

# Organizational Culture and Digital Transformation: Capabilities in SMEs: A Comparative Study of AI/ML adoption in German and Italian SMEs

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**Abstract:** Small and Medium Enterprises (SMEs) are the center of the economy for every country, but they are lagging behind the large enterprises in the digitalization, AI implementation and ML optimization due to different facts like the absence of skills, limited digital maturity and cautious investment cultures. This study is focused on exploring how organizational cultural typologies shapes artificial intelligence (AI) and machine learning (ML) adoption and digital transformation capabilities by SMEs in Italy and Germany. Focusing on Competing Values Framework (CVF), in this study the goal is to find out how these cultural typologies (e.g. Clan, adhocracy, hierarchy and market) constrain or enable AI/ML and digital transformation in processes and products innovation. A comparative qualitative research design is considered which is based on twenty semi structured interviews where ten interviews will be from German SMEs and ten interviews will be from Italian SMEs. These semi structured interviews are covering the CVF dimensions, digital transformation capabilities, AI/ML use cases and their impact on process and products innovation. Interview transcripts will be analyzed thematically through NVivo, and a four-stage coding framework is considered to capture General, Cultural, AI/ML and performance related themes like resistance, perceived risk and challenges including dark side of digital transformation. The results of this study will be showing the mixture of how cultural aspects are either driving or resisting the usage of AI/ML and digital transformation in process and products of SMEs. The aim of this study is to contribute to digital transformation and AI-adoption research through organizational culture, not just the resources and technology as a key mechanism. Further the cross-country analysis will highlight the key differences in how SMEs realize the value from AI-based digital transformation. The results may provide new insights for industry professionals and policymakers on how to diagnose cultural typologies and align policy support, capability building and cultural change to foster effective and responsible AI adoption in European SMEs.

**Keywords:** Organizational Culture, Digital Transformation, SMEs, Artificial Intelligence, Machine Learning, Competing Values Framework, Innovation, Digital Maturity, Artificial Stupidity

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## 1. Introduction

We have seen Nokia, Walmart, Pay-tv Providers, and top hotels (Hilton, Marriott) are left behind and Apple, Google, Alibaba, Amazon, Netflix, Airbnb and Booking.com are successful (Lang, 2021). Rapid technological advancements make the adoption of digital transformation (DT) challenging for many firms. There are several reasons where many countries, companies, and industries have faced challenges in why organizations struggle with adaptation of digital transformation (DT) internally (Kraus et al., 2022). Small and medium enterprises (SMEs) are considered the backbone of economy globally as more than 400 million enterprises where 90% are SMEs and contribute around 70% of GDP and employment (World Economic Forum, 2024).

In Europe, 99.8% enterprises are SMEs which are the backbone of the EU economy and employment (SCHULZE et al., 2024) but still they are behind large enterprises in adoption of digital technologies (Judijanto et al., 2024). The biggest challenges faced by small and medium enterprises (SMEs), are the resistance to change (Alojail et al., 2023 ; Kallmuenzer et al., 2024), lack of resources (Mahboub & Sadok, 2024), complexity of advanced technologies like artificial intelligence and machine learning (Voronkova et al., 2024; Bradač Hojnik & Hušek, 2023), regulatory barriers (Zeya et al., 2023), cyber security risks (Möller, 2023), lack of innovation initiatives by the management (Ju & Weiwei, 2024), and lack of trained staff with digital skills (Rupeika-Apoga & Petrovska, 2022; Zhang et al., 2023).

SMEs also struggle for alignment of their overall business goals with the digital strategies which led to inefficiencies and failures (Oliveira Pereira et al., 2020; Ajibade & Mutula, 2020; Pelletier & Raymond, 2024). Another aspect is the absence of DT-oriented culture which is a barrier in adoption of DT in SMEs (Restrepo-Morales et al., 2024), because organizational structure, culture and leadership influence DT in SMEs (Leso et al., 2023). If an organization is having good leadership as role model, and support innovation, then either it is a family business, non-family business or a sole proprietorship, it will have innovation culture (Villaluz & Hechanova, 2019). This innovative culture can improve the innovative performance regardless of their job type while, if the organization is having a conservative culture, there will be reduced benefits (Al-Khatib et al., 2022).

Another important thing which helps in adaption of innovation is the creativity of employees which can be used as a strategy to foster the innovation but organizational culture (OC) and less trust of employees in management create hurdles for innovation.

Further, SMEs can enhance their market flexibility through OC and the leadership, which allows them to adapt market changes and environmental dynamics to be competitive in the market (Anning-Dorson, 2021). It may result in likeness of flexibility and agility inside the organizational structures but with the support of the management who can guide organizational flexibility and promote a culture to tolerate the risk (Mladenova, 2024). Therefore, we can say that OC, leadership and organizational structure in SMEs influence the adaption of digital transformation (Leso et al., 2023).

SMEs need a clear roadmap driven by a digital strategy (Gobble, 2018) because it can enhance the efficiency, productivity, competitive advantage, resilience (Unegbu et al., 2024; Teixeira et al., 2025) and ESG performance (Chen & Wang, 2024). DT can be through new digital technologies like artificial intelligence (AI), Mobile phones, Internet of things (IoT), Blockchain (BC), and cloud services (Warner & Wäger, 2019). SMEs in general are having less funds to invest in adoption of digital technologies like AI and ML (Sargut, 2019; Kassem et al., 2024), but in most cases there is no clear vision and strategic direction in SMEs (Pujari & Saha, 2024).

This study is focused on European context where EU initiatives and policies shape the DT and AI adoption but national differences in terms of cultures, and structures of SMEs remain pronounced. Italian business landscape is dominated by SMEs with 94.5% share and contribute to 40% GDP and account two third of employment in private sector (Habibi et al., 2024). However, Italian SMEs face resistance in adoption of digital technologies (AI/ML) because of several factors. Major issue which hinders this adoption is the presence of managerial conservatism, since these are family-owned SMEs where conservatism impacts the organizational culture and decisions (Costa et al., 2023; Farace & Tarabella, 2024). Lack of skilled staff and resistance to change are also some reasons where employees are not aware of digital know-how and keep relying on their legacy systems (Seppänen et al., 2025).

In Italy, the governance of AI is also aligned with EU directives for transparency and human centred AI usage (Bertolini et al., 2024). For example, an initiative for AI research and development for industries (SMEs/LEs) is established which is called, High performance computing for Artificial Intelligence (HPC4AI) in Turin (Aldinucci et al., 2018). Digital literacy can be enhanced in Italian SMEs by proper training, through networking and co-created initiatives which can promote to adopt the new technologies (Coco et al., 2024). Adoption of AI/ML in Italy is not widespread and there are many regional disparities for DT readiness (Marino & Tebala, 2020). However, participation of Italy in GPAI is a broader strategy to integrate AI in national frameworks, ethical concerns and for promoting innovation (Colcelli & Burzagli, 2021).

SMEs in Germany are the main driver of economy where around 99% of industries are SMEs and generate 33% of revenue and 57% of workforce (Hopf, 2021). Implementation of AI and ML in German SMEs is considered as the main success factor which can improve efficiency, productivity and improved decision making (Schönberger, 2023), but it is sluggish (Ulrich et al., 2021; Böhme et al., 2024) as compared to larger German companies (Licht & Wohlrabe, 2024). Same resistance reasons are evident in German SMEs like lack of knowledge, funds, skilled workforce (Sargut, 2019; Oldemeyer et al., 2025) and cultural factors (Ångström et al., 2023). However, the focus on ethical AI and governance are the main focus in Germany where “AI made in Germany” is a strategy to promote human centric approach to balance innovation and legal principles (Hälterlein, 2025).

Overall, digital transformation through AI/ML usage in work, for productivity, for innovation and for skills programs have no borders. But its usage need more rules and laws and governance system like GPAI, to monitor the changes and the progress to ensure that AI technologies are providing benefits for humanity and minimizing the risks (Keith, 2024; Ala-Pietilä & Smuha, 2021; Mike, 2024). In this study, we compared the role of organizational culture in German and Italian SMEs to see if it shapes their DT capabilities particularly AI/ML adoption, skills and digital strategies. Further how these cultural typologies can influence the impacts of DT on processes, performance and products.

## **1.1 Problem Statement**

Digital transformation drives the adoption of key technologies (Artificial Intelligence/Machine learning, Internet of Things and data analytics for enhancing efficiency, products innovation and sustainability in SMEs. However, DT brings challenges which includes resistance in workforce, over-reliance on algorithms, and cyber security risks. Among DT enabling factors, organizational culture plays a vital role (Vial, 2019; Meena et al., 2024; Grover

et al., 2022; Ghafoori et al. 2024; Pedersen, 2022). But it is a complex set of values, assumptions, beliefs and symbols which defines how the firm conducts its business (Barney, 1986, p. 657). Recent studies expand the concept of DT by examining digital transformation capabilities, while assuming that they are influenced by four cultural types; clan, adhocracy, market, and hierarchy (Cameron and Quinn, 2011). In particular, adhocracy, more than others, is positively related to DT, while hierarchy is the weakest driver. Adhocracy emphasizes a high level of individual flexibility while hierarchy promotes control and efficiency. These typologies have been applied in prior research on DT (Grover et al., 2022; Sánchez-Báez, 2020) and align with processes observed in SMEs. The concept of digital transformation capability encompasses a wide set of organizational capabilities, such as digital skills, strategic orientation, the company values, and other resources which interact with technologies into the processes. Thus, according to Cao et al (2025), this conceptualization opens to a comprehensive observation of drivers and impacts of DT. This study explores how organizational cultural typologies shape digital transformation capabilities including AI/ML adoption, skills and digital strategies in German and Italian SMEs and their competitive impact on services, products and performance. We focus on the SMEs setting for the following reasons but still gap persist in understanding the role of culture in SMEs. Particularly the comparative dynamics of Italy and Germany and the underexplored "dark side" of DT like risks and resistance which could be addressed through qualitative interviews.

## **1.2 Research Gap**

Leadership in SMEs have to be empowered strategically so that they can foster a culture of innovation and Digital transformation adaptability (Colombo, 2024). According to a study by Matarazzo, there is strong cultural difference between southern and northern regions of Italy which is also seen in SMEs, and they recommend expanding analysis to different drivers and applications of DT (Matarazzo et al., 2021). Literature is less focused on role of AI/ML as most of the scholars have focused on either AI as a Blackbox or they have just described it descriptively (Richard, et al., 2023). We also found in literature that in the context of small and medium enterprises (SMEs), AI/ML tools and the application of these tools is not similar as in LEs (Ayinaddis, S. G., 2025). Despite the usage of these, several significant issues are there due to interaction of AI and humans including, interplay between existing human capital and AI/ML technologies, the relationship of AI to human judgment and the variability of this relationship across different contexts (Natarajan, et al., 2018). Germany is the largest economy in EU and having a well-established innovative ecosystem where government supports DT in SMEs, still there is a need to check how organizational culture conditions for DT benefits in German SMEs (Bella, et al., 2024). Overall, productivity of Italian SMEs is lower than peer countries Germany and France where Germany is 21% more productive than Italy which is because of lower level of DT in Italian SMEs and most of productivity difference between these countries is unexplained (Eib. (2021). In another study on German SMEs, authors found that DT in SMEs can increase revenue, higher productivity, enhanced customer and employee satisfaction and they recommend to test it on SMEs of different countries (Pfister, et al., 2023). However, another study has found that small enterprises lack of IT support and knowledge in Italy and future research should study international markets to understand digitalization and e-commerce (Dallocchio, et al., 2024). Literature from other European countries such as from Netherlands, shows that in Dutch SMEs, they concluded that DT helped in improving the performance which depends on the characteristics of SMEs and further they suggested to explore other countries where DT have different strategic importance and have different performance outcomes (Etienne, et al., 2024).

Keeping these gaps in view, there is little comparative research available which is focused on how the cultural typologies of a firm can shape DT capabilities and AI/ML adoption in SMEs across countries. Especially between Germany and Italy and how this contributes to difference in performance and innovation. Therefore, this study will be playing its part to enhance the existing literature from a cultural and comparative aspect.

## **1.3 Research Objectives**

- To identify and compare dominant cultural typologies in SMEs of Italy and Germany
- To find how cultural typologies influence adoption and utilization of AI/ML in SMEs?
- To evaluate impact of DT on products and services

## **1.4 Hypotheses**

- OC typologies significantly differ between SMEs in Italy and Germany

- Certain cultural typologies (Adhocracy, clan, market, hierarchy) positively influence AI/ML usage in SMEs
- More level of AI/ML in SMEs improve the products and process innovation.

## 1.5 Theoretical Explanation

This study is focused on the CVF theory which categorize organizational culture into four categories (Adhocracy, Hierarchy, Clan, Market) which impacts the organizational performance differently (Ortega & Acero, 2025). CVF can be used as a blueprint for culture change and to map the organizational culture (L. Gong et al., 2022), which can promote innovation and enhance performance (Zeb et al., 2021). OC has a critical role in adoption of digital technologies as the culture support resilience, agility and adaptability which foster the success of digital technologies implementation in SMEs (Nugraha et al., 2024). DT, sustainability and OC are interconnected which can affect the business management and need successful approaches of management (Isensee et al., 2020). Because good leadership and OC can allow SMEs to adapt the environmental dynamics, market flexibility and DT for a competitive advantage (Anning-Dorson, 2021). OC is divided into two dimensions (Internal vs External, and Flexibility Vs Stability) as per the objectives of the current study. CVF support cross cultural analysis because of its framework to understand different cultures based on the cultural values and management styles. Further it helps in predicting which cultural settings are less conducive or more towards AI/ML adoption, therefore this makes CVF a valuable theory to explain behaviour of SMEs regarding digital transformation. Since this study is also aimed at understanding how culture shapes DT capabilities and their effects of process and product innovation, CVF offers cultural profiles to link with these outcomes. Overall CVF can help in understanding the dominant cultural profiles in Germany and Italy and facilitate the exploration of how different cultural typologies can influence the technology adoption (AI/ML). CVF can help in diagnosing and changing the organizational culture where individual change and personal management skills are crucial (Cameron Kim & Quinn Robert, 1999) and it boost innovation, financial performance, organizational effectiveness and value creation (Cameron et al., 2006).

## 2. Literature Review

### 2.1 Digital Transformation

We often get confused in terms digitation, *digitalization* and *digital transformation* as interchangeable terms or similar. But it is very important to understand that these three concepts, as the incorrect use of these will lead to distortion and may affect the organization negatively (Polyvana et al., 2022). Therefore, we have to go into the concept of data, processes and strategy where the *digitization* is about transforming the data from analog to digital numbers (0s & 1s), and then this data is processed for meaningful values (Hippmann et al., 2019; Vrana & Singh, 2021). Processing this data into physical space after transforming the information into a digital format is *digitalization* (Востряков & Сибирцева, 2024) which is technical driver for *digital transformation* (Турковский, 2023) and used to improve the way of working of an organization (Große Kamphake, 2020). While *digital transformation* is about using these processes to make business strategies, and it is an ongoing process to improve business processes. But still a unified definition of DT is needed to understand by the researchers and the practitioners to advance the theory, and the practice of the discipline (C. Gong & Ribiere, 2021). The term “Digital transformation” refers to a process where organizations improve their performance, profit, competitive position and market penetration by using digital technology (Froehlich et al., 2024). It plays an umbrella role where it encompasses digitization and digitalization and their constituting components even, they are small components because DT has major impact on the activities carried by the organization (Savić, 2020). The emergent digital technologies explored in the literature encompass a wide range of ICT tools, such as artificial intelligence, digital platforms, cloud computing, robotics, big data, blockchain and other cyber technologies (Wang, 2021; Pchelintsev, 2024; Joel et al., 2024).

### 2.2 Organizational Culture

Culture is used as a word which indicate sophistication when we say this person is very cultured whereas anthropologists used it as some customs which develops with time (PEAKE, 1922). In management perspective, culture is considered as certain values which managers want to indicate in their organization by speaking that they need a culture of quality or right kind of culture. We cannot analyse organizational culture (OC) as a universal concept, but it can be better understood through myth, ideational systems, symbols and ritual (Meek, 1988). It is also a prominent barrier where resistance to change within the corporate and structural culture

mismatched (Packmohr et al., 2023). Because it significantly impacts employee's behavior, organizational efficiency (Fernandes et al., 2023), performance by influencing the strategies (Marcoulides & Heck, 1993), and organizational learning through leadership style (Hosseini et al., 2020).

However, SMEs with hierarchy culture value efficiency, consistency and internally focused with control on stability. This cultural type effect on business performance in negative way which shows that such SMEs will face low performance comparing to other cultural SMEs (Eisend, et al., 2016; Greer, et al., 2018; Hawa, et al., 2023). SMEs use this culture to emphasize compliance and order but for higher performance and competitive advantage they must create a family type environment with internal cohesion (Oborilová, et al., 2020).

### 2.3 Artificial Intelligence/Machine Learning

Artificial intelligence is a set of algorithms which are used for information research (Bendig, et al., 2024), and it is an expansive domain dedicated to developing intelligent systems. It is a technology which uses machines for simulation of human cognitive processes like how they learn, process, generate reasons, solve problems and make decisions (Haenlein, et al., 2019). However, speculative fiction's AI storylines profoundly influence and mirror society aspirations and anxieties offering essential insights for developers, policy makers, and media professionals to promote responsible AI innovation consistent with ethical and social principles (Appio, et al., 2025). AI is intended to enhance human capabilities, but it may paradoxically dehumanize, demobilize individuals, oppress, leads to failures, or maybe towards potential calamities which means it exhibit manifestations of artificial stupidity (Su, M., & Ma, H. 2024). These risks arise from limitations and errors which are made by AI, including the biased algorithms, incomplete data or the inherent restrictions can be placed by the AI to stimulate more human like decision making (Dayal, A. (2024). Further a system which is using artificial stupidity and provide wrong tasks, can lead to absurd solutions (Lieber, et al., 2024) and it could be because of any AI failure or by an accident or due to design as seen in robotics (Roldán-Gómez, et al., 2024).

Machine learning is often quoted as "A discipline which enables computers to acquire knowledge autonomously without explicit programming". It is also a kind of AI, and it use algorithms to train itself from previous data, experiences, patterns and relationships. The concept was given by Arthur Samuel in 1959 who defined it as a subset of Artificial Intelligence (AI) which is based on supervised learning, unsupervised learning and in case of errors, reinforcement learning (Shapiro, A. F. 2021). It is a branch of AI which employs computational techniques to enhance system performance from experimental learning, statistics, mathematics and. Computer science (Zhou, Z. H. (2021). It can help in lowering the costs, to boost the business processes or to improve customer service (Lee, I., & Shin, Y. J., 2020)) but SMEs face several issues and struggle to use the ML due to knowledge (Aruna, et al., 2023). AI and ML are general purpose technologies which are swiftly disseminating across enterprises and these technologies possess the capacity to revolutionize the industry and influence the efficacy of enterprises (Natarajan, et al., 2021). They are advancing different fields rapidly like the field of oncology to improve diagnostic approaches and therapeutic strategies for cancer patients (Fountzilias, et al., 2025), in finding solutions to complex science and engineering problems (Willard, et al., 2022).

### 2.4 DT in Italian SMEs Vs German SMEs

SMEs play a very important role in job creation, economic growth and poverty alleviation with innovation and investments (Gherghina, et al., 2020). SMEs are providing 50% of global employment and 90% of global organizations are SMEs (Raihan, A. (2024). In Europe, SMEs contribute 50% plus gross value in the economy but still these SMEs are lacking in implementing industry 4.0 and business innovation models (Sati, Z. E., 2024). In the EU, DT in SMEs serves different purposes like 40% SMEs use it for digital commerce, 30% are using it for digital presence, 10% are using for technological infrastructure, 10% for Research and innovation and 10% are using it for digital skills whereas only 7% SMEs in EU are using AI (Webidoo., 2025). DT leads to increased SMEs' revenue with an average of 13.44%, high efficiency and productivity, improved employee satisfaction and customer satisfaction (Pfister, et al., 2023), competitiveness, more value creation and distribution channels (Garzoni, et al., 2020). Nevertheless, both government and scholars assume that despite these potential benefits, SMEs lag in the digital transformation (OECD, 2021; Sati, 2024).

In Italy, 99% of businesses are SMEs (Amiri, et al., 2023) which are the basis of Italian economy and generate 70% of turnover and 81% employment (PMI.IT, 2021). Italian SMEs require awareness, inquiry, collaboration and transformation to fully exploit DT (Matarazzo, et al., 2021). Italy is at 24th position in EU ranking for adoption of DT in SMEs and Germany is at 13th, whereas Italy is at 10th number in adoption of AI and Germany at 12th position (Marino, et al., 2023). According to ISTAT, around 60.3% SMEs in Italy have basic digitalization which is

more than average EU index of 56% and government have a vision that 90% of SMEs in Italy will be having DT by 2030 (Martinelli, et al., 2024). AI adoption in Italian SMEs can be successful if SMEs are considering processes, people, customers and products (Del Sarto, et al., 2021).

In German SMEs, digital transformation increases revenue with 33.77% average return on investment (ROI) and cuts operational expenditure (Pfister, et al., 2024). DT in these SMEs of Germany, not just increase the revenue, it also help in improving customer satisfaction, efficiency, employees productivity and satisfaction with a weighted average ROI of 13.44 (Pfister, et al., 2023). SMEs in Germany have a vital role in sustainability and digitalization where the focus is on risk management, innovation, and digitalization with a future perspective of market diffusion, sustainability and governmental programs (Bella, et al., 2024). SMEs in Germany have shown sluggish adoption of AI where some of them focused on enhancing customer service and reduction of costs (Ulrich, et al., 2021) while there are lack of skills concerns by some SMEs in adoption of AI (Schönberger, M. (2023) however, family-owned SMEs intend to adopt AI (Saleem, et al., 2023).

### **3. Methodology**

For a better understanding of the research questions of this study a qualitative research design is considered because it allows an in-depth exploration of how organizational culture can shape DT capabilities and adoption of AI/ML in SMEs. The sample is divided between Italian SMEs and German SMEs where 20 semi-structured interviews were conducted with 10 interviews from each country. Only those SMEs which have initiated or completed the implementation of some emergent technologies, such as AI and ML, were selected using purposive sampling to make sure the information is enriched. We developed literature informed semi-structured interview guide from the actual measurements for the study variables. For measuring organizational culture, we have used competing values framework (CVF) which is a useful scale to explore impact of organizational culture (Ojogiwa, et al., 2023; Mardalis, et al., 2023; Asri, et al., 2024). It is developed by Quinn, et al., (1991) where it consists of 16 scale items which are divided equally into four subscales and each subscale have four items and a seven points Likert scale. CVF help managers in developing their behavior repertoire which will enrich their skills to manage complexity (Tong, et al., 2015). For measuring digital transformation capabilities especially adoption of Artificial Intelligence (AI) by SMEs, we used Digital maturity model which can measure the level of digital maturity in SMEs from basic to advance technologies and it provides a roadmap to improve digital maturity after identification of maturity levels and it recommends future growth (Haryanti, et al., 2023). For measuring organizational performance which is measured here by checking if the organization has innovation (Product or Process) and for that related scale of Wang et al., (2004). This study is designed to identify a comparison of SMEs in Italy and Germany and therefore a cross-country data, considering different national cultural aspects and institutional setting as control variables and policy documents will help in understanding the role of digital technologies in SMEs of both countries. Further if a quantitative study survey is required in future, same CVF and digital maturity model scales can be used to complement the qualitative findings and test relationships statistically.

### **4. Results and Implications**

The data from some German SMEs is collected and being tested for pilot results however for Italian SMEs the data is scheduled to be collected in coming months (e.g. May, June, July). The basic idea of this research is to contribute to the existing literature on DT in SMEs by shifting the focus from technology alone to cultural drivers which enable or constrain DT capabilities. It is focused on digital transformation as a process or outcome, expanding the vision beyond the dynamic system of drivers that enables this transition within SMEs. Also focusing on the role of organizational culture that in small context refers directly to entrepreneur's imprinting. Different typologies of organizational culture in SMEs will provide novel insights about the DT in SMEs. Further this study will help policy makers, governments and management on implementing the DT in SMEs and the learning processes, with some recommendations for entrepreneurship on fostering a culture of innovation and technological readiness.

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## Ethics Declaration

The participants of this study are from the SMEs of Italy and Germany, and their inputs are included after their full consent. All the ethical protocols will be followed, and individual identities will not be disclosed, perhaps the study results will be shared with them.

## AI Declaration

For the formation of semi structured interviews, some AI-tools (e.g. Perplexity, Scholar AI Labs, ScopusAI) have been used which helped in linking the context of the semi structured interviews with the scales selected for the study variables. Further these semi-structured interviews were translated through AI-tools (e.g. Gemini, GPT, Claude) and then refined with human input.

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