Article

Digital Transformation: Inevitable Change or Sizable Opportunity? The Strategic Role of HR Management in Industry 4.0

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Abstract: Background: The impact of technologies on workers has been a recurring theme in occupational health psychology. In particular, the sudden digital transformation of the last two decades, accelerated by the COVID-19 pandemic, has stressed the urgency to investigate new ways of working that are characterized by flexibility and a constant increase of autonomy. In this perspective, this study aims to investigate the state of the art of the innovation process in Italian factories, explore whether and how digitalization can be seen as an opportunity, and imagine a new way of working characterized by adaptability, resilience, and openness to change. Methods: Thirty in-depth interviews of Italian experts in HR management were collected and analyzed using a mix-method approach. Results: The findings underline the Italian HR experts' perceptions of the risks associated with rapid changes required by technological progress in terms of workers' wellbeing and satisfaction and suggest how important it is that organizations rapidly set up learning and training programs to guide workers to the acquisition of new skills required by Industry 4.0. Conclusions: Future workplaces will be characterized by extreme versatility, which requires workers to increasingly have both technical and soft skills as well as the ability to collaborate and build functional relationships.

1. Introduction

The impact of technologies on workers has been a recurring theme in occupational health psychology. However, the sudden digital transformation of the last two decades has stressed the urgency to investigate how these new ways of working, characterized by flexibility and a constant increase in autonomy, can accelerate processes and change the traditional way of work. This transformation has been influenced and strongly accelerated by one of the greatest black swans of this century: the COVID-19 pandemic. In this critical scenario, digitalization has represented one of the most important allies against COVID-19. In fact, to contain and proactively react to the spread of the pandemic, many countries not only implemented social distancing (Galanti et al. 2022; Scheid et al. 2020) but also encouraged organizations to adopt remote work practices (Donati et al. 2021). In Italy, where this study took place, before COVID-19, only 8% of the total workforce practiced remote working (Caronia 2021); during the first wave of the pandemic, this practice involved about one-third of Italian workers (INAP 2020). The pandemic, therefore, created the conditions to reinforce and accelerate digitalization, which offered new technologies to manage more flexible, automated, and interconnected work (Molino et al. 2020).

However, the literature is not unanimous about the implications of digitalization for employees' wellbeing and productivity and, consequently, the role of human resource (HR) management in promoting their adaptation to technologies at work. The urgency to

use technology-based work arrangements because of the COVID-19 pandemic allowed researchers to gather data during this unprecedented time. Nevertheless, even though the health emergency is now over, remote working and the use of technology at work will likely remain a stable feature of the workplace (Molino et al. 2020). Thus, it is crucial to explore the role of digitalization at work after the pandemic by taking into account the representations of HR and innovation managers as well as academic experts in the field. This aim is particularly meaningful for organizational health psychologists as technology shapes the perception of work experiences (e.g., Christensen et al. 2020; Ferrara et al. 2022); and, consequently, poses specific challenges to HR managers, for example in terms of employee engagement (e.g., Gigauri 2020; De-la-Calle-Durán and Rodríguez-Sánchez 2021; Galanti 2021). The following sections aim to set out, albeit not exhaustively, the different viewpoints emerging in the literature on the effects of digitalization on employers and employees.

2. Literature Review

In the last two decades, we have witnessed one of the most radical changes in how we live, work, communicate, transmit and search for information: the advent of Industry 4.0. It is often described as the Fourth Industrial Revolution (FIR) (Schwab 2016), consisting of the implementation of cloud and mobile computing, big data and machine learning, sensors and intelligent manufacturing, and advanced robotics (Johansson et al. 2017).

After the first revolution of the 18th century and the discovery of electric motors in the 19th century, the introduction of electronic and information technologies in industrial systems set the basis for Industry 4.0. The reason underlying this revolution is found in two keywords: efficiency and resilience. The first allows organizations to satisfy ever-changing demands better, and the second is to be increasingly adaptable and responsive in the face of sudden changes.

Conceptualized in Germany in 2011 (Kagermann et al. 2011), this vision rapidly spread to other industrialized countries and has become a non-negligible asset for industries that want to compete and try to improve productivity and reduce costs (Badri et al. 2018). Its paradigm consists of three dimensions: horizontal integration between value creation networks, end-to-end engineering in the product life cycle and connectivity, and vertical integration in manufacturing systems. This revolution has resulted in a new way of production, characterized by low-cost, higher-quality products and services, fewer errors, short production time, and flexible production systems able to respond to customer requests quickly.

The existing literature on the FIR has focused mainly on IT and innovations, application fields, and new opportunities and challenges (Lasi et al. 2014; Vogel-Heuser and Hess 2016; Liao et al. 2017). However, less explored appear to be the psychological aspects associated with the FIR. Thus, the present paper contributes to the literature offering the point of view of work and organizational psychology (WOP) in order to expand the knowledge of this transformation and shed light on the implications in terms of human resource management.

Several researchers have compared Industry 4.0 to a flat organization with more organizational innovations, learning, knowledge, human–machine interaction, and especially, a more human-centered view of new technologies. In this sense, digital innovation is seen as a core task for the success of industrial production in the future (Dombrowski and Wagner 2014; Lee et al. 2014). Some authors also argue that the transition to Industry 4.0 provides great opportunities for sustainable manufacturing (Stock and Seliger 2016), underlining how much this change can produce resilience in terms of the transformation process and advancements in knowledge. Many studies, in fact, have shown the positive impact of Industry 4.0 in terms of the improvement of production processes and the reduction of energy and natural resource consumption (Margherita and Braccini 2020; Shahbaz et al. 2012; Strange and Zucchella 2017).

However, if most industrial companies are aware of the potential benefits of achieving such a vision and are investing in Industry 4.0 capabilities and technologies, the majority are still in a transitioning phase, experimenting and piloting standalone solutions and working on establishing a digital foundation (Kadir and Broberg 2020).

Several authors have questioned the reasons for such latency, underlining the presence of several psychological barriers to adopting Industry 4.0 technologies in the manufacturing sector (Stentoft et al. 2020; Kumar et al. 2021; Mahmood et al. 2021). One of the major challenges to implementing FIT is the fear of job losses (Kamble et al. 2018; Muller 2019), which is negatively related to employee motivation and acceptance of I4.0 introduction. Another challenge is that a lack of skills threatens the adoption of these technologies (Muller 2019; Schneider 2018), e.g., the employees' perception of not having the necessary skills to perform their new role is an obstacle to this transition. At the same time, the organizations can also foster or dissuade employees' acceptance: having a culture that fosters digital innovation is essential to convey a positive idea of FIT (Raj et al. 2020).

Other studies have suggested that data security could be a significant obstacle to implementation (e.g., Kiel et al. 2017). First, because there is a psychological perception that highly interconnected systems are more exposed to hacker attacks; secondly, because it is hard to manage data consistency and integrity without specific software know-how.

The global COVID-19 pandemic can be considered a change driver in our productive realities, speeding up several innovation processes that would otherwise have remained virtuous isolated cases. It is, for example, the case for remote work implementation. According to Cotrino et al. (2020) the pandemic has shown the importance of companies embracing agile forms of work and the introduction of I4.0 made their implementations possible through its components of cloud computing, virtual reality solutions, and the internet of things. However, new ways of working also imply new ways for workers to experience work and new challenges for employers and employees. In this perspective, several recent studies have underlined both the positive and negative potentials of new technologies for working conditions and worker wellbeing (e.g., McFadden et al. 2021; Chang et al. 2021). From a positive perspective, ICT and digitalization seem to be positive in terms of satisfaction in teamwork-related contests (Meske et al. 2020), flexibility, and employee control over the time and place of their work. Moreover, a study by Kraan et al. (2014) showed that working with technology increases the need for job autonomy and the control of workers. Similarly, recent studies conducted during the first wave of COVID-19 underlined the positive role played by individual and organizational resources, such as goal setting, self-monitoring, and autonomy, in predicting satisfaction and wellbeing while teleworking (Wang et al. 2020; Miron et al. 2021).

Nevertheless, working away from traditional workspaces consists of being able to work anytime and anywhere and always being connected. Therefore, if this flexibility represents a benefit in terms of autonomy for some workers, it could also be seen as a pressure (Barber and Santuzzi 2015) and an invasion of one's personal life for others. As a result, the employees seem to have no private sphere left that allows them to unwind or recover from the workday (Chen and Karahanna 2018). In recent years, the term "technostress" (Brod 1982, 1984) has spread rapidly to denote one of the darker sides of new technologies. It has also been defined as "an inability to cope with the demands of organizational computer usage" (Tarafdar et al. 2010, p. 304) and consists of five dimensions: techno-overload, which forces the employee to work faster; techno-invasion, which invades personal life; techno-complexity, related to feelings of incompetence; techno-insecurity, due to the rapid changes of ICTs; and techno-uncertainty, due to unpredictable changes. The effects of technostress are anxiety, fatigue, skepticism, and inefficacy in using ICT (Cazan and Maican 2016; Schaufeli and Salanova 2007; Karsten et al. 2012). For these reasons, some countries have begun to safeguard the right to disconnect (Schlachter et al. 2018; Hesselberth 2018) by pushing organizations to clarify work times and ways of working. Another dark side of new technologies consists of techno-addiction, which implies excessive and compulsive work with ICT (Salanova et al. 2013), associated with lower levels of

wellbeing (Huang 2010). Moreover, as mentioned above, new technologies also require new types of knowledge and skills for which workers may find themselves unprepared and, sometimes, unable to learn quickly. A recent study underlined how new ways of working, such as remote work, can overturn beliefs by suggesting that traditional positive elements, such as a good relationship with one's superior, risk becoming detrimental due to remote work (Toscano et al. 2022).

However, many studies have investigated moderator factors able to mitigate the impact of new technologies. According to Chen et al. (2009), for example, receiving specific training on a new IT system results in greater satisfaction after implementation. Additionally, including employees in the planning and implementation of new systems seems to play a crucial role in satisfaction and wellbeing (Elfering et al. 2010), showing the importance of promoting participation and ownership in workers.

Therefore, it is clear how complex a phenomenon Industry 4.0 actually is. Its implications can be, in fact, traced to three levels: macro-level, meso-level, and micro-level.

From a macro-level perspective, we can investigate the effects of digitalization on future employment. At this level, the literature is again split into two points of view. The positive viewpoint states that digital innovation may be the driving force behind employment growth in the future, leading to the emergence of new job roles, thanks to the cooperation between humans and machines (Evangelista et al. 2014). The negative viewpoint, instead, emphasizes the risks of unemployment due to automation (Dachs 2018; Osborne and Hammoud 2017), with several implications for workers' wellbeing (Herbig et al. 2013).

At the meso-level, we can examine how much the organizations are investing in new technologies to ensure more efficacy and productivity and what organizational actions are needed to guarantee a positive transition toward digital innovation (i.e., the adaptation of a method of risk assessment or communication) (Nielsen et al. 2010).

Finally, at the micro-level, the focus is shifted to individuals to underline the implications of human–robot interaction, on-screen control activities, and the monitoring of work performance. Regarding the last aspect, several studies have underlined the dichotomic consequences of monitoring systems. If, on one hand, they simplify employees' activities (Cascio and Montealegre 2016), on the other hand, monitoring can lead to high levels of stress and, in extreme cases, burnout. According to the job demands–resources model (Schaufeli and Bakker 2004; Bakker and Demerouti 2017), high demands with low control and little autonomy lay the foundation for negative working conditions, especially if the monitoring is perceived as unclear or non-transparent by the employees (Cascio and Montealegre 2016). On the contrary, a supportive culture would seem to represent an element that could foster the acceptance of digital surveillance (Spitzmüller and Stanton 2006).

Nevertheless, there are several countries where a real drive for digitalization has come as a result of the socio-sanitary emergency caused by COVID-19. This is also the case in Italy, where the present study was conducted. Before the pandemic, very few Italian companies had begun to experience the great possibility offered by digitalization, and, for a lot of them, it was not a choice but the only chance to survive and guarantee products and services (Galanti et al. 2022). Unfortunately, however, very few studies in the literature have focused on this sensitive theme, namely, the consequence of forced digitalization processes on organizational and individual levels.

3. Aim of the Study

Based on these premises, this exploratory study aims to investigate how different experts in the field have experienced and considered their role during the digital transformation process, as well as the implications for employees and organizations in general. More specifically, the study aims at exploring whether and how digitalization can be seen as an opportunity to look forward to the socio-economic crisis provoked by COVID-19 and imagines a new way of working, characterized by adaptability, resilience, and openness to change. Furthermore, it aims to underline to what extent human resource management is

implicated in this transformation process and what role organizational psychology could play in fostering the transition to Industry 4.0. For these reasons, this study adopts a bottom-up approach, intercepting HR managers, innovation managers, and academic experts to explore the multidimensional phenomenon of digitalization in the era of Industry 4.0.

4. Materials and Methods

4.1. Design

This exploratory study adopted a triangulation of methods to guarantee scientific and methodological rigor. Data were collected through the qualitative methodology of in-depth interviews and subsequently analyzed through both qualitative and quantitative methods to preserve the heuristic power of a qualitative level and the rigor of quantitative methods. This choice can also be explained by the researchers' intention to adhere to the paradigm of methodological appropriateness (Patton 1990), according to which a researcher should choose a method of collecting and analyzing data consistent with the research object rather than with personal competencies.

In this perspective, the in-depth interview is a technique designed to elicit a vivid picture of the participant's perspective on the research topic. During in-depth interviews, the respondent is considered the expert, and the interviewer the student. The researcher's interviewing techniques were motivated by the desire to learn everything the participant could share about the research topic, even without any hypotheses to be verified. The conversation was structured around three major themes: (1) the strategic role of HR management in the promotion of transformative resilience and innovation; (2) the risks associated with rapid changes required by technological progress; and (3) the transformation of work between old and new job skills.

4.2. Participants and Procedure

The sample consists of 30 Italian experts in human resource management (primarily HR managers and academic researchers), of which 21 are men and 9 are women, with an average of 17.5 years of experience. Table 1 shows the socio-demographic characteristics of the sample. To maximize the heterogeneity of professional realities and to obtain a broader and exhaustive understanding of the different points of view, the participants come from different Italian regions (center, south, and north) and from different backgrounds (small- and medium-sized enterprises).

Participant recruitment was done via email, having the following inclusion criteria as a reference: belonging to a medium- or small-sized organization; having at least five years of experience in human resource management, declined practical/field or academic/research experience; and playing a role in processes of innovation and organizational change.

Data were collected with the qualitative methodology of the in-depth interview in order to adopt a bottom-up procedure that was able to explore the management of human capital and the digital innovation strategies and procedures adopted in Italian organizations as well as the implications of the digitalization spearheaded by the COVID-19 pandemic.

The in-depth interviews took place virtually in Italy via the Google Meet platform between October 2021 and April 2022. Each interview lasted about an hour and was recorded and then transcribed verbatim. Using a semi-structured interview, various questions related to the research objectives were asked of the participants. For example, the following questions illustrate the theme covered by this study: "In your opinion, starting from the forced digitalization during the COVID-19 pandemic, what has changed in the way of working? And what will remain? What do you think about new challenges/risks to be faced? How could you cope with these challenges? Do you think there is a need for new professional figures, or how should existing figures change?". During the interview, the interviewer used probing questions to clarify more ambiguous answers, asking participants to give examples to support his/her affirmations.

Table 1. Socio-demographic characteristics of the sample.

C	Age	Gender	Years of Experience	Job Role	Company Type	Business Sector
1	49	M	15+	CEO	Small	Food and Tech
2	51	F	15+	CEO	Small	Hotel
3	35	M	10	CEO-CO-F	Small	Neuromarketing
4	68	M	30+	CEO	Medium	Env. Ser and Tech
5	53	M	20+	CEO	Medium	Luxury
6	54	M	20+	Director	Medium	Healthcare
7	61	M	30+	CEO	Small	Tech
8	45	M	15+	HR M	Medium	Tech
9	55	M	20	Professor	Medium	University
10	38	M	10	CEO	Small	Hotel
11	67	F	30+	HR M	Medium	Tech
12	72	M	40	Director	Medium	Healthcare
13	59	M	30	Freelancer	-	Journalism
14	33	F	10	Director	Small	Hotel
15	23	M	5	Operational M	Medium	Healthcare
16	36	M	10	Professor	Medium	University
17	66	M	30+	HR M	Medium	Industrial
18	64	M	30+	Professor	Medium	University
19	38	F	10+	Consultant	Small	HR
20	29	F	5	Professor	Medium	University
21	43	M	15	Partner	Small	Tech
22	45	M	15	CEO	Small	Tech
23	45	M	15	Professor	Medium	University
24	52	M	20+	Professor	Medium	University
25	43	M	15	HR M	Medium	Sustainable places
26	42	M	15	HR D	Medium	Services
27	36	F	10+	HR M	Small	Tech
28	38	F	10+	HR M	Medium	Bank
29	47	M	15+	IC D	Medium	Motor
30	37	F	10+	CT D	Medium	Services

1HR M = human resource manager; HR D = human resource director; IC D = internal communication director; CT D = cultural transformation director.

4.3. Analysis

In order to provide the research with a thorough structure and quality, the Standard for Reporting Qualitative Research was followed (O'Brien et al. 2014).

Regarding the analysis of the interviews' content, a theoretical premise seemed to be necessary. More specifically, the theoretical approach of narrative analysis applied to organizational contexts (Manuti and Mininni 2013) was chosen, according to which organizations live by discourses. According to this theory, researchers should be ready to disentangle the collective narratives and discourses shaped through and by the shared practices of accounting (Cortini 2014).

Interviews were audio-taped and transcribed. Then, three different researchers read the transcripts several times to obtain an overall impression of the data collected and to ensure that the transcripts accurately reflected the arguments held by the participants before starting the coding stage. Next, data were analyzed using different techniques, such as discourse analysis and content analysis, and were run through T-LAB software (analysis of word occurrence and co-word mapping, analysis of Markovian sequences). For qualitative analysis, a thematic analysis and a classic analysis of discourse were conducted (Mininni and Anolli 2002), consisting mainly of an analysis of metaphors and linguistic agency.

Each sentence, paragraph, or passage representing an idea named by a participant was considered a unit of meaning. The smallest unit of meaning considered was a sentence containing at least one verb and one subject. Then, the coding of the data was subjected to a validation process of inter-rater agreements to ensure that the units of meaning coded

represented the data. Inter-rater validation is defined by the consistency in which different analysts attribute, according to the same coding scheme, the same code to a randomly given segment (Mukamurera et al. 2022). For this reason, two researchers trained in qualitative analysis coded the interviews to identify and categorize the participants' metaphors, with a subsequent accordance calculated, thanks to the Cohen Kappa (0.85). Then, another research coded a sample of the full interviews to raise some ambiguities in the definitions of the codes and made it possible to specify certain elements related to the division of the coded segments, i.e., the defined unit of meaning.

We chose to use T-LAB software to better adhere to the paradigm that inspired us while guaranteeing a qualitative analysis, relating to the analysis of the speech, and a quantitative analysis, relating to the analysis of the content (Cortini 2014; Cortini and Tria 2014). Despite the typically qualitative nature of our data, which concerns transcripts of semi-structured interviews and, therefore, textual material, the T-LAB software allowed us to carry out both types of analysis, qualitative and quantitative, by triangulating the analysis methods. According to SRQR (O'Brien et al. 2014), triangulation can enhance the trustworthiness and credibility of data analysis. The quantitative part, specifically, allowed us to identify the repetitions of words and the most frequent associations within the text.

5. Results

5.1. Qualitative Results

The interviews were analyzed by triangulating two qualitative techniques: content analysis and discourse analysis. Discourse analysis is a qualitative, interpretative, and constructionist methodology that allows researchers to explore how participants actively construct categories or clusters regarding the themes investigated. It considers metaphors and linguistic agency. Metaphors are considered a tool of thought conceptualization that can broaden the vision of the research object, creating connections with other themes. Linguistic agency, instead, refers to the use of the lexical and morphological aspects of the linguistic system to result or not result in oneself as the agent responsible. In this perspective, the content of the interviews was faithfully transcribed, and all linguistic metaphors used to talk about the topic were identified, interpreted, and explained. The idea was to generalize the conceptual metaphors they exemplified from them and to use the results to suggest understandings or thought patterns that construct or constrain people's beliefs and actions.

From the interviews' analysis, the three more interesting clusters appeared to be: (1) digitalization experience and consequences, (2) the need for competence and new professional figures, and (3) the human factor in digitalization.

Regarding the first theme, the results underlined the heterogeneity of the participants' digitalization experience and showed a misalignment with the traditional concept of digitization, which had especially declined in the adoption of agile forms of work, such as remote work, and the support offered by information technology in the performance of work activities. In this limited perspective, digitalization is seen as a positive tool that can be used to guarantee efficiency and immediacy. It is also considered a "COVID heritage to be capitalized" (Respondent n. 18). "It is absolutely negative—said one respondent—that many companies are returning to pre-COVID ways of working", referring to the fact that digitalization can be seen as an opportunity for organizations and workers to change and develop. It is interesting to note respondents' difficulty in separating the phenomenon of digitization from its pandemic consequences, ending up perceiving its merits and limitations only within this emergent framework. On the other hand, the limits of this digital innovation process emerge clearly. First, the realization that it was too sudden a change, in the face of which both companies and workers were unprepared. "Forced digitalization has almost been imposed even on people who were furthest from this concept" (Respondent n. 5), and "If you have people who until yesterday didn't use that kind of program, you can't expect them to learn right away overnight because there is also a kind of defense of one's horticulture" (Respondent n. 9) are only two of several

expressions that clearly show workers' disorientation in the face of such an imposed change. This resistance to change emerges at a twofold level: the individual level, understood as workers' difficulty in adapting to change and taking a role in innovative processes, and the organizational level, shown in managers' concern over career management and people development in a digital context.

The theme of disorientation correlates to the second key theme: the need for competence and new professional figures. Several respondents, in fact, underlined how workers found themselves unprepared to adapt to the new work environment and new ways of work. For example, referring to the experience of working remotely, one respondent says: "communicating through a system rather than live for some people is a change that requires different skills because you miss out on some of the communication". Another important element that emerges from the interviews is the inhomogeneity of digitalization in Italian factories. "There are some companies that have always worked on digitalization and technological transformation, so they have been more ready, while others have had to reinvent themselves", said one respondent, introducing a key element related to digitalization and the pandemic experience, namely, the ability of both organizations and workers to be flexible and open to change. This aspect is strictly related to resilience, as underlined by several respondents through some interesting metaphors. The first of them associates resilience with "a tree branch able to bend without breaking" (Respondent n. 20) and also to a "Japanese technique of Kintsugi, through which it is possible to repair with gold" to symbolize a new way of looking at resilience, not as the ability to return to a pre-existent situation but rather as recognizing that "you are now something different from yesterday, something new and with more value" (Respondent n. 20). In a similar way, Respondent n.19 spoke about a recent concept of anti-fragility (Taleb 2012; Tseitlin 2013), that is, "the person who with respect to an external shock, to an event a stimulus that forces you to change you not only readjust but you improve, you change for something better than you were before, so you strive to improve yourself with respect to the external event".

Another theme extrapolated from interviews is the implications of digitalization for workers. According to the literature, a double scenario opens up. On one hand, participants seem to agree that digitalization has had positive consequences in terms of more flexibility and job autonomy. Some of them emphasize the increase in efficiency, especially related to communication processes. "The positive aspect is that the relationship has become more effective, more immediate", said Respondent n. 8, and he added, "today, even though we have returned (in presence), we continue to have meetings remotely because they are more effective". On the other hand, several risks and downsides emerge, first of all, the risk of alienation and loss of motivation at work. "We saw the alienation especially during the lockdown: people wanted to go back to the office afterwards, or at any rate they wanted to have a normalcy that was not just that of their home, which risked a bit of a cave effect, where a person is so well off that he or she never leaves the house again" (Respondent n. 5). Another negative aspect of digitalization is related to the progressive loss of relationships and opportunities for constructive discussion, which are key elements for professional and personal growth. "One of the important elements of work is the relationship, because we all go to work for the salary, because there is a social value in what we do, for a social identity, etc., but we also go to work because there we meet the people with whom we talk, with whom we go for coffee, with whom we weave relationships, with whom we also have conflicts. Smart-working cuts you off from this piece or makes it virtual and therefore changes it dramatically" (Respondent n.12) and "The best creative things I did were talking in the lunchroom with my colleagues" (Respondent n. 13) are two examples of the negative drift of the high use of IT systems to "remotize" work life.

Some participants then underlined the costs in terms of work–life balance and the techno-invasion of their private boundaries. Regarding this aspect, one participant referred to the neologism "onlife" (Floridi 2009, 2015), saying "it is as if to say that we are always online and there is no longer a distinction between offline and online digital but that we should get used to this kind of continuum whereby we manage our digital and non-

digital lives simultaneously" (Respondent n. 19) and another remembered "meetings where we would see the baby climbing behind a colleague's back in a dangerous position" (Respondent n. 27). An encroachment of work into private life and private life into work will have inevitable consequences in terms of job performance but especially of workers' satisfaction and wellbeing.

5.2. Quantitative Results

The content of the interviews was also analyzed with a quantitative methodology using the statistical software T-LAB, which was able to return a mapping of the contents characterizing the interview. Before deeply exploring the details of the analysis, it is important to remark that we prepared our text for analysis through lemmatization, which reorganizes the T-LAB database, creating different tables used to analyze data; in particular, the idea is that words that have the same root meaning are clustered together, such as "work" and "working". Such an operation was performed only for the words (lemmas or categories) considered interesting for the subsequent analyses, such as "innovation", "digitalization", "industry", etc. The authors carried out an automatic analysis of the content, which started from the idea that the more specific language to which families are referred (analysis of word occurrences), the more active these concepts are in the respondent's mind. In other words, when people often refer to the same concepts, it is because they are important to them.

Analysis of Occurrence and Co-Occurrence

The first thing T-LAB does with textual material is to analyze word occurrences and co-occurrences. The software output shows the most cited word in the middle, and all around are the words that co-occur the most with it, according to an association index: the Cosine coefficient. In graphical terms, the more two words co-occur, the more they are closed in the dimensional space (Cortini and Tria 2014). It is always possible to "dialog" with the software, asking it to put a specific word of interest in the middle for the user to have a graphical representation of its associations. In such a sense, T-LAB can assist the user by following both an automatic analysis path and a customized one. Concerning our study, it was remarkable that "person" and "work" were the most cited words. By clicking on the words associated with the central term, it is possible to obtain the phrase where the two words co-occur. This cue is particularly useful in mixed methods because, with just a "click", the original textual material is obtained, which can be analyzed by discourse analysis. We checked occurrences and co-occurrences, setting a frequency threshold of four. As Figure 1 shows, the value association of the thematic elements is graphically represented in terms of distance from the keyword in the center.

The most cited word is "work" (Figure 1). Firstly, it appeared strongly associated (see Table 2) with several lemmas related to the new typologies of work most widespread in Italy in response to the COVID-19 emergency. However, the presence of a strong association between the lemmas "work" and "company" (cosine coefficient 0.35) would seem to underline how, for participants, the idea of work performed in a typical working environment, rather than at home, for example, is still vivid. The presence of expressions such as work "from home" (cosine coefficient 0.26), "smart-working" (cosine coefficient 0.25), a typically Italian way to refer to agile forms of work, and also "remote" work (cosine coefficient 0.19) report the respondents' confusion and disorientation about this way of working as well as the absence of clear regulations to refer to. Another theme that emerged from the associations is related to the digitalization processes (cosine coefficient 0.18) and the related need to develop new skills (cosine coefficient 0.19) and professional figures (cosine coefficient 0.18) who are able to manage this unavoidable transition better. Finally, it seems interesting to dwell on the word "before" (cosine coefficient 0.19), an emblem of how, in order to innovate, a careful analysis of the organizational antecedents cannot be ignored.
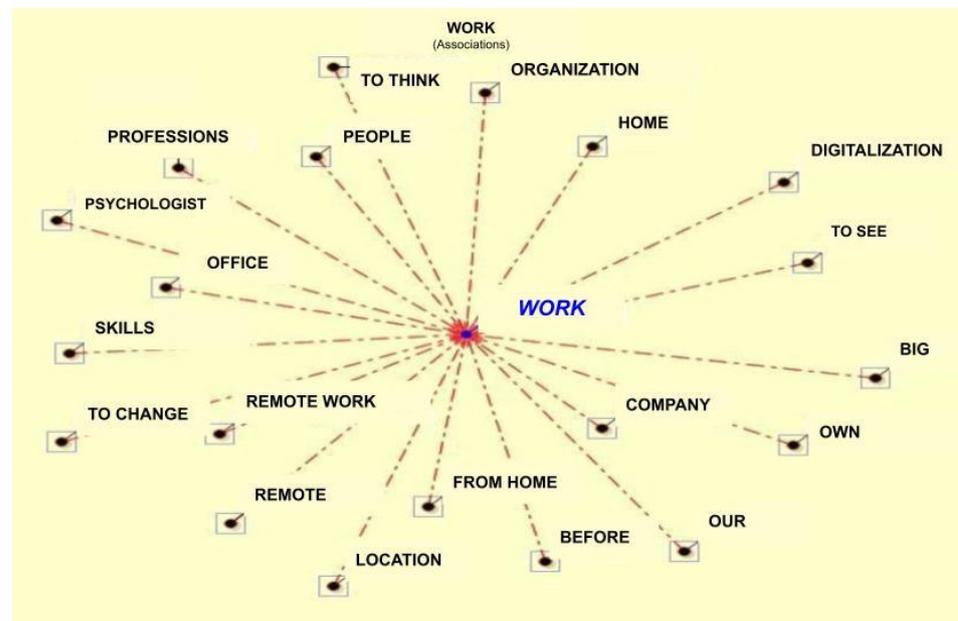
Figure 1. Co-occurrence with the lemma "lavoro" (WORK).

Table 2. Coefficient of cosine and chi2 of co-occurrence with the lemma.

LEMMA	COEFF	C.E.(A)	C.E.(AB)	CHI^2
Company (azienda)	0.354	591	232	5.26
From_home (da casa)	0.255	69	57	69,401
Smart_working	0.248	169	87	20,685
Office (ufficio)	0.237	169	83	15,028
People (persona)	0.221	194	83	5,038
Home (casa)	0.218	155	73	9,942
Before (prima)	0.19	232	78	0.382
Remote (a distanza)	0.187	60	39	23,588
Skills (abilità)	0.185	105	51	8,328
Professions (professionalità)	0.184	102	50	8,639
Organizations (organizzazioni)	0.182	73	42	16,135
Digitalization (digitalizzazione)	0.181	263	79	3,861

The second most cited word was "people" (Figure 2), and it appeared strongly associated (see Table 3) with the word "work" (cosine coefficient 0.22) and "management" (cosine coefficient 0.13), clearly underlining the focus of this explorative research, namely, the investigation of the implications of industrial digital innovation processes in terms of human resource management.

The results seem to suggest three major critical points in the HRM in a digitalized context: firstly, the ability to support the integration between digital and fiscal activities; in this sense, several respondents have paid attention to the risk of losing their specificity in the run-up to digitalization; secondly, the need to review performance measurement systems and incentive and reward procedures; finally, the urgency to fostering the idea of a workplace understood not as a workplace but rather as a dimension in which organizational development and growth depend on the ability to create working relationships independent of physical presence or proximity.

In a similar way, the association with the verbs "to change" (cosine coefficient 0.15) and "challenge" (cosine coefficient 0.28) seems to validate the hypothesis that a change of thinking is necessary to see digital innovation not only as a challenge with an inevitable price to pay but also as an opportunity for organizational improvement and growth. According to this, even the word "responsible" (cosine coefficient 0.12) underlines the

opportunities offered by new technologies in the era of Industry 4.0, which can promote positive changes if properly managed. Finally, the theme of work–life balance clearly emerged from interviewees' frequent use of the words "home" (cosine coefficient 0.11) and "life" (cosine coefficient 0.12), confirming that any transformational process cannot be separated from a careful analysis of costs, especially in terms of the human factor.
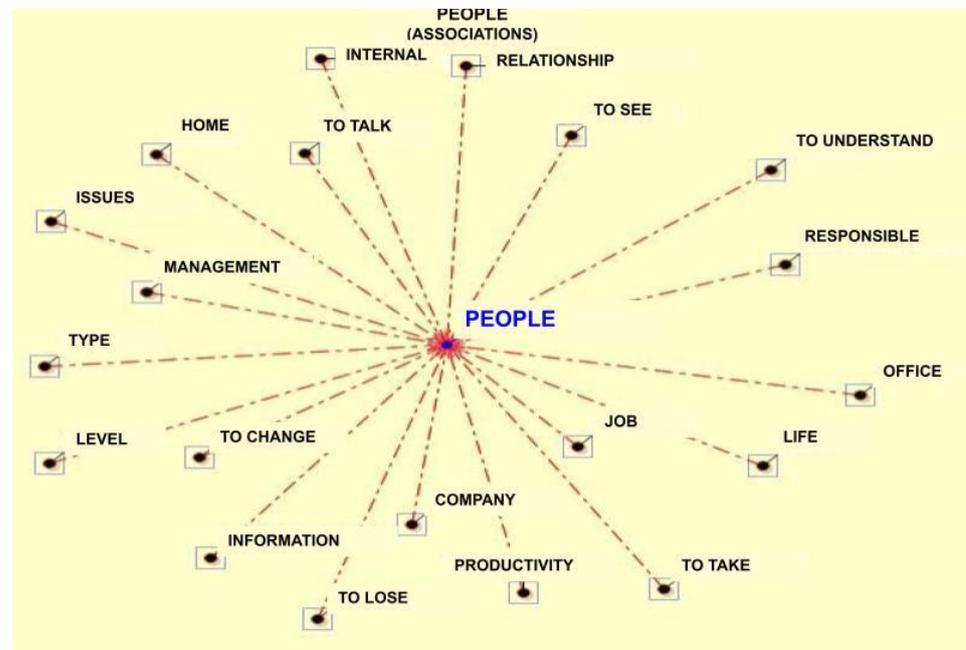

Figure 2. Co-occurrence with the lemma "persone" (people).

Table 3. Coefficient of cosine and chi2 of co-occurrence with the lemma PEOPLE.

LEMMA	COEFF	C.E.(A)	C.E.(AB)	CHI^2
work (Lavoro)	0.22	726	83	5,038
company (azienda)	0.17	591	56	0
(to) change (cambiare)	0.15	134	24	11,904
management (gestione)	0.13	82	18	15,511
(to) talk (parlare)	0.14	152	24	7.64
(to) see (vedere)	0.13	265	30	1,212
responsible (responsabile)	0.12	34	10	16,029
life (vita)	0.12	59	13	11,178
productivity (produttività)	0.12	83	15	7.46
information (informazione)	0.11	33	9	12,393
home (casa)	0.11	155	19	1,517
relation (relazione)	0.11	45	10	8,722
(to) understand (capire)	0.11	116	16	2,677
office (ufficio)	0.11	169	19	0.673
problem (problema)	0.10	98	14	2.78

Next, a personalized analysis was conducted, asking the software to map the co-occurrences with the stimulus words "digitalization" (Figure 3) and "professional_figures" (Figure 4). This choice is explained by the research interest to investigate the relationship between digitalization processes and the human factor and to underline if and which new skills and professional figures are needed to promote this change. Clear examples of this are statements such as the following: "I will instead have to develop new soft skills that are increasingly adaptive to what is our reality" (Respondent n. 30) and "this digitalization in small- and medium-sized enterprises has expressed the need to rebalance jobs and skills,

with the need to revise production and work processes in many cases as well" (Respondent n. 24).
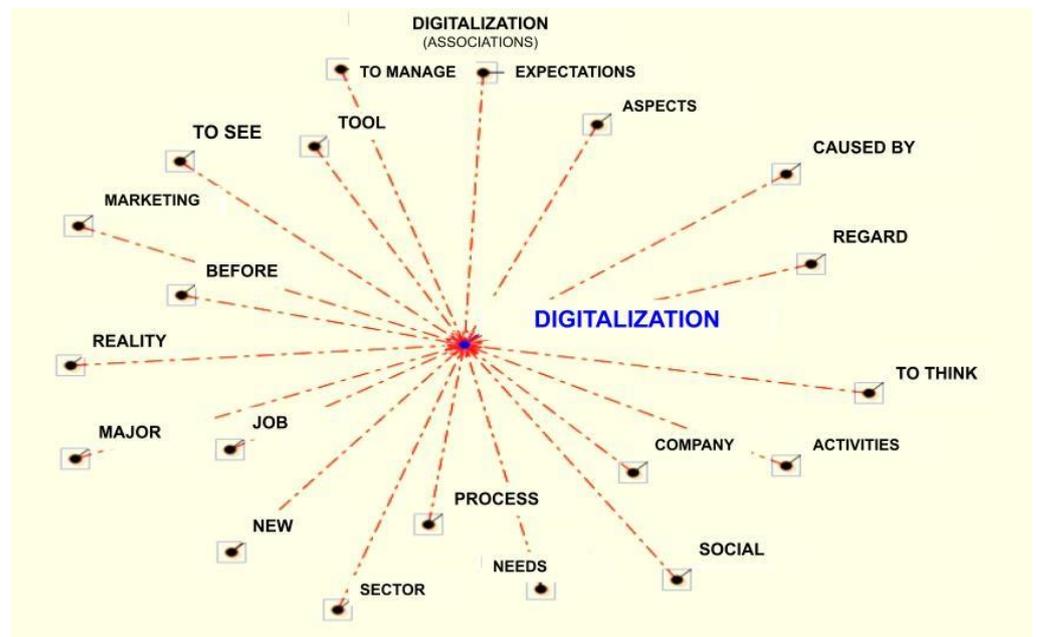

Figure 3. Shows the co-occurrence with the lemma "digitalization".
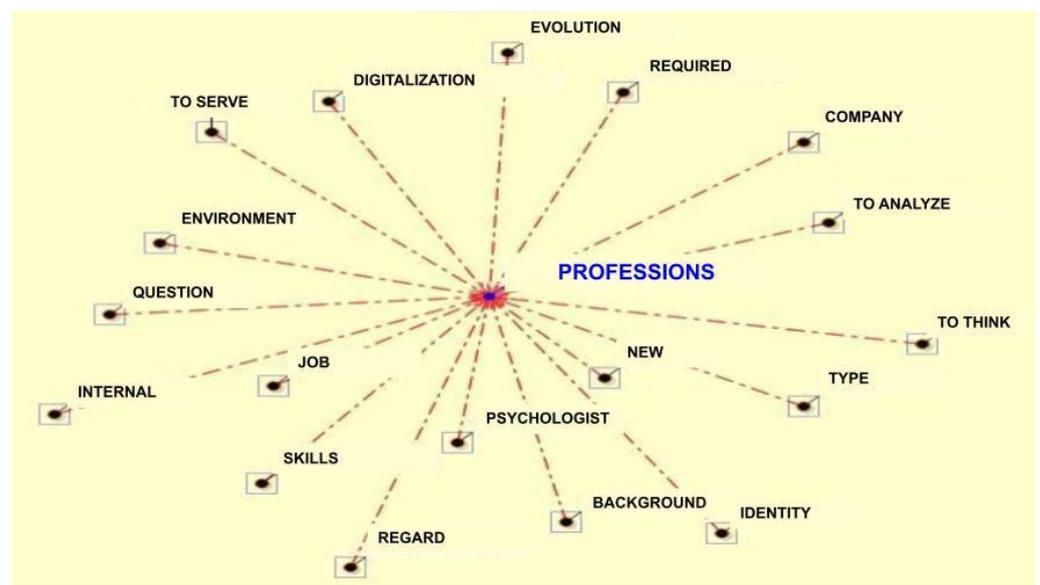

Figure 4. Co-occurrence with the lemma "professioni" (professions).

It is interesting to note (Table 4) that it is related to words such as "process" (cosine coefficient 0.19) and "work" (cosine coefficient 0.18) to indicate the dynamic nature of the innovation. If, on one hand, digitalization requires a clear distinction between a "before" (cosine coefficient 0.17) and a "new" (cosine coefficient 0.13), understood as the ability to come up with new and divergent ideas, it also imposes the possession of specific skills to "manage" it (cosine coefficient 0.10) effectively.

Table 4. Coefficient of cosine and chi2 of co-occurrence with the lemma "innovation".

LEMMA	COEFF	C.E.(A)	C.E.(AB)	CHI^2
Company (azienda)	0.200	591	78	0.094
Process (processo)	0.190	58	23	38,342
Work (Lavoro)	0.180	726	79	3,861
Before (prima)	0.174	232	43	7,575
Tool (strumento)	0.153	102	25	13,057
Necessity (necessità)	0.136	53	16	14,628
New (nuovo)	0.131	128	24	4,258
Reality (realtà)	0.129	121	23	4,369

Finally, in Figure 4 and Table 5, we can see the association with the word "professions". In the current context, which requires organizations to continuously "evolve" (cosine coefficient 0.18), digitalization (cosine coefficient 0.16) could be a viable opportunity, provided there are professionals with context-specific "skills" (cosine coefficient 0.18) capable of dealing with this challenge (risks included).

Table 5. Coefficient of cosine and chi2 of co-occurrence with the lemma "professions".

LEMMA	COEFF	C.E.(A)	C.E.(AB)	CHI^2
New (nuovo)	0.34	179	54	195,857
Psychologist (psicologo)	0.26	37	19	134,156
Work (lavoro)	0.21	153	31	57,219
Skills (abilità)	0.18	790	60	4,629
To evolve (evolvere)	0.18	11	7	63,751
Digitalization (digitalizzazione)	0.16	326	34	12,355
Evolution (evoluzione)	0.14	13	6	36,538
Context (contesto)	0.14	30	9	30,236
Identity (identità)	0.14	45	11	26,891

6. Discussion

The present study underlines the complexity of digitalization and innovation processes in organizations. In line with other studies conducted on the implementation of Industry 4.0, we found a multidimensional phenomenon whose implications cannot be reduced to a single level. Therefore, adopting a bottom-up approach, we wanted to investigate both individual- and organizational-level perspectives, exploring the different viewpoints HR managers, innovation managers, and academic experts had on digitalization processes in Italian small- and medium-sized enterprises.

Overall, participants showed mixed opinions and viewpoints on only one of the three main themes emerging from the analyses. More specifically, homogenous positions could be individuated to describe the digitalization experience (Theme 1) and the feeling of being unprepared (Theme 2) for the shift towards more digitalized work arrangements. The overlap between digitalization processes and remote working arrangements due to the pandemic was strictly connected to the feeling of low competencies and skills to manage the digitalization process. Consistently, participants reported the perception that organizational sectors and familiarity with digital products and techniques influenced the digitalization experiences of several organizations during the pandemic. These points are confirmed by the T-LAB results (see, for example, Table 1), where the terms "from home" and "smart-working" emerged among the most frequently linked to "work". While it is safe to affirm that COVID-19 acted as a digitalization accelerator within organizations, digitalization processes go beyond the shift to remote working conditions, including, for example, paperless processes and offices and automated digital systems to create and share documents, organize and pursue tasks, and meet colleagues (see Amankwah-Amoah et al. 2021). A valuable implication for the feeling of unpreparedness that arose from the interviews is the spread of training opportunities. According to the literature, new

technologies (but in general, every change) will require new types of knowledge and skills. At the present time, we know little about what competencies will be needed, but it is reasonable to believe that we will be faced with an "augmented employee" (Cantoni and Mangia 2018), namely, an employee who is an expert in data treatment and analysis, supervision, and advanced decision-making. However, when the change happens so suddenly, it is difficult to plan specific and useful training, with the risk of leaving workers unprepared. Thus, this study suggests how important it is that organizations rapidly set up learning and training programs to help workers acquire new skills required by this changing reality (D'Alterio et al. 2019; Sartori et al. 2018).

It is also essential to be conscious that the need for training, expressed by workers, is twofold in nature. On one hand, they stressed a lack of technical skills and knowledge. On the other hand, the need to work on spreading a culture of innovation emerges clearly, where openness to new experiences and flexibility become shared values.

In applicative terms, these results open several future perspectives. Firstly, recruitment and training and development initiatives will need to consider the new skills required by workers and a new cultural mindset to support a collaborative work environment. With respect to talent attraction and retention processes, there are some questions that future studies may try to answer, such as "What will talent consist of in a digitized working world?" or "How will it be possible to recognize it and help it flourish?".

A case study conducted in a French industry (N'Cho 2017) showed they used digitalization to enhance their talent management process by identifying the best talent based on the requirements of each project phase and defining the right time and way to develop talent appropriately. Similarly, McIver et al. (2018) showed how HR analytics can predict store performance improvement using online assessment data and in-store interview processes.

In contrast with the uniform viewpoints for the first two themes, opinions on the third theme emerging from the interviews, namely, the human factor in digitalization, suggest two main approaches to human–technology interaction at work. The first describes working out of the office as a way to reach higher autonomy and flexibility; the other underlines experiences of lower integration between personal and organizational life and fewer opportunities to engage with colleagues meaningfully. The polarization likely arises from the overlapping of digitalization at work and remote working experiences. It is quite common, indeed, to find similar representations in reviews and meta-analyses describing the effects of remote working arrangements on employees' health and wellbeing (e.g., Charalampous et al. 2019; Crawford et al. 2011; Juchnowicz and Kinowska 2021). This overlapping, which permeates all the results, calls for a wider approach to digitalization within organizations and a better understanding of digitalization processes during training and development activities.

At the same time, the three themes are deeply connected. According to the literature, our results suggest that it is impossible to think of a digitalization process that does not consider the human factor (Ghislieri et al. 2018; Fernandez and Gallardo-Gallardo 2020). This means questioning the benefits introduced by I4.0 (i.e., agility and work simplification) and also lucidly analyzing the costs and implications on the psychophysical wellbeing of workers as well as the starting conditions necessary to understand how ready different organizational realities are for this innovation process. So, the first element to be considered is the distinction between a deliberate choice and an inevitable change. In Italy, before the COVID-19 pandemic, there were very few companies that could boast of their digitalization processes, especially if we consider the realities of small- and medium-sized businesses. The need to prevent the spread of COVID-19 and simultaneously guarantee products and services led to a drastic acceleration in using IT systems and digitalization. However, urgency hardly goes together with planning, and, to be rapidly ready to work, many companies have seen in digitalization the best (in some cases, the only) opportunity without questioning whether their realities were adequately prepared to cope with such change. This study highlights the difficulties experienced by workers and HR managers in dealing with the rapid transition from traditional to new ways of working.

When accounting for training, the human factor influences how innovative features of work, such as the introduction of digitalized solutions, processes, and tools at work, can be appreciated and welcomed by different employees according to their individual differences (for example, regarding demographic features). In fact, while some papers in the field suggest that new technologies facilitate more flexible, automated, and interconnected work (Molino et al. 2020; Galanti et al. 2022), there is clear evidence that individual differences, for example, the age of workers, may moderate this relation negatively (Iancu and Iancu 2020; Arenas-Gaitán et al. 2019). Indeed, senior workers are more fatigued when learning and using new technologies than younger ones, probably due to their lower adaptability and flexibility. Future studies could investigate this aspect to highlight what actions HR managers can implement to reduce this resistance. Interestingly, a recent study by Fernandez and Gallardo-Gallardo (2020) proposes two competing views of how digitalization affects workers of different ages. The first is that younger persons, more familiar with IT technologies, should be better able to deal with new software than older workers (Fernandez and Gallardo-Gallardo 2020). The second view is that recent generations of software are so simplified that they reduce the specialized knowledge required to use them, leveling, in effect, the gap caused by age differences. Besides these aspects, another interesting issue is the challenge of work and organizational identity, which the literature has proven to be interconnected with age (for example, Avanzi et al. 2012). In other words, we see an urgent call for studies investigating the risks for the organizational identity of digitalization and, especially, mass teleworking. Furthermore, it would be interesting to analyze in detail how teleworking, especially for specific age groups, may affect the process of both job socialization and organizational identification.

All these results further stress the need for a radical transformation of HR departments that need to consider how workers will interact with smarter machines.

Last but not least, all these changes call for detailed and specific company policies, as others have previously stressed (Cortini and Fantinelli 2018), to guarantee HR practices that can support both performance and wellbeing.

In conclusion, future workplaces will be characterized by extreme versatility, which requires workers to have increasing technical and soft skills and, first of all, the ability to collaborate and build functional relationships.

7. Limits and Future Perspective

The study's limitations are the research method and the participants. Because there has been little research on Industry 4.0 in the Italian context, this study is exploratory. The gender distribution is skewed because many of the participants were men. The qualitative approach used in this study is not generalizable and cannot be applied to a larger population. However, this is an explorative study whose preliminary results, even if not entirely representative, indicate the urgency of future research.

The future line of research will be to determine the effectiveness of the measures incentivizing smart and sustainable manufacturing, whether the Italian regions that are most advanced in the adoption of the I4.0 paradigm have shown greater resilience during the crisis after the pandemic, and whether the less prepared regions have started to catch up. Future studies could also explore the existence of differences in the consequences of digital transformations for blue-collar and white-collar workers.

Moreover, it would be interesting to map and compare the supporting measures introduced by different European regions and compare their level of readiness and responsiveness.

Finally, the findings of this study can be used by HR departments to develop new training and learning strategies that incorporate the specialized knowledge required to use IT technologies and interpersonal and communicative skills, which are increasingly necessary in new work scenarios.

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