Journal of Innovation & Knowledge 7 (2022) 100275

Journal of Innovation & Knowledge

https://www.journals.elsevier.com/journal-of-innovation-and-knowledge

Managing the dark side of digitalization in the future of work: A fuzzy TISM approach

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ARTICLE INFO

Article History:
Received 26 April 2022
Accepted 18 September 2022
Available online 23 September 2022

Keywords:
Digitalization
Future of work
FoW
Human resource management
Fuzzy TISM

ABSTRACT

The rise of new-age technologies has spurred a new industrial revolution, resulting in a digital transformation in the way we work. The global COVID-19 pandemic has further accelerated the digitalization of work. While digitalization has many positive outcomes, its darker side should be proactively managed, not neglected. In this regard, this paper aims to identify and investigate human resource (HR) practices that can enable employees to manage the challenges caused by digitalization in the future of work (FoW). To do so, we employ fuzzy total interpretive structural modeling (TISM) on survey data acquired from senior professionals with HR responsibilities to ascertain the influence of HR practices in managing the dark side of digitalization in FoW. In doing so, we showcase the influence of (i) *practices that promote work-life balance*, (ii) *democratization of work and work technologies*, (iii) *practices that promote employee empowerment*, (iv) *practices that promote entrepreneurial behavior*, (v) *reskilling for mastery*, and (vi) *practices that promote employee wellbeing* in managing the dark side of digitalization in FoW, thereby advancing theory and practice of FoW.

Introduction

Digitalization at work is not only happening but also proliferating at an exponential pace (Bresciani et al., 2021a; Bresciani et al., 2021b; Ferraris et al., 2019). This new reality of digital transformation is spearheaded by new-age technologies (such as artificial intelligence, augmented reality, big data analytics, blockchain, cloud computing, machine learning, the Internet of things, and robotics), resulting in significant changes at the workplace, most notably workplace automation (Bresciani et al., 2021a; Kumar et al., 2022; Spencer, 2018; Verhoef et al., 2021). Myriad aspects of work such as employment relations, the labor market, and the nature, model, and process of work have been greatly affected by the agile and significant disruptions of new-age technological advancement (Acemoglu & Restrepo, 2020; Maran et al., 2022; Scully-Russ & Torraco, 2020). The notable changes witnessed encompass the characteristics of jobs, employment relations, institutional and regulatory policies, and work practices, among others (Ciasullo & Lim, 2022; Malhotra, 2021; Santana & Cobo, 2020). Digitalization is shaping the future of work (FoW) involving the workforce and the workplace, including work technologies and working conditions. These changes yield significant implications for how jobs are done and will be done in the future (Skare & Soriano, 2021; Varma et al., 2022).

While new-age technologies offer many benefits such as automation, collaboration, flexibility, innovation, and productivity in work (Burnett & Lisk, 2019; Jain & Ranjan, 2020; Santana & Cobo, 2020 (Bouncken, Kraus, & Roig-Tierno, 2021) (Bouncken & Kraus, 2022)), they also raise many concerns such as employee anxiety, privacy, remuneration, and wellbeing alongside job ambiguity, redundancy, and security (Acemoglu & Restrepo, 2020; Arntz et al., 2016; Brougham & Haar, 2020; Makridis & Han, 2021; Santana & Cobo, 2020; Yu et al., 2022; Spencer, 2018). These contemporary developments have necessitated organizations that wish to survive and thrive in the new-age disruptive, volatile, uncertain, complex, and ambiguous (DVUCA) environment to promptly adapt to continuing changes, develop new capabilities, engage in upskilling and reskilling of employees, and implement future-ready human resource (HR) practices to prepare employees for FoW (Malhotra, 2021). Yet, little is known about future-ready HR practices (Santana & Cobo, 2020) and

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https://doi.org/10.1016/j.jik.2022.100275

how these practices can help employees in managing the dark side of digitalization in FoW, mainly due to the fact that they largely remain as "work in progress" (Vasudevan, 2020). Given that new-age technological advancement is proliferating at an accelerated pace, especially in the aftermath of the global COVID-19 pandemic (Lim, 2021), there is a need to understand what kind of HR practices or systems must be designed to address the challenges associated with digitalization in FoW.

Considering the speed and impact of new-age technological advancement on work, workforce, and workplace, especially in light of the global COVID-19 pandemic that has resulted in overnight digital transformation and technology adoption (Lim, 2021) for remote and hybrid work (Sutarto et al., 2022), the topic of the future of work (FoW) has attracted considerable scholarly attention across various disciplines such as business (Cowie, 2020; Verhoef et al., 2021), economics (Jeffrey, 2021), education (Teo et al., 2021), HR management (HRM) (Mello & Tomei, 2021), information systems (Kumar et al., 2022), information technology (Willcocks, 2021), management (Choudhury et al., 2020), psychology (Demerouti, 2022), and sociology (Vicsek, 2020). This has led to a plethora of studies that have shed light on FoW. For example, Ferraris et al. (2019) focused on the emergence of smart cities and emphasized the importance of managing ambidextrous work. Other scholars such as Bresciani et al. (2021b) highlighted the importance of HRM in managing digitalization at the workplace. Indeed, the infusion of new-age technologies at work such as AI augmented HR (Prikshat et al., 2021) have been acknowledged by recent scholars, resulting in the call for a rethink of HR practices (Malik et al.., 2022). Moreover, at the micro level, scholars have highlighted the need to manage employee online work (such as online knowledge sharing) given the proliferation of hybrid and remote work (Nguyen et al., 2021), whereas at the macro level, scholars have recognized the need to respond with agility to the evolving opportunities in global business (Lim, 2022) and international HRM (Budhwar et al., 2022). Scholars such as Makridis and Han (2021) pointed out that employees feel empowered to utilize their skills and competence using new technologies when they receive mentoring and operate with a culture of trust in the workplace environment. However, these FoW studies are largely concentrated on the bright side of digitalization, or in other words, the HR practices that prepare employees to leverage the power of new-age technologies for work. Noteworthily, the dark side of digitalization (such as employee anxiety, privacy, remuneration, and wellbeing as well as job ambiguity, redundancy, and security) differs from its bright side (such as greater agility, automation, collaboration, efficiency, flexibility, innovation, and productivity in work), and it is often overlooked in favor of its brighter counterpart. Therefore, to date, little is known about the HR practices required to mitigate the dark side of digitalization in FoW, thereby necessitating new research in this direction.

To address the extant gaps and extend the aforementioned line of inquiry, we raise and pursue the answer to the question of *what organizations can do to promote the symbiosis between people and technology so that their employees are well-prepared to respond to the challenges arising from digitalization in FoW*? In this regard, the goal of this study is *to identify and investigate HR practices that can enable employees to manage the challenges caused by digitalization in FoW*. To achieve this goal, this study reviews the literature to identify suitable HR practices for managing the challenges of digitalization in FoW, and following that, deploys fuzzy total interpretive structural modeling (TISM) to explore the linkages and effectiveness of these HR practices for the said purpose.

This study contributes to FoW theory and practice. From a theoretical perspective, this study extends understanding on FoW in two major ways: first, this study broadens the breadth of understanding on digitalization in FoW from its bright side to its dark side, and second, this study extends the depth of understanding on the dark side of digitalization in FoW from its issues to its solutions (namely, HR practices). From a practical standpoint, this study contributes to HR strategy to manage work, workforce, and workplace in two major ways: first, this study provides a collection of actionable HR practices that HR professionals can adopt to mitigate the dark side of digitalization in FoW, and second, through the fuzzy TISM approach, HR professionals will be equipped with pragmatic insights that should be useful for prioritizing HR practices to manage the dark side of digitalization in FoW. Such insights are inarguably valuable for HR professionals today, who have to do more with less given the scarcity of available resources (such as HR budget and headcount).

The remainder of this paper is structured as follows. The next section presents a literature review on FoW, impact of digitalization on FoW, and HR practices to address the challenges that employees may experience resulting from digitalization in FoW. Following that, this paper presents the methodological procedures and findings of the study before discussing the equivalent theoretical and practical implications. Finally, this paper concludes by acknowledging its limitations and providing suggestions for future research.

Literature review

FoW

Work and workplace are integral parts of society that have been largely affected by the disruptive and rapid changes in the business environment (Mitchell et al., 2022). Forces such as demographic changes, energy consumption, globalization, societal trends, and technological advancement have impacted—and continue to impact—work at large (Gratton, 2010; Lim, 2022). In the quest to understand the impact of these forces on work—or more popularly, FoW—numerous investigations have been undertaken, revealing concerns around the future of jobs, job quality, wage gaps, social protection, and industrial relations (Anner et al., 2019; Spencer, 2018).

Few recent reviews have also endeavored to systematically structure the knowledge base of FoW. Mitchell et al. (2022) found that the key topics characterizing FoW literature consist of age discrimination, contingencies, diversity, evolution of workplace, global crisis, grievance process, international migration, job insecurity, mentoring, skill gaps, telecommuting, wellbeing, and work-life balance, which can be broadly clustered into themes exemplifying diversity, personal skills, workplace change, and workplace relation. Similarly, Santana and Cobo (2020) identified various topics in FoW literature such as automation, career, innovation, older workers, satisfaction, talent management, telework, and vulnerable workers, which can be broadly grouped into themes reflecting the economic, political, social, and technological essence of FoW. While FoW is multi-faceted, the current and trending discussion in the field pertain to the impact of the digitalization revolution ignited by new-age technological advancement on work, workers, and workplaces.

Impact of digitalization on FoW

Almost two-decade ago, Lobel et al. (1999) highlighted technological advancement as a major factor that would affect the nature of work, triggering ensuing scholarly debates on the impact of technology on work and life. On the one hand, technological advancement can help to increase employee productivity, promote work-life balance, improve workplace safety, and raise earnings, among others (Grimshaw, 2020). On the other hand, the recent advancement and adoption of new-age technologies capable of learning and developing themselves (e.g., autonomous systems involving artificial intelligence, big data, machine learning, and robotics) have caused significant concerns among workers (Connelly et al., 2021) such as unemployment due to automation, decreased human participation in economic activities, deterioration of job quality, human-machine

conflict, job polarization, social and economic inequality, and wage gap (Bhattacharyya & Nair, 2019; Jarrahi, 2018; Santana & Cobo, 2020).

A comprehensive review of FoW reports from five international organizations consisting of the *International Labour Organization, Organisation for Economic Cooperation and Development, United Nations Industrial Development Organization, United Nations Development Programme*, and *World Bank* maintained that recent technological developments have significantly caused job losses, inequalities, and precarious work, leading to employee anxiety and poorer conditions of employee wellbeing (Grimshaw, 2020). Similar concerns were observed in Méda (2019), wherein digitalization has led to blurred boundaries between work and professional life, crowd-work, de-skilling, polarization of society, and uberization of work. While digitalization has added value, its radical dark side that promotes anxiety, frustration, and stress among employees cannot be ignored (Jain & Ranjan, 2020).

Given the dark side of new-age technological advancement and the equivalent challenges that entail for employee performance and wellbeing, HR has been earmarked as the key function of an organization that must proactively develop suitable interventions to mitigate the challenges of digitalization in FoW (Minbaeva, 2021). In this regard, it is important to identify and investigate the HR practices that can be pursued to support employees in managing the dark side of digitalization in FoW (Delisle & Lajoie, 2022).

HR practices to address the challenges of digitalization in FoW

One of the possible interventions that could address the challenges of digitalization in FoW involve reducing deskilling and promoting reskilling of employees (Santana & Cobo, 2020)—or in other words, *reskilling for mastery*. Delisle and Lajoie (2022) indicate that mastering active listening, collaboration, communication, creativity, critical thinking, curiosity, emotional intelligence, learning agility, service orientation, and self-efficacy should help employees in embracing FoW with confidence and forging ahead with high-performance work. They added that developing initiatives that promote cross-functional competence and specialization in higher-order jobs can make people more employable and thus enhance job security and raise employee earnings and quality of life.

Besides that, HR practices that promote creativity, learning, problem solving, and resilience can counter the challenges of digitalization, especially when such *practices promote entrepreneurial behavior* among employees (Oppert, et al., 2022; Ratten & Ferreira, 2016; Santana & Cobo, 2020). Indeed, the entrepreneurial mindset and practice can help employees in developing their ability for cobotization and symbiosis with disruptive technologies and thus reduce anxiety and frustration associated with the digitalization of work (Méda, 2019). The outcomes sought also reflect the importance of *practices that promote employee wellbeing*.

Furthermore, HR practices promoting the *democratization of work and work technologies* can empower employees and facilitate work-life balance. Noteworthily, past scholars have found that employee empowerment and wellbeing are positively linked to work engagement, efficacy, performance, and stress management when the adoption of disruptive technologies at work is considered, and thus, organizations should offer autonomy to employees so that they can adapt to technological changes and pick up technologies that would make work most effective and efficient (Makridis & Han, 2021; van Woerkom, 2021). This observation also reflects the importance of engaging in *practices that promote employee empowerment* and *practices that promote work-life balance*.

To this end, employees could be supported to manage the dark side of digitalization in FoW through (i) practices that promote work-life balance, (ii) democratization of work and work technologies, (iii) practices that promote employee empowerment, (iv) practices that promote entrepreneurial behavior, (v) reskilling for mastery, and (vi) practices that promote employee wellbeing. Nonetheless, empirical evidence remains bleak and scattered—the potential HR practices for managing the dark side of digitalization in FoW have not been formally established, consolidated, and tested collectively in a single study (Appendix). Therefore, the present study aims to provide new evidence by testing the linkage of these HR practices with employee attitude and orientation in managing the dark side of digitalization in FoW.

Methodology

Fuzzy TISM

The current study adopts a fuzzy TISM approach to examine the influence of six HR practices identified from the literature review in enabling employees to manage the challenges caused by digitalization in FoW. In essence, fuzzy TISM is a multicriteria decision-making method (MCDM) suitable for solving problems with vagueness, subjectivity, and imprecision or fuzziness (Khatwani et al., 2015; Sushil, 2012), which resonate with the state of the six HR practices that had bleak and scattered evidence when the dark side of digitalization in FoW is considered. This approach is well established and extensively used in complex decision-making situations involving competitiveness (Bamel & Bamel, 2020; Bamel et al., 2019; Jain & Soni, 2019) and sustainability (Ali et al., 2022; Mohanty & Shankar, 2017). As an extended approach of interpretive structural modeling and fuzzy set theory, fuzzy TISM supports decision makers in understanding the relationship between various criteria (variables) and their degree of influence though a structural self-interaction matrix (Khatwani et al., 2015).

TISM is a popular MCDM. The reachability in TISM is constructed using binary digits (0 and 1). However, real values may lie between these binary digits as real-life situations may be fuzzy, uncertain, and vague—the complexity may naturally vary by degree or level (Khatwani et al., 2015). Unfortunately, TISM lacks the ability to account for such realities. Thus, to overcome this limitation, fuzzy logic is integrated into TISM, resulting in fuzzy TISM, which can be used to account for the variations in realities (Khatwani et al., 2015; Thayyib & Khan, 2021).

Another potential approach to address ambiguous problems is fuzzy-set qualitative comparative analysis (fsQCA), which is an increasingly popular technique for deriving predictive conclusions through a configurational approach (Kraus et al., 2018; Kumar et al., 2022). Although fsQCA could have been employed in this study, the fuzzy TISM approach was chosen because of its suitability for a purely exploratory study, which is the case for the current study, whereas fsQCA was not chosen because of its suitability for a study that "sits midway between exploratory and hypothesis testing" (Kent, 2005, p. 226), which is not the case for the present study. The fuzzy TISM method has eight steps (Sushil, 2012) that will be detailed in the analysis and results section of this study.

Instrument

The literature review identified six HR practices that could enable employees in managing the challenges of digitalization in FoW. We created a knowledge base (questionnaire) using these HR practices as variables following the steps in fuzzy TISM. The total number of variables in this study is seven including the dependent variable, and thus, the knowledge base has 42 statements as per the $n(n\text{-}1)$ rule of fuzzy TISM. Sample items in the knowledge base include "managing the dark side of digitalization will influence practices that promote employee wellbeing" (if yes, rate the strength of relationship from 0 to 1) and "practices that promote work-life balance will influence managing the dark side of digitalization" (if yes, rate the strength of

relationship from 0 to 1). Participants in the study are required to indicate the strength of relationship or the level of influence between variables on a range of scores from 0 to 1, wherein "0.0" represents "no relationship" or "no influence", "0.1" represents "very low influence", "0.3" represents "low influence", "0.5" represents "medium influence", "0.7" represents "high influence", "0.9" represents "very high influence", and "1.0" represents "full influence".

Sampling

The present study collected data from senior professionals with HR responsibilities (e.g., chief executive officer of an HR consulting firm, director of people management of a large manufacturing company, general manager of a state-owned power distribution company, and senior HR managers from small, medium, and large enterprises) who were identified from the professional network of authors (e.g., LinkedIn). In this regard, a purposive snowball sampling strategy was deployed to select participants for this study, wherein senior professionals with HR responsibilities of at least 10 years of experience were recruited and encouraged to share the opportunity to participate in this study with other suitable colleagues within their professional network. The experience criteria are necessary as the fuzzy TISM approach requires expert opinion to rank order the HR practices in managing the challenges of FoW, whereas the snowballing technique widens the sampling reach, which is necessary given the necessary rigidness of the experience criteria.

An online survey by means of questionnaire administration was deployed following the steps of fuzzy TISM. Sixteen participants qualified based on the experience criteria (i.e., not meeting the criteria meant that the survey was automatically terminated) and completed the survey. No missing values were recorded as all questions had to be answered—otherwise, participants cannot complete the survey. The completion of all questions is mandatory for fuzzy TISM.

Analysis and results

The influence of HR practices in enabling employees to manage the challenges caused by digitalization in FoW is investigated using fuzzy TISM. This approach consists of eight steps.

Step 1. involves *reviewing the literature* to identify HR practices relevant to *managing the dark side of digitalization in FoW* (C1)—i.e., the dependent variable. This step has been conducted and reported through the second section of this paper—i.e., literature review. Though the literature is fragmented and sparse, we managed to identify six relevant HR practices, namely practices that promote work-life balance (C2), democratization of work and work technologies (C3), practices that promote employee empowerment (C4), practices that promote entrepreneurial behavior (C5), reskilling for mastery (C6), and practices that promote employee wellbeing (C7)—i.e., the independent variables. Taken collectively, C1 to C7 denotes the study variables for fuzzy TISM.

Step 2. involves *recruiting and requiring experts to rate the strength of relationship or level influence among the study variables* on a seven-point scale ranging from no influence (i.e., 0) to full influence (i.e., 1). This step has been conducted and reported through the third section's second and third sub-sections of this paper.

Table 1
Fuzzy reachability matrix.

Variable	C1	C2	C3	C4	C5	C6	C7
Managing the dark side of digitalization in FoW (C1)	1.0	0.3	0.1	0.0	0.0	0.0	0.3
Practices that promote work-life balance (C2)	0.5	1.0	0.3	0.7	0.7	0.7	0.7
Democratization of work and work technologies (C3)	0.7	0.7	1.0	0.3	0.7	0.9	0.9
Practices that promote employee empowerment (C4)	0.7	0.3	0.5	1.0	0.5	1.0	0.7
Practices that promote entrepreneurial behavior (C5)	1.0	0.3	0.3	0.3	1.0	0.3	0.5
Reskilling for mastery (C6)	0.9	0.1	0.3	0.3	1.0	1.0	0.3
Practices that promote employee wellbeing (C7)	0.9	0.0	0.1	0.3	0.7	0.9	1.0

Step 3. involves *developing a fuzzy reachability matrix for the study variables* (Table 1). The table indicates that (i) C5 (i.e., practices that promote entrepreneurial behavior) has a full influence (i.e., 1), (ii) C6 (i.e., reskilling for mastery) and C7 (i.e., practices that promote employee wellbeing) have very high influence (i.e., 0.9), (iii) C3 (i.e., democratization of work and work technologies) and C4 (i.e., practices that promote employee empowerment) have high influence (i.e., 0.7), and (iv) C2 (i.e., practices that promote work-life balance) has medium influence (i.e., 0.5) on C1 (i.e., managing the dark side of digitalization in FoW). No HR practice or study variable had low (i.e., 0.3), very low (i.e., 0.1), or no (i.e., 0.0) influence.

Step 4. involves *developing a defuzzied reachability matrix* (Table 2). This matrix is developed by converting the scores in Step 3 (Table 1) into binary codes, wherein full, very high, high, and medium influence equals to "1" and low, very low, and no relationship equals to "0". Through this matrix, it is clear that C2, C3, C4, C5, C6, and C7 have full influence on C1.

Step 5. involves *developing a reachability matrix with dependence power, driving power, and transitivity*. The dependence power of a variable refers to the total number of variables needed by that variable to achieve an outcome, whereas the driving power of a variable refers to the total number of variables that can be achieved by that particular variable (Singh and Gupta, 2020). This matrix (Table 3) is built off Table 2. The matrix indicates that C1 has full dependence on C2, C3, C4, C5, C6, and C7, with C2, C3, and C4 holding the strongest driving power on the study variables. The matrix also flags the transitive enablers for C2, C3, C4, C5, C6, and C7, wherein C1 is related to C2 to C7 through other variables (for example, C2 is related to C1 via C4). Taken collectively, this matrix highlights the direct and indirect roles of HR practices (C2 to C7) in managing the dark side of digitalization in FoW (C1).

Step 6. involves *level partitioning of the study variables* to develop the hierarchical directional structure among the study variables, and the

Table 2
Defuzzied reachability matrix.

Variable	C1	C2	C3	C4	C5	C6	C7
Managing the dark side of digitalization in FoW (C1)	1	0	0	0	0	0	0
Practices that promote work-life balance (C2)	1	1	0	1	1	1	1
Democratization of work and work technologies (C3)	1	1	1	0	1	1	1
Practices that promote employee empowerment (C4)	1	0	1	1	1	1	1
Practices that promote entrepreneurial behavior (C5)	1	0	0	0	1	0	1
Reskilling for mastery (C6)	1	0	0	0	1	1	0
Practices that promote employee wellbeing (C7)	1	0	0	0	1	1	1

Table 3
Reachability matrix with dependence power driving power, and transitivity.

Variable	C1	C2	C3	C4	C5	C6	C7	Driving power
Managing the dark side of digitalization in FoW (C1)	1	0	0	0	0	0	0	1
Practices that promote work-life balance (C2)	1	1	1*	1	1	1	1	7
Democratization of work and work technologies (C3)	1	1	1	1*	1	1	1	7
Practices that promote employee empowerment (C4)	1	1*	1	1	1	1	1	7
Practices that promote entrepreneurial behavior (C5)	1	0	0	0	1	1*	1	4
Reskilling for mastery (C6)	1	0	0	0	1	1	1*	4
Practices that promote employee wellbeing (C7)	1	0	0	0	1	1	1	4
Dependence power	7	3	3	3	6	6	6	-

Note: * = Transitive enablers.

Table 4
First iteration of level partitioning.

Variable	Reachability set	Antecedent set	Intersection set	Level
Managing the dark side of digitalization in FoW (C1)	1	1,2,3,4,5,6,7	1	Level 1
Practices that promote work-life balance (C2)	1,2,3,4,5,6,7	2,3,4		
Democratization of work and work technologies (C3)	1,2,3,4,5,6,7	2,3,4		
Practices that promote employee empowerment (C4)	1,2,3,4,5,6	2,3,4		
Practices that promote entrepreneurial behavior (C5)	1,5,6,7	2,3,4,5,6,7		
Reskilling for mastery (C6)	1,5,6,7	2,3,4,5,6,7		
Practices that promote employee wellbeing (C7)	1,5,6,7	2,3,4,5,6,7		

Table 5
Second iteration of level partitioning.

Variable	Reachability set	Antecedent set	Intersection set	Level
Practices that promote work-life balance (C2)	2,3,4,5,6,7	2,3,4		
Democratization of work and work technologies (C3)	2,3,4,5,6,7	2,3,4		
Practices that promote employee empowerment (C4)	2,3,4,5,6,7	2,3,4		
Practices that promote entrepreneurial behavior (C5)	5,6,7	2,3,4,5,6,7	5,6,7	Level 2
Reskilling for mastery (C6)	5,6,7	2,3,4,5,6,7		
Practices that promote employee wellbeing (C7)	5,6,7	2,3,4,5,6,7		

ensuing outcomes (i.e., reachability, antecedent, and intersection sets for the study variables) across three iterations are detailed in Table 4 (Iteration 1), Table 5 (Iteration 2), and Table 6 (Iteration 3). For each variable, the reachability set comprises the variable itself and all the variables it influences, the antecedent set consists of the variable itself and all the variables influencing it, and the intersection set calculates the intersecting variables across reachability and antecedent sets. Variables that have the same reachability and intersection sets are given top rank and subsequently removed for the next interaction process that continues until all variables are ranked. The first iteration of level partitioning assigns C1 as a Level 1 variable, whereas the second and third iterations of level partitioning assigns C5, C6, and C7 as Level 2 variables and C2, C3, and C4 as Level 3 variables, respectively.

Step 7. and *Step 8* involve illustration tasks. In particular, *Step 7* involves *developing a cross-impact matrix multiplication applied to classification (Matrice d'Impacts Croisés Multiplication Appliquée á un Classement) (MICMAC) graph* (Fig. 1) based on the reachability matrix (Table 3) in Step 5 and the level partitioning outcomes (Tables 4, 5, and 6) in Step 6. Finally, *Step 8* involves *developing* a diagram that explains the major levels (i.e., three levels: Tables 4, 5, and 6) and influences (i.e., medium, high, very high, and full: Table 1) of study variables (Figure 2). The graph provides abundant direct and indirect insights. For example, C3 has only a high influence (dotted line) on its own but a very high influence (solid line) via C6 and C7 on C1.

Discussion

This paper aimed to identify and investigate HR practices that can enable employees to manage the challenges caused by digitalization in FoW, thereby answering what organizations can do to promote the symbiosis between people and technology so that their employees are well-prepared to respond to the challenges arising from digitalization in FoW. This paper argues that the dark side of digitalization cannot be ignored and advocates those proactive initiatives should be undertaken to mitigate the challenges resulting from the changes caused by technological advancement in FoW. Through a literature review, this paper identifies six HR practices that could enable employees in managing the dark side of digitalization in FoW (C1), namely practices that promote work-life balance (C2), democratization of work and work technologies (C3), practices that promote employee empowerment (C4), practices that promote entrepreneurial behavior (C5), reskilling for mastery (C6), and practices that promote employee wellbeing (C7).

Table 6
Third iteration of level partitioning.

Variable	Reachability set	Antecedent set	Intersection set	Level
Practices that promote work-life balance (C2)	2,3,4	2,3,4	2,3,4	Level 3
Democratization of work and work technologies (C3)	2,3,4	2,3,4	2,3,4	
Practices that promote employee empowerment (C4)	2,3,4	2,3,4	2,3,4	

Driving power								
Strong	7			C2, C3, C4				
	6							
	5							
	4						C5, C6, C7	
	3							
	2							
	1							C1
Weak		1	2	3	4	5	6	7

Weak — Dependence power — Strong

Fig. 1. Cross-impact matrix multiplication applied to classification (MICMAC) graph.

Next, to assess the influence of these HR practices, a fuzzy TISM approach was employed. The findings of the fuzzy TISM indicate that all six HR practices (C2 to C7) have a medium to full influence in enabling employees to manage the dark side of digitalization in FoW (C1), wherein the dependence power of the latter outcome is strongly associated to the former practices. Noteworthily, the strongest influence is derived from HR practices that have the strongest driving power, namely those that promote entrepreneurial behavior (C5), reskilling (C6), and employee wellbeing (C7).

Upon detailed scrutiny, the findings show that the promotion of empowerment (C4) enables the democratization of work and work technologies (C3), wherein the latter is a HR practice that is especially relevant in the tech-rich FoW where new-age technologies (such as artificial intelligence, augmented reality, big data analytics, blockchain, cloud computing, machine learning, the Internet of things, and robotics) are prevalent and extensively used. This is consistent with prior research suggesting that empowerment and democratization provide employees with a higher degree of control over work, triggering greater involvement and responsibility leading to a sense of fulfillment as opposed to suffering (Lopes, 2021). It is interesting to note that a cyclic relationship exists between C3 and C4. That is, while C4 fosters C3, C3 is also found to promote C4 through the promotion of work-life balance (C2). The existence of causation and reverses causation suggests that a degree of complementarity may be achieved among these variables for attaining desired goals.

However, the technology-focused HR practice is not adequate on its own. Specifically, there is also a need to reskill for mastery (C6) in order to equip employees with the necessary skills to co-exist and work together with new-age technologies. Without the necessary skills, employees would not have the confidence, expertise, and self-efficacy to embrace and work with new-age technologies (Delisle & Lajoie, 2022). Similarly, the promotion of entrepreneurial behavior (C5) is also important as it enables employees to make the best use of new-age technologies. This is consistent with existing research that highlighted the importance of entrepreneurial orientation in promoting cobotization and symbiosis between people and technology

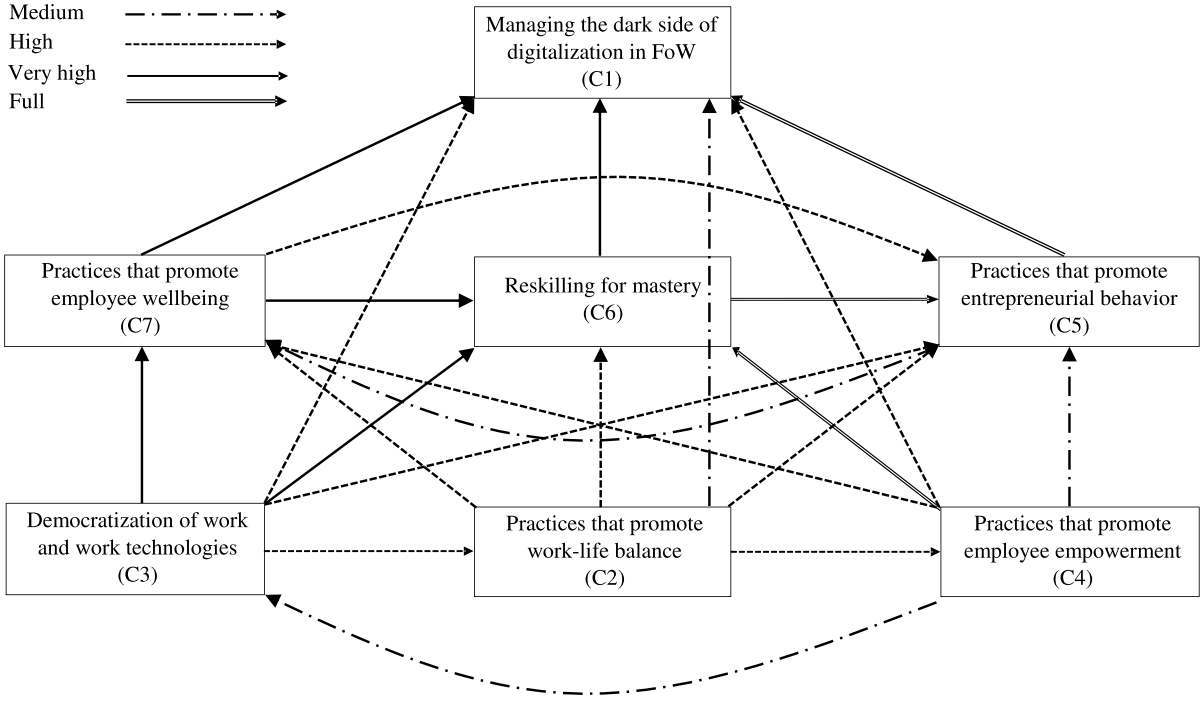

Fig. 2. Managing the dark side of digitalization in FoW context.

(Méda, 2019). This is also in line with past scholars who suggested that entrepreneurial orientation correlates with achievement motivation (Stewart et al., 2003), implying that employees who are entrepreneurial are motivated to leverage on resources available (e.g., new-age technologies) to achieve their goals.

As the euphoria of new-age technologies continue to remain high, it is crucial that employee wellbeing (C7) is not neglected. In this regard, the promotion of work-life balance (C2) is critical to safeguard employee wellbeing as part of the effort to enable employees to manage the challenges of digitalization in FoW. Indeed, a sense of work-life balance can improve employee wellbeing as it reflects employee success in negotiating personal life and workspace at the individual and institutional level (Forson, 2013; Olsson & Bernhard, 2021). When work-life balance and employee wellbeing is taken care, entrepreneurial behavior, which is crucial to managing the challenges of digitalization (Fauzi et al., 2021), is expected to follow through accordingly (C5).

In summary, the exploratory study herein identifies and validates a collection of HR practices that can be used for managing the dark side of digitalization in FoW. The findings of this study also contribute to advancing FoW theory and practice, which will be discussed in the next sections.

Theoretical implications

This paper contributes to theory in three major ways.

First, this paper acknowledges a commonly overlooked aspect of FoW in terms of the challenges associated to the dark side of digitalization in the workplace. While FoW has attracted significant attention in recent years (Malhotra, 2021; Santana & Cobo, 2020), the ways in which employees can overcome the challenges brought by new-age technologies in a tech-rich FoW have not been subjected to adequate investigation and scrutiny. In this regard, this paper represents a seminal effort to trigger academic debate around the challenges of digitalization in FoW, thereby giving visibility to an otherwise dark or gloomy area of the literature.

Second, this paper highlights the prominent role of the HR function to support organizations in responding to a technology-driven DVUCA environment, helping employees to make successful transitions accordingly. While FoW is a continuously evolving phenomenon, the immediate future of FoW is shaped by new-age technologies that have posed significant threats to job ambiguity, redundancy, and security and thus causing and raising concerns on employee anxiety, privacy, remuneration, and wellbeing (Acemoglu & Restrepo, 2020; Arntz et al., 2016; Brougham & Haar, 2020; Makridis & Han, 2021; Santana & Cobo, 2020; Yu et al., 2022; Spencer, 2018). In this regard, this paper represents a seminal effort to develop a stream of HR literature dedicated to addressing the challenges of digitalization in FoW, thereby giving rise to a body of knowledge that would otherwise remain absent or infertile in the literature.

Third, this paper sheds light on the possible solutions from a HR perspective to enable employees to manage challenges in a tech-rich work environment in FoW. Conventionally, HR has relied on practices involving recruitment, remuneration, and performance management to support organizations in dealing with change. However, these practices may not be suitable nor sustainable in the long run, especially in a DVUCA environment shaped by new-age technologies. Through this study, a collection of six HR practices were identified and investigated to determine their influence on enabling employees to manage the challenges of digitalization in FoW. The conditional approach—i.e., the $n(n\text{-}1)$ rule—of the fuzzy TISM employed herein implies that the insights of this study are both comprehensive and rigorous. Noteworthily, the findings revealed nuanced insights into both the direct and indirect influences among the six HR practices, thereby extending the portfolio of HR practices that could be relied upon to manage new-age developments in FoW.

Practical implications

This paper contributes to practice in two major ways.

First, this paper highlights that digitalization does not only result in positive outcomes—it also has a dark side that threatens its initial and continued adoption and success. Noteworthily, the review of the literature herein shows that digitalization causes employee anxiety and raises concern about employee privacy, employee wellbeing, job ambiguity, job redundancy, job remuneration, and job security, among others (Acemoglu & Restrepo, 2020; Arntz et al., 2016; Brougham & Haar, 2020; Makridis & Han, 2021; Santana & Cobo, 2020; Yu et al., 2022; Spencer, 2018). These challenges, when coupled with emergent trends (such as The Great Reset involving high employee turnover and shortage of new-age skillsets), require organizations and HR professionals to (re)imagine and (re)introduce HR practices that can effectively promote the symbiosis between human and technology that leverage off the elements of ability, motivation, and opportunity. In this regard, this paper calls for senior professionals with HR responsibilities to consider both the benefits and challenges of digitalization in ensuring that human capital remains well-prepared for FoW.

Second, this paper delivers managerial recommendations that senior professionals with HR responsibilities can consider and implement to prepare and support their colleagues in managing the challenges of digitalization in FoW. Noteworthily, the study in this paper provides rich empirical insights to support the pursuit of six HR practices relevant for this task. While practices that promote entrepreneurial behavior, reskilling, and employee wellbeing have the strongest driving power, detailed scrutiny of the findings suggests that practices that promote empowerment (e.g., de-centralized and hybrid work) is crucial to enable the democratization of work and work technologies (e.g., freedom to adopt new technologies and determine equivalent work—e.g., job sharing) and entrepreneurial behavior (e.g., creative and resourceful use of new technologies to achieve greater performance), and that practices that promote work-life balance (e.g., flexible hours) is crucial in ensuring employee wellbeing (e.g., mental health, productivity). In this regard, these HR practices should be considered collectively as part of a comprehensive HR portfolio of strategies for enabling employees to manage the dark side of digitalization in FoW.

Taken collectively, a specifically designed HRM system with the aforementioned HR practices embedded should help organizations in managing people-related challenges associated to the digitalization of work, workforce, and workplace. This recommendation is in line with Ferraris et al. (2019), who noted that well-developed HRM systems, which includes but goes beyond capability development, incentivization, coaching, and mentoring, can play a vital role in achieving organizational success. Therefore, HR practices around work, workforce, and workplace are crucial and thus must be prioritize in order to ensure that organizations are well prepared to handle the challenges and succeed in FoW.

Conclusion

To this end, this paper has delivered on its promise to identify and investigate HR practices that can enable employees to manage the challenges caused by digitalization in FoW. The literature review herein led to the identification of six HR practices—i.e., practices that promote work-life balance, democratization of work and work technologies, practices that promote employee empowerment, practices that promote entrepreneurial behavior, reskilling for mastery, and practices that promote employee wellbeing—and subsequent fuzzy TISM analysis led to the empirical verification of the influence of these practices in enabling employees to manage the dark side of digitalization in FoW. The FoW field continues to be evolving, and the issues of theoretical legitimacy and generalizations are among its

biggest challenges. The strategic use of fuzzy TISM to address these issues have contributed to greater conceptual clarity and theoretical development of FoW theory and practice.

Notwithstanding its contributions to theory and practice, this paper and its study remain limited in several ways.

First, the HR practices in this paper remain limited, mainly due to the fact that the evidence available for different practices in the field remains fragmented and nascent. Nonetheless, the present study hopes to inspire future efforts to develop and discover alternative practices that may be suitable for the HR function in an organization to adopt and implement to support employees manage the challenges emerging from new-age developments such as digitalization in FoW. Hence, future research may look into broadening the scope of categorical HR practices as well as specific forms of HR practices to advance both the breadth and depth of knowledge for FoW theory and practice. For example, the role of collaboration, which may be derived internally or externally (Ferraris et al., 2019), represents an opportunity to expand the breadth of categorical HR practices to manage FoW challenges, whereas co-working spaces and flexible work arrangements could be explored as avenues to deepen the depth of understanding of how tangible and intangible HR practices could shape workforce capability to respond to FoW challenges while maintaining or maximizing the work-life prosperity and wellbeing.

Second, the nature of literature review herein remains critical and descriptive. While the review remains consistent with the guidelines stipulated by Lim et al. (2022) for literature reviews that are a part of conceptual or empirical studies, we highly encourage future research to pursue systematic literature reviews, such as those using a bibliometric approach (Donthu et al., 2021; Varma et al., 2022; Varma et al., 2022) or an organizing framework (Lim & Rasul, 2022; Lim et al., 2021), to consolidate extant literature, highlight extant gaps, and propose ways forward for advancing theory and practice on FoW more rigorously. Unlike literature reviews in conceptual or empirical studies, literature reviews that are developed and published as independent studies should demonstrate their contribution to theory and practice, particularly in terms of the ways forward for the field (Lim et al., 2022; Mukherjee et al., 2022).

Third, the insights from this study remain limited to the perspective of senior professionals with HR responsibilities. While this segment of the workforce has professional legitimacy in addressing HR challenges, we do not discount the importance of including the voices from other stakeholders, including employees themselves and policy makers at large. Thus, future research is encouraged to explore the generalizability of the findings herein through the perspectives of other relevant stakeholders of FoW, including the use of alternative analytical techniques such as fsQCA, which is popular and profound technique that offers a link between exploratory and confirmatory research (Kraus et al., 2018; Kumar et al., 2022) .

Appendix. HR practices for managing the dark side of digitalization in FoW

HR practice	Source(s)
Practices that promote work-life balance	Makridis and Han (2021) and van Woerkom (2021).
Democratization of work and work technologies	Makridis and Han (2021) and van Woerkom (2021).
Practices that promote employee empowerment	Makridis and Han (2021) and van Woerkom (2021).
Practices that promote entrepreneurial behavior	Méda (2019), Oppert et al. (2022), Ratten and Ferreira (2016) and Santana and Cobo (2020).
Reskilling for mastery	Delisle and Lajoie (2022) and Santana and Cobo (2020).
Practices that promote employee wellbeing	Méda (2019).

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