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ORGANIZATIONAL DEPENDENCE, WORK CHARACTERISTICS AND EMPLOYEE WORK ENGAGEMENT IN THE DIGITAL ERA

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Purpose: In order for enterprises to effectively operate within the unpredictable dynamics of digital development and achieve above-average outcomes in terms of innovativeness, it is essential to build teams characterized by creativity and the ability to generate innovation. The present study examines whether specific configurations of organizational dependence, encompassing four dimensions: technological, relational, emotional, and benefit dependence in combination with work characteristics in the digital era, may foster a high level of employee work engagement. The aim of the study is therefore to identify key configurations of factors that determine work engagement in the context of ongoing digitalization.
Design/methodology/approach: The study employed fuzzy-set qualitative comparative analysis (fs/QCA) to examine the interdependencies among six factors: job complexity, career prospects, technological dependence, relational dependence, emotional dependence, and benefit dependence. This methodological approach addresses the limitations of prior research by accounting for the co-occurrence and non-linear nature of relationships among these factors. The research was conducted on a sample of 56 small and medium-sized enterprises (SMEs).
Findings: The findings of our study indicate the existence of diverse configurations of factors shaping employee work engagement. The application of fs/QCA enabled the identification of multiple pathways through which the examined determinants interact to influence engagement, thereby providing a deeper and multidimensional understanding of the conditions that foster employee involvement in the context of digital transformation.
Originality/value: From a theoretical perspective, this study contributes to the literature by identifying diverse configurations that determine employee work engagement. The applied methodology makes it possible to capture the complex interdependencies among the examined variables and their combined impact on engagement, thereby providing a more in-depth understanding of this phenomenon. Furthermore, the findings offer practical value by delivering empirical insights that can inform the design of managerial interventions aimed at enhancing employee engagement in the context of ongoing digitalization.
Keywords: organizational dependence, work engagement, digital transformation, fs/QCA.
Category of the paper: Research paper.

1. Introduction

The advancement of information and communication technologies (ICT), accompanying the fourth industrial revolution-particularly solutions such as blockchain, the Internet of Things, artificial intelligence, and big data analytics-has contributed to the emergence of new business formats, thereby transforming organizational structures, production processes, and business models (Nambisan et al., 2019). Many enterprises have undertaken digital transformation to gain a competitive advantage. However, this process is inherently risky and presents considerable challenges, with the majority of difficulties arising at the organizational and employee levels.

In this regard, enhancing the professional status of employees deserves particular attention, as they constitute both the core of the enterprise and a critical factor in the success of digital transformation. Technological progress imposes significant demands on employees, and prior research highlights that work characteristics play a crucial role in shaping employee attitudes and engagement (Kuratko et al., 2005; Wales et al., 2011). Specifically, attributes such as job complexity and career prospects can be understood as elements of the broader social context within which human resource management systems operate.

Moreover, employees' attitudes toward new technologies, their learning capacity, as well as organizational dependence, defined as the degree to which individuals or entities rely on the organization for resources and support, represent additional factors that must be considered in the course of digital transformation. These dimensions critically influence work engagement under the pressures associated with rapid technological change.

Work engagement is defined as a positive, work-related state of fulfillment and well-being that translates into favorable organizational outcomes, such as improved performance, customer satisfaction, and competitive advantage (Bakker et al., 2008). The present study focuses on examining the antecedents of work engagement from the perspective of the organizational environment and job characteristics. Prior research has emphasized the importance of conceptualizing organizational environments as multidimensional structures, understood as configurations of various factors shaping employee behavior and engagement (e.g., Douglas et al., 2020; Fiss, 2011; Misangyi, Acharya, 2014). This approach allows for a more comprehensive reflection of the complexity of organizational contexts and their impact on employee behavior.

However, traditional analytical methods, primarily regression-based approaches, often prove insufficient for studying the complex causal mechanisms underlying employee engagement. Work engagement is inherently multifactorial, and classical statistical techniques struggle to adequately capture both the co-occurrence of multiple determinants and the causal asymmetry typically present in complex organizational settings (Fiss, 2011). To address these limitations, this study employs fuzzy-set qualitative comparative analysis (fs/QCA; Ragin,

2008; Rihoux, Ragin, 2008), which conceptualizes the organizational environment as a set of interrelated profiles rather than isolated attributes. The application of this method enables the identification of multiple alternative configurations of factors, particularly different dimensions of organizational dependence and job characteristics, that may lead to high levels of work engagement.

The central assumption of this study is that analyzing factors such as job characteristics and organizational dependence from the perspective of a supportive ecosystem enables a more comprehensive understanding of the complexity involved in fostering employee engagement. This approach makes it possible to capture the interdependencies among variables and their combined influence on work engagement, thus providing a more accurate and in-depth account of the phenomenon. Adopting such a perspective may also support employees in effectively coping with dynamic changes, particularly in light of the profound transformations driven by digitalization in the workplace.

Based on the literature on work engagement, six categories of factors within the supportive ecosystem have been identified as influencing employee engagement (see Figure 1): job complexity (LePine, 2005), career prospects (Akerlind, 2015), technological dependence, relational dependence, emotional dependence, and benefit dependence (Luo, Chen, 2024).

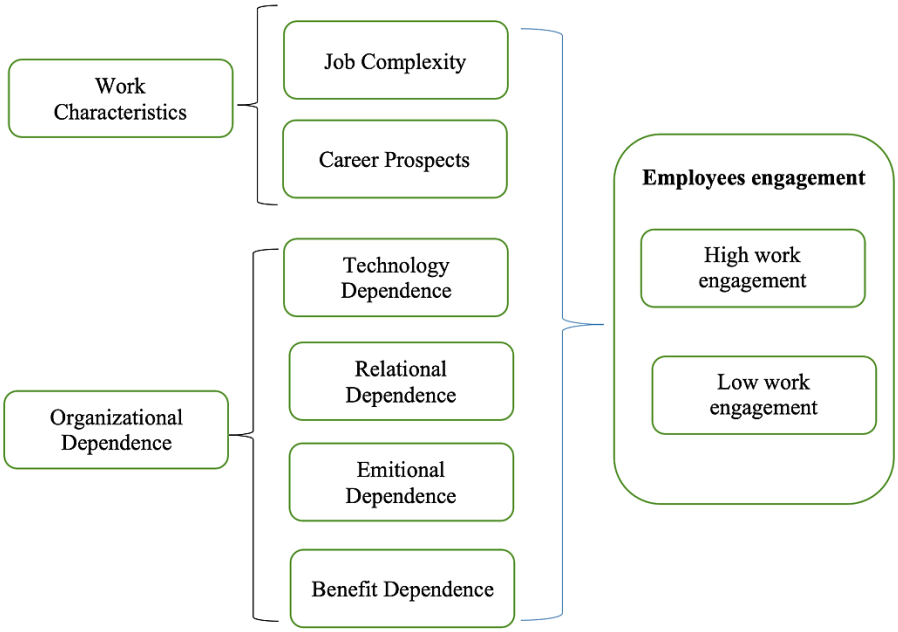

Figure 1. Research model.

Source: own study.

This article addresses at least two limitations of previous studies. Most prior analyses were based on the assumption that factors operate independently and do not interact with one another (Knight et al., 2017). Such an approach often led to the identification of a single optimal pathway and equilibrium point, while overlooking the interdependencies among variables as well as the issue of causal equifinality in outcome analysis. Moreover, earlier research predominantly relied on quantitative methods, such as correlation and regression analyses,

which typically accounted only for linear and symmetric relationships between determinants and work engagement. This perspective neglected the possibility of non-linear and asymmetric dependencies, as well as the role of configurational effects in shaping employee engagement.

The objective of this study is to identify equifinal configurations of factors influencing employee work engagement and to formulate relevant managerial recommendations. The research is based on the assumption that employee attitudes and behaviors play a pivotal role in the process of organizational digital transformation. Accordingly, work engagement has been designated as the outcome variable, in line with the terminology of fs/QCA.

The remainder of this paper is organized as follows: the next section introduces the theoretical background, after which the data and research methodology are presented in detail. This is followed by a discussion of the empirical results and their interpretation. Finally, the paper closes with a summary of the key contributions, practical implications, and suggestions for future research avenues.

2. Literature review

Work engagement is defined as a positive, fulfilling, and work-related psychological state (Van Wingerden et al., 2017). It is recognized as a key factor contributing to the effectiveness of organizational performance (Wibawa, Takahashi, 2021). Kahn (1990) argues that a high level of employee engagement leads to stronger integration between the individual and their professional role. Previous studies further demonstrate that the compatibility between employee characteristics and the work environment significantly enhances engagement (Fu et al., 2022; Srimulyani, Hermanto, 2022). The literature emphasizes that social information influences job characteristics, which in turn shape employee attitudes and determine various behaviors (Kuratko et al., 2005; Wales et al., 2011). In particular, job features such as task complexity and career development opportunities can be viewed as elements of the social context in which employees operate. The existence and modification of these job characteristics may be affected by the transmission and interpretation of social information within the organization.

In today's digital technological environment, marked by constant change, employees face increasingly complex and continuously evolving working conditions. This requires them to adapt to new responsibilities and procedures arising from technological advancement, which consequently intensifies the complexity of work dynamics (LePine, 2005). A substantial body of research highlights that job complexity plays a critical role by influencing problem-solving abilities, knowledge of work methodologies, and skills development. Empirical studies further show that job complexity generates both stress and developmental opportunities, including prospects for advancement (Podsakoff et al., 2007).

When established work paradigms are disrupted and job complexity reaches unprecedented levels, employees are compelled to adopt innovative behaviors as a means of responding to the growing demands of their roles (Janssen, 2000). Consequently, within enterprises operating in the digital era, the complexity of the work environment becomes of fundamental importance, significantly shaping individual tendencies toward work engagement and innovative behaviors (Zacher, Frese, 2011).

According to the assumptions of social information processing theory, social factors significantly shape the way individuals perceive their needs and values (Benjamini, Hochberg, 1995). In the context of digital transformation, effective communication and information exchange are crucial, as they enable employees to develop a shared understanding of organizational strategies (Zhang et al., 2022). In the digital economy, employees' aspirations-particularly among younger generations-are becoming increasingly complex, with motivation extending beyond financial rewards toward purpose and meaningful work. In this regard, career prospects, understood as opportunities for advancement and growth, constitute a key motivational factor (Akerlind, 2015).

Consistent with social information processing theory employees draw upon various sources of information, which they utilize in processes of interaction and communication with other members of the organization. This mechanism fosters the formation of career aspirations and values aligned with individual development (Bhave et al., 2010). Consequently, organizational leadership has the ability to influence how employees perceive their career prospects by effectively communicating the organization's vision and strategic goals. When employees gain confidence in the organization's future direction, they are more willing to engage in innovative activities and adopt proactive behaviors. Furthermore, research on career prospects indicates that internal promotion enhances an individual's status and recognition within the organization, thereby increasing motivation to support and leverage one's innovative potential.

In contrast, the technological uncertainties characteristic of the digital age, particularly those linked to external information originating from other organizations, tend to generate anxiety among employees, prompting responses aimed at regaining control or avoiding perceived risks (Hogg, 2000). Within such a context, employees are more inclined to display confidence and motivation toward engaging in innovative activities when they recognize meaningful opportunities for career advancement within their organization. A sense of security regarding professional development prospects provides them with both the drive and the confidence required to pursue innovation despite the challenges posed by digital disruption.

As highlighted in the literature, organizational dependence emerges as a particularly important factor in this context. This concept refers to the extent to which individuals or entities rely on the organization for access to resources, support, and developmental opportunities. It encompasses the interdependencies between individuals or groups and the organization, where both parties rely on one another to accomplish their objectives and tasks.

According to Luo et al. (2021), organizational dependence can be examined across four dimensions: technological, relational, emotional, and benefit-based.

In the context of digital transformation, various forms of organizational dependence emerge as significant drivers of work engagement. One such form is technology dependence, which reflects employees' reliance on advanced digital tools, platforms, and infrastructures. This reliance enhances operational efficiency, reduces repetitive workload, and allows employees to focus on higher-order tasks requiring critical thinking and creativity (Molino et al., 2020). As a result, technology becomes a motivating factor rather than a source of resistance, contributing to heightened interest, involvement, and engagement in work processes.

Relational dependence also plays a pivotal role in shaping employee engagement. Strong interpersonal relationships and supportive workplace networks create a sense of belonging and psychological safety, both of which are critical during periods of technological change. These social connections not only provide emotional support but also enable the sharing of knowledge and collaborative problem-solving (Wood et al., 2016). In digital environments, where change is rapid and often complex, collective adaptation supported by team cohesion significantly enhances engagement by reinforcing communication, shared responsibility, and mutual trust.

Another key factor is emotional dependence, which refers to employees' psychological attachment to the organization's mission, values, and culture. In the digital era, this attachment fosters resilience, loyalty, and proactive behavior in the face of continuous change. Emotional bonds with the organization promote a sense of meaning and purpose in employees' roles, encouraging them to remain engaged despite external pressures. Supportive leadership and a strong organizational culture further reinforce this emotional connection, increasing confidence and long-term commitment (Shin et al., 2020).

Finally, dependence on organizational rewards and benefits, such as fair compensation, opportunities for career advancement, and professional development also significantly influences employee engagement. When employees perceive these benefits as a fair exchange for their contribution, their motivation and identification with the organization increase (Eldor, 2016). Particularly in the context of digital transformation, access to training programs, upskilling initiatives, and clear career paths boosts employees' self-efficacy and readiness to embrace change, resulting in deeper engagement and performance improvement.

In sum, technological, relational, emotional, and reward-based dependencies collectively foster a strong foundation for employee engagement in digitally transforming organizations. These interrelated forms of dependence enhance adaptability, motivation, and organizational commitment, enabling employees to actively contribute to innovation and long-term success.

In summary, the existing literature has extensively examined the predictors of employee work engagement, with particular emphasis on the impact of individual factors on such behaviors. However, it remains insufficiently understood how complex interactions among

multiple determinants contribute to work engagement in a nonlinear manner. Enhancing employee engagement should therefore be conceptualized as a multidimensional process, shaped by the synergistic interplay of interrelated variables. In this regard, the fs/QCA approach provides a valuable methodological framework for analyzing the intricate relationships between antecedent conditions and outcomes (Du et al., 2017).

This study integrates six key factors: job complexity, career prospects, technology dependence, relational dependence, emotional dependence, and benefit dependence. The integration aims to address two research questions through the fs/QCA approach:

1. Can any single condition independently lead to a high level of employee work engagement?
2. How do these six conditions interact synergistically to form configurations that result in high levels of employee engagement?

By addressing these questions, the study seeks to advance the understanding of employee work engagement as a multifaceted phenomenon shaped by the interdependence of organizational and individual factors. This perspective not only extends existing theoretical frameworks but also provides a foundation for empirical investigation into how specific configurations of workplace conditions foster or hinder engagement in the digital era.

3. Methods

A structured questionnaire was employed to investigate the key determinants of employee work engagement. At the preliminary stage, the reliability of the instrument was assessed through a pilot study involving 39 respondents representing ten Polish SMEs. To examine six critical factors influencing employee work engagement in the context of digital transformation, data were collected from Polish SMEs undergoing such transformation and possessing relevant experience. The automotive industry was selected as the focal sector due to its pioneering role in implementing innovative digital technologies and its comparatively advanced technological infrastructure relative to other industries (Schuh et al., 2017).

The data collection was conducted in 2024 and targeted middle- and senior-level managers from 56 small and medium-sized enterprises in Poland. In total, 113 completed questionnaires were initially obtained. However, to ensure data quality, incomplete or blank responses were excluded from the final dataset. Consequently, 73 fully completed questionnaires were retained for analysis.

The data collection was conducted in 2024 and targeted middle- and senior-level managers from 56 small and medium-sized enterprises in Poland. A purposive sampling approach was adopted, focusing on companies actively involved in digital transformation processes and managers with relevant decision-making responsibilities. Participation in the survey was

anonymous. In total, 113 completed questionnaires were initially obtained. However, to ensure data quality, incomplete or blank responses were excluded from the final dataset. Consequently, 73 fully completed questionnaires were retained for analysis

A frequency analysis of demographic variables was conducted using the collected questionnaires. Among the respondents, 85.7% were male and 14.3% female. The majority were under the age of 46, with 37.2% aged 25 years or younger, 35.8% between 26 and 35 years, and 27% between 36 and 46 years. Respondents demonstrated a relatively high level of education, with more than 65% holding at least a bachelor's degree. With regard to organizational positions, the sample consisted primarily of middle-level managers (59%) and senior-level managers (41%). In terms of professional experience, 13.9% reported less than two years, 18.6% had between two and four years, 33.7% between five and seven years, 22.8% between eight and ten years, and 11% more than ten years.

For the fs/QCA, all conditions and the outcome were calibrated into fuzzy sets with values ranging from 0 to 1 (Ragin, 2000). In accordance with established procedures (Campbell et al., 2016; Fiss, 2011; Ragin, 2008), cases were anchored at full membership (90th percentile), full non-membership (10th percentile), and the crossover point (50th percentile). As the variables were measured on a seven-point Likert scale with distributions diverging from theoretical anchors, direct calibration was applied to minimize measurement error. To ensure precise crossover assignment, a minor constant (0.001) was added, consistent with prior studies (Fiss, 2011; Ragin, 2008).

Job complexity was measured using four items adapted from Zacher and Frese (2011), aligned with Morgeson and Stephen's (2006) definition, capturing task difficulty, decision-making demands, and cognitive requirements. Responses were recorded on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree). Cronbach's $\alpha = 0.85$.

Career prospects were assessed with ten items based on Wan et al. (2014), reflecting perceptions of compensation, advancement, promotion, and long-term career opportunities (e.g., "promotion possibilities in the industry are satisfactory"). Responses were recorded on the same 7-point Likert scale. Cronbach's $\alpha = 0.88$.

Organizational dependence was assessed using the multidimensional scale developed by Luo, Chen (2024), which captures four dimensions: technology, relational, emotional, and benefit dependence. Each dimension was measured with multiple items reflecting distinct aspects of organizational reliance (e.g., "my skills and talents are fully utilized in my work"; "the company performs well in signing and fulfilling labor contracts"; "the relationships between colleagues in the department are quite harmonious"; "the company offers generous salary and benefits"). Cronbach's α values were 0.87, 0.90, 0.86, and 0.87, respectively.

Employees' work engagement was assessed using the UWES-9 scale developed by Schaufeli et al. (2006). A representative item is "At my work, I feel bursting with energy." The scale demonstrated high internal consistency (Cronbach's $\alpha = 0.93$). Table 1 reports the conditions, calibration anchors, and descriptive statistics.

Table 1.
Sets, calibrations and descriptive statistics

Sets	Fuzzy-set calibrations			Descriptive statistics			
	Full in (90%)	Crossover (50%)	Full out (10%)	Mean	SD	Min	Max
Employee work engagement	6.1	5.3	3.7	5.52	1.28	1.5	7
Job complexity	6.3	5.2	3.2	4.8	1.2	1.4	7
Career prospects	6.7	5.5	2.5	5.8	0.8	1.8	6.3
Technology dependence	7	5.4	3.1	4.4	1.2	1	7
Relational dependence	6.8	5	3.7	4.3	1	1	7
Emotional dependence	6.7	4.5	3.3	5	1.1	1.5	7
Benefit dependence	6.9	5.2	2.9	5.5	1.2	1.5	7

Source: own study.

4. Results

As a first step, an analysis of necessary conditions was conducted for all six conditions included in the study. The objective of this analysis was to determine whether any of the conditions were indispensable for achieving high of low levels of work engagement in the model. Following prior research (Kwiotkowska, 2024; Du, Kim, 2021; Greckhamer et al., 2018), a fuzzy-set analysis of necessary conditions was performed, applying a consistency threshold of 0.90. The results of this analysis are presented in Table 2. The findings indicate that neither the presence nor the absence of any of the six conditions constitutes a necessary requirement for attaining high or low work engagement. This outcome reinforces the expectation of causal complexity within the model.

Table 2.
Results of necessary condition analysis

Conditions	High work engagement		Low work engagement	
	consistency	coverage	consistency	coverage
Job complexity	0.72	0.39	0.77	0.38
~ Job complexity	0.37	0.78	0.37	0.72
Career prospects	0.84	0.83	0.81	0.38
~ Career prospects	0.33	0.39	0.38	0.41
Technology dependence	0.76	0.74	0.71	0.38
~ Technology dependence	0.79	0.77	0.41	0.74
Relational dependence	0.41	0.43	0.76	0.33
~ Relational dependence	0.75	0.40	0.73	0.73
Emotional dependence	0.52	0.83	0.44	0.37
~ Emotional dependence	0.76	0.51	0.76	0.42
Benefit dependence	0.36	0.4	0.34	0.43
~ Benefit dependence	0.71	0.79	0.38	0.71

Source: own study.

Following the analysis of necessity, a sufficiency analysis was performed. The frequency threshold for sufficiency analysis is generally determined by sample size (Schneider, Wagemann, 2012). For studies based on small- or medium-sized samples, this threshold is

typically set at 1. In line with the recommendations of Du et al. (2017), the PRI consistency threshold was set at 0.80, while the consistency threshold for the truth table was established at 0.85.

Consistent with prior research practices, this study reports both the intermediate and parsimonious solutions generated using fsQCA 3.0 software. According to the guidelines proposed by Ragin (2008), conditions that appear in both the intermediate and parsimonious solutions were classified as core conditions, whereas those present only in the intermediate solution were designated as peripheral conditions. Consequently, the subsequent statistical interpretation focused exclusively on the parsimonious and intermediate pathways.

Table 3 reports the sufficiency analysis, identifying two sets of pathways associated with high work engagement (configurations HC1a/HC1b and HC2a/HC2b). Considering the causal asymmetry of fs/QCA, additional analysis was performed for low work engagement outcomes. The corresponding configurations (LC1, LC2a, LC2b) are presented in Table 4. Consistent with prior research, "●" was used to indicate the presence of a core condition, "⊗" to indicate its absence, "•" to represent the presence of a peripheral condition, and "⊗" to represent its absence (Fiss, 2011). A blank space was applied to denote an "irrelevant" condition.

According to the results presented in Table 3, both configurations HC1a and HC1b demonstrated identical core conditions, namely the presence of emotional and benefit dependence alongside the absence of job complexity, which jointly served as the primary drivers of elevated work engagement. Nevertheless, the peripheral conditions differentiated the two configurations. In configuration HC1a, relational dependence was absent, technology dependence was present, and career prospects were classified as irrelevant. In contrast, in configuration HC1b, career prospects functioned as a peripheral condition, technology dependence was low, while relational dependence was considered irrelevant.

Table 3.
Configurations related to high work engagement

Conditions	**High work engagement**			
	HC1a	**HC1b**	**HC2a**	**HC2b**
Job complexity	⊗	⊗	●	●
Career prospects		•		
Technology dependence	•	⊗	●	●
Relational dependence	⊗			•
Emotional dependence	●	●	•	
Benefit dependence	●	●	•	
Raw coverage	0.281	0.294	0.407	0.257
Unique coverage	0.198	0.034	0.035	0.071
Consistency	0.921	0.958	0.946	0.891
Overall solution coverage	0.666			
Overall solution consistency	0.903			

Source: own study.

Table 4.
Configurations related to low work engagement

Conditions	Low work engagement		
	LC1	**LC2a**	**LC2b**
Job complexity	⊗		
Career prospects	●	●	
Technology dependence		⊗	⊗
Relational dependence	⊗		●
Emotional dependence		⊗	⊗
Benefit dependence	⊗	⊗	⊗
Raw coverage	0.387	0.421	0.388
Unique coverage	0.054	0.029	0.063
Consistency	0.985	0.934	0.899
Overall solution coverage	0.509		
Overall solution consistency	0.912		

Source: own study.

Taken together, these findings suggest that the presence or absence of technology dependence did not alter the explanatory power of the core conditions-emotional and benefit dependence combined with the absence of job complexity-in fostering high levels of work engagement.

For configurations HC2a and HC2b, technology dependence and job complexity emerged as the core conditions driving high levels of work engagement, while the peripheral conditions distinguished the two configurations. In HC2a, the presence of emotional dependence and benefit dependence functioned as supportive factors, whereas in HC2b, relational dependence fulfilled this role. The difference between HC2a and HC2b thus lies in the peripheral conditions associated with high work engagement. Specifically, these results indicate a substitution effect, whereby emotional and benefit dependence in HC2a can be replaced by relational dependence in HC2b without altering the outcome of elevated work engagement.

The sufficiency analysis for low levels of work engagement, as presented in Table 4, identifies two broad categories of causal configurations (LC1 and LC2a/LC2b). Configuration LC1 is characterized by the core absence of job complexity, relational dependence, and benefit dependence, suggesting that insufficient task challenges, weak interpersonal ties, and inadequate organizational rewards jointly undermine employees' engagement with their work. In contrast, configurations LC2a and LC2b highlight a different causal pathway, wherein the core absence of technology dependence and emotional dependence, combined with the core presence of job complexity, is central to explaining reduced engagement. This indicates that when employees perceive their work as cognitively demanding but lack both emotional connection to the organization and reliance on technological resources, their engagement tends to diminish. Taken together, these findings demonstrate that low levels of work engagement may emerge through multiple and non-equivalent pathways, underscoring the principle of causal asymmetry in fs/QCA. They also reveal that both the absence of supportive

organizational dependencies (relational, emotional, and benefit-related) and the misalignment between job demands and technological reliance can serve as critical barriers to sustaining work engagement.

To evaluate the robustness of the fs/QCA findings, sensitivity analyses were conducted by modifying the calibration and consistency parameters. First, the cross-over point was shifted from the 50th to the 55th percentile, and the results indicated no changes to the complex, intermediate, or parsimonious solutions. In addition, calibration anchors were adjusted by defining full membership and full non-membership at the 90th and 10th percentiles of the distribution, respectively, while the consistency cutoff was systematically varied by ± 0.5. The evaluation focused on potential alterations in the number and composition of configurations, as well as in their consistency and coverage values. Across all specifications, no substantive differences were detected, thereby reinforcing the reliability and validity of the results.

5. Discussion

In line with the principle of equifinality, the analysis identified four distinct configurations leading to high levels of work engagement and three configurations associated with low work engagement. Importantly, due to causal asymmetry, the conditions that prevent high engagement are not identical to those that generate low engagement. This empirical finding highlights that the drivers of engagement differ fundamentally from the factors that fail to support it. Such an observation constitutes a significant theoretical contribution, as it provides a more nuanced understanding of both the enabling and constraining mechanisms of employee work engagement. Notably, the overall solution coverage for high engagement was greater than for low engagement, suggesting that employees are more likely to experience conditions conducive to strong engagement. This finding underscores the predominance of positive drivers of engagement in organizational contexts, indicating that fostering supportive configurations is more impactful than merely eliminating unfavorable ones. Although the findings suggest that certain factors are pivotal for achieving specific outcomes - for instance, the combination of emotional dependence and benefit dependence or the interplay of job complexity and technology dependence appear in configurations leading to high work engagement, while the absence of job complexity, relational and benefit dependence or the absence of technology and emotional dependence emerge in configurations leading to low engagement - most results are considerably more nuanced. This complexity reinforces the importance of examining interaction effects holistically rather than focusing solely on individual variables, thereby highlighting the configurational nature of employee work engagement.

Configurations HC1a and HC1b highlight, based on their core conditions, a pathways that fosters high levels of employee work engagement in the digital era. When organizations address emotional dependence and benefit dependence, while simultaneously addressing job complexity, they create a supportive environment in which employees feel valued, understood, and secure in their roles. Emotional suport, manifested through effective communication and opportunities for collaboration, plays a crucial role in strengthening employees' sense of belonging and mitigating anxieties associated with technological change (Ahmed et al., 2016). Such support enhances employees' psychological resilience, providing a foundation for managing uncertainty and the challenges that accompany technological advancement.

At the same time, the provision of tangible benefits, such as fair compensation, career development opportunities, and job security, reinforces employees' trust in the organization's commitment to their well-being. These benefits foster a sense of stability and confidence in the future, enabling employees to embrace change, acquire new skills, and pursue growth opportunities. By integrating both emotional and benefit dependence, organizations enhance employees' adaptive capacity, thereby enabling them to navigate technological transformations more effectively.

Configurations HC2a and HC2b indicate that high levels of employee work engagement are primarily driven by job complexity and technology dependence. The implementation of advanced digital technologies not only enhances production efficiency, reduces costs, and improves product quality (Tang et al., 2022), but also creates conditions that require greater flexibility and adaptive capacity from employees. Within this context, job complexity emerges as a critical determinant of organizational behavior. On the one hand, it fosters the development of analytical skills and problem-solving capabilities; on the other, it stimulates employees to adopt innovative behaviors as a means of responding to the increasing demands of the technological environment (Zacher, Frese, 2011). Task complexity therefore contributes to a work setting in which innovativeness becomes a natural mechanism for addressing emerging challenges. Simultaneously, technology dependence intensifies the necessity for continuous professional development. Employees are compelled to systematically expand their competencies in order to keep pace with technological change and to utilize new tools and work methods effectively. In this sense, commitment to ongoing learning and development becomes a prerequisite for maintaining both individual and organizational performance and competitiveness. Taken together, the interplay between job complexity and technology dependence not only enhances employee engagement but also promotes the cultivation of pro-innovative attitudes, which are essential for the effective implementation of digital transformation initiatives.

Based on the sufficiency analysis for low levels of work engagement, the findings indicate the existence of two principal pathways, defined by core conditions, that lead to reduced employee engagement in the era of digital transformation. Configuration LC1 indicates that the lack of relational dependence, benefit dependence, and job complexity may lead to a decline

in employee work engagement. Insufficient relational dependence fosters feelings of isolation and limits access to the support and resources necessary for effective performance within the organization (Wood et al., 2016). Similarly, benefit dependence plays a crucial role in sustaining engagement by providing employees with a sense of appreciation and adequate rewards for their contributions. Elements such as fair compensation, job security, and opportunities for advancement represent fundamental aspects of this dependence. The absence of these benefits can result in feelings of underappreciation and diminished motivation to actively participate in organizational life. Furthermore, low job complexity restricts the development of cognitive processes and reduces the need for engagement in diverse activities, thereby weakening employees' willingness to take on challenges and fully commit to their work (Ahmed et al., 2018). Consequently, the absence of these conditions creates an environment in which employees feel disconnected, undervalued, and deprived of developmental opportunities, ultimately leading to reduced levels of work engagement.

The configurations LC2a and LC2b indicate that job complexity, when combined with the absence of technology dependence and benefit dependence, can lead to low levels of work engagement during digital transformation. This finding highlights that job complexity, although often regarded as a driver of problem-solving, innovation, and adaptive behavior (Zacher, Frese, 2011; LePine, 2005), requires adequate technological and organizational support to function as a motivating factor. In the absence of technology dependence, employees lack access to digital tools that could help them manage complexity more effectively, transforming job complexity from a developmental challenge into a source of strain and overload. Similarly, the lack of benefit dependence signals insufficient organizational rewards, such as fair compensation, job security, and career opportunities, which reduces employees' motivation to invest effort in demanding tasks.

In summary, traditional approaches to studying work engagement often assume linear and symmetrical relationships between variables (Knight et al., 2017), thereby overlooking the potential for nonlinearity and causal asymmetry. By employing the fs/QCA method, this study extends the scope of inquiry beyond conventional models, allowing for a more nuanced understanding of the complex interdependencies among conditions. For example, Configuration LC1 demonstrates that the simultaneous absence of relational dependence, benefit dependence, and job complexity is associated with reduced work engagement. This finding underscores the inherently nonlinear and asymmetric nature of the pathways leading to work engagement outcomes. By accounting for equifinality and nonlinear dynamics, this study uncovers diverse configurations that shape work engagement, offering deeper insights into the underlying mechanisms. This methodological approach allows organizations to recognize and respond to distinct constellations of factors that undermine work engagement, thereby strengthening their capacity to cultivate committed and productive work environments in the digital era.

Moreover, this study contributes to the literature on employee behavior. It expands the body of research on employee behavior by addressing the call for studies examining the role of the digital environment in fostering employee behaviors (Nambisan et al., 2019). By incorporating organizational dependence and job characteristics, this research systematically investigates the causal relationships shaping employee work engagement from a configurational perspective. The findings provide practical implications for organizations seeking to motivate employees toward work engagement under diverse conditions and demonstrate that the key distinction in these configurational outcomes lies in employees' heterogeneous understanding of organizational dependence and job characteristics. From an integrated perspective, this study examined the impact of the organizational environment on employee behavior, with a specific focus on work engagement in organizations undergoing digital transformation. At the micro level, prior empirical research analyzing such influences has been limited. Addressing this gap, the present study explored how organizational contexts shape work engagement within a single research design, thereby contributing to the growing body of literature on the interplay between organizational factors and employee engagement.

The study also provides empirical insights that can assist managers in designing targeted interventions aimed at enhancing employee work engagement. By identifying specific pathways and critical determinants of engagement, the findings offer actionable guidance for organizations. In particular, organizations should foster a combination of employees' emotional dependence and benefit dependence. While digital technologies enhance efficiency, they cannot replace meaningful interpersonal connections. Managers should therefore foster open communication, empathy, and collaboration to create a supportive and human-centered culture. At the same time, fair compensation, recognition of contributions, and career development opportunities are essential for maintaining trust and long-term engagement.

In addition to this relational and benefit-oriented pathway, the findings highlight a second complementary mechanism: the interplay between job complexity and technology dependence as a critical driver of employee engagement in the digital era. On the one hand, complex tasks stimulate the development of analytical skills, foster innovativeness, and encourage employees to adopt more creative approaches. On the other hand, increasing reliance on technology necessitates continuous competence development and a commitment to lifelong learning. The synergy of these two factors not only promotes higher levels of engagement but also cultivates pro-innovative attitudes, which are essential for the successful implementation of digital transformation processes.

Together, these insights emphasize the necessity of balancing supportive, human-centered practices with the strategic use of task complexity and technological advancements in order to sustain employee engagement in the digital era.

Although this study sheds light on important aspects of employee work engagement, it is important to recognize that many other factors may also shape these dynamics in the digital era. The scope of the research, the size and composition of the sample, as well as the chosen methodological approach, inevitably place certain limits on the generalizability of the findings. To build on these results, future research should broaden its lens by incorporating additional variables that may play a role in shaping engagement. Larger and more diverse samples, spanning different sectors and organizational contexts, would allow for more robust conclusions. Furthermore, investigating elements such as cultural settings, leadership approaches, and organizational design could offer a richer and more nuanced understanding of how engagement is fostered and sustained in environments increasingly shaped by digital transformation.

6. Conslusion

The conducted study, based on the application of fuzzy-set Qualitative Comparative Analysis (fs/QCA), enabled the identification of complex configurations of factors determining employee work engagement in the digital era. The findings reveal both mechanisms that foster and hinder engagement, highlighting the importance of a configurational perspective in the analysis of organizational behavior. The conclusions drawn have significant practical implications, they can support organizations in designing strategies tailored to the specific characteristics of their environment and the needs of their employees. A better understanding of the interactions between organizational and technological factors facilitates the creation of work environments that promote innovation, motivation, and long-term engagement in the context of dynamic digital transformation.

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