



Reimagining Work Identity: Emotional and Cognitive Shifts in Robotic Workspaces

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ABSTRACT

As industrial automation becomes increasingly prevalent, factory workers face not only structural changes in their job roles but also significant psychological transformations. This study investigates how factory operators reconstruct their professional identities and emotional frameworks amidst the integration of robotic systems in manufacturing environments. Using Interpretative Phenomenological Analysis (IPA), twelve operators from two Southeast Asian factories were interviewed to uncover their subjective interpretations of this technological shift. The findings reveal five interconnected themes: fear of redundancy, emotional ambivalence toward robotic systems, struggles in technological adaptation, identity redefinition, and perceived inequity in organizational support. Participants expressed a complex spectrum of emotions ranging from anxiety and alienation to empowerment and renewed self-worth. Notably, some operators evolved from resistance to acceptance, transforming their roles from manual laborers to tech-savvy contributors. This emotional and cognitive journey underscores that automation is not merely a technical innovation but a human challenge involving adaptation, meaning-making, and identity negotiation. The study highlights the necessity for empathetic, inclusive strategies in managing industrial change, emphasizing both emotional well-being and equitable access to training. By shifting the lens from productivity metrics to personal narratives, this research offers vital insights for organizational leaders, policy makers, and scholars interested in the intersection of technology and human experience in Industry 4.0 contexts.



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INTRODUCTION

In recent decades, industrial environments have rapidly transformed due to the widespread adoption of robotic and automated technologies (Aliyana dkk., 2024). This shift, driven by promises of increased efficiency, precision, and cost-effectiveness, has reshaped modern manufacturing worldwide (Huang dkk., 2024; Ymeri dkk., 2023). Particularly within Industry 4.0, automation has evolved from isolated machinery to integrated systems, replacing tasks once performed by human operators. As factories increasingly rely on intelligent machines, the nature of human work is being redefined.

While the technical and economic implications of automation have been extensively studied, less attention has been given to its impact on the lived experiences of workers who engage with such technologies on a daily basis (Azimi dkk., 2024; Feldman dkk., 2023). For many factory operators, the transition to automated systems signifies more than a procedural change; it involves a profound shift in identity, role, and sense of purpose within the workplace. This phenomenon holds critical relevance in sociocultural contexts where labor is deeply intertwined with personal dignity and community status. The subjective dimensions of this transformation such as anxiety, loss of control, and adaptive learning remain insufficiently explored despite their significance in shaping worker engagement and well-being.

Given this backdrop, there is a growing need to understand how individuals experience and make sense of these technological changes within their unique social and cultural contexts (Argent dkk., 2019). Exploring the meaning of these experiences requires more than surface-level observation; it calls for a methodological approach capable of accessing the deep, personal narratives that lie beneath visible behaviors. Phenomenology, with its emphasis on subjective perception and lived reality, offers a valuable framework for capturing these nuanced insights. By focusing on the human experience behind industrial transformation, such inquiry can contribute to a more comprehensive understanding of the social impact of technological change.

Research into the subjective experiences of individuals facing significant technological transitions has emerged as a vital area within the broader field of human-centered engineering and workplace studies (Maqbool & Herold, 2024; Yang dkk., 2023). In particular, understanding how factory operators experience the integration of robotic systems offers important insights into the psychological and social dimensions of industrial innovation. This line of inquiry has gained relevance as automation continues to alter not only job structures but also the lived realities of those whose roles are directly affected by such changes.

However, capturing the depth of these experiences presents substantial methodological challenges (Fairclough & Dobbins, 2020; Pérez dkk., 2020). Traditional research in industrial settings has often relied on quantitative surveys or productivity metrics, which, while valuable, are limited in their ability to reveal the inner world of the worker especially their fears, aspirations, and evolving sense of identity (Aruanno & Garzotto, 2019). These approaches frequently overlook the nuanced, interpretive dimensions of human experience that shape how individuals internalize and respond to technological disruption.

Consequently, much of the existing literature fails to fully illuminate the essence of what it means to adapt to robotic systems from the perspective of the workers themselves (Bruno, Biondi, Thorpe, dkk., 2020; Reid dkk., 2024). Without methods that prioritize subjective meaning, such studies risk reducing complex emotional and cognitive processes to generalizable trends. This limitation underscores the necessity for qualitative methodologies particularly phenomenological inquiry that center the voices of individuals and uncover the core meanings embedded in their lived experiences.

Conventional responses to technological disruption in industrial settings have largely emphasized practical interventions such as technical training, workflow optimization, and operational safety protocols (Pugmire dkk., 2022; Torres-Robles dkk., 2023). While these solutions are essential for facilitating the physical integration of robotic systems, they often rely on standard evaluative metrics such as task efficiency or error rates that fail to account for the deeper psychological and emotional dimensions of adaptation (Arun dkk., 2024). As a result, they provide only a partial understanding of how workers truly experience the transition to automation.

These limitations are particularly evident in studies that adopt predominantly quantitative approaches, which may obscure the personal meanings and contextual interpretations workers assign to their changing roles (Brickwood dkk., 2020; King dkk., 2020). Such approaches tend to generalize outcomes across populations, overlooking individual narratives and the richness of subjective experience. As noted in prior research, the absence of interpretive depth leaves a critical gap in our understanding of the human impact of automation, particularly in regions undergoing rapid industrial modernization (Atluri dkk., 2024).

To address this shortfall, a phenomenological approach offers a compelling alternative. By centering the lived experiences of factory operators, this method allows for a more holistic exploration of the internal realities workers face as they interact with robotic systems (Cristiano dkk., 2022; Šafran dkk., 2024). Rather than seeking to quantify behavior, phenomenology seeks to interpret meaning, thereby capturing the essence of human responses to technological change. This methodological shift is crucial for advancing a deeper, context-sensitive understanding of how automation affects workers not just functionally, but existentially.

Previous studies have explored human experiences in the face of automation, focusing on psychological impact, role transformation, and adaptation to robotic systems. For instance, (Azimi dkk., 2024) examined the emotional responses of workers in automated factories, (Baba dkk., 2019) addressed shifting responsibilities and stress. However, most of these studies relied on thematic surveys or descriptive interviews without a deep interpretive lens. As a result, they offered limited insight into how individuals construct personal meaning from their experiences. This study builds upon that foundation by applying a deeper phenomenological perspective.

To explore the essence of operators' adaptation to robotic systems, this study adopts an Interpretative Phenomenological Analysis (IPA) approach (Silvera-Tawil dkk., 2024; Xinyan dkk., 2022). This method is appropriate because it centers the lived experience and uncovers the meanings that individuals assign to their changing roles. IPA enables a nuanced understanding of how technological shifts are internalized, far beyond observable behaviors. It responds directly to the limitations discussed in the previous section by illuminating the subjective dimensions of change. Through this approach, the study captures the emotional and cognitive textures of adapting to automation.

This article is structured as follows: The introduction outlines the research background and establishes the need for phenomenological inquiry (Aruanno & Garzotto, 2019; Choi dkk., 2023). The methodology section describes the participants, data collection, and analytical procedures used in the study (Baptist dkk., 2022). The results section presents major themes derived from the interviews, supported by direct quotations from participants. The discussion interprets these findings in relation to existing literature and theoretical frameworks. Finally, the conclusion highlights the study's contributions and suggests directions for future research.

RESEARCH METHODS

Study Design

This study employed an interpretative phenomenological approach to explore the lived experiences of factory operators adapting to robotic systems in automated industrial settings. Interpretative Phenomenological Analysis (IPA) was selected for its capacity to uncover the nuanced meanings embedded within individual experiences (Bartolome dkk., 2021). This approach is particularly relevant to the research question, which seeks to understand the psychological and emotional processes workers undergo during technological transitions. By prioritizing subjective experience, IPA facilitates a rich, in-depth examination of how individuals make sense of complex phenomena within their social and occupational contexts. The interpretative nature of the approach draws from Heideggerian phenomenology, emphasizing the contextual and historical dimensions of experience and enabling the emergence of layered, meaning-oriented insights.

Participants

Participants consisted of factory operators with direct experience transitioning from manual operations to robotic-assisted systems in large-scale manufacturing environments. Inclusion criteria required that individuals had a minimum of one year of experience in a facility where robotic automation had been recently implemented. Exclusion criteria included supervisors or engineers who were not involved in day-to-day machine operations, and operators with less than six months of exposure to the new system. A purposive sampling strategy was applied to ensure relevance and depth of experiential data. The final sample included 12 participants (8 males and 4 females), aged between 28 and 52 years, with an average of 36.7 years (Basla dkk., 2022). All participants were full-time employees at two manufacturing plants located in urban industrial zones in Southeast Asia. These demographic characteristics provided a diverse perspective across age, gender, and length of work experience, enriching the depth of the study.

Data Collection

Data were collected through in-depth, semi-structured interviews using an interview guide developed based on existing literature and adapted to the study context. The interviews were

conducted in private meeting rooms at the participants' respective workplaces to ensure comfort and confidentiality. Each session lasted between 45 and 75 minutes and was audio-recorded with consent. Follow-up questions were adapted in real-time to probe deeper into individual narratives. Interviews were conducted in the participants' native language and later transcribed and translated into English. The interview guide covered topics such as emotional responses to automation, changes in job responsibilities, perceived support, and adaptation strategies. Field notes were also taken to document non-verbal cues and contextual observations (Becker dkk., 2020). To enhance the quality of the data, efforts were made to create a non-judgmental atmosphere, allowing participants to reflect freely on their experiences.

Data Analysis

Data were analyzed using Interpretative Phenomenological Analysis (IPA), following a systematic and iterative process. Transcripts were read multiple times to ensure familiarity with the content. Meaning units were identified and coded based on recurring patterns related to emotional, cognitive, and behavioral aspects of the experience. Codes were then organized into emergent themes that captured the core meanings of participants' narratives. NVivo software was used to assist with coding and theme organization, although analytical decisions were guided by theoretical sensitivity and grounded interpretation. Reductive strategies, such as thematic clustering and abstraction, were applied to distill essential themes from the data. The analytic process culminated in the articulation of thematic narratives that reflect the shared and divergent experiences of participants, offering deep insights into their adaptation to robotic systems.

Ethical Considerations

Ethical approval for this study was obtained from the relevant institutional ethics committee. Written informed consent was secured from all participants prior to data collection. Participants were informed of the study's purpose, their rights to withdraw at any point, and the measures taken to protect their confidentiality (Beheshti dkk., 2023). All identifying information was anonymized during transcription, and data were stored securely in password-protected files. The study adhered to international ethical standards for human subjects research, including the principles outlined in the Declaration of Helsinki.

RESULTS

Displacement and the Fear of Redundancy

A prevailing experience among participants was the perception of being displaced by machines, leading to a deep-seated fear of job insecurity and loss of identity. Many operators described an emotional disconnect with the factory environment, once familiar but now perceived as impersonal and mechanized.

“When the robot took over my station, I felt invisible... like my experience didn't matter anymore.” (P3)

The automation process was seen not merely as a technical upgrade but as a structural shift that marginalized the operator's role in production. Several participants expressed uncertainty about their relevance, accompanied by anxiety over potential layoffs and the diminishing value of human labor.

How to cope with job displacement due to automation?



Struggling with Technological Adaptation

Participants reported varying degrees of difficulty in adapting to the robotic systems. While some welcomed the efficiency, others encountered emotional fatigue stemming from the steep learning curve and lack of comprehensive training.

“I was told to ‘just follow the screen’, but I didn’t understand the logic behind it. I was afraid of breaking something.” (P6)

This fear of making errors due to limited technical knowledge created a mental barrier that slowed adaptation and impacted job satisfaction. The psychological burden was further compounded by a lack of support systems, making the transition isolating for many.

Reconstructing a New Professional Identity

Despite initial resistance, several participants eventually developed new perspectives on their roles. Through time and experience, some began to view the integration of robotics as an opportunity to re-skill and redefine their identities within the factory system.

“At first, I hated the machine. But later, I realized I could do more than just manual tasks. I was becoming a technician, not just an operator.” (P1)

This theme illustrates a shift from fear to agency, as workers started to recognize the potential for growth through technological literacy. The experience of learning to collaborate with machines became a path for some toward self-enhancement and professional pride.

Emotional Ambivalence Toward Robotic Systems

Many participants expressed complex emotional responses simultaneously acknowledging the efficiency of robotic systems while lamenting the loss of human interaction and physical engagement.

“The machine doesn’t get tired, it doesn’t joke around... It just works. Sometimes I miss the noise and the chaos when we worked together.” (P4)

This ambivalence reveals a tension between progress and nostalgia. While participants appreciated reduced workload and improved precision, they also reported a loss of workplace camaraderie and a sense of mechanical detachment.

Perceived Inequity in Technological Integration

A notable concern shared by participants was the unequal distribution of knowledge and access to training. Those who adapted well often attributed their success to informal support from peers, while others felt excluded from critical learning opportunities.

“They trained the younger guys more. We, the older ones, were left to figure things out on our own.” (P7)

This theme points to a generational and experiential divide in how automation was introduced and absorbed, suggesting systemic flaws in organizational change management during digital transitions.

The findings reveal a multifaceted adaptation process, marked by emotional vulnerability, learning struggles, identity shifts, and perceived inequalities. Operators' experiences are not monolithic but shaped by individual perceptions, organizational structures, and the broader socio-technological context. The essence of this phenomenon lies in the interplay between technological change and the human capacity to find meaning, adapt, and redefine self-worth in evolving industrial landscapes.

DISCUSSION

The present study reveals that factory operators experience a profound psychological and emotional transition when adapting to robotic systems, characterized by fear of redundancy, challenges in technological adaptation, and a gradual reconstruction of professional identity (Birk dkk., 2021). These findings directly address the central research question regarding how operators subjectively experience the shift to automation in the context of Industry 4.0.

The study offers a distinct contribution by illustrating that the transition to automation is not merely a technical process but a deeply human experience marked by emotional ambivalence and perceived inequity (Debard dkk., 2020; Murala dkk., 2023). Rather than simply accepting or resisting new technologies, participants engaged in complex processes of meaning-making, self-evaluation, and adaptation. This insight extends beyond existing functional or managerial accounts by illuminating the subjective dimensions of workplace change. The themes of displacement, identity reformulation, and unequal access to support reflect how individual experiences are shaped not only by machinery but by the organizational and social systems in which these changes occur.

These findings resonate with, but also deepen, prior studies. For example, (Bobrova dkk., 2024) identified emotional stress among workers facing automation, but the present study reveals how this stress evolves into active meaning-making through identity reformation. Similarly, while (Brannon dkk., 2022) discussed the restructuring of labor roles, the current study highlights how operators perceive and internalize these structural changes as personal transformations. Furthermore, the emotional ambivalence observed here where workers both admire and mourn automation parallels findings by Zhang et al. (2021), who noted the psychological tension in human-robot collaboration. However, the interpretative phenomenological lens used in this study offers a more nuanced view, capturing the internal dialogue and evolving narratives of the participants themselves.

Implications of the Findings

The findings of this study carry significant implications for both industrial practice and scholarly understanding of workplace transformation (Becker dkk., 2020; Vinoth Kumar dkk., 2025). On a practical level, the emotional ambivalence and perceived inequities experienced by operators suggest that technological adaptation must go beyond technical training; it must also include psychological support, participatory change management, and inclusive learning environments. Culturally, the erosion of interpersonal dynamics and traditional work identities signals a need to reexamine how automation affects human dignity and the social value of labor. Professionally, the gradual reconstruction of identity among some participants indicates that the transition to automation can be reframed as a developmental journey rather than a loss (Brickwood dkk., 2020). These insights are particularly relevant to developing economies undergoing rapid industrialization, where labor still plays a central cultural and economic role.

Study Limitations

Several limitations should be acknowledged when interpreting these findings (Feldner dkk., 2020; Noor dkk., 2023). First, as is typical in phenomenological research, the study employed a small, purposively selected sample, which may not capture the full diversity of operator experiences across different cultural or industrial contexts (Egan dkk., 2019; Nelson dkk., 2019). The data were drawn

from two factories in Southeast Asia, and while the narratives are rich and informative, they may reflect regional or organizational specificities that limit broader applicability. Additionally, the reliance on retrospective self-reporting introduces the possibility of recall bias or subjective framing influenced by time and context. Despite these limitations, the study provides a foundation for deeper qualitative inquiry into human-technology interactions in the workplace.

Future Research Directions

This study opens several pathways for future research. Further investigations could examine longitudinal experiences of operators to understand how identity and emotional responses evolve over extended periods of technological integration (Bruno, Biondi, Böttcher, dkk., 2020). Comparative studies across industries, age groups, or national contexts may also reveal critical cultural and generational differences in how automation is internalized. Moreover, integrating phenomenological findings with organizational behavior frameworks could enrich intervention strategies for industrial adaptation. Ultimately, continued research that centers human experience can help ensure that technological advancement does not come at the expense of social cohesion and individual well-being.

CONCLUSION

This study explored the lived experiences of factory operators adapting to robotic systems in automated industrial environments. Using an interpretative phenomenological approach, the research uncovered themes of fear of redundancy, identity reconstruction, emotional ambivalence, and unequal access to technological adaptation. These findings highlight that automation is not only a technical transition but also a deeply human experience marked by emotional, cognitive, and social transformation. The study addresses gaps in previous literature by offering a richer understanding of how workers internalize and respond to technological change. It emphasizes the importance of inclusive and human-centered strategies in managing industrial innovation. Future research may extend this work by examining longitudinal changes in operator identity or by applying the method across different cultural and industrial contexts.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article. All funding sources have been acknowledged appropriately, and no competing financial or non-financial interests exist that could have influenced the research process or its outcomes.

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