabisarjou *et al.*, 2016).

Literature refers that percentages of at least 70%–80% make it possible to consider consensus was reached (Azeredo, 2019), despite this, in the case of this research, since high percentages were obtained for all categories, we chose to consider only the 9 competencies which obtained 90% or higher punctuations.

5.6 Result Presentation and Discussion

"Public sector organizations are organizations that are owned and controlled by the government or local government" (Howieson and Hodges, 2016, p. 40). "Public service is a service which is provided by government to people living within its jurisdiction, either directly thought the public sector…" (Howieson and Hodges, 2016, p. 40).

Public Administration leadership is essential for tomorrow's societies given the importance of Public Administration in social and economical development, and as a partner to the private sector, companies and non-governmental entities (Barreto and Sousa, 2021).

As such, this sector's leaders have to work with several partners and hold a common objective as Virtanen and Tammeid refer to (2020) (cit in Barreto and Sousa, 2021).

E-leaders should have capabilities that allow them to create and maintain virtual teams (e-teams) with high performance and adopt a management style that takes the most advantage possible of the potential of information and communication technologies and minimize the need for face-to-face interaction as refer Colfax *et al.* (2009), quoted by Samartinho (2013).

It is within this context that the present study can be considered very useful since identifying the most relevant capabilities allows leaders to develop in those areas.

The growing use of virtual teams in public administration is increasing in scope. Efficient leadership in a virtual team is a necessity because virtual teams are different from traditional teams.

It is therefore necessary that e-leaders understand the specific leadership competencies that are exclusive to a virtual environment and develop them to achieve efficient leadership.

Given this, the present study identified and analyzed the competencies needed through a local public administration study, in several municipalities that

experienced leadership in telework and remote work teams, considering the literature review regarding virtual leaders and their leadership style.

The results of this study show that competencies obtained through the Delphi method are not significantly far from those described in the literature regarding virtual leadership, even though telework needs in Covid-19 times implied the use of innovation management, often improvised, adapted to the demands of the situation.

The competency that emerges as distinct is "capacity to ensure and maintain team cohesion" due to how a remote work environment involves reduced face-to-face interactions and leaders having to lead virtual teams in a different way than they do in in-person situations.

This competency is highlighted with emotional support towards each team member, together with permanent communication using available means like video conference, phone, and email, with every team member which reveals the complexity of e-leadership.

Even though e-leadership maintains essential leadership characteristics for an in-person context, it implies a different way of action, with a higher focus on team empowerment and delegation process and space for autonomous work, with a stronger orientation for results and goal achievement, supporting the continuous development of the team.

The set of fundamental competencies proposed in this study refers to the importance of competency models for local municipalities, for the benefit of organizational deciders, and human resource development professionals, as a base over which training programs can be created to motivate competency development and promote a more efficient form of e-leadership while maintaining a strong connection with the organization's strategy (Pedro, 2014).

As explained, in this e-delphi study with the local public administration, after the two questionnaires were performed, nine competencies were considered. Out of these, two had already been approved during the first round since they obtained wide consensus: (i) "capacity to problem solve and take on responsibilities" and (ii) "empowering", as seen in table one which is presented in the section where the procedure is described.

Hereby follows the analysis of each of these nine characteristics presented and described in the inquiries.

"Capacity to problem solve and take on responsibilities" was described as "capacity to overcome obstacles and challenges and solve problems with flexibility, assuming inherent decision making and responsibilities. Demonstrates capacity to identify work solution and efficient management processes".

This description cannot be separated from the need for continuous education (Van Wart *et al.*, 2017) or the need to develop human and digital skills that promote initiative and change in attitude (Cortellazzo *et al.*, 2019).

"Empowering" was described as follows "Promotes empowerment through the areas they are responsible for which includes committed and autonomous responsibility for workers to execute their job" which implied fostering people to be autonomously capable of fulfilling the activities inherent to their functions (Cortellazzo *et al.*, 2019; Walvoord *et al.*, 2008).

The seven competencies cleared through the second round are: (i) capacity to manage change; (ii) creativity and Innovation; (iii) "ethical and rigorous behavior"; (iv) emotional intelligence; (v) communication; (vi) capacity to ensure team cohesion; and (vii) delegation.

In the second questionnaire the competency **"capacity to manage change"** was tied to the following description: "Accepts and adapts to change quickly, assimilates new concepts and work methods fast and shows ability to diagnose the need for change, propelling new processes for management and involving teams to cohesively and following a rhythm manage the change process".

It cannot be left unmentioned, in what comes to change management in public administration Fernandez and Rainey (2006, cit in Van Wart *et al.*, 2017) and the relevance of proactivity.

"Creativity and Innovation" was described as "Within a virtual work context, the capacity to promote a collaborative environment of generating ideas, sharing of knowledge between team members and promote the sharing of information" which resonates with the real or virtual creation of networks between internal or external practice communities (Cortellazzo *et al.*, 2019).

"Ethical and rigorous behavior" was described as "capacity to act as a model for all organization members in what comes to using technology exclusively for the ends that are foreseen, acting with ethic, rigor and mutual respect" we should emphasize that e-leader should demonstrate a model behavior in what comes to rigor, ethics and mutual respect (Cortellazzo *et al.*, 2019).

"Emotional Intelligence" was described as "capacity to use emotional intelligence in their relationship with team members, in particular for conflict resolution, creating a culture of trust and encouraging team members to communicate, developing activities and making adequate use of available technologies" which is in agreement with the increase of virtual communication to create trusting relationships as advocated by Bryant (2013, cit in Alward and Phelps, 2019).

"Communication" was defined as "clear and empathic way of communicating with team members, adapting to the communication style of each person, consistently active listening and the multiple channels of efficient communication", showing great proximity as Darics (2020) makes explicit, with collaboration amongst team members as a direction.

"Delegation", in turn, represents "capacity to delegate tasks to subordinates, establishing clear commitments for result control, performance evaluation and personal and professional development promotion" as referred by Zhang *et al.* (2012).

What was here called **"capacity to ensure team cohesion"** emerged in the second questionnaire as suggested by the experts in the first round of the questionnaire and it means "capacity to support team members in their activities, sharing problem analysis and searching for solutions with the team, favoring cohesion and team spirit.

It also includes each one's situation and developing an individual plan for overcoming challenges and promoting work-life balance in personal and professional life amongst team members".

Regarding methodology, it cannot be left unsaid that this research is in line with other studies on leadership competencies for virtual environments as is the case of Fígaro (2015) and Samartinho (2013).

On the other hand, Barreto and Sousa (2021) identify similar data regarding public administration and telework.

Looking towards the future development of the investigation, it is suggested that this competency model is replicated and implemented on other governmental levels, in different sectors (for example private, not for profit), and in a wider range of countries in such a way as to validate and generalize capacities that contribute to a more efficient and effective e-leadership in organizational contexts of telework.

5.7 Conclusion

Thinkers, researchers and academics that have focused on leadership over the past century produced an array of important studies about leadership practices. Nevertheless, research on virtual leadership is still in an embryonic state, in its early stages.

Through this study, we analyzed the importance of the digitalization of administrative spaces and their effects on society and organizations in the public sector.

Thor impacted studies on leadership and e-leadership, leading to the concept of e-leader.

Even though to date the focus on virtual leadership in studies regards mostly the effective use of ICT, we believe it is important to develop a model for competencies that can potentiate effective e-leadership in organizational telework contexts through traits, skills, styles and behaviors.

Traditional leadership is no longer adequate in fulfilling the demands of a fast-changing organizational environment, dynamic and complex, especially when Covid-19 brought massive worldwide experience with telework and remote work.

Virtual environments, collaborative work and social networks bring new opportunities for leaders and followers.

Through efficient and effective ICT use, virtual leaders can connect and build relationships that are essential for innovation and team performance under telework.

By using the Delphi method it was possible to identify, throughout 2021, the nine most relevant competencies to lead telework teams in local public administration.

The competencies that were identified by the experts that accepted to participate in this study are: capacity to problem solve and take on responsibilities, empowering, capacity to manage change, creativity and innovation, ethical and rigorous behavior, emotional intelligence, communication, capacity to ensure cohesion and delegation are all in line with a literature of reference for this theme.

We believe this study contributed to the development of the still-diminished literature on effective leadership for virtual teams and, as a consequence, support the academic community in performing more research connected to this theme in the future.

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Chapter 6

Challenges of European Organisations in the VUCA World and the Emergence of the Bani World

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6.1 Introduction

The third decade of the 21st century brings constant social-economic challenges encouraged by the emergence of technological innovations that impact business changes (Alkaraan *et al.*, 2022; Kraus *et al.*, 2021). Between the factors that shape the socioeconomic changes and business development of both the EU and its members in the post-2019 period, it can be exposed that digitalisation, Covid-19, political risks and financial and economic risks (Poruchnyk *et al.*, 2021). For the first time after 1970, when neoliberalism emerged, we witnessed a wholesale transformation of the industry worldwide (Free and Hecimovic, 2021). In contrast to the theory of neoliberalism, which was based on the limited economic role of the state (establishing property rights, enforcing contracts, and regulating the money supply) and the promotion of international free trade and privatisation initiatives (Abildgaard and Jørgensen Mølbjerg, 2021; Biebricher, 2019), current economic and political actions come to fore. While after 1980, there was a structuring of production in terms of global supply chains (or global value chains) (Gereffi *et al.*, 2005); in 2022, the EU decided to support chip production in member states because they had lost trust in global suppliers. The EU Commission even prepared a European Chips Act. The Act states that semiconductor crisps are an essential component of digital and digitised products. Therefore, Europe must provide its semiconductor production facilities. It is going for the only way it can secure its

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future competitiveness and maintain its technology leadership and security of supply (European Commission, 2022). Crises in the process of globalisation may also indicate its end and opens up a possible new globalisation path, amongst which inclusive globalisation warrants exploration (Liu *et al.*, 2018). Political decisions such as Brexit (Pandzic, 2021) or the Ukraine crisis, China's and Russia's plans for new world order, and the protectionism of the United States are affecting the disruption of global supply chains, possibly leading to the end of globalisation processes and the emergence of regional economic partnerships (Rachman, 2022). The Chinese government's proposed Belt and Road Initiative (BRI). It is going probably in the current situation for the most prominent that promote inclusive globalisation, the characteristics of which could be justified by inclusive growth with effective and efficient government regulation, inclusive infrastructure development, nationally chosen development paths that fit national conditions, inclusive participation, and cultural inclusion (Liu *et al.*, 2018).

The other two factors that significantly impact the current and future economic situation in the EU are digitalisation and the pandemic, which coincide in time and space and have a converging significance (Dvorak *et al.*, 2021; Rapaccini *et al.*, 2020). First of all, the rapid and accelerated development of digital technologies and disruptive innovations during the pandemic completely changed the views and possibilities of socioeconomic development. It drastically changed the way of production, work, business, retail, entertainment, culture, and information due to the easy accessibility, mass production of technological devices and general internet access). Until recently, a scale was difficult to understand and practically unattainable (Bin *et al.*, 2021; Dahlke *et al.*, 2021; Jiang and Stylos, 2021).

In the dynamic and unstable environment created by profound changes in the digital space, he pursues and directs the development of a society, which according to the scientist Saurunga, is called "VUCA" (Volatility, Uncertainty, Complexity and Ambiguity) direction or age, which is an acronym for instability, the threat, complexity, and ambiguity of the times in which we live (Millar *et al.*, 2018). The acronym VUCA itself was coined at the US Army War College in the late 1980s as a response to the collapse of the USSR to suit the new circumstances of a post-Cold War world. With the end of the Cold War in the late 1980s and early 1990s, people expected a peacetime world to emerge as the expected normalcy and stability (Shambach, 2004). Instead, the world has returned to the state of the Cold War. It has become unpredictable, volatile and, above all, very chaotic with the outbreak of the Ukrainian crisis.

To stabilise the business in the VUCA world, companies have begun to adopt new business models, such as the circular economy and the sharing economy. They are also undergoing digital and green transformation processes. These newer business models and smart technologies, combined with proactive decision-making, promote ethical business practices that can ensure sustainable business in the future (Müller and Däschle, 2018). However, the precondition for the emergence of new business models and digital technologies is acquiring new skills and competencies within Industry 4.0, which is expected to pass the fifth industrial revolution or Industry 5.0 in 2030 (Hiremath *et al.*, 2021). In such a rapidly changing and chaotic environment, the explanatory model of the VUCA environment is no longer

sufficient to explain new business models and current challenges for companies and society as a whole. Therefore, developing a new explanatory model is necessary to deal with a changing world. Anthropologist, historian and futurologist Jamais Cascio named Bani world an acronym for Brittle, Anxiety, Non-Linearity and Incomprehensible (de Godoy and Ribas Filho, 2021).

In this chapter author's goal was to find the answer to the research questions: RQ 1. What are the main characteristics of the world in the post-Covid-19 period?; RQ 2. What are the current main risks that threaten European organisations, and how management can establish resilience against them?; RQ 3. Which managerial approaches will enable European organisations to survive in the post-Covid-19 period, and what will be their consequences for organisation stakeholders? RQ 4. How is the Vuca world transformed into the Bani world in the post-Covid-19 period?

The first part of the chapter presents the introduction. The second part explains the Vuca world's meaning for European organisations. Then, the third section discusses the challenges of organisations in the current chaotic and changeable environment. The fourth section explores the emergence of a Bani world. The last part includes conclusion.

6.2 European Organisations and the Vuca World in the Third Decade of the 21st Century

European organisations are in the third decade of the 21st century, exposed to technological change brought about by the fourth industrial revolution and various risks arising from the external and internal business environment (Alkaraan *et al.*, 2022; Kraus *et al.*, 2021). In such complex situations, however, the company's management is faced with different risks that management must accept as a challenge. As part of the search for solutions that will ensure that the company becomes resistant to various risks, management is faced with the complexity of changing decisions. It often happens that they are unclear. Such a scenario represents a volatile, uncertain, complex and ambiguous world known as the VUCA world. Its components and impact on changes in a global world are presented in figure 6.1. In contrast, figure 6.2 shows managerial solutions for solving volatile, uncertain, complex and ambiguous situations in the Vuca world.

6.2.1 Volatility

Risks to which are organisations exposed in the volatile environment are related to exponentially accelerating change, unexpected situations, unstable environment, maybe of unknown duration, and require accelerated decision-making and urgent response. A key feature of challenges in a volatile environment is that they are mainly incomprehensible and that knowledge about them is often available (Schick *et al.*, 2017; Bennett and Lemoine, 2014). Volatility first came to the fore in 2008, at a time of global financial crisis and the collapse of international financial markets. The speculative bubble that caused the financial crisis is an example of the

socioeconomic consequences of instability. All market players such as mortgage lenders, financial and insurance institutions, and government officials were aware of the situation and knew how secure the securities were. In addition, the financial institutions that packaged, hedged and sold these derivatives were aware of the widening speculative bubble. However, none of those involved assessed the critical point at which the balloon would burst during that period.

On the contrary, most involved thought that such a situation could not occur. In fact, by 2008, an underestimated attitude towards unforeseen events had been perceived (Dalko and Wang, 2018). The financial crisis led to different approaches to analysing and preventing the consequences of the risks in the ever-changing world of VUCA. Probabilistic models have been developed to measure the volatility of financial and real estate markets and business or education management sectors (Lemoine *et al.*, 2017).

The second example of a volatility challenge presents price fluctuation after a natural disaster. In recent years, European companies have increasingly faced the consequences of natural disasters such as floods and earthquakes. Natural and medium-sized organisations are the most affected by natural disasters, and they are also the backbone of economic development in Europe. That is why both companies and the local community must prepare to manage and prevent the significant consequences of natural disasters. Therefore, in the local environment, it is necessary to ensure the cooperation of all key actors in the disaster management system and provide public resources to address the consequences.

Furthermore, as part of the disaster prevention mechanism, it is necessary to establish a mentoring program where entrepreneurs who have experience and knowledge of natural disasters transfer their knowledge to other entrepreneurs and managers. Furthermore, it is essential to strengthen informal local business and political networks, train entrepreneurs for risks and promote private insurance. A company must have capital, loyal customers and a flexible workforce available for such cases. It is also essential that so-called entrepreneurial-oriented factors have been developed, including psychological resilience, social networks and political efficiency. The effects of floods can increase the risk of bankruptcy if they coincide with economic and personal challenges. Therefore, SMEs deserve special attention in disaster risk management, considering business and entrepreneurial factors (Winkler *et al.*, 2022).

6.2.2 Uncertainty

Uncertainty presents the second component of the Vuca world. Uncertainty is considered to arise from problems that arise in interpreting events and situations that the company is facing at a given time. The cause of the event and its consequences can be predictable. However, it is impossible to assess how these will affect the company's future and predict whether an immediate response is needed, such as investing in appropriate assets. Situational uncertainty itself makes it difficult to determine a definitive description of the meaning and essence of a particular situation or condition. This makes it difficult to offer concrete solutions – without

knowing which one may be most effective and under what circumstances. It is also often not clear whether action is needed to provide (Mack and Khare, 2016).

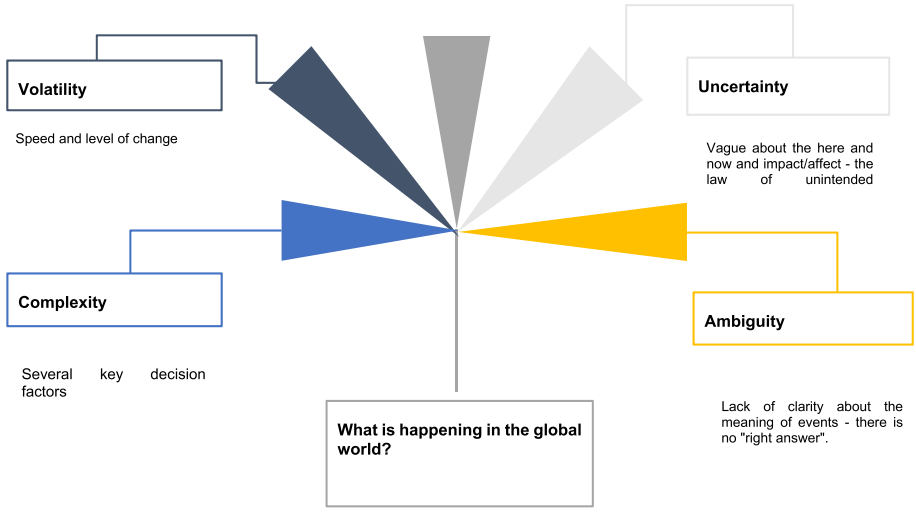

FIG. 6.1 – Volatility, uncertainty, complexity and ambiguity: a new reality in the global world.

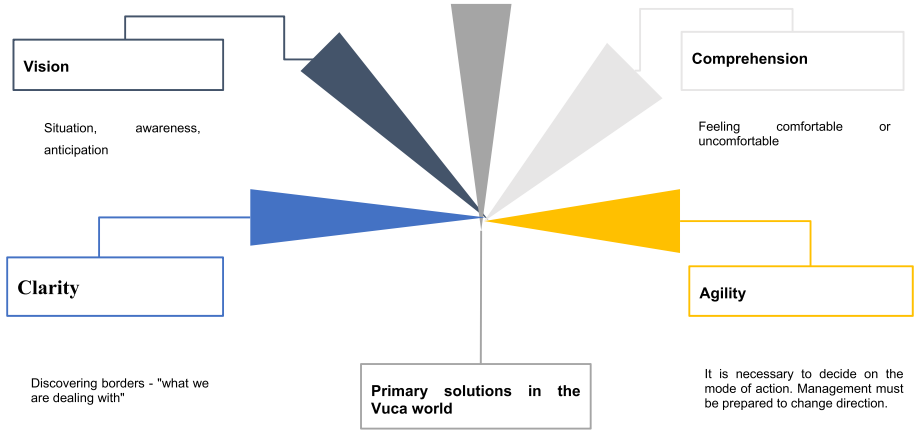

FIG. 6.2 – Volatility, uncertainty, complexity and ambiguity: managerial solutions.

The uncertainty in the company's business can be demonstrated in the case of shorter life cycles of products and services. As a result, market analysis is losing relevance much faster in such an uncertain environment. As a result, quantitative bases for decision-making are no longer available, and the precarious situations of

many decision-makers are increasing. Therefore, companies are under much pressure in the VUCA environment if they want to respond more quickly to change (Minciu *et al.*, 2020).

Disruptive innovations also represent uncertainty for companies. As early as 1975, Kodak developed a prototype digital camera. However, management failed to see its massive disruptive potential and make coherent long-term plans to capitalise on its innovation. The question arises as to why industry-leading companies such as Kodak do not remain, leaders when faced with technological or market changes (Ho and Chen, 2018). The fundamental idea of disturbance theory answers a tool that predicts behaviour (Christensen and Dillon, 2020). Its core value lies in the ability to evaluate and forecast within the organisation. The ability required by an organisation is to choose the right strategy and avoid the wrong one (Shang *et al.*, 2019). Thus, IBM sensed in time that there would be a decline in interest in laptops and sold the Lenovo brand. This decision contributed to IBM's survival and continued growth (Roblek *et al.*, 2021).

6.2.3 Complexity

This component or characteristic should not be confused with complexity. Complexity refers to looking at the world through the lens of the need to analyse an infinite amount of data. Of course, management tries to divide the overpowering whole into its more manageable, individual parts, which they can then process and understand (Mack and Khare, 2016). However, such a division and focus on the analysis of individual parts could lead to situations where some parts have not been adequately considered. As a result, the whole picture can become blurred or even completely obscured. Therefore, focusing on individual elements often becomes an obstacle to the correct interpretation of the whole. However, it is part of human nature to prioritise the known and the safe as the unpredictable and the unknown. Sometimes the whole thing can be too intimidating. The essence of the VUCA world is the multitude of connected parts that create a network of information, procedures and actions. These parts can be individually multi-layered, multi-component and multi-stage; they do not need changes. Together, they create a system (Bartscht, 2015).

In the 21st century, companies face that change is no longer manageable. Companies are thus increasingly exposed to the risks posed by challenges related to the implementation of digital and green technologies, new regulations, globalised markets, new competitors, customer-oriented products and marketing. These external and internal business environment changes make it increasingly difficult to understand the causes and consequences of various events. Moreover, in companies, change occurs in parallel on several levels simultaneously. As a result, management no longer controls the system. Unintentionally, companies often further mass the situation, which can lead to chaos when (Roe and Dalton, 2019; Garcia-Lorenzo *et al.*, 2003):

– The company divides activities into smaller and smaller tasks to increase the quality of work. Management's mission is to guide experts, who should take care

of professionally based processes to improve work quality. Otherwise, the share of the effort invested by employees to achieve a higher quality of work will be disproportionate to the efficiency of what has been completed, and the organisational culture will become more complex.
- Management increases the diversity of products or services to increase sales. However, because management does not follow the guidelines that a particular product or service must be designed, developed and marketed separately, there is an increase in the complexity of the product or service.
- Management in the company increases the speed of work processes to complete projects in the shortest possible time. Unfortunately, the consequence of such a decision is that the company neglects standards and plans processes, which leads to the complexity of actual processes.
- In a complex environment, management is also increasingly facing challenges in predicting the impact of risks and the success of innovation. Because management prefers to cling to existing solutions and processes, they do not want to risk making a different decision from the classic ones, leading to a mistake due to the possible loss of function. Maintaining the status quo leads to a decline in the level of innovation, the company's development is halted, and, as a result, the company's future is threatened.

6.2.4 Ambiguity

Ambiguity represents the fourth or last of the Vuca components. Ambiguity is directly linked to the emergence of more innovative solutions in the fourth industrial revolution in digital and green technologies, information science, governance strategies and society itself, which is transforming into a digital society in which the digital economy represents a new and critical paradigm that will enable sustainable growth of companies and social wellbeing. However, due to the rapidly changing environment in which we are witnessing phenomena – unprecedented events – which have not happened in the past, it is no longer possible to learn from past experiences. In Vuca World, we are thus witnessing a fundamental lack of knowledge about the game's rules, which is increasingly absolute. The emergence of the Covid-19 outbreak and the growing digital transformation of the business, which is increasingly based on artificial intelligence, maybe indicate that reality cannot be confronted with past experiences and that this is at some stages inadvisable or even dangerous. Management is faced with contradictory and paradoxical phenomena that lead to testing a personal value system. At the forefront of organisational development are questions of what needs to be withdrawn, why and how. Decision-making requires courage and the awareness that mistakes can occur that can stop the further development of a company (*e.g.* incomplete implementation of digital transformation).

The following section presents the challenges and risks companies are exposed to in today's Vuca world. Themes are divided into macro level, meat level and micro level. Thus, the full spectrum of phenomena that make up today's changing environment is covered. Not only to understand Vuca's world but also to determine

whether the Covid-19 pandemic has ushered in a new world named BANI World, it is necessary to face the analysis of the political and economic situation, the course of industrial revolutions, cultural changes in the organisation, company lifetime disruption and disruptive innovation examples.

6.3 The Challenges of Organisations in the Current Chaotic and Changeable Environment

6.3.1 Macro-Level – Political and Economic Situation in the World and the EU

The global pandemic demonstrated how fragile the world economy is—covid-19 showed the vulnerability of global supply chains and demand elements. The quote best represents the situation, «covid pandemic could be the straw that breaks the camel's back of economic globalisation» (Niblett, 2020). Covid-19 has raised the critical question for the EU, for example, how to prevent cross-border economic crises due to border closures and national lockdowns in an area as interconnected as the Schengen area at the micro-level and at the macro level of national and continental interdependencies. Thus, the post-2020 period was characterised by anti-human policies that changed the cornerstones of the global economy. Even in the pre-Covid period, increasing regulation began to influence the decline of neoliberal globalisation (Palley, 2019) out the global supply chain disruption due to China's zero-tolerance policy (Nguyen *et al.*, 2022; Dunford and Qi, 2020). China's policy leads to the closure of factories or ports.

Nevertheless, it also requires strict quarantines and travel restrictions on meat or landscapes where outbreaks occur. However, these restrictions impact factories and supplies worldwide and exacerbate the supply chain crisis (Sheffi, 2021; Yang *et al.*, 2021). Therefore, it is expected that those future minor disruptions because of Covid-19 in China can lead to 'ripple effects' across the global supply chain.

Covid-19 opened new opportunities to promote anti-globalist trends. The Covid-19 pandemic, which occurred between 2020 and 2022, exposed political and economic problems. It forced states, organisations, and societies to increase their capacities to enable economic self-sufficiency. However, the Covid-19 crisis somehow coincided with a growing national populism. Palley (2019) argues that neoliberal globalisation faced severe challenges from "above" and "below" in the second decade of the 21st century. In the case of "below," neoliberal globalisation faced the resentment and anger of working-class voters in economically developed countries, where right-wing populism emerged. It was fostered in the US by Trump's pronouncement of "America first." At the same time, in Europe, right-wing populism caused Brexit in the UK and the rise of the so-called far-right in EU countries (*e.g.*, in France in 2022, the new political star of the far-right is Éric Zemmour, in addition

to the already established Marie Le Pen, Geert Wilders in the Netherlands, Giorgia Meloni and Matteo Salvini in Italy, Joerg Meuthen and Alice Weidel in Germany).

Management in European organisations must be aware of the far-right views, which openly reject any possible future political federalisation of the EU. However, there is a possibility that some of its members support certain types of intergovernmental cooperation. In this context, some far-right parties advocate withdrawal from the EU, others its dissolution, and still others the "shrinking" of the EU to the sole economic coordinator of sovereign states. It is being challenged by the American elite, which is concerned about growing geopolitical threats. For example, COVID-19 and the issue of Taiwan's independence have strained U.S.-China relations during both the Trump and Biden administrations. Unlike Trump, however, Biden sees China not as an existential threat but as an economic and normative challenge to the EU. China's growing economic and military power has led to a bipartisan determination in the United States to deny China access to American high technology and intellectual property. The United States is forcing all of its allies to do the same. The establishment of a political and economic axis at the level of China and Russia in early 2022 as a result of strained relations between members of NATO and Russia due to the Ukraine crisis has also raised questions about the new geopolitical distribution of the world that will have economic consequences for EU organisations.

As a result, the US has begun to look for new energy supply routes for the EU, accusing the EU of being too dependent on Russia for natural gas supplies. At the same time, political pressure and public opinion in the EU are increasingly demanding that companies meet carbon emissions reduction targets and ensure that their suppliers are socially responsible companies. Therefore, it is increasingly essential for business leaders, managers and their companies in the EU to find answers to the green transition challenge and political developments regarding Russian gas supplies and their prices for European companies. At the same time, China is threatening the competitiveness of European industry with a lower supply price and even confronting companies with energy crises. The current actual situation in the EU shows that efforts to decarbonise and diversify Russia's fossil fuel reserves have led to a sudden energy transition, with severe consequences for industry such as power shortages and blackouts. This may explain why Germany–Russia's largest gas importer in Europe, is much more cautious about Ukraine than the US and the UK and why Russia is expected to maintain its role as the EU's dominant natural gas supplier until at least 2040. Also to decide that natural energy sources include natural gas and nuclear power, at least until 2045, when it can still obtain a construction permit for a nuclear power plant. The post-Covid-19 period will thus be one in which the meaning of the international division of labour and the importance of the global organisation of production will be reconsidered. Such a situation came out mainly due to the Covid-19 crisis, which plays a vital role in highlighting the threat posed by the global wave of national security and supply security in times of crisis. However, Musgrave (1959) and Stiglitz (2000) show that location decisions always involve trade-offs between economic efficiency and other legitimate concerns that are either (i) economic, *e.g.*, macroeconomic stability, dynamic efficiency, and technological development

concerns, such as late industrialisation policies in the least developed countries or (ii) non-economic motivations such as distributive justice, environmental sustainability, national security, or security of supply.

Whether economic or non-economic, all these concerns affect the emerging international economic and political order. From an EU economic perspective, the emergence of regional economic relationships consisting of a significant country and its allies linked to it through bilateral/regional agreements must be closely monitored. Such poles serve both military-strategic and economic interests. The lead state will promote the regionalisation of the global value chain and support the development of more integrated supply chains among countries associated with its sphere of influence, including convergence strategies. Recent projects such as the Chinese Silk Road Initiative (BRI), the U.S.-Mexico-Canada Agreement (USMCA), and the new Western Hemisphere Strategic Framework of the US Strategic Framework for Latin America are motivated by this logic.

The AUKUS (2021) security pact between Australia, the United Kingdom and the United States is a concrete example of excluding a French submarine manufacturer from an already agreed agreement with Australia due to creating a new military and economic pole. It is a good sign for the EU economy and politics that the EU's natural allies are also changing their geopolitical goals. We can conclude that the direction of the EU's trade and investment policy will change in the future due to geopolitical restructuring. Various factors will also play an essential role in such a decision, such as the distributional impact of globalisation and the threat to the security of the supply of vital products from public health crises, such as COVID-19. Given the efforts of the US and China to build economic poles through more regionally integrated supply chains, the EU will also need to consider the extent to which it wants to promote more regionalised production models. It is also likely that it will make sense for the EU industry to shift production back to Europe, which could also have positive economic and political effects in Eastern Europe and the Western Balkans.

6.3.2 Meso Level – European Industrial Sector

The pandemic COVID-19 hit 2020 and 2021, the EU economy hard, disrupting supply chains, industrial production, foreign trade and capital flows. The shock to the EU economy is much worse than the last economic and financial crisis in 2008. For this reason, and because of Europe's economic solid interdependence, it is crucial that the recovery is symmetrical and involves comprehensive and coordinated measures (Ferry-Pisani, 2020). Therefore, the EU Commission has decided to add to or amend the package of new guidelines for the European economy in 2020, including the Industrial Strategy to 2030 (Euro-Lex, 2020), the new strategy for small and medium-sized organisations published before the pandemic (European Commission, 2020a), the Action Plan for the Circular Economy (European Commission, 2020b) and the Long term action plan for better implementation and enforcement of single market rules (European Commission, 2020c). Moreover, the EU industrial sector faces a green transformation in addition to digital

transformation, requiring large-scale technological dispersion (Mollet and Pilati, 2021). In the coming years, both the transition to a green economy and the digital transformation will require the EU Commission, Member States, SMEs and stakeholders to support research and innovation and, in particular, the development of new green and digital technologies by the end of 2030. For their implementation and further R&D, the EU commission must prepare the financial instruments and programs. All this will help industry and businesses restructure, become more resilient, and recognise the current situation of EU industrial policy (Claeys *et al.*, 2021).

Covid-19 has impacted the supply chain and accelerated digitisation and the adoption of digital transformation in organisations. It is also evident that many organisations that did not think about digital transformation in the pre-Covid-19 period in the Covid period started to think about it or began with it. However, this represents a risk for the organisation. Lower profits or losses can lead to insolvency if the digital transformation fails. However, Covid-19 has also helped the European Commission and member states and organisations consider new sustainable business strategies. Thus, the Covid-19 crisis and individual measures introduced by governments have also led to some "accidental" positive impacts on the environment and natural ecosystems. As a result, a fundamental shift in human biophysical activities on Earth is emerging on the spectrum of possibilities for the future (Anderson *et al.*, 2021). However, as Naidoo and Fisher (2020) noted, relying on globalisation and economic growth as drivers of green investment and sustainable development is no longer realistic. Adopting the circular economy (CE), an industrial economic model that accomplishes many tasks of decoupling economic growth from resource consumption, waste management, and wealth creation, is already a viable solution in the EU manufacturing sector. One such positive example is Audi, which manufactures car seats for electric cars from plastic extracted from used bottles.

Let us look at the development of European organisations up to 2030 in line with the labour market developments and the socio-economic situation. The main problem will be labour shortages (the European Union will need 20 million ICT experts by the end of 2030, twice as many as in 2021) and an ageing European society, which will also be reflected in the ageing of the workforce. By 2030, HR managers will be faced with the need to prepare age management strategies, with measures to find and retain young talent, find employees with appropriate training and experience (both inside and outside the organisation), and introduce training and development of workers in line with the future emergence of jobs as a result of digital and green transformation. With all these challenges, the organisation's European production has been facing digitalisation and even the organisation's digital transformation since 2011. Due to the increasing speed of the digital transformation as a result of Covid-19, which has reduced social contacts as factors presented in the previous paragraph, organisations are in a situation that requires not only a reorganisation of the organisation but also a complete change of must ensure the transformation of the organisation into a nimble organisation. Thus, the goal of management must be to ensure the adoption of agile business models that increase the flexibility of the organisation and increase its leanness, which means

that administration is reduced to a minimum or the human presence in administration is no longer necessary. This organisation will solve complex human resources and technology situations and offer services and products focused on customised production shortly.

6.3.3 Micro-Level – Organisation

6.3.3.1 Work

Digital transformation of corporate activity is changing existing business models. The crucial role in these processes gets transformational leadership as a significant driver of business model transformation (Şimşek *et al.*, 2022). In organisations, organisational forms are changing, and becoming more flexible, affecting management styles and work organisation (Hess *et al.*, 2016). The changes affect (Cirillo *et al.*, 2021): (i) the hierarchical levels, (ii) the coordination of work both within and between organisations, (iii) the reorganisation of jobs, and (iv) structural changes in education and skills requirements. As they become affordable, sophisticated digital technologies have a central role in work management systems (Llopis-Albert *et al.*, 2021). However, these technologies can also have adverse effects on workers. In practice, it is coming to the processes of:

- "Gamification" of work. The process introduces game elements such as competition and scoring and creates pressure on employees. It also affects the "platformisation" of work and, thus, workers' objectification (Silic *et al.*, 2020).
- Control over employees in organisations is increasing. For example, information systems enable capturing and collecting more and more data in various forms and outside the workplace (*e.g.*, social media) (Wood, 2021). Therefore, it is necessary to establish codes of ethics that define who owns this data and in what cases it can use (*e.g.*, employee performance appraisal).
- Covid-19 pandemic increases algorithmic assignment and task management in teleworking. For this reason, cyber data security is becoming important thematic not only in organisations but also in workers' computer networks at their homes.
- Technology enables "people analytics" and profiling. As a result, new task management and data-driven HR practices emerge based on algorithmic inference from personal data obtained (Varma and Dutta, 2021). Such practices can hinder employees' creative and independent thinking, limit autonomy, cause stress, and decrease trust in management. However, such a tool can also reveal physical hazards, optimise work processes to reduce work intensity and stress, and identify and trigger opportunities for skill development (Katsabian, 2020).

Digital transformation in organisations also affects elements of work organisation, such as working time and place of work (Peter *et al.*, 2020). In this context, it should first be pointed out that cultural issues are one of the main obstacles to successfully ensuring transformation (Martinez-Caro *et al.*, 2020). Covid-19 only further increase the complexity of solving the critical situations related to the organisational culture. Organisations have found themselves in a situation where they have to provide hybrid work. They must ensure that the production line workers work on-site and

that knowledge workers and other employees can work remotely (Josten and Lordan, 2021). Digitalisation has the effect of increasing teamwork and influencing the nature of teamwork by integrating elements such as improved human-machine interaction or virtual collaboration through cloud solutions (Cirillo *et al.*, 2021). However, it raises the issue that it is harder for the hybrid workforce to innovate. They develop new ideas that enable new products and services in a remote environment. The solution lies in organising informal meetings of remote employees. Employees should be present at the company once a week to establish direct contact with their colleagues (Yang *et al.*, 2022). The flexibility of companies in the organisation of work and work processes and the forms of organisation (*e.g.*, nimble organisations) improves employees' work-life balance and promotes it in other ways (Lovejoy *et al.*, 2021). However, if the digital transformation does not consider the interests of employees, it can impact the occurrence of overtime and working hours, which prevents the normal flow of life (Hallman *et al.*, 2021). Constant connectivity can occur, blurring the lines between personal and professional time. Increased work intensity affects stress and increases physical and psychosocial risks (Basińska-Zych and Springer, 2021). Digitalisation is also impacting management practices. Managers are more likely to let their employees work autonomously in highly digitised companies. While greater autonomy is generally seen as beneficial to workers, digitally driven work arrangements can lead to lower quality work for those workers whose personal preferences in work organisation do not fit this management style (Nudurupati *et al.*, 2021; Pinchot and Soltanifar, 2021).

Based on the assessment of the situation in automation, it is possible to conclude that robots will replace humans mainly in repetitive and routine work. So, work should solve problems and complex situations and resolve human relationships. The future trends and challenges that will have an essential role in redefining work and impact work organisations depend on automation and digitalisation. The Covid-19 pandemic has accelerated automation, technology-enabled division of labour, and algorithmic workforce management (across all platforms) (Bhargava *et al.*, 2021; de Lucas Ancillo *et al.*, 2021). Production processes and forms of work have changed and will continue to change. The consequences of digital transformation are already evident in changes in corporate employment policies. For example, companies are laying off workers who do not have the skills to do the job under the new conditions while at the same time hiring employees with the required knowledge and skills. In the case of BMW, we see the consequences of restructuring, which include layoffs. For example, the company laid off 6000 employees in 2020, but by the end of this year, the company plans to create 6000 new jobs in 2022. The new jobs will be created primarily in Germany, and the auto industry is looking for experts in battery research, automated driving, development, software and computer security, among other areas. It is also looking for production workers, especially electrical maintenance and plant managers (Reuters, 2021). As the trend of job losses in the EU due to digital transformation increases and will continue in sectors that have not yet recovered from the Corona 19 shock, it will be necessary to retrain, retool, or realign laid-off workers.

It should be noted that workers who lack skills and are unable to retrain or retool will be particularly vulnerable due to the consequences of the digital divide.

In sectors that do not fully recover from the economic crisis, the risk of long-term unemployment and poverty will be high, primarily if the state does not support active labour market policies, retraining and income support. Cedefop's forecast (2020) shows that skills in sectors with medium to high impact on economic activity, about one-fifth to one-quarter of new jobs expected to be created by 2030, are at risk of automation. This corresponds to about 1.4 million jobs in the EU-27, with workers in manufacturing sectors such as metal and machine operators, the digitalisation of working processes (emergence of skills gaps) such as metal and machine plant operators, traders and food preparation assistants.

6.3.3.2 Workforce

Over the last thirty years, there have been demographic changes in the EU that have led to increasing population diversity. Moreover, as part of the fourth industrial revolution, digital transformation has also led to changes in the social contract between employees and employers. As a result of the digital transformation, new forms of work offer employers the opportunity to outsource, insure within the nimble organisations, hire independent contractors and employ forms such as gig workers and crowd-sourcing, in addition to the traditional form of full-time employment (Schwartz *et al.*, 2019).

In response to the increasing changes in the world of work, new phenomena are developing in the world of work. Indeed, these forms are available to solve problems, get work done, and help leaders create more flexible and nimble organisations (Faro *et al.*, 2021). The emergence of new both new forms of work and new organisational structures and notions of organisation are opening questions of future cooperation between organisations and workers, development of talent sources career and because of the demographic changes, especially EU brings to the fore the issue of age management in a changed digitised and green environment. Both Corona-19 and the accelerated digital transformation have raised questions about future forms of work organisation, the concept of work, and the need to redefine social policy. Therefore, future work concepts must be sought in the context of the determinants of future organisational change. In 2021, for example, the new concept of the "nimble organisation" emerged, able to adapt quickly to an exponentially changing world. As part of its business model, such an organisation will want to develop strategies to move from a traditional bureaucratic business model to an agile, nimble, learning, and networked organisation. These newer business models and technologies of the fourth industrial revolution, combined with proactive decision-making, promote ethical business practices that can lead to sustainable business in the marketplace and enable organisations to quickly adapt to the demands of an exponentially changing world (Persis *et al.*, 2021). However, a prerequisite for adopting new business models and digital technologies is the acquisition of Industry 4.0 knowledge and skills. In addition, Human Resource Management (HRM) 4.0 has emerged in organisations based on fostering employees' digital literacy and supporting the acquisition of skills in development and innovation so that their skills and competencies remain relevant for working in a new business context under conditions of instability, uncertainty, complexity, and ambiguity (Hiremath *et al.*, 2021).

A new governance model that pays special attention to the evolution of HRM 4.0 needs to be developed to ensure an innovative, dynamic, and agile business environment in the chaotic world. (Mocci *et al.*, 2020). HRM 4.0 should address employee training and factors relevant to employee retention. Therefore, companies need to create a corporate culture that enables a positive climate among employees and makes them more motivated, efficient, and engaged. The organisation can also influence this by replacing classic hierarchical or matrix forms of team organisation with agile teams (Balog, 2020). However, HRM 4.0 will also be to take into account ethical guidelines, protect the interests of employees and employers, and ensure that by 2025 people and machines will be doing the work in equal parts. Appropriate measures must be taken to protect workers whose positions will be eliminated by automation. In the event of termination of employment, the worker must be provided with career development, retraining and redeployment to meet technological developments that will require new forms of professional and personal skills. As part of age management processes, finding solutions for older workers with often insufficient digital skills will be necessary. On the other hand, it will be essential to care for young people at the beginning of their careers.

Creating more sustainable employment opportunities will also bring new challenges. It will be necessary to create green jobs, requiring retraining workers to perform these new roles. Workers in companies that offer teleworking must be guaranteed the right to switch off at certain times (workload reduction, stress) (World Economic Forum, 2020). In the EU, the Covid-19 pandemic has led to more and more work processes being done remotely. According to Eurofound (2021), about 40% of paid work hours were performed from home in the first months of the coronavirus crisis. However, teleworking also negatively affects workers, significantly workload and stress levels ("technostress"). Workers must therefore be given the "right to disconnect".

Social and labour relations changed significantly during COVID-19. During the quarantine period, people adapted to the telework model and shared the reduced space with their relatives. Homes become hybrid places where they share work at home and in the office. This scenario has a significant impact on people's lives and risks loss of income or loss of employment. The general situation represents both an economic and a social drama (Almeida *et al.*, 2020). The social and professional changes brought by COVID-19have accelerated digital transformation processes and exacerbated the social divide between social classes (Milanesi, 2020). Not all companies and people have the same resources to meet the challenges of digital transformation. The degree of dematerialisation of tasks and services depends on the specifics of each business activity. It seems clear that smaller companies, especially micro-organisations, will be particularly affected in areas of activity strongly affected by COVID-19 (*e.g.*, hospitality and tourism, transport and warehousing) (Almeida *et al.*, 2020).

The rapid and unplanned digitisation process enforced by COVID-19makes companies unable to attract the talent they need for the future. So, people and their skills will remain at the centre of economic activity. The digital economy can, therefore, only work if it is accompanied by a public and private strategy for the digitisation of education and training, both at the level of the overarching knowledge that the entire population must have concerning information and communication

technologies and at the level of the overarching knowledge in the training of highly specialised people in the fields of computer science (Goos *et al.*, 2019). It can be concluded that a solid commitment to digitalisation does not necessarily mean not investing in human resources. On the contrary, the new challenges of the digital economy require the recruitment and management of the most qualified and suitable employees. Accordingly, this need may lead to a change in training at different levels of education, which may mean restructuring existing courses and/or expanding short courses. These courses should provide specific skills in various areas, including technology. Still, we must not forget the responses to the societal challenges, including interpersonal relationships, that workers will face in the post-COVID-19 era. One possible answer is to promote the development of vocational education in close collaboration with public and private employers through diversification and specialisation of educational offerings (Almeida *et al.*, 2020; Hazelkorn and John, 2019).

It is not easy to define the skills profile of the workforce in the post-COVID-19 era. The digital transformation of organisations supports the growing importance that data science, digital marketing, and cybersecurity may gain in organisations. In conjunction with these dimensions, methodological knowledge and creativity must be applied to transform data knowledge into technologically sustainable business models that combine security with economic feasibility. In contrast to the previous industrial revolutions, Saracco (2019) notes that productivity growth is separate from job and income creation in this digital transformation process. It essentially results from creating new types of products/services and transforming production systems.

Finally, the predictable increase in the number of teleworkers, even if it is a hybrid model, has contributed to the sustainable development of cities. The environmental dimension, severely affected by globalisation, may benefit (Figge *et al.*, 2017). It will no longer be necessary for all workers to live in or around cities, which will help reduce car traffic and improve the population's quality of life. For this to happen, there should be no regional asymmetries in the digitalisation process, especially in terms of access to data networks, which can lead to a digital divide between areas. Furthermore, according to COVID-19, technology in the world should serve the development of areas that are currently excluded and economically disadvantaged, thus helping to reduce regional asymmetries.

6.3.3.3 Workplace

The European Agenda estimates that 25%–45% of jobs will be automated until 2025, depending on the country and occupation (European Commission, 2020c). The emergence of digitalisation and the informatisation of processes will require education, upskilling, and reskilling of the workforce by 2025. However, SMEs also face the problem of an ageing workforce in the EU (Holmquist and Sundin, 2021; Calzavara *et al.*, 2020; Cristea *et al.*, 2020) and the emergence of new, more flexible forms of employment (Gong *et al.*, 2020) arising from the redefinition of work, which is understood as problem-solving in the digital economy (Parent-Rocheleau and Parker, 2021; Singh *et al.*, 2021; Almeida *et al.*, 2020). Informatisation in SMEs and the consequences of Covid-19 are expected to impact the flexibilisation of SMEs'

forms of new workplaces and organisational structures (digital platforms, nimble organisation) by 2030 (Belitski *et al.*, 2021; Kinsella *et al.*, 2021; Nyfoudi *et al.*, 2020).

Digitalisation and informatisation have enabled organisations to organise work in different workplaces. Thus, it can be organised in more classic collocated workplaces or purely distributed and dependent on virtual interactions. In addition, collaboration platforms are coming to the fore, enabling social and market changes and providing more opportunities for distributed teams as part of companies' work organisations (Schwartz *et al.*, 2019).

The comprehensive approach to developing the digital platform as the organisation's business model is considered one of the reasons why few traditional companies adopt a successful platform business model without first going through a digital transformation. If a company wants to innovate, it will always have to undergo a digital transformation. Blockchain technology is expected to bring about changes in the economics of business models. One of the functions of the platform operator is to foster trust between market participants. In practice, people can trust the platform by setting up a rating system or offering transactions. Blockchain technologies enable the implementation of some of these functions, allowing transparency and joint verification of transactions. The EU is also aware of the importance of digital platforms. In December 2020, it adopted a Digital Services Act (DSA) proposal. This Digital Markets Act, expected to come into force in 2022, will create a safer and more open digital market for all users and provide a level playing field for businesses (EU Commission, 2021). The Digital Markets Act refers to the EU's proposal to ensure competition in the digital market by curtailing the power of "gatekeepers" – operators of digital platforms with revenues or market shares above a certain threshold. The introduction of business models on digital platforms is changing the content and role of existing social models in the EU. At the same time, the importance of the workforce is changing. Thus, with the introduction of the DSA in the EU, digital labour platforms are also emerging, providing opportunities for businesses, workers and the self-employed and giving consumers better access to services. However, the emergence of new forms of work (we also speak of the definition of work itself changing) also brings many new challenges. For example, a question about the classification of employment status has emerged, which in some cases could lead to a dismantling of existing labour rights and social protection in the EU. There is also the question of how older people can advance professionally and how companies can ensure that existing employees acquire the necessary skills to successfully perform the redefined work in the digital economy. In addition, the use of algorithms in the work of platforms may raise issues of accountability and transparency.

6.4 The Emergence of a Bani World

Vuca emerged in 1987 and has become a widely used explanatory model of situations in the world in those thirty-five years (Shambach, 2004). However, the global systemic changes fueled by the Covid-19 pandemic, accelerating technological developments, the environmental crisis, the global political situation, and other elements

encouraged consideration for enforcement of a BANI model, which is supposed to be more suitable for understanding the complex organisational and social processes that require new business models based on agile philosophy. As a result, the model was established by Jamais Cascio in 2016. The model is based on the assumption that the situation in the world has substantially changed, and its complexity has turned into chaos (Cascio, 2020). Chaos in the company is caused by inefficiently implemented digital transformation (Hai *et al.*, 2021) and natural and human disasters (Kirschenbaum, 2019) and organisational systems themselves. There is a continuous process of convergence and divergence in every organisation, stability and instability, evolution and revolution. These processes are part of the organisational characteristics and present how the organisation is managed (Thietart and Forgues, 1995). The organisation is understood in theory as a non-linear dynamical system. It is subject to the forces of stability and instability that push it into chaos. In conditions of chaos, a state is likely to occur when an organisation demonstrates the qualitative properties of chaotic systems. Properties such as sensitivity to initial conditions, discreteness of change, attractiveness for specific configurations, structural invariance on different scales, and irreversibility establish the six propositions: (i) organisations are potentially chaotic due to the mobilisation of opposing forces; (ii) the path from organisational stability to chaos follows a discrete process of change; (iii) when an organisation is in a chaotic domain, small changes can have significant consequences that cannot be foreseen in the long run; (iv) new stability emerges from chaos – strange attractors – assimilated by organisational configurations. (v) similar samples must be found on different scales; (vi) in a single lifetime or between two different organisations, similar acts should never lead to the same result (Guastello, 2013). The emergence of chaotic situations in the Covid-19 and post-Covid-19 periods and the parallel expansion of digital technologies, which brought to the fore Big Data analytics, machine learning and artificial intelligence that become critical factors in implementing processes and dealing with complex and unstable situations are influenced the emergence of the Bani model, which was supposed to provide an understanding of phenomena in the rapidly changing post-Covid-19 period. The author of the model Cascio (2020), defined it as «Situations in which conditions are not simply unstable, they are chaotic. In which outcomes are not merely hard to foresee. They are completely unpredictable. Alternatively, to use the particular language of these frameworks, situations where what happens is not simply ambiguous, it's incomprehensible».

In the framework of a Bani model, the vulnerability is replaced with a Brittle because the world is not only vulnerable. Rapid change is a problem, especially if the system is inflexible. A fragile system usually gives the appearance of stability, but over time it becomes porous and mostly breaks unexpectedly. The surprise factor exacerbates the consequences of such a fragile system. A fragile system can give the impression of being strong and solid, but a critical point of failure can lead to a sudden breakdown with devastating consequences (Cascio, 2020).

Uncertainty is replaced with an Anxious. Anxiety reflects uncertainty and involves the fear of failing to give up something important at any time. Anxiety is a way to protect security. An insecure system can therefore cause tremendous anxiety.

Fear of new technologies such as artificial intelligence can hamper the development of technological innovation (Cascio, 2020).

The complex is replaced with a Non-Linear. Non-linearity is an addition to complexity. The reason is that we live and work in incredibly complex systems. This means that the connection between cause and effect in these complex systems is not always given. It is necessary to be aware that it is not the only probability that A leads to B and that we get from B to C. B cannot be taken for only one reason, as most of the time, the whole construct and synergies stand behind it.

In the same way, A does not inevitably lead to a single effect but can lead to multiple goals. This means that the measures taken cannot be linked to the result recognisably or predictably. Significant efforts show no effect, or small decisions have a significant impact. As an example, we can highlight global warming. The period between cause and effect is so great that we can barely understand this connection. Even if we stopped most of the symptoms present today, the impact on the climate would not be significant (Cascio, 2020).

Ambiguity is replaced with an Incomprehensible. Incomprehensibility results from a non-linear world and goes a step further than ambiguity. Cascio (2020) cites an example from software development. In this case, code does not fulfil an explicit function and would be redundant in theory. However, if we remove this code, the program crashes or cannot be installed anywhere. There is no definitive explanation.

Comprehensibility leads to orientation and clarity, which is central to times of change. In addition, it reduces surprise, which intensifies subsequent effects. A not entirely unpredictable crisis that does not surprise us has a weaker impact on us. Understandability, therefore, ensures that we can at least take a cognitive step towards a solution (Mitzkus, 2022).

When we do not understand something, it is usually too strong. Incomprehensibility is a product of today's flood of information or information overload. However, the bright point is that something we do not understand today does not necessarily mean we cannot understand it soon. We can actively create understanding by establishing a culture of cooperation with sufficient transparency. Unfortunately, the Corona crisis has shown us that this is easier said than done (Mitzkus, 2022).

The purpose of the BANI model is not to guide developing organisations. Therefore, it cannot be understood as an instrument to prepare organisations for change or offer all the answers related to the upcoming political, economic and technological changes, but it can help understand the situation.

6.5 Conclusions

This chapter discusses the importance of new business models and digital transformation and the green transformation of business operations, which enable companies within the VUCA world and its successor BANI model short-term and medium-term survival in the market. We also focus on the meaning of work and the workforce in the new situation. However, the study's main limitation is that it

reviews the literature, and no primary research has been conducted. Thus, this chapter presents the starting points and approaches that can be understood as a reaction to the current situation and not as natural solutions. The BANI model serves as a starting point for understanding events becoming increasingly chaotic in the post-Covid-19 period (Brexit, Covid-19, digital transformation, stopping globalisation, the war in Ukraine, …). Therefore, it will be necessary to focus on research studies in companies, explore both external and internal organisational impacts, and focus more on digital and green transformations and their importance for reorganising business processes, emerging new organisational cultures, and changing personnel policies. Artificial intelligence is of growing importance in business processes at the human-robot level.

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Chapter 7

Telework in Times of Technological Transformation and Pandemic and the Impact on the Work-Family Relationship: Spillover and Boundary Control

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Abstract

The deep changes that have progressively been observed, largely due to the dynamics underlying industry 4.0, and the challenges resulting from the pandemic context felt over the last few years, have given rise to significant changes in the organization of work, but also the implications of these in the work-family relationship. Technological evolution and the pandemic imposed teleworking on a large scale and brought great repercussions on the work-family dynamic. Our research, based on a brief review of the literature on the main theories related to this theme, points to some reflections on spillover and boundary control between the labor and private domains, taken from the current scenario, namely regarding the increase in paper permeability and flexibility. Among our conclusions, it stands out that the success of remote work is associated with several factors of an individual, organizational and cultural nature and, if applied indiscriminately, can result in damage to the balance of relationships. For this reason, and given the current and growing tendency to resort to this form of work, we are of the opinion that it is a fertile field for further research.

Keywords: Work-family balance, Covid-19, Telework, Spillover, Boundary theory

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7.1 Introduction

There are strong indications that telework will be strengthened after the crisis that the world is currently facing during the Covid-19 pandemic. Many organizations have already disclosed that this modality has brought gains in productivity and employee approval. Of course, this will only be confirmed with time. But what we already have in concrete is that many of these companies are already planning to incorporate remote work into their strategies, which highlights a positive balance.

We still don't know very well what to expect from what has been called the "new normal". But at this moment when the world tries to adjust, it is up to scholars in the labor and social field to focus on the topic of telework, in order to understand how this change has been reflected in the life of workers and companies, and try to extract some solutions, despite of the overloads and stressors of this critical scenario.

Although working from home is widely celebrated, it is important to analyze it in light of research carried out in terms of work-family balance. The present has shown that people are working more hours at home than they worked in companies. As an example, VPN provider, NordVPN, highlighted that, after restrictions on the movement of people, US workers started to work three hours longer, while in France, Spain and the United Kingdom, the working day was extended by another two hours. The provider Surfshark, reported peaks of usage, from midnight to 3 am, which had not been seen before (Exame-Carreira, 2020).

In order to make better use of the flexibility conferred by this model, it is essential that there is a balance between the professional and family spheres, in order to avoid an accentuation of conflicts in one direction or another. Therefore, it is necessary to understand how these mutual interferences work.

In order to answer these questions, we promoted an exploratory study, with the aim of reviewing and synthesizing the main concepts and empirical findings related to spillover and boundary theory, in association with the current scenario imposed by the Covid-19 pandemic. With this parallel study, we seek to understand more clearly how the interaction between work and private life has occurred, especially in families, as well as identify some gaps that will possibly be the object of further research, notably with regard to the future of telework.

7.2 Telework as a Trend

The work carried out remotely *via* information and communication technologies (ICTs), called telework or telecommuting, has been much discussed in recent decades, especially in the residential or home office format. Many studies highlighted the positive aspects of this new way of working and some organizations saw it as a promise of gain in family life and leisure activities while providing relief from urban and environmental pressures, in order to reduce the stress associated with these factors. Indeed, the reduction in commuting to work leads to a decline in the emission of pollutants derived from fossil fuels, a reduction in congestion and traffic

accidents, etc. Add to these advantages the current concern to reverse the spread of Covid-19 and other diseases.

Not being considered the solution to all problems, remote work also acquired more cautious contours. In a recent publication, and as a consequence of digitalization and ICTs, inserted in the context of the fourth industrial revolution, the International Labor Organization (2019) admitted that there is a likelihood of people working more and more remotely. In this work, some potential risks related to psychosocial and health factors were summarized, associated with ergonomics, sedentary lifestyle, cognitive overload, feeling of having to be "available" at any time, high-performance monitoring, and isolation from co-workers, among other factors. With regard to the balance between personal and professional life, the International Labor Organization highlighted that there is both an opportunity and a challenge, confirming the ambiguous nature of the topic, highlighting that teleworking normally implies not only more intense levels of work but also increases the probability of conflicts that affect the workers' well-being.

Until the period before the pandemic, teleworking had been viewed with optimism, mainly by the business area, although with some skepticism on the part of some segments, since the organizational culture was still very marked by distrust in relation to the supervision of work at home and the possible drop in performance resulting from the loss of integration and employee bond with the organization (Rocha and Amador, 2018). For example, only 3% of US workers said they worked full-time from home in 2017, and even among IT professionals that number was low expressive (Davis and Green, 2020).

Today, due to the great experience we have seen, it seems that working from home is being perceived as a natural trend. Several specialists and organizations have already pronounced positive results, which leads us to believe that these actors are starting to see it as a good strategy. The Portuguese government, for example, has even announced that it intends to keep 25% of employees who have teleworked at home (Caetano, 2020). However, it is necessary to focus more intensively on this topic, to analyze it from the perspective of theories related to work-family relationships, insofar as it is not immune to the distortions that can make the home office a tool of exploration and precariousness of work, leading to harm the balance between the two dimensions.

7.3 Work-Family Conciliation in the Scope of Telework: A Brief Literary Review

Several theories have emerged since the 1960s to explain the interface between work and extra-work life. From the classic to the most recent, the concern has been to understand and seek solutions that allow workers to achieve well-being derived from the harmonious combination of multiple roles: family, work, household tasks, leisure, spirituality, physical activities, etc. Throughout the different studies that have been developed, many theoretical perspectives have been used. In order to understand the mutual interference between these areas, focusing on the work-family relationship

within the scope of telework, our review will specifically discuss spillover theory and boundary theory.

7.3.1 Spillover Theory

The first perspectives in the field of work-family relationships led to the idea of segmentation and autonomy between the two spheres, assuming that the conflicts experienced by each of them are not influenced by each other (Santos, 2011). Focusing on negative interferences, the investigation from the segmentation perspective represents a search for the ideal balance point, which is very difficult in practice. It is important to emphasize that this perspective has led to some interpretations in order to justify a structural pressure for women to be restricted to domestic work, while men are to external work.

It should be noted, however, that the increasing participation of women in the labor market, the new lifestyles that have emerged, and the progressive emergence of single-parent families and "dual career" couples are, among others, some of the factors that have contributed to overcoming the paradigm of separation (Burke and Greenglass, 1987, ref. by Santos, 2011).

Contrary to the previous thesis, the spillover theory assumes that, to a greater or lesser extent, one area inevitably influences the other, either in the direction of work to private life or from private life to work, positively or negatively, there is no clear boundary between the two. Thus, if the individual is satisfied with his work, he will positively spill over into his family life and *vice versa*. The same is true of negative influences. Hence, the constant interaction between these domains can result in benefits or conflicts. In the model categorized by Greenhaus and Beutell (1985) the tripartite nature of these conflicts is evidenced: by time constraints, excessive effort and certain behaviors that generate dissatisfaction.

Kanter (1977), in a pioneering study, systematized aspects related to the structure of work that influences family life, namely the degree of absorption, the amount of time and hours dedicated, the cultural dimension and the rewards and resources. The latter is mainly associated with lifestyles and standards. Regarding the impact of the family on work, Kanter identifies three ways in which greater interference occurs: the cultural traditions, family businesses and the emotional climate as a result of family requirements. In this last aspect, the arrival of children and the attitudes of other family members in relation to the career stand out.

Most of the empirical findings showed a predominance of negative emotional spillover in the flow of work to the family, which is why most research has focused on this scope (Santos, 2011). Evans and Bartolomé (1984) consider, however, that each individual can experience this relationship in different ways, at different moments in life. The authors emphasize some factors responsible for these negative emotions: the difficulty of adapting to a new job, the constant need to be successful, the pressures inherent to the restructuring of the work, the general feeling of dissatisfaction at work (little stimulating or routine) and, finally, uncertainties about the future due to the turmoil of the external environment (fear of losing one's job in an unfavorable

economic conjuncture). The relationship that some of these factors have with the current situation is notorious.

Still, on the characteristics that most contribute to the work-family conflict, Voydanoff (2005, p. 720) mentions "extra work hours without notice, job insecurity, time pressure, and an unsupportive work-family culture". This author also noticed that the home office is associated with a higher level of conflict in the direction of the family to work, while the time of commuting from home to work generates more conflicts from work to family.

From the evolution of studies on spillover, a dichotomy was found regarding the scarcity/expansion of resources. From the scarcity perspective, roles compete with each other for the limited time and energy of individuals, potentially leading to conflict situations (Santos, 2011). In some circumstances, this conception is quite visible, as in the case of parents with young children. Women are more affected in this aspect, due to the involvement in a greater number of roles, with greater susceptibility to absorb the demands of parenting, largely influenced by the ideology that establishes the man as a breadwinner and the woman as a caregiver.

The second perspective deals with the resource expansion hypothesis, focusing on the benefits associated with the performance of the various roles. In this thesis, Greenhaus and Powell (2006) refer that time and energy only become scarce because individuals are very committed to certain roles, and little to others. According to those researchers, there are several benefits that can be extracted bilaterally from the combination of all areas, namely in terms of broadening skills and perspectives, physical and psychological resources, such as improving self-esteem, addition to resources related to social capital, namely, the ability to exert influence, the greater network of contacts, access to information, etc. In the same sense, Kanter (1977) highlights the greater power of negotiation in the marital relationship felt by women present in the labor market.

Regarding the benefits brought by extra-labor functions, some results showed enrichment in the professional sphere and also a decrease in conflicts triggered by work. The family remained perceived as a factor of support and encouragement to professional life, acting as a "buffer" for work problems, and providing skills such as better time management and patience in the face of difficulties (Kirchmeyer, 1992; Crouter, 1984, ref. by Santos, 2011). Roehling *et al.* (2003), in the same direction, infer that parenting helps men and women to more effectively separate work from family, however, they warn that women who work from home end up experiencing lower levels of positive spillover, in both directions.

In another line of research, Wayne *et al.* (2004) underline the predictive role of the individual's personality in the development of conflicts between work and family, based on the Big Five classification of the factors that characterize the personality – conscientiousness, agreeableness, neuroticism, extroversion and openness to experience. Research results indicated a correlation between neuroticism and conscientiousness with a higher and lower level of conflict, respectively. A greater predisposition to stress is the underlying factor of this conclusion, in contrast to the presence of better mechanisms of coping with difficulties, potentially reducing stress, in the case of more conscientious individuals and, therefore, inclined towards self-discipline and planning. In the same study, the extraverted personality was

found to be associated with facilitation between roles, that is when involvement in one role serves to positively influence the other.

Wayne *et al.* (2004) also assert that their findings do not diminish the responsibility of organizations and public policies, in the sense of promoting the necessary structural interventions to facilitate work-family reconciliation. Thus, knowledge of individual differences contributes, not in the sense of excluding the aforementioned responsibilities, but to maximize the effectiveness of organizational programs. In this direction, the authors suggest that companies, once the personality types of their employees are identified, offer help to those who have a greater tendency to live negative emotional states, through employee assistance programs.

7.3.2 Boundary Theory

The development of studies on the theme of work-family conciliation gave rise to a new theory, which looked at another important aspect: the multiple daily transitions that take place between the various roles. Called border theory or boundary theory, the theory aims to investigate the physical, temporal and psychological boundaries that each individual creates to operate the transitions between home and work (Ashforth *et al.*, 2000; Clark, 2000; Nippert-Eng, 1998).

Boundary theory assumes that there are two main processes that are relevant to understanding how transitions occur, flexibility and permeability, and the measure of the greater or lesser occurrence of these processes will point to integration or segmentation of roles, respectively. Flexibility concerns the malleability of temporal and spatial boundaries. Permeability refers to the degree of psychological involvement in another domain, different from the one in which the individual is physical. For example, when the person manages to receive work calls during the hours dedicated to the family, it can be said that there is a permeable barrier in this situation (Ashforth *et al.*, 2000).

According to Ashforth *et al.* (2000), the attributes of flexibility and permeability are adjusted according to the characteristics of the tasks performed and the preferences of each individual. In this way, when the person has a job that requires a segmentation of roles, or when he considers it desirable to establish a division between the professional and personal universe, he will tend to seek to establish solid and thick boundaries between the two spheres.

For segmenters, face-to-face work in the organization is more suitable, as working at home increases permeability (Man *et al.*, 2008; Ashforth *et al.*, 2000; Clark, 2000; Perlow, 1998). The routine of commuting daily between home and work, including the time spent on the way and the change of landscape, can be relevant in this process, functioning as a «key» that closes one cycle to enter another. The negative spillover in these cases tends to be reduced. Here, however, there are some disadvantages to consider: the hours elapsed, the traffic, the expenses with fuel, the transport ticket, etc. Ashforth *et al.* (2000) consider that when the profession requires strong impermeability, it may be more difficult to cross this border, requiring a major psychological transition due to the contrast in the roles played. In this sense, the authors emphasize the role of social identity, noting that the more

different the characteristics associated with each role are, the greater the magnitude of the transition.

There are people, however, who cannot manage this division of roles well and may stop being productive on one side or the other, or both, thus opting for integration. These professionals want or need to bring the two spheres closer, establishing fine boundaries, which allow for the merging, without major constraints, of private and professional psychological tasks and attitudes. Working from home can be a great strategy in this case. Here the transition occurs faster and more frequently. However, there is also an associated cost: the high possibility of interference from one role over the other, or even the mixing of roles (Ashforth *et al.*, 2000; Clark, 2000; Nippert-Eng, 1998).

A set of situational factors exert influence to determine the nature of the integration or segmentation. Parenting, conjugality, specific characteristics of work and organizational culture and the existence or not of support from bosses and co-workers are on this list (Demerouti and Gours, 2004, ref. by Santos, 2011).

Some studies also addressed the importance of psychological involvement in each of the domains, focusing on the centrality of roles. The one with which the individual most identifies is most easily integrated into other roles. For example, when professional bias is more central, shifts outside normal working hours are better tolerated. In this hypothesis, evidence was found of greater conflicts arising from work in the family sphere (Santos, 2011; Evans and Bartolomé, 1984).

Some of the researchers directed the studies to describe how the control and pressures on work are processed when employees have greater flexibility. On this issue, Man *et al.* (2008) concluded that flexible hours may be elusive in the face of increased work pressures. Perlow (1998, p. 328), in this regard, found, within the scope of a study with software developers, three forms of control over the temporal boundary between work and the private life of employees: "(1) imposing demands, by setting meetings, reviews, and internal deadlines, controlling vacations, and requesting extra work; (2) monitoring employees, by standing over them, checking up on them, and observing them; and (3) modeling the behavior they want employees to exhibit", here in a clear attempt to influence them to extraordinary work without the pecuniary consideration. Perlow recalls that this stimulus is often trivialized in many companies through the example of the managers themselves.

According to Perlow (1998), these traditional forms of control are best adapted by single employees with no off-work responsibilities or married with a spouse who takes care of off-work responsibilities. People resistant to these forms of control, in the research carried out, clearly adopted segmentation strategies but ended up having their careers somewhat more limited in terms of rewards and recognition. In that regard, the author concludes that the restructuring of work to include large periods of time reserved for working independently improved the productivity of the studied organization.

It appears from these researches that teleworking is associated with greater flexibility and permeability of roles. Furthermore, depending on the personal and organizational context, it can represent gains in the management of work-family spheres, or losses that will accentuate the conflicts in one direction or another. It is also inferred that the predominant organizational culture needs to be profoundly

modified, and it is necessary to oppose the mistaken view that commitment to work must be measured through conformation to strict control of schedules or the extra hours that are dedicated to working.

7.3.3 Boundary Control and Information and Communication Technologies

In recent years, the focus of studies on work-family reconciliation has largely been directed towards border control in the context of new tools incorporated into daily life, concerning information and communication technology, themes that stimulated a new range of works and opened space for other relevant perspectives.

Regarding border control, Kossek *et al.* (2012) highlight the importance of understanding how each individual controls their time to manage the work-family dynamics, based on a person-centered approach, that is, what are the approaches that individuals use to demarcate boundaries and serve both spheres. Such control is exercised from the perception of the time spent, and the frequency and direction of mental, physical and temporal transitions between the two domains. The result of the research by Kossek *et al.* (2012) identified six distinct management profiles, according to the following criteria: (a) low/high interference control; (b) identity centrality of each of the roles and (c) perceived control of limits. In these groups, a great variety of behaviors is perceived, with people who are very predisposed to balance between domains and people who tend to conflict.

In summary, two relevant practical implications are raised by Kossek *et al.* (2012): (1) the potential usefulness of developing different strategies for each group, once the individual profile of each employee has been identified; (2) managers and workers must support policies related to work-family balance, so as to respect the diversity of boundary management profiles. Researchers also point out that the Work Life indicator is a good example for measuring perception at this level and encouraging people's support. From this perspective, the study suggests that formal flexibility regarding the workplace and flexible hours should be applied in conjunction with a well-perceived perspective of boundary control, since flexibility without limit control may not necessarily be useful for very centralized people, especially if they have double shifts and small children.

The use of information and communication technologies can be seen as a resource or a demand, depending on organizational expectations and individual preferences (Piszczek, 2016; Day *et al.*, 2010). About this issue, Piszczek (2016) highlights the two main perspectives commonly adopted by researchers to understand the use of these tools: (a) increase in the total time spent at work, negatively interfering with the family domain and causing stress and exhaustion, (b) facilitation to manage the flexibility, through easier transitions between domains and greater possibility of boundary control.

In order to provide answers to the paradox that surrounds ICTs, Piszczek (2016) promoted field research, whose results showed that the use of these technologies is associated with higher control of limits for those who prefer the integration of functions, compared to those who opt for segmentation, for whom the use of

electronic communications from work, outside of their own hours, can configure an undesired reaction. Overall, the results suggested that technology, in itself, is a neutral tool and that it can be used by employees to increase or decrease boundary control, emphasizing, however, that integrators experience less emotional exhaustion.

As noted, the perspective of border control gained prominence with the development of ICTs and the growing expectation of work migration to informal homes and spaces, which was not possible before for most workers. However, the finding of the paradoxically conflicting effects of the use of technology on individual well-being reveals a lack of further studies.

7.4 Teleworking in the Context of the COVID-19 Pandemic

Normally, social facts unfold gradually and the sciences, physical and social, gradually adapt to the changes. We live in a different time today. It is necessary to hurry to fit social relationships in a pandemic, which has arrived with a strong impact on the professional and private spheres and has raised teleworking to a level of greater importance. The world has become a great laboratory for this type of work.

Today we have a scenario that contributes to increased stress and a consequent negative spillover, since both family and work demands are overloaded: insecurity, economic loss, children out of school, limitation of social interaction, adaptation to technological tools for remote work, and adaptation of residential spaces. Undoubtedly, these events significantly unbalanced the work-life balance. And it is necessary to try to understand how people are dealing with this scenario and how managers can help.

One factor that jeopardizes the assessment of teleworking on an individual basis is the determination of closing daycare centers and schools, still in force in many countries at the moment, or even keeping children at home as a precaution from parents. Many professionals are reporting real chaos at home. And it couldn't be different, since some age groups are still very dependent, not to mention the educational support that the parents were responsible for. It is clear that the return of children to those establishments would be necessary for these parents to have a better idea, positive or negative, of working at home.

In this line of thought, and based on the theories reviewed in the previous section, the advent of the Covid-19 pandemic and the consequent mass implementation of teleworking allows us to affirm, without fear, that there was a greater approximation between the work and family spheres, demanding from the workers a greater ability to manage the permeability and flexibility of roles. And the closing of schools gave a greater dimension to this meeting. If the negative spillover was almost always unilateral, in the direction of work to the family, it is observed that working from home, in times of a pandemic, also brought an approximation in the opposite direction, opening space for family demands to permeate the work environment more intensely and frequently.

The fact that the current experience is serving to demystify many issues regarding remote work is another point to highlight. Effectively, those who had never tried it, are now having the opportunity to build a more consolidated opinion. That is, many stereotypes were set aside by employees and managers. Likewise, those who have always wanted to test it, but never had the opportunity, are now in a position to better evaluate it in practice.

Overall, organizations have released more positive than negative analyses of the reality of working from home. To illustrate, one of the surveys carried out, operated by the Portuguese agency "Fixando", from 1300 interviews, concluded that 65% of workers would like to remain at home office after the end of lockdown, while 75% of employers agree that the working from home should continue for the time being, and 59% believe teleworking as a long-term solution (Jornal de Notícias-Nacional, 2020). The same study revealed that, from the employers' side, 45% said that productivity and income had increased, against 31% who disagreed, while, on the part of workers, 55% perceived themselves to be more productive.

However, there are many unanswered questions. It is not yet known, for example, to what extent the increase in productivity translates to us, in terms of satisfaction and motivation, that workers are more comfortable with the home office. Or, on the contrary, if they are feeling pressured by employers, reflecting a distrust resulting from the greater flexibility granted. It is also necessary to clarify how remote work has been felt in terms of gender differences, among other relevant issues.

The practice of telework, in addition to increasing new skills and competencies for workers, has also allowed it to be perceived in a more individualized way, that is, according to their own social, psychological and situational reality. As seen, remote work can be used as a facilitating resource, in order to provide a better adaptation between professional life and other needs or, in the opposite direction, unwanted entropy can occur between the labor and private domains. Therefore, it is necessary for each professional to make a self-assessment about how they exercise control across these borders and whether their performance flows better in the direction of integration or role segmentation. It seems certain that for work from home not to harm family life, it is necessary to improve the ability to detach psychologically from work.

7.5 Final Remarks

Recent events regarding the Covid-19 pandemic point to an even greater need to deepen studies on the variants that determine whether the spillover will be negative or positive in the context of telework. Especially in relation to the multiple daily transitions, of a physical, temporal and psychological nature, that are present between the work and extra-work domains. Undoubtedly, there is also a lot to go through within the perspective of border control, inserted in the context of remote connection *via* the internet and other technological resources.

Professionals and companies must be aware and prepared to manage the greater permeability of functions that will be noticed from now on. Certainly, it is useless for

people to choose to work from home believing that it is advantageous if this change is not accompanied by a better understanding of the gains and risks at the individual level, and personalized support by the company. This imbalance can even affect medium/long-term job performance. In this direction, in the light of the investigations already carried out, teleworking has proved to be more advantageous when placed as an option, and not a generic imposition on all employees, given that its success is conditioned to a formula that involves personal, organizational and cultural factors. Nothing even prevents a mixed alternative from being offered, so that the professional works partially remotely.

From an organizational point of view, it is necessary to act in terms of the pressures that are felt on work, thus helping to trust more in remote work, avoiding the excessive use of this type of work, in addition to the which is legal and acceptable, under the guise of monitoring employees.

In short, it is clear from these first impressions that, in addition to the studies already carried out in the field of the work-family relationship, there is a lack of new empirical works to measure the magnitude of the changes in the post-pandemic situation, within the scope of the repercussion brought by telework. Undoubtedly, there should be a deepening of investigations on the subject in the next years, as a reflection of these transformations.

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