Worker-Management Interactions in Digital Technologies Acceptance: A Multiple-Case Study

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Abstract

To better support the digital transformation in industrial contexts, it is necessary to investigate why users accept or reject digital technologies. This study aims to understand the rationale behind the implementation of digital technologies in manufacturing firms and the key factors influencing employee acceptance. Through a multiple-case study in five manufacturing companies, the research reveals that acceptance is shaped by dynamic worker-management interactions, emotional responses, and employee involvement in decision-making. Findings suggest expanding existing models like UTAUT to reflect these dimensions, while offering practical and policy-relevant insights to support more effective, human-centered implementation of digital technologies on the shop floor.

Keywords: Digital transformation, Acceptance, Industry 4.0

Introduction

The so-called Fourth Industrial Revolution, coupled with the demand for more competitive products in shorter timeframes, has underscored the need for workers to interact rapidly with new digital technologies. To better explain and support the digital transformation in industrial contexts, it is necessary to investigate why users accept or reject digital technologies. In doing so, academics and practitioners may be able to understand how to engage employees to effectively implement them and leverage workers' skills and expertise (van Dun and Kumar, 2023).

Technology acceptance is influenced by a number of antecedents, which have been extensively studied through models such as the Unified Theory of Acceptance and Use of Technology (UTAUT). This model identifies determinants including performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh *et al.*, 2003). However, recent literature reveals that digital technologies' acceptance is often more dynamic and complex, shaped by continuous interactions between workers and management. For instance, involving employees in decision-making for technology adoption can significantly influence their willingness to use it, particularly when their feedback leads to meaningful changes (Klein *et al.*, 2024). Therefore, this study aims to: (1) understand the rationale behind the implementation of digital technologies in manufacturing firms, (2) analyze the key antecedents of employee acceptance and resistance, and (3) examine the dynamics and interactions between workers and management that shape employee acceptance.

This study makes a significant contribution to the academic understanding of technology acceptance by highlighting the dynamic interactions between workers and management in shaping digital transformation. It suggests expanding existing models, such as UTAUT, to incorporate factors like employee involvement, evolving workplace dynamics and emotions. For industry, the findings emphasize the importance of engaging workers in decision-making, since addressing their concerns and reactions can enhance acceptance, with the potential to improve both efficiency and job satisfaction. Furthermore, it is imperative for firms to allocate resources into environments that facilitate employee engagement and into training programs that align with employees' skills and needs. This will ensure a smoother transition to digital workflows. Finally, the study underscores the need for policies that encourage reskilling initiatives, to protect workers from unintended consequences of automation, and to foster industry standards that balance technological advancements with human-centered implementation strategies.

Theoretical background

Digital technologies are characterized by their embeddedness in material artifacts and their high degree of interconnectivity, communicative capability, editability, and reprogrammability (Benbya *et al.*, 2020). These features originate from symbol-based computation, which utilizes binary strings (0s and 1s) as a universal language to encode, process, and generate diverse tasks and cognitive processes (Faulkner and Runde, 2019). This symbolic computation facilitates continuous interactions between material artifacts and human agency, leading to the ongoing mutual redefinition of both elements and the evolution of dynamic sociotechnical systems.

Traditionally, the Unified Theory of Acceptance and Use of Technology (UTAUT) model has approached technology adoption from a deterministic standpoint, conceptualizing the sociotechnical system as an external factor that shapes individual behaviors (Johns, 2006; Venkatesh *et al.*, 2016). Within this framework, individuals' adoption and use of technologies are understood to be influenced by their perceptions of performance expectancy, effort expectancy, facilitating conditions, and social influence, including managerial and peer expectations (Lee *et al.*, 2003; Venkatesh *et al.*, 2008). Consequently, the UTAUT model is grounded in a subject-object dualism, portraying technologies as predefined artifacts and the social environment as a set of situational factors that influence behavior.

However, the dynamic nature of sociotechnical systems in the context of digital transformation challenges this deterministic perspective, instead supporting a complementary view of technology based on social affordances (Orlikowski and Scott, 2008). This social constructivist perspective, which contrasts with "early contingency theorists who championed materialistic determinism" (Leonardi and Barley, 2010), posits that technologies are not merely predefined artifacts but rather affordances that enable different enactments in practice, depending on how individuals engage with them (e.g., Leonardi and Barley, 2010; Orlikowski, 2000). In this view, material artifacts and human agency interact through processes such as imbrication (Leonardi, 2011), collaborative tuning (Barrett *et al.*, 2012), and mutual adaptation between technology and organizational contexts (Leonard-Barton, 1992), thereby reinforcing the dynamic nature of sociotechnical systems (Sandberg *et al.*, 2025).

These two contrasting perspectives—technology as a deterministic context versus technology as a socio-material affordance—offer valuable insights for the analysis of the findings of this multiple-case study. By juxtaposing these conceptual frameworks, this study aims to provide a more nuanced understanding of how digital technologies influence user acceptance and, reciprocally, how users adapt these technologies to enhance and facilitate their adoption.

Methodology

Considering the exploratory nature of this research, a multiple case-based grounded theory approach was utilized (Corbin and Strauss, 1990). Grounded theory is a suitable methodology for process analysis and therefore aligns well with examining employee communication and engagement dynamics in the context of digital transformation (Langley, 1999).

A theoretical sampling strategy was employed to advance current knowledge on technology acceptance, ensuring a targeted selection of cases aligned with the study's research objectives (Yin, 2015). The selected cases share four key commonalities: first, the firms are of similar size and at comparable stages of digital transformation, ensuring the transferability of findings; second, all belong to the manufacturing sector and have implemented digital technologies in their production operations; third, the transformation process engaged various stakeholders across the organizational hierarchy; and fourth, their employees are expected to use digital technologies in their daily tasks. The information regarding the selection of cases was obtained from the websites of the firms in question, as well as from databases and consultancy reports. Furthermore, the authors had prior experience with some of these companies as a result of their involvement in previous research projects.

Data collection utilized multiple sources to enable triangulation across methods, including site visits, semi-structured interviews with managers responsible for digital transformation initiatives, and individual interviews with operators who interact with the technology in their daily tasks (Eisenhardt, 1989). The sites of five firms were visited to assess their level of digital technologies adoption. During these visits, preliminary interviews were conducted with key informants, and factory tours were carried out. Additionally, plans were made to organize interviews with operators directly involved in the daily use of digital technologies. Interviews with managers and operators were subsequently conducted following the conditions established during the preliminary visits and using a research protocol. Additional plant visits were conducted as required. After the exclusion of two firms—one of which was used as a pilot company to validate the research protocol—the selection process continued with the exclusion of a second firm due to the nascent stage of their digital technology adoption. The remaining five firms satisfied the selection criteria and were suitable for data analysis.

The primary focus of the data analysis is grounded in a series of 31 interviews conducted between June 2024 and April 2025. These interviews, each spanning between 45 and 70 minutes for managers and between 15 and 30 minutes for operational staff, were meticulously designed to minimize disruption to their daily routines. The case studies were conducted in the same manner, with participants being interviewed with a structured questionnaire during the interviews. The objective of this approach was to facilitate cross-case analysis, with the aim of identifying compatible patterns across the companies. This process was undertaken to ensure the internal validity of the findings (Yin, 2015). Table 1 provides an overview of the case studies.

Table 1 – Case study overview.

	Case A	Case B	Case C	Case D	Case E
Sector	Manufacture of agricultural tractors	Manufacture of transmission elements	Manufacture of electric domestic appliances	Manufacture of electric domestic appliances	Manufacture of air and spacecraft and related machinery
No. of field visits	2 visits	2 visits	1 visit	1 visit	1 visit
Adopted digital technologies	Digital work instructions, material traceability system	Digital work instructions, material traceability system	Digital work instructions, material traceability system	Digital work instructions, MES	To be finalized
Number of interviewees	2 managers; 6 employees	2 managers; 4 employees	2 managers; 5 employees	2 managers; 6 employees	2 managers

Regarding the analysis, it is important to note that all interviews were transcribed verbatim. In order to facilitate the content analysis, an initial open coding of the transcriptions was conducted to identify determinants and factors that either facilitated or hindered employee acceptance. Subsequently, the identified factors were grouped into broader acceptance antecedents through axial coding, aligned with their potential contribution to the UTAUT model. These first-order coding steps followed an inductive approach (Gioia *et al.*, 2013), informed by existing literature on digital transformation and technology acceptance. Then, the antecedents were deductively categorized into a framework based on the core constructs outlined by the UTAUT model.

Finally, the data collection plan involves the engagement of seven to eight manufacturing companies, aligning with the recommendations for multiple-case study designs (Barratt *et al.*, 2011).

Results

Preliminary results from the multiple-case analysis are promising, shedding light on the rationale behind digital technology implementation, identifying key antecedents of employee acceptance, and underscoring the critical role of communication dynamics between management and employees in fostering the acceptance of digital technologies.

Table 2. Data structure.

First-order coding: acceptance antecedents	Second-order coding: thematic categories	Aggregate dimensions
Error reduction	*Perception of enhanced work productivity*	Performance expectancy
Technology not working as expected		
Purpose of technology not clear		
Less effort to complete tasks		
Technology providing more information		
Greater autonomy		
Time savings	*Task efficiency enhancement*	
Less tasks to be performed		
Technology supports my work		
Perceived job insecurity	*Career and job-related impacts*	
Job insecurity not perceived		
Relying on past experience	*Employee readiness*	Facilitating conditions
Initial training only		
Learning on the job		
Lack of knowledge		

Technical support available	*Organizational readiness*	
Problems can only be solved with support		
Compatibility and integration problems		
Support from younger colleagues		
Participation in technology selection	Employee engagement	
Involvement in technology roll-out		
Participation in technology improvement		
Management support	Managers' influence	Social influence
Perception of being monitored		
Unexpected top-down implementation		
Indifference perception of problems		
Colleague use	Colleagues' influence	
Younger colleagues like to use technology		
Colleagues do not see the value of technology		
Colleagues fear technology adoption		
Technology implementation introduced by a colleague		
Learning from a peer		
Increased system complexity	*Implementation effort*	Effort expectancy
Ease of learning		
Gradual implementation		
Ease of use	*Use effort*	
Task clarity		
Perception of increased workload		

Performance expectancy emerged as a central determinant of acceptance, with employees across firms acknowledging the value of digital tools in improving productivity, reducing errors, and enhancing autonomy. Technologies such as barcode scanners and automated interfaces were praised for providing clearer instructions, reducing repetitive work, and minimizing mistakes. These features reinforced employee perceptions that digital tools could improve work quality and efficiency. However, some interviewees reported uncertainty about the purpose or long-term use of the technologies, especially when benefits were not clearly communicated. This suggests that while performance improvement expectations drive acceptance, clear objectives and shared understanding of benefits are also important.

Facilitating conditions reflected both structural and experiential elements that influenced adoption. Many workers reported limited formal training and described relying on peer support or experiential learning to adapt. In particular, experienced employees highlighted how traditional skills remained essential in managing breakdowns or technical issues, demonstrating the importance of hybrid knowledge in digital environments. Some companies lacked sufficient internal expertise, which contributed to uneven implementation experiences. These findings emphasize that successful adoption depends not only on infrastructure and resources, but also on the availability of contextualized support mechanisms that respond to users' skill levels and knowledge bases.

Social influence acceptance antecedents' also played a key role in shaping attitudes. Peer collaboration and the presence of informal technology champions supported smoother adoption and helped reduce resistance, especially among less digitally fluent employees. However, in cases where technologies were implemented top-down without clear communication, workers felt disoriented or monitored, which undermined trust. The establishment of a culture that prioritizes shared understanding and ongoing dialogue was found to be of great relevance in the companies under analysis in aligning individual acceptance with organizational objectives.

Finally, effort expectancy was commonly linked to increased cognitive load and system complexity. Many employees reported that adjusting to multiple systems simultaneously—sometimes with minimal training—led to frustration or fatigue. The perception that digital tools added tasks rather than simplifying them also created resistance. Nonetheless, in cases where technologies provided intuitive interfaces or were introduced progressively, workers reported greater ease of use and engagement. These insights highlight that sustained acceptance depends on minimizing unnecessary complexity, aligning technologies with users' workflows, and ensuring continuous support throughout the implementation process.

Table 3. Emotion-related results.

Illustrative statement	**Second-order coding: emotion**	**Aggregate dimensions**
"In some jobs, technology is more than useful, and it's not just beneficial, it also facilitates small tasks where a person isn't needed in the end" (C1W4)	*Enthusiasm*	Technology as an opportunity
"Thanks to the technology, good levels have been reached, in the sense that we know in advance when the material will arrive. When it arrives, I say that I already have the necessary, then I start the task" (C1W1)	*Satisfaction*	
"Before we were quite blocked, now there is more freedom regarding quality and discarding pieces" (C2W4)	*Confidence*	Technology as a reliable support
"Thanks to the visual support, you see the image of a machine of which you may manufacture only a few units, and the procedure and what you need to do immediately come to mind" (C1W6)	*Reassurance*	
"I am more relaxed, more serene, because if there is some error I notice it immediately. Before instead we had to go looking to see half an hour, an hour to understand where the kit was, where it wasn't, who did it, who didn't do it, instead now with the excuse that everything is traced, fortunately many problems have been reduced to a minimum" (C1W4)	*Serenity*	
"Let's say I don't have a computer at home, and in my previous job I didn't need to use one either. Then I was paired with two colleagues, and it was tough to learn because we have so many new systems, and in less than a year we had to learn them all — and it wasn't easy" (C2W4)	*Overwhelm*	Technology as a source of pressure
"Another problem is that, for the past year, the firm has yet to define who should be the person to intervene in case of problems. But for example, this week Marco is on vacation — if anything happens, I don't know who's available" (C1W4)	*Anxiety*	
"Other people might be afraid that technology will replace their jobs. Especially older workers have this fear, and they are people who have nothing to do with technology in their work" (C4W4)	*Fear*	Technology as a threat to control
"The technology was implemented… To show what? To you, or to whoever visits, that everything looks nice and high-tech?" (C1W2)	*Anger*	
"The introduction of the technology was all a bit unexpected, and they immediately put me to work" (C4W4)	Apathy	Technology as an imposition
"The technology is fine but it could actually increase the workload" (C4W5)	Mistrust	

The cross-case analysis revealed that employee acceptance of digital technologies is not only driven by functional expectations and contextual conditions but is also deeply intertwined with emotional responses. These emotions reflect how workers interpret and engage with digital technologies over time, as well as how they perceive their own role and agency in the process.

Employees' positive perceptions of digital technologies, such as enthusiasm and satisfaction, engendered a sense of opportunity. Employees expressed appreciation for tools that reduced errors, clarified procedures, and saved time, particularly when technologies simplified complex processes or removed redundant manual tasks. These positive emotions were more pronounced when employees saw a clear connection between technology use and tangible work improvements.

In contexts where support mechanisms were available—such as knowledgeable peers, intuitive systems, or responsive technical teams—employees reported a strong sense of confidence, reassurance, and serenity. These emotions were especially prevalent when workers were able to rely on help during breakdowns or when they had learned the system through hands-on experience. The feeling of being in control, particularly when technical knowledge was built gradually or transferred among colleagues, contributed to more resilient and proactive user behavior.

In contrast, when employees perceived a lack of preparedness or found themselves overwhelmed by complex systems and multiple interfaces, emotions such as anxiety, overwhelm, and mistrust surfaced. These negative emotions were intensified when training was insufficient or when communication about implementation was vague. For instance, workers described situations where they were expected to use new technologies without understanding their purpose or receiving adequate instructions—circumstances that led to uncertainty and emotional strain. In some cases, these conditions gave rise to apathy, where employees disengaged emotionally from the technology, perceiving it as an obstacle rather than a tool.

The most acute emotional tensions emerged when digital technologies were experienced as impositions rather than opportunities. In these cases, implementation was top-down, and employees were given little say or forewarning. Interviewees described moments when they were "put to work straight away" without understanding how the technology would impact their job or long-term role. These conditions often generated fear (e.g., of job loss), resignation, or resistance, especially when the introduction of technology coincided with unclear expectations about job stability or evolving responsibilities. The absence of participatory design, combined with poor communication, thus triggered emotional responses that actively hindered acceptance.

Taken together, these findings demonstrate that emotional responses are not peripheral but central to the acceptance process. Emotions act as a barometer for how employees experience technology in real time—shaped by trust, task clarity, involvement, and perceived value among other antecedents. Significantly, these emotions evolve, suggesting that acceptance is a dynamic and ongoing process that must be actively supported by management through communication, responsiveness, and emotional awareness. Recognizing and managing these emotional dimensions is key to fostering not only functional integration but also employee well-being in digital transformation contexts.

Conclusions

This study provides novel insights into the processes and dynamics that shape employee acceptance of digital technologies in manufacturing settings. While prior research has predominantly focused on generalized models of technology acceptance, this multiple-case study emphasizes the situated nature of acceptance as it unfolds through ongoing interactions between workers and management. In contrast to top-down, prescriptive approaches, the findings underscore the importance of participatory practices, contextual adaptation, and open communication in promoting digital transformation success on the shop floor.

By identifying key determinants—such as management support, participatory decision-making, peer collaboration, and training adequacy—the study offers operational guidance for managers overseeing digital initiatives. It also reveals that acceptance is not solely shaped by functional expectations but is strongly influenced by workers' emotional responses, including confidence, reassurance, overwhelm, and engagement. These findings highlight the need to treat acceptance not only as a cognitive or rational process but also as an affective one. Emotional responses are triggered by both enabling and hindering factors, such as increased workload or improved autonomy, and evolve throughout the implementation process.

This research holds significant implications for practitioners, policymakers, and scholars. For managers, the study provides actionable strategies to tailor communication, involve workers meaningfully, and adapt technologies to workplace realities. By doing so, organizations can reduce resistance, enhance engagement, and foster a sense of shared ownership in transformation efforts. For policymakers, the findings suggest the value of supporting initiatives that improve facilitating conditions, such as targeted training and communication infrastructure, as part of a more human-centric digital transition agenda.

Academically, the study complements and extends existing models such as UTAUT by demonstrating that acceptance antecedents are not uniformly distributed among users and that acceptance is often negotiated through dynamic, bidirectional exchanges. Future research should explore how different configurations of antecedents—both cognitive and emotional—emerge in practice and how they interact with organizational structures, job roles, and employee identities. A comprehensive understanding of the intricacies involved in technology acceptance is of great relevance for the development of more adaptable and inclusive models of technology acceptance. These models must reflect the actualities of digital transformation in industrial contexts. However, the incorporation of emotional dimensions introduces additional layers of complexity, potentially rendering acceptance models more subjective constructs contingent on the individual and his or her context, and less predictive.

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