



**KEY FACTORS OF THE ORGANISATIONAL CULTURE FOR EFFECTIVELY DIFFUSING
MANAGEMENT AND TECHNOLOGY INNOVATIONS FOR SUCCESSFUL ADOPTION OF
INDUSTRY 4.0 IN MANUFACTURING SMES IN THE AUTOMOTIVE INDUSTRY.**

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Abstract

Studies on organisational culture in the context of Industry 4.0 (I4) in the automotive industry are mostly limited to samples from management, and an isolated view of organisational culture and technological development still dominates the literature. An isolated approach poses the risk that divergences and complexities in the concept of organisational culture in manufacturing Small Medium Enterprises (SMEs) during the adoption of I4 remain unrecognised. Another argument in the literature is the ambiguity and diversity ascribed to organisational culture, which presents challenges in its practical applications. Implementing a concept of organisational culture in manufacturing SMEs during the adoption of I4 in the automotive industry remains a prevalent and unresolved problem. These two issues are addressed in this research.

This research employed a mixed-method research design that combined sample survey of 84 participants and semi-structured interviews with 15 respondents to obtain a comprehensive data set and perspective of industry experts to analyse the organisational culture in manufacturing SMEs for effective diffusion of management and technology innovations for successful adoption of I4 in the automotive industry. Finally, recommendations of eleven key factors of organisational culture have been developed for effectively diffuse management and technology innovations for successful adoption of I4.

This research makes a contribution to knowledge by providing a comprehensive framework of eleven key factors of organisational culture combined with four cultural dimensions: Power-, Role-, Achievement- and Support- oriented. This PRAS framework facilitates a methodological examination of organisational culture from a holistic perspective across different stages of I4 adoption. The PRAS framework presents a pragmatic approach for practitioners and researchers addressing the prevailing challenges faced by manufacturing SMEs during adoption of I4.

Author's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. For copyrighted material permissions have been received before submission. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas. Any views expressed in the thesis are those of the author and in no way represent those of the University.

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This thesis is dedicated to my beloved parents
Emine and Yasar for their support!

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Glossary of Terms

SMEs	Small and Medium Enterprises
I4	Industry 4.0
IoT	Internet of Things
HRM	Human Resources Management
VCM	Value Chain Management
TE	Technological Entrepreneurship
CIO	Chief Information Officer
IT	Information Technology
TAS	Technology Adoption States
ICT	Information Communication Technology
AMT	Advanced Manufacturing Technology
CVM	Competing Value Model
JAI	Job Adaptability Inventory
HTS2025	High – Tech Strategy 2025
RAMI4.0	Reference Architecture Model I4
MES	Manufacturing Execution System
TRA	Theory of Reasoned Action
TAM	Theory Acceptance Model
AM	Agile Manufacturing
NVivo	Qualitative Data Analysis Software

Chapter 1 Introduction

This chapter outlines the motivations for this thesis and its underlying research philosophy. It describes the selection of manufacturing Small Medium Enterprises (SMEs) adopting Industry 4.0 (I4) in the automotive industry, where the data was collected. It explains how organisational culture is measured in the company and concludes by outlining the research questions and research objectives. A wide range of terms and phrases are used to describe the concept of I4, including digitalisation, digital manufacturing and smart factory. This is because there is no consensus on the definition of I4 (Fettermann, Cavalcante, Almeida, & Tortorella, 2018), or the meaning of state of the art could differ by each manufacturing SME in the automotive sector (Da Costa, Dos Santos, Schaefer, Baierle, & Nara, 2019). However, the I4 concept for SMEs in the automotive industry ascribes horizontal and vertical integration of the connected entire value chain, including comprehensive data exchange between supply chain management and processes of end-to-end integrated manufacturing companies throughout the entire product life cycle by using shared standards and state-of-the-art technologies in the areas of Internet of Things (IoT), Big Data Analytics, visualization and simulation, and Advanced / Additive Manufacturing (AM) (Brettel, Friederichsen, Keller, & Rosenberg, 2017; Sony, 2018). Under I4, new technologies and far-reaching innovations are spreading much faster and further than in previous industrial revolutions (Schwab, 2017, p. 12). He points out that the scope of impact of the technological revolution are expected to lead to economic, cultural, and social changes, whose extent can be hardly predicted (Schwab, 2017, p. 31).

1.1 Project Background

This thesis focuses on the key factors of organisational culture for effectively diffusing management and technology innovations for the successful adoption of I4 in manufacturing SMEs in the automotive sector. I4 represents a paradigm shift for manufacturing SMEs in the automotive industry (Pinto, Silva, Costa, Campilho, & Pereira, 2019). These manufacturing SMEs are subjected to continuous and innovative development within this new paradigm. I4 includes exchanging information between all stakeholders working collectively towards the common business goal (Thoben, Wiesner, & Wuest, 2017). Comprehensive implementation often seems to be neglected when implementing I4 in manufacturing SMEs (Birkel, Veile, Müller, Hartmann, & Voigt, 2019). This research aims to propose a set of key factors which effects the organisational culture for diffusing management and technology innovations for the successful adoption of I4 for manufacturing SMEs in the automotive sector, which should result in better support management when adopting I4. Research to date has primarily focused on developing and validating different technologies when adopting I4 in manufacturing SMEs (Moeuf, Pellerin, Lamouri, Tamayo-Giraldo, & Barbaray, 2018). Over the past five decades, vast amount of research has been devoted to the study of culture (D. R. Denison, 1996). Clark (1972) argues that an organisational saga is a collective understanding of a

unique accomplishment in a formally established group (Clark, 1972, p. 178). It is argued that members of the organisation demonstrate loyalty and derive pride and identity from it (Clark, 1972, p. 178). Lewis (1996) outlines the history and development of organisational culture management in the 20th century and provides an overview of the most prevalent organisational theories. They outline the development of organisational culture in the 20th century in the literature review (Lewis, 1996). At the same time, it could be argued that organisations were subject to continuous change due to the emergence of new management theories and practices. Although the underlying drivers of organisational change in manufacturing SMEs in the automotive industry can be manifold, a prominent contributor to change seems to be technology transfer (Bell & Albu, 1999). Levin (1997) argues that technology transfer enforces organisation development (Levin, 1997). They suggest that culture is built into technological artefacts; the operation of new technology invokes an organisational development process linked with the introduction of new technology (Levin, 1997). Tornatzky and Klein (1982) use meta-analysis to comprehend how different factors affect technology transfer or innovation adoption rates through insight into what influences them in order to ensure that innovations have higher chances of being successfully implemented. The results of their meta-analysis show that only three of the ten characteristics analysed were consistently related to adoption of innovations. Compatibility and relative advantage were positively related to adoption ($p < 0.5$). By compatibility of innovation is understood "the degree to which an innovation is perceived to be consistent with the existing values, past experiences, and needs of the receivers." (Roger and Shoemaker, 1971, cited in Tornatzky & Klein, 1982, p. 32). Bessant (1982) suggests influential factors that are typically involved in the adoption of new technology (Bessant, 1982, pp. 122-127). They grouped their findings under four headings: 1) innovation characteristics, 2) supplier characteristics, 3) user characteristics, and 4) environmental characteristics. According to Schroeder et al. (1989) "Innovation in manufacturing is the implementation of new ideas or changes, big or small, that have the potential to contribute to organisational (business) objectives." Tornatzky and Klein (1982) points out that research on innovation characteristics research examines the relationship between the characteristics of an innovation and the adoption of that innovation (Tornatzky & Klein, 1982, p. 28). The relative advantage of innovation "is the degree to which an innovation is perceived as being better than the idea it supersedes" (Roger and Shoemaker, 1971, p.138, as cited in Tornatzky & Klein, 1982, p. 34). In contrast, complexity was negatively related to adoption ($p = 0.062$) (Tornatzky & Klein, 1982, p. 40). The complexity of an innovation is the "degree to which an innovation is perceived as relatively difficult to understand and use (Rogers and Shoemaker, 1971, p.154, as cited in Tornatzky & Klein, 1982, p.35). Bessant (1982) found that higher innovation characteristics, such as high-profit enhancement potential, were positively associated with new technology adoption. Conversely, the low-profit potential was negatively related to adopting new technologies. Bessant (1982) also found that suppliers were often used as an indicator of expected cost and use of the

technology. User characteristics have also been associated with innovation characteristics. Users who considered themselves very competent in using new technologies tended to adopt more complex innovations. Bessant (1982) found that the performance of other firms, level of competition and uncertain future market conditions had significant negative impacts on users adopting new technologies. Similarly, users who were low in self-perceived ability to use new technologies tended to adopt less complex innovations. Bessant (1982) suggested that this was due to a more significant consideration of user characteristics when evaluating alternative innovation characteristics.

Environment characteristics have also been identified as influential in adopting new technologies. According to Freel (2005), small companies facing more significant environmental uncertainty invest more in innovative activities than firms experiencing less uncertainty. More innovation in manufacturing firms is related to higher perceived uncertainty among suppliers in the market and technological environment (Freel, 2005). Smircich (1983) posits that the intersection of cultural theory and organisational theory is evident in five current research topics: comparative management, organisational culture, organisational cognition, organisational symbolism, and unconscious processes and organisation. Panda and Gupta (2001) examine the role and importance of symbolism in facilitating or hindering organisational functioning, suggesting how managers can facilitate the process of integrating, differentiating, and sustaining symbols that enable smooth organisational functioning (Panda & Gupta, 2001). Hence, a clear understanding of symbols and their mirroring the uniqueness and commonality of organisations was likely to contribute to the effectiveness of diffusion management and technological innovation. In this thesis, the diffusion of management innovations refers to new management techniques and strategies that are adopted and spread among manufacturing SMEs in the automotive industry during the adoption of I4. The diffusion of management techniques could be driven by the need to improve organisational performance, competitiveness, or innovation. This can involve the transfer of knowledge, technology and expertise from one organisation to another or developing and adopting new techniques or practices within a single organisation during the adoption of I4 in manufacturing SMEs in the automotive industry. It can involve implementing new processes, tools, or methods and developing new skills and capabilities among employees, which could influence the effectiveness of the adoption of I4. Symbolism is often instrumental or functional, for example, creating a sense of shared identity and community and contributing to the stability of organisational culture (Panda & Gupta, 2001, p. 16). The definitions of organisational culture in the literature review differ significantly in terms of underlying factors.

Allaire (Allaire & Firsirotu, 1984) highlights three influencing factors in defining organisational culture: 1) the values and characteristics of the surrounding society, 2) the history of the organisation, 3) incidental factors such as technology and industry characteristics. Allaire (Allaire & Firsirotu, 1984) believes that in practice these three factors always interact and compete to shape the culture of an organisation.

Defying suggestions that organisational culture should be treated as a controllable and manipulable variable, Meek (Meek, 1988) sees culture as a whole thing that cannot be manipulated. The basis of their argument is that culture should be viewed as something that an organisation "is" rather than something that an organisation "has." Culture, in Meek's (Meek, 1988) view, cannot be an independent variable, nor can it be created, discovered, or destroyed by the whims of management. They suggest that further research is needed to find some theoretical model of cultural interpretation that does account for the richness of human culture. Organisational development (OD) theories emphasise the importance of organisational culture in influencing organisational performance and offer guidelines for practitioners, which include strategic planning and change management (Lewis, 1996, p. 13). Smircich (1983) argues that it is challenging for researchers and managers to both live in and question their cultural context as they are influenced by their own cultural beliefs (Smircich, 1983). With this said, it is essential for them to be mindful of their cultural biases when establishing the organisational culture for the diffusion of management and technology innovations for streamlined deployment of I4 practices. They have contended that it is difficult to engage in contextual, reflexive management and research, where one's cultural beliefs and values must be examined and critiqued (Smircich, 1983). Furthermore, the difficulty for management in manufacturing SMEs was to determine the most appropriate organisational culture for the diffusion of management and technology for the successful implementation of I4 in their organisation, alongside their own underlying individual cultural beliefs and values.

Henri (2006) focuses on the relationships between organisational culture and performance measurement systems developed for top management teams (Henri, 2006). They argue that organisational culture is a ubiquitous factor that affects practically all aspects of organisational interactions (Henri, 2006, p. 97). Furthermore, they assert that organisational culture relates to developing, implementing, and using performance measurement systems. Therefore, Henri (2006) suggests that managers should be aware of the organisational culture before implementing performance measurement systems to adopt specific organisational processes (Henri, 2006, p. 97). Tidor et al. (2012) believe that the organisation cannot achieve its performance without diagnosing and changing organisational culture (Tidor, Gelmereanu, Baru, & Morar, 2012). For Pettigrew (1979), organisational culture captures individuals' underlying belief systems, myths, heroes, language, rituals, ceremonies and values in an organisation (Pettigrew, 1979). Its constituents include social structures, the informal rules that govern behaviour in the organisation, and how people interact in it (Buono, Bowditch, & Lewis III, 1985; Meek, 1988; Ogbonna, 1992). Organisational culture provides critical insights into the traits of an organisation's strategic direction, its challenges and opportunities, as well as its future possibilities (D. Denison & Mishra, 1995; Dougherty & Hardy, 1996). Organisational Culture creates a shared meaning of belonging within an organisation (Arregle, Hitt, Sirmon, & Very, 2007; Harris, 1998; Harris & Ogbonna, 1999). As a result, by using symbols, people

feel that they belong to a particular group or organisation (Deery & Shaw, 1997; T. J. Kallio, Kallio, & Blomberg, 2015; Kondra & Hurst, 2009). Shared norms can actively foster the development of innovative ideas and support the implementation of new approaches (O'Reilly, 1989, p. 14).

Furthermore, the author provides an in-depth look on "Norms That Promote Innovation" and indicates that without a shared definition of what is considered "appropriate to say" or "appropriate to do," individuals within a group often struggle to contribute ideas and innovations to the overall project because they feel they are not being heard or supported (O'Reilly, 1989). According to Levin (1997), the major managerial challenge in technology transfer is to use the transfer process as a vehicle for creating a culture of learning organisation (Levin, 1997). This argument suggested that the technology transfer or diffusion of management and technology innovations can be leveraged to not only bring in new technologies and processes but also create an organisational culture of learning and development. Skerlavaj et al. (2007) presents a model of an organisational learning culture that can be used to predict proximal outcomes for employee engagement and innovation. (Škerlavaj, Štemberger, & Dimovski, 2007). The study discusses the role of cultural influences play in driving these outcomes by addressing how such factors relate to an organisation's performance (Škerlavaj et al., 2007, p. 361). Clear articulation of mission and vision by the management ensures that employees are aligned with their roles and responsibilities, and it also accelerates the process of cultural change (VISION & TODAY'S, 1996). People feel that they understand the mission and vision and can align their behaviours accordingly (Sattari, Pitt, & Caruana, 2011, p. 290; Wright, Moynihan, & Pandey, 2012). Adherence to the company's mission and vision activities can require a sustainable organisational culture. Galpin et al.(2015) provide a framework for developing organisational factors that promote a culture of sustainability (Galpin, Whittington, & Bell, 2015).An organisation's culture is shaped by its leaders and the way they translate the company's mission and vision to their employees in a way that will stimulate creativity and innovation (Kostempska, 2017; Szczepańska-Woszczyna, 2015, p. 66). Ahmed (1998) argues that most innovative companies will be dominated by those who have built enduring work environments by creating cultures and climates (Ahmed, 1998, p. 43). In this thesis, the important aspect of leadership in manufacturing SMEs will be explored, which is the impact of creating a supportive work environment that allows employees to develop their potential and increase their creative and innovative skills in the adoption of I4. Openness to change is encouraged when individuals feel they have control over their work, that they are involved in decision-making processes when there is a positive attitude towards risk-taking and organisational learning, when management encourages employees to flexibility and when the roles of employees are clearly defined (Sanz-Valle, Naranjo-Valencia, Jiménez-Jiménez, & Perez-Caballero, 2011, p. 1007) . Schein (2010) states that the role of leadership is perhaps the most important for the cultural beginning in the organisation. (Schein, 2010, p. 226). They act as facilitators, who equip employees with the resources they need such as financial support, adequate information technology and services to help them succeed. Another major

challenge for the managers in manufacturing SMEs was to create an organisational culture where creativity and innovation flourish (Wilson & Stokes, 2005). Creativity and innovation in an organisation can be fostered or inhibited by the values and beliefs that govern it. They depend on how they influence the behaviour of individuals and groups (Martins & Terblanche, 2003, p. 73).

Furthermore, it is proposed a model that describes organisational culture which influence creativity and innovation. According to Schein (2010), organisational culture consists of (1) the beliefs, values, and assumptions of the founders of organisations, (2) the learning experiences of group members as their organisations evolve, and (3) new beliefs, values, and assumptions brought in by new members and leaders (Schein, 2010, p. 225).

Little research is evident that investigates the convergent or deviating perceptions of organisational culture and the need for determinants to effectively diffuse management and technology innovations for seamless adoption of I4 practices in manufacturing SMEs in the automotive industry. Currently, there is scant literature that explores the knowledge gap identified during the literature review.

Therefore, this thesis aims to contribute to this gap by presenting evidence of how the identified knowledge gap may influence the organisational culture and contribute to the effective diffusion of management and technology innovations for successfully adopting I4 practices. This thesis aims to contribute to the identified knowledge gap by providing an overview of the key factors of organisational culture based on semi-structured interview data and sample survey with different stakeholders across Germany, the United States, the United Kingdom, France and Norway, and demonstrating how this gap may influence the organisational culture for effectively diffusing management and technology innovations to successfully adopt I4 in manufacturing SMEs in the automotive industry across countries. Most articles focused more on discussing what is happening in a large organisation rather than a manufacturing SME and how it relates to the organisational culture and adoption of I4. These findings were unsatisfactory and these aspects deserve better recognition. The decision was made to conduct semi-structured interviews with industry experts to discover what issues these gaps have caused in their company's organisational culture. The investigation of these issues involved asking questions about perceptions of organisational culture, its determinants and the perceived relationship between the current culture of the organisation and its future. Consequently, this notion drove their research and motivated them to investigate these aspects more deeply. It also narrowed the research and served as the basis for defining the objectives in section 1.2.3.

Manufacturing SMEs in the automotive industry appear highly susceptible to competitive pressures regarding innovation and development. Technological developments and innovations are in high demand in the automotive industry, where innovation is a crucial factor for the competitiveness of manufacturing SMEs. Due to their close ties to funding institutions, companies in this industry are exposed to solid technical pressure. Hence, these manufacturing SMEs must develop and adopt I4 to

meet or exceed these expectations to compete. The research investigates the convergent or divergent perceptions of organisational culture among manufacturing SMEs in the automotive industry. This study explores the key factors for effectively diffusing management and technology innovations to optimise the adoption of I4 practices in manufacturing SMEs in the automotive industry. While manufacturing SMEs in this sector tend to face higher levels of competitive factors (Metts, 2007, p. 40), the literature review suggests that organisational culture elements have not yet been fully explored as regards their impact on the diffusion of management and technology innovations. The lack of a generally applicable concept of organisational culture based on key factors has also been identified as a knowledge gap, along with the need for practical guidelines to ensure the successful adoption of I4. This research proposes that the degree of conformity of work processes to the organisational culture is critical for the successful adoption of I4. However, the limited number of companies participating in this research limits the development and proposition of key organisational culture factors. Further research is needed to produce a more comprehensive methodology to help management and organisations optimise their strategy for adopting I4.

1.2 Overall Aim and Research Objectives

1.2.1 Aim of the Research

This research aims to investigate the organisational culture of manufacturing SMEs in the context of adopting I4 in the automotive industry, specifically exploring the key factors of organisational culture that impact the successful diffusion of management and technology innovations. The research seeks to address existing gaps in knowledge between theoretical knowledge and operational practice by answering four specific research questions as outlined in 1.2.2. The research questions aim to provide a practical guideline for management to manage organisational culture during I4 adoption effectively.

1.2.2 Research Questions

Four research questions will be addressed:

- (1) How do SMEs foster the organisational culture during the adoption of I4?
- (2) To what extent is the organisational culture in manufacturing SMEs in the automotive industry defined by management during the adoption of I4?
- (3) What are the criteria to examine if the organisational culture of SMEs is successfully developed during adopting I4?
- (4) What key factors of organisational culture in manufacturing SMEs in the automotive industry to use to manage their organisational culture for diffusing management and technology innovations for successful adoption of I4?

1.2.3 Research Objectives

This thesis aims to fill the gaps emerging from a review of prior studies in the areas key factors of the organisational culture for effectively diffusing management and technology innovations for successful adoption of I4 in manufacturing SMEs in the automotive industry. Accordingly, the research objectives are:

- (1) To analyse the organisational culture during the implementation of I4 in SMEs.
- (2) To evaluate the extent of the organisational culture in manufacturing SMEs in the automotive industry defined by the management when adopting I4.
- (3) To identify, analyse and evaluate key factors of organisational culture which enable a successful implementation of I4 in manufacturing SMEs in the automotive industry.
- (4) Propose a set of key factors which effects the organisational culture for diffusing management and technology innovations for successful adoption of I4 for manufacturing SMEs in the automotive sector.

1.3 The Contribution to Knowledge

Manufacturing is undergoing a shift from mass production to mass customization (Tien, 2011). This shift is a transformation process triggered by I4 technologies, which created the necessity for the involved manufacturing SMEs in the automotive industry to cope with the diffusion of management and technological innovations, taking into account limited resources, talents and skills available during the adoption of I4 to align their organisational culture with success. The literature review reveals that various perceptions of the concept of organisational culture exist, but there is a knowledge gap in the definition of key factors of organisational culture for effectively diffusion of management and technology innovations for successfully adoption of manufacturing SMEs I4 in the automotive industry. The literature research also shows that the extent of this knowledge gap is influenced by various factors, such as the lack of understanding within manufacturing SME organisations of how organisational culture and I4 adoption are aligned. The research fills this gap in providing causal links between the key factors of the organisational culture and the effectively diffusion of management and technology innovations for effective deployment of I4 initiatives in manufacturing SMEs in the automotive industry. This research can be used as a basis for academic, industrial, or professional practices in this field, as it provides insight into the organisational culture factors for effectively diffusing management and technology innovations for thorough deployment of I4 technologies in manufacturing SMEs in the automotive industry.

1.4 The Thesis Structure

The thesis is structured and presented in seven chapters. In Chapter 1 "Introduction" the motivation to conduct an interpretive and post-positive approach is explained and the research aim, question and objectives to contribute to new knowledge generation are derived. In Chapter 2 "Literature Review", a foundation for the subsequent chapters by critically reviewing the literature for identifying the research gaps in the area of the organisational culture for effective diffusion of management and technology during adoption of I4 in the automotive industry. In Chapter 3, "Research Methodology and Design", the ontological stance as an interpretivist and post-positivist is outlined and evaluated. The epistemological assumptions of the grounded theory approach, which are useful for analysing the interview data and deriving key factors of organisational culture, are expounded. In Chapter 4, "Initial Data Collection, Presentation and Data Analysis", a sample survey and semi-structured interviews have been applied to collect and presents experts opinion. In Chapter 5, "Findings and Evaluations", the Survey results are investigated, and the interview data analysed, codes determined and described. The key factors of the organisational culture have been identified and the correlations between the codes are outlined. In Chapter 6, "Mixed Method Analysis", a mixed method analysis has been applied to synthesise the survey results with the interview data for the proposition of eleven key factors of the organisational culture. The analysis is underpinned by managerial practices shared in the interviews and identified key factors of organisational culture to the extent of the survey results for the existing and preferred organisational culture. In Chapter 7, "Conclusion and Further Work", the key results are summarised, and future applications of the key factors of the organisational culture are proposed. The chapter concludes with the outlook for future work.

Chapter 2 Literature Review

2.1 Introduction

This chapter is a critically review of the literature for the organisational culture in the context of diffusion of management and technology innovations during I4. It explores research on the effectiveness of an organisational culture and diffusion of management and technology innovations in the adoption of I4, with a particular focus on manufacturing SMEs in the automotive industry. This chapter identifies the issues in manufacturing SMEs associated with organisational culture and diffusion of management and technology innovations during I4.

2.2 Process of the Literature Review

The literature review outlined in Chapter 2 indicates a lack of consensus on defining key factors of organisational culture for the effective diffusion of management and technology innovations in the context of I4 adoption by manufacturing SMEs in the automotive industry. This knowledge gap is further compounded by the lack of understanding within the SMEs of the alignment between organisational culture and I4 adoption. This aims to address this gap by identifying the key factors of organisational culture and their causal links to the effective diffusion of management and technology innovations for successfully deploying I4 initiatives in manufacturing SMEs in the automotive industry. The findings of this research are expected to contribute to academic, industrial, and professional practices by providing insights into the organisational culture factors that facilitate the diffusion of management and technology innovations in the context of I4 adoption. Efron and Ravid (2018) interpret the process of literature review as a systematic examination of the scientific literature on a particular topic that critically analyses, evaluates, and synthesizes research findings, theories, and practices related to a particular field (Efron & Ravid, 2018). Literature review in this thesis facilitated the structuring of knowledge (Machi, 2016, p. 164) and provided a framework for analysing and interpreting sources to inform research syntheses: The scope of the literature review in this study was to critically investigate the existing literature on the role of organisational culture in the effective diffusion of management and technology innovations during the adoption of I4 in manufacturing SMEs in the automotive industry. This literature review aims to identify how current challenges related to the adoption of I4 by manufacturing SMEs have been addressed in the literature. Specifically, the literature review aims to provide practical guidance for managers facing sociological and technological challenges related to I4 adoption, including the impact of the challenges posed by the Covid-19 pandemic. The primary goal of this literature review was to identify how today's challenges related to the adoption of I4 in manufacturing SMEs have been addressed in the existing literature. Xia and Watson (2019) argue that conducting literature reviews systematically can enhance the quality, replicability, reliability, and validity of the respective sources (Xiao & Watson, 2019).

Furthermore, literature reviews provided guidance on how to conduct a critical literature review, introducing key elements such as typology, selection criteria of the research topic, screening procedure, data collection methods, identifying primary research studies, coding and abstraction methods, searching strategies for locating studies in different databases, assessing the methodological quality of studies included in the review and in reporting the findings from the review. Moreover, scholars can rely on software for assistance in the literature review process, such as EndNote, RefWorks, and Zotero to manage bibliographies, citations, and references (Xiao & Watson, 2019, p. 17). Rigorous literature reviews played an essential role in supporting the research by building theory and framing study issues, and guiding decisions concerning the design and implementation of empirical studies. The nature of rapid proliferation of Information System (IS) research, coupled with the increased complexity of the research designs, has created a need to review and synthesise a broad range of reviews (Bandara, Furtmueller, Gorbacheva, Miskon, & Beekhuyzen, 2015). Therefore, it was advantageous to utilise technological tools for the literature review and synthesise literature findings. Bandara et al. (2015) examine qualitative analysis tools such as NVivo to analyse, synthesise, and write up and present the results. Moreover, Bandara et al. (2015) delineate the application of qualitative data analysis tools in organising and preparing the research for analysis and presents detailed guidelines for the actual coding and analysis of the research, including detailed illustrative strategies for effective writing and presentation of findings (Bandara et al., 2015). Most academics lacked sufficient knowledge of previous research to develop a literature review effectively. Webster et al. (2002) contend that a review of prior, relevant literature is an essential feature of any scholarly project. Furthermore, the intellectual challenge of abstraction is believed to lie at the core of the literature review. Moreover, the challenges stemmed from the lack of agreed definitions for these concepts and from the dualistic nature inherent in language. This lack of clarity prompted disagreement about the merits and validity of citing sources. Tranfield et al. (2003) discuss the challenges of a systematic literature review in developing an appropriate methodology and suggest successive stages for the development of evidence-based management knowledge through systematic reviews (Tranfield, Denyer, & Smart, 2003). Furthermore, these stages are (a) planning the review, (b) conducting a review, and (c) reporting and dissemination (Tranfield et al., 2003). Moreover, their work contributed to the process of systematic literature review in the field of management science, leading to the creation of a reliable body of knowledge and the improvement of practice through the development of context-sensitive research. Qualitative research methods are most often used in areas of social science that deal with human experiences such as history, sociology, psychology, and cultural studies (Brady, Fryberg, & Shoda, 2018; J. Rosiek, 2003; J. L. Rosiek, 2013). This thesis explores the subjective experiences of industry experts as they viewed the world around them and their personal experiences during the adoption of I4. The decision was made to use qualitative methods to study such phenomena as organisational culture, meaning, beliefs, attitudes, and social

interactions during adoption of I4. In previous studies, the presence of different approaches to conducting quality research in social science has led to discordant views, as it might involve different "world views." (Given, 2008; Hancock, Ockleford, & Windridge, 2001, p. 9). The qualitative literature review included methods and procedures (Onwuegbuzie, Leech, & Collins, 2012) that helped in strategizing and pinpointing the views of the respondents regarding to the research question, as well in analysing the collected data and providing evidence for assertions about social constructionism across cultures and subcultures (Ormston, Spencer, Barnard, & Snape, 2014, pp. 48,56). The main purpose of the qualitative literature review was to summarize and synthesise (Walsh & Downe, 2005) an understanding of how different phenomena across a given field may be interrelated, and how these relationships may be applied to a specific study design or analysis (Ormston et al., 2014, p. 468; Randolph, 2009). Moreover, qualitative research involved emerging questions and procedures, collecting the data typically in the environment of the participant, data analysis that leads inductively from specifics to general themes, and the researcher's interpretation of the meaning of the data (Creswell, 2018, p. 32). In contrast to qualitative research, the quantitative literature review focused on how variables that serve as independent, dependent, or intervening variables may be related to the phenomenon being examined (Fakis, Hilliam, Stoneley, & Townend, 2014). In this thesis, the quantitative analysis was a systematic approach for gathering relevant data for the research to assess the underlying existing and preferred organisational culture of the respondents (Treiman, 2014, p. 8). Scott et al. (2003) identified thirteen quantitative instruments for measure culture and cultural change in the other areas such as in health care (Scott, Mannion, Davies, & Marshall, 2003). In a study, researchers need to operationalise two types of variables: independent and dependent variables (Mertens, 2017, p. 21). Furthermore, the independent variable refers to the variable that is manipulated and it typically involves a treatment or intervention, while the dependent variable represents the outcome or response. The third approach to research was the Mixed-methods research, which provided the context to the quantitative aspect of the present research. By employing the method of triangulation, a more comprehensive or in-depth understanding of the research topic was obtained. Thurmon (2001) points out that triangulation as the combination of at least two theoretical perspectives, methodological approaches, data sources, or data analysis methods (Thurmond, 2001). Moreover, it can be seen that triangulation is serving two main purposes, mitigating the limitations of a single approach (qualitative or quantitative), and enhancing the ability to interpret the findings. The underlining belief of this approach is that a combination of qualitative and quantitative approaches provides a more comprehensive understanding of a research problem than either approach alone (Creswell, 2018, p. 32). The results of mixed-analysis will then be used to complement one another (Grafton, Lillis, & Mahama, 2011; Johnson & Onwuegbuzie, 2004; Mackey & Bryfonski, 2018). Thus, while mixed-methods research is often used across fields of study (Tashakkori & Creswell, 2007) in order to gain a better understanding of multiple factors that may be

involved in a particular issue or variable, it was particularly suitable for studies focusing on complex phenomena (McKim, 2017), organisational culture in this thesis, where multiple factors interact with one another and influence the outcome of the research.

2.2.1 Summary of the Process of the Literature Review

This literature review aims to explore the existing research on the role of organisational culture in the effective diffusion of management and technology innovations during the adoption of I4 in manufacturing SMEs in the automotive industry. The scope of the literature review is to investigate on practical guidance for managers in manufacturing SMEs in the automotive industry, facing the sociological and technological challenges of I4 adoption, including the added complexity brought on by the Covid-19 pandemic. The literature review explores the approaches used in social science research for studying organisational culture, beliefs, attitudes, and social interactions during the adoption of I4 in manufacturing SMEs in the automotive industry. The review will cover qualitative and quantitative methods, as well as mixed-methods research, to better understand the interrelated phenomena that influence the research outcome. Moreover, the review will examine in the following sections the current literature on the organisational culture and diffusion of management and technology innovations, adoption of I4 in organisations and manufacturing SMEs in the automotive industry.

2.3 Key Factors of Organisational Culture

2.3.1 Concept and Development of Organisational Culture

The present literature review aims to provide insight into the role of organisational culture in an I4 environment. It also informs the definition and the methods that apply to I4 in the automotive industry. As per Smircich (1983), there are two major approaches in which organisational culture has been studied: a variable and a root metaphor (Smircich, 1983). In the first approach, organisational culture was viewed as part of the environment that sets behavioural expectations and constitutes a shaping force (Smircich, 1983). In the second approach, organisational culture was viewed as a root cause metaphor that promotes a view of organisations as expressive forms, manifestations of human consciousness (Smircich, 1983). Hennestad (1986) proposes to view organisations as a framework that is constantly being created and reshaped by the cognitive frames of its Members (Hennestad, 1986). Furthermore, this framework was considered as a fruitful organisational metaphor to comprehend organisational change processes (Hennestad, 1986). Moreover, organisational members were unable to explore existing models of organisational behaviour when inconsistent metaphorical formulations prevail (Hennestad, 1990). Erdem and Satir (2003) examine the organisational culture within manufacturing organisation through the use of metaphors (Erdem & Satir, 2003). Furthermore, they highlight the importance of metaphors during organisational change process. Moreover, they

indicate that metaphor provided a useful tool for uncovering feelings toward the organisation. However, due to the scope of this study, which was limited to only three organisations, a generalization of the findings of this study to other manufacturing organisations might not be applicable. Barner (2008) delineates how visual metaphors can help people give voice to their emotional responses to organisational change and how they can frame and interpret their experiences of organisational change (Barner, 2008). According to Schein (1990) the analysis of organisational culture distinguishes three fundamental levels: observable artefacts, values and basic underlying assumptions. Furthermore, the first level included the observable artefacts generated and disseminated by the organisational culture; the second level consisted of the organisation's values, which was essential for satisfying its needs and achieving its goals and the third level includes the basic assumptions that are accepted by all and considered as facts about people and their organisation (Schein, 1990). Chow et al. (1991) examines the effect of national culture and management control system on the manufacturing performance. Furthermore, individualism and collectivism were examined as dimensions of the national culture. Moreover, they concluded that the individualism and the management control system have an independent effect on production performance (Chow, Shields, & Chan, 1991). Hence, the effective meshing of management practices with national cultures in the adoption of new technologies in a manufacturing organisation was posing a complex theme in research. Hofstede's (1990) research constitutes of the earliest empirical attempts to identify organisational culture as a multidimensional phenomenon in the organisation (Hofstede, 1990). Furthermore, Hofstede et al. (1990) developed an instrument to measure cultural dimensions in different national cultures, which identified country-specific differences in the cultural dimensions, and examined the relationship between cultural dimensions and specific workplace values in different cultures and countries (Hofstede, 1990). Moreover, the key outcome of the research is a six-dimensional organisational culture model, defined as: (1) Power Distance, (2) Uncertainty Avoidance, (3) Individualism versus Collectivism, (4) Masculinity versus Femininity, (5) Long-Term versus Short-Term Orientation and (6) Indulgence versus Restraint (Hofstede, 1990). Moreover, it has been asserted that their findings have the potential to shift the underlying values and beliefs of organisational culture from a temporary trend to an integral part of the management theory and practice. Organisational values change over time through external forces such as social change or new technology (Abrahamson & Fombrun, 1994; Howard, 1998; Wiener, 1988). Hence organisations exposed to the requirements of their industry, such as changes in customer needs, competitors, and society, may change the organisational culture accordingly (Grubbs & Denhardt, 2000; Lawson & Ventriss, 1992). For this thesis, this highlighted the necessity for manufacturing organisations to align their organisational culture to the changes in their external environment triggered by management and technology innovations during the adoption of I4 in the automotive industry. According to Gordon (1991), organisations are based on industry-driven assumptions about customers, competitors and

society, which form the basis of the organisational culture (Gordon, 1991). Furthermore, it has been demonstrated a model for industry-oriented culture formation, where certain values regarding the "right things" are formed, and the management, in accordance with these values, establishes the strategies, structures, and processes necessary for the company to operate its business (Gordon, 1991). According to the author, the prerequisites for a company's survival arise from the alignment of the organisational culture with the needs of the industry. Whereby the survival and success of the companies was limited not only by the requirements of the industry, but also by internal organisational factors. According to Moran and Volkwein (1992), organisational culture influences the emergence of organisational climate in the organisation (Moran & Volkwein, 1992). Organisational climate denoted the emotional or cognitive energy that members have with an organisation or person. High levels of engagement were when people are motivated toward doing things they enjoy because they feel comfortable in that environment. Low engagement was when people do not want to do anything because they do not like what is happening in that environment (Ashkanasy, Wilderom, & Peterson, 2000; D. R. Denison, 1993; Mearns, Flin, Gordon, & Fleming, 1998). Moran and Volkwein (1992) define Organisational Climate as the interactivity of members as they interact within a context created by organisational culture. It could be distinguished between three perspectives in explaining organisational climate: 1) Structural approach, 2) Perceptual approach, and 3) Interactive approach (Moran & Volkwein, 1992). Tesluk et al. (1997) demonstrate a framework for the concepts of organisational culture and organisational climate that consider the interrelation between organisational practices and individual creativity (Tesluk, Farr, & Klein, 1997). It could be concluded that providing appropriate incentives for employees who are creative at work can contribute to greater personal creativity among employees and thus increase organisational effectiveness. (Tesluk et al., 1997). Saffold (1988) suggests a high correlation between strong cultural values and organisational effectiveness (Daniel Denison, Nieminen, & Kotrba, 2014; Kotrba et al., 2012; Saffold III, 1988). Whereat, according to Burke et al. (1992) oversimplified models of organisational culture do not adequately depict the relationship with organisational performance (W. W. Burke & Litwin, 1992; Janićijević, 2010). Whereas other scholars argue that to examine the linkages of organisational culture and organisational performance, organisational culture ought to be considered as a whole to account for its multifaceted nature and its role within organisational processes (Almaraz, 1994; Coyle-Shapiro, 1999; Saffold III, 1988). Denison et al. (1995) demonstrate a model of organisational culture and effectiveness based on four traits of organisational cultures as shown in Figure 2.1 : 1) involvement, 2) consistency, 3) adaptability, and 4) mission (D. Denison & Mishra, 1995).

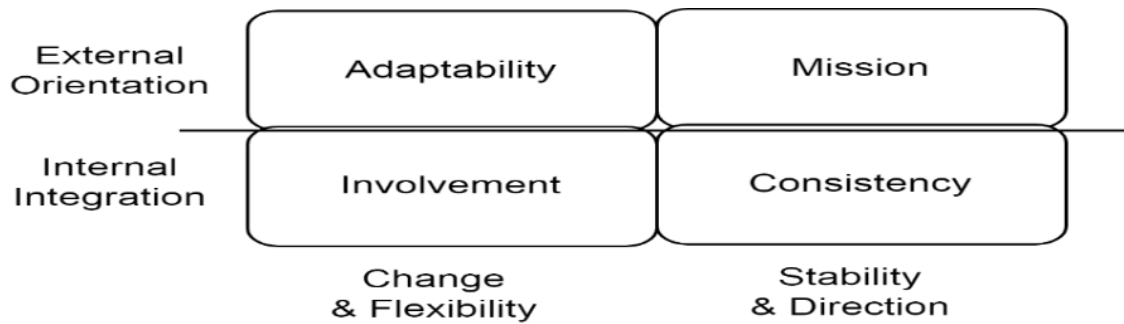


Figure 2.1: Theoretical Model of Culture Traits, Source: Denison et al. (1995)

Denison and Mishra (1995) suggest that organisational culture have an impact on organisational effectiveness. In their findings, they demonstrated that the four cultural characteristics exhibit a significant positive association with a wide range of subjective and objective measures of organisational effectiveness (D. Denison & Mishra, 1995, p. 219).

More specifically, the findings of this research suggested that culture can be regarded as an integral part of the organisational adaptation process and that specific culture traits such as “Adaptability”, “Involvement”, “Mission” and “Consistency” are useful predictors of performance and effectiveness in organisational science (D. Denison & Mishra, 1995).

Hill and Carley (1999) contend that knowledge is generated through social interactions among researchers. Furthermore, they deploy the cognitive network approach to identify areas of consensus in a scientific subfield (Hill & Carley, 1999; Krackhardt, 1987). Moreover, Davidson et al. demonstrate a framework that illustrate the evolution, diffusion, and transformation of technology within organisational domains (Davidson & Pai, 2004, p. 488). Davidson (1997) used the term of “organising vision” for characterising the culturally constructed rationale for adopting of new technology and the shared expectation about how the new technology will affect practice (Swanson & Ramiller, 1997, p. 462). Swanson and Ramiller (1997) outline the Institutional Production of Organising Visions model for the rationale of information systems (IT) adoption and implementation, which takes into account the social structure, as the network approach of the organisation (Swanson & Ramiller, 1997, p. 461). The prevalence of IT has become ubiquitous, and its application in the manufacturing sector is pervasive in modern organisational world (Nylén & Holmström, 2015; Yoo, Boland Jr, Lyytinen, & Majchrzak, 2012; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007). Milgrom and Roberts (1990) focused on how IT impacts organisational characteristics and outcomes (Milgrom & Roberts, 1990). Organisations with extensive IT- users tend to adopt organisational practices that include a decentralisation of decision authority, and greater reliance on skills and human capital (Bloom, Garicano, Sadun, & Van Reenen, 2014; Hitt & Brynjolfsson, 1997; Rasel, 2015; Sabath, Autry, & Daugherty, 2001). The emergence of IT organisations has stimulated debate in the literature that the IT- organisation has been overlooked for many years in the process of establishing

the organisational culture (Hurst, 2013; Kavanagh & Ashkanasy, 2006; Martin, 2001; Peppard & Ward, 1999, p. 119).

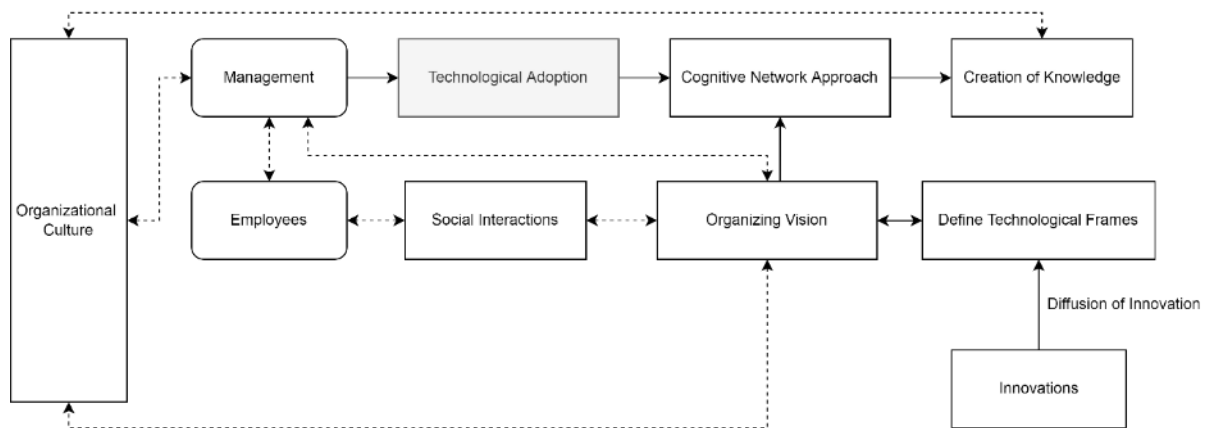


Figure 2.2: Visualized Social Interactions in Information-Technology-Organisations in Context of Innovation Diffusion and Knowledge Creation, Source: Hill and Caley (1999), Davidson and Pai (2004).

The role of IT has been evolved into a much broader strategic position in entrepreneurial organisations (Albadvi, Keramati, & Razmi, 2007; Davenport & Short, 1990; Gunasekaran & Nath, 1997; Illes, 2009). IT-organisations are no longer just part of the system backup and support function but has been elevated in line with a new paradigm that sees IT as an integral part of the business organisation (Baartman, 2017; Luftman & Brier, 1999; Rockart, Earl, & Ross, 1996, p. 297). Figure 2.2 depicts the social interactions in information technology companies from a contextualized perspective, with particular attention to the intersections with organisational culture, innovation diffusion, knowledge creation, and other aspects necessary for understanding the competitive environment. Moreover, it illustrates how social interactions play a role in shaping the diffusion process within organisational culture, and includes the perspectives of managers, employees that participate in adopting new technology while sustaining the creation of knowledge. It also demonstrates how social interactions play a role in shaping the diffusion process within organisational culture and includes the perspectives of managers and employees involved in the adoption of new technologies and sustaining knowledge creation. De Long et al. (2000) investigated on the cultural barriers in the process of the creation of knowledge (De Long & Fahey, 2000). Furthermore, they have identified four ways to which organisational culture influences organisational behaviour: 1) Organisational culture shapes assumptions in the organisation, 2) defines relationships between individual and organisational knowledge, 3) creates contexts for social interactions and 4) shapes organisational processes (De Long & Fahey, 2000). Moreover, they concluded that managers should promote social interactions that recognize the value of knowledge-sharing among employees, moving away from the individual view of knowledge as a method of securing jobs. Martin and Terblanche (2003) demonstrate a framework that describe the relationship between creativity, innovation and

culture (Martins & Terblanche, 2003). Furthermore, they consider organisational characteristics such as strategy, structure, support mechanisms and behaviour encouraged by innovation and open communication as the determinants for the organisational culture. Moreover, managerial leadership remained critical to organisations seeking to "evolve" their culture into a collaborative knowledge-supportive culture. Schein (2004) posits that culture begins with leaders who instil their own values and assumptions in a group (Schein, 2004, p. 23). Moreover, if employees have difficulty adapting to the organisational culture, according to the authors, the leadership's task was to change the existing culture in such a way as to initiate evolutionary change processes in the organisation, thereby making the organisation more adaptable. Lemmon and Sahota (Lemon & Sahota, 2004) state that organisational culture plays an important role in ensuring that the process of creation knowledge are continuously replenished and updated to enable efficient responses to changes in the competitive environment (Lemon & Sahota, 2004).

Schein (2004) argues that leadership creates and changes organisational cultures, while management and administration function within them (Schein, 2004, p. 32). Nahm et al. (2004) evolved a framework that describe the linkage between manufacturing practices and performance, drawing on the above mentioned "Institutional Production of Organising Visions" model (Nahm, Vonderembse, & Koufteros, 2004; Swanson & Ramiller, 1997, p. 461). Moreover, they conceptualised organisational culture as shown in Figure 2.3 with the underlying assumption of customer orientation and espoused values, how beliefs affect the manufacturing practice (Nahm et al., 2004, p. 581).

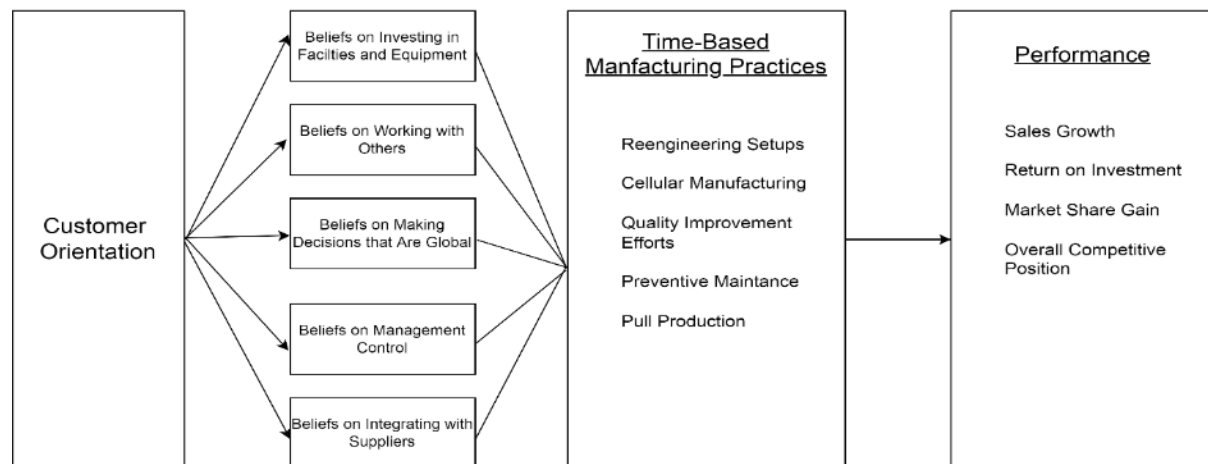


Figure 2.3: How Beliefs Aspects Affect Time-Based Manufacturing Practice, Source: Nahm et al. (2004)

Heracleous and Jacobs (2008) examine the in-depth use of embodied cognition to underpin strategy formation in organisations. Moreover, they suggested that the use of embodied metaphors can provide

strategic benefits by capturing the intangible and collective dimensions of organisational identity or culture (Heracleous & Jacobs, 2008).

De Vrande et al. (2009) compiles in his study a survey database of 605 innovative SMEs in the Netherlands to explore how manufacturing SMEs practice and adopt open innovation activities (Van de Vrande, De Jong, Vanhaverbeke, & De Rochemont, 2009). Moreover, they concluded that SMEs practice and embrace open innovation activities extensively (Van de Vrande et al., 2009). However, the term "openness to innovation" in the study was multifaceted and not clearly delineated. Dahlander and Gann (2010) suggest a conceptual framework for defining openness and how it affects firms' ability to be innovative and adopt the benefits of innovation (Van de Vrande et al., 2009) .

Furthermore, the organisational culture to which the employees adopted had a significant impact on the organisational success and survival in the long term. Costanza et al. (2016) suggest that organisational culture can be used as resource for organisations to adopt to dynamic environments and persist in the long term (Costanza, Blacksmith, Coats, Severt, & DeCostanza, 2016). Costanza et al. (2016) demonstrates that the organisation's activity between two dimensions "values about change" and "action oriented" as shown in Table 2.1 can predict the organisations survival span (Costanza et al., 2016). Moreover, the results of this study provide some initial insight into the concept and implications of adaptive cultures, some limitations should still be considered. First, the development of dimensions and measures of adaptive cultures relied on extant definitions in the literature, some of which dated back to the 1920s and 1930s. Second, archival sources were used. Thus, it is possible that the profiles did not contain enough information to assess adaptive cultures accurately or that characteristics of adaptive cultures were reported in a way that made assessment difficult.

Table: 2.1.: Characteristics and Dimensions of Adaptive Cultures

Values About Change
External focus: The organisation pays attention to its external environments, especially its customers. The organisation values reading and interpreting signals from their environments.
Anticipation: The organisation proactively works to identify internal and external problems; the organisation focuses on future problems or environment changes.
Confidence: The organisation believes that it has the ability to change.
Action-Orientation
Open to change: The organisation is receptive to innovation, change, and new ideas. The organisation is flexible; it does not feel that it is bound by particular rules and procedures for carrying out its business.
Development of capabilities: The organisation develops the capacity to handle environmental situations

Collaborative action planning: The organisation enables collaboration between business units that allow it to proactively and reactively develop solutions to problems.
Executing change: The organisation is able to implement adaptive change
Sustaining change: The organisation is able to sustain the change by creating systems that reinforce the change
Dropped due to Low Commonality
Risk-taking: The organisation is willing to take risks

Source: Costanza et al. (2016)

Denison et al. (1991) consider the competing values approach to organisational culture. Furthermore, they posited that organisational culture is a complex concept that affects organisational effectiveness, how the competing values framework can be used to illuminate cultural change initiatives, and finally, how practitioners and researchers can work together to improve both theory and practice in this area (D. R. Denison & Spreitzer, 1991). Moreover, the competing values approach is based on two dimensions, which is competing demands of change and stability, and the conflicting demands created by the internal organisation and external environment (D. R. Denison & Spreitzer, 1991). They conclude that the competing values approach produces four types of cultural orientations: 1) Group culture, 2) Developmental culture, 3) Rational culture, and Hierarchical culture (D. R. Denison & Spreitzer, 1991). With this said, Denison and Mishra (1995) devised a conceptual model of the relationship between organisational culture and organisational performance (D. Denison & Mishra, 1995). In this conceptual model organisational culture consists of four traits: commitment, consistency, adaptability, and mission. Furthermore, they conclude that organisational culture is positively related to organisational performance and that these organisational culture traits are valuable predictors of organisational performance (D. Denison & Mishra, 1995). Moreover, the presented cross-sectional in the study, had several limitations in inferring causality. However, while they developed explanations for the relationship between culture and performance in the five participating companies, they offered little basis for inferences.

2.4 Diffusion of Management and Technology Innovations

2.4.1 Management 4.0

Damanpour and Schneider (2009) argue that innovation and manager characteristics influence the adoption of innovation. Furthermore, they demonstrated that the level of education of managers has a positive influence on innovations in the organisation. (Damanpour & Schneider, 2009). Talukder and Quazi (2010) point out that "management support" and "incentives" are the key factors that affect employees decisions to adopt innovations. Specifically, they noted that management involvement in

providing the technical, administrative, and other necessary support, including training and dissemination of information to employees, is key to increasing employee acceptance and use of innovation. Moreover, they suggest that appropriate incentives may also have an impact on motivating employees to experiment and practice a new technological innovation (Talukder & Quazi, 2010). Armstrong and Sambamurthy (1999) demonstrate that the business and IT knowledge of the chief information officer (CIO), as well as the digital maturity of the IT infrastructure have a significant impact on adoption of IT within organisation (C. P. Armstrong & Sambamurthy, 1999). This highlighted the significance of informed managers in leading the adoption of IT in companies. Technological Entrepreneurship (TE) encompasses the knowledge and skills required to design, develop, and commercialize new technologies (Elia, Margherita, & Petti, 2016). Moreover, the size of the organisation and the IT knowledge of the managers in the study have not significantly influenced IT adoption (C. P. Armstrong & Sambamurthy, 1999). According to Schircks and Schneider (2017), organisational capabilities embody the ability of equipment, machines and people to work together. Moreover, they suggested the development of a new organisational culture to harmonise the work process in organisation (Arnulf D. Schircks & Schneider, 2017, p. 10). According to Zheng et al. (2010), the organisational structure and culture need to be considered for the knowledge management to be as effective as possible (Zheng, Yang, & McLean, 2010). During the adoption of I4 in manufacturing SMEs, the tendency to view the change as disruptive to the individuals or the organisational culture can contribute to resistance (De Long & Fahey, 2000). The match of the right candidate to the task using scorecards that reflect the company's efficiency and effectiveness have shifted the role of human resources toward data science. (Fitz-Enz & John Mattox, 2014, p. 126). Hence, building a sustainable organisational structure that offers a high degree of flexibility was essential to improve the company's ability to adopt to ever-changing market conditions (Powell, 1992).

2.4.2 Diffusion of Innovation in Organisations

Duric (1976) considers innovation as "value"; whereby values refer to human needs and can be evaluated objectively by measuring them in the context of its social, legal or economic consequences (Durić, 1976). Furthermore, it has been suggested that the diffusion of innovations represents a complex process consisting of (a) the social presentation of the innovation and (b) the adoption of the presented innovation. Moreover, it has been argued that the diffusion process contain three basic elements: (1) the innovation, (2) the adopter entity and (3) the actual process of adopting and using the innovation (Durić, 1976).

For the perceived characteristics of innovations, there should be no premise that all innovations are equivalents for analysis (Rogers, 2003, p. 33). Furthermore, it has been suggested five characteristics of innovation (1) Relative Advantage, (2) Compatibility, (3) Complexity, (4) Trialability and (5)

Observability that are perceived by individuals in organisation. Moreover, these characteristics are essential, unique to each innovation, which need to be purposefully perceived so that the member of the organisation can comprehend the information technology and its function (Rogers, 2003, p. 235). Furthermore, it has been suggested that an innovation's degree of relative advantage determines the rate depending on their degree of superiority or inferiority concerning existing options. Whereat, compatibility was the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters (Rogers, 2003, p. 247). According to Hansen and Birkinshaw (2007), the compatibility of an innovation is an important concept for managers to understand when deciding the best ways to incorporate an innovation into the organisational structure (Hansen & Birkinshaw, 2007). According to Armstrong (2006) the organisational structure development process is not neutral to organisational culture. Furthermore, the manufacturing SME organisations comprised different cultures throughout the integrated value chain that affected the implementation of technology in manufacturing organisations by establishing common organisational values or standards. (M. Armstrong, 2006, pp. 306-308). Limayen et al. (2007) discuss the role of habit in the technology adoption and suggest that satisfaction, frequency of previous behaviour, stability of context, and amount of use contribute to the formation of habit (Limayem, Hirt, & Cheung, 2007). Bayerl et al. (2016) suggest differentiating group-based adoption into different technology adoption states (TAS). Therefore, they complement previous group-based models with a new, qualitative view on the emergence and stability of adoption patterns in complex user groups. Furthermore, it is postulated a basis for practical guidelines on how to deal with problematic adoption situations when actors from multiple organisations are involved (Bayerl, Lauche, & Axtell, 2016). This highlighted the need for organisations to understand how innovations in their external environment can impact their organisational culture and how to effectively diffuse management and technology innovations for successful adoption in the automotive industry. Bayerl et al. (2016) contend that TAS provide a new conceptual perspective for analysing adoption or non-adoption decisions in heterogeneous group settings, as well as a framework for dealing with challenging situations (Bayerl et al., 2016). Warkentin and Beranek (1999) stated that virtual teams becoming increasingly common consisting of members from different organisations or companies who rely on electronic communication to share information (Warkentin & Beranek, 1999). Majchrzak et al. (2000) states that the adoption process of virtual teams has more malleable structures than typical organisational units (Majchrzak, Rice, Malhotra, King, & Ba, 2000). Moreover, it has been proposed a model for the adoption process that attempts to reconcile the pre-existing organisational environment, group and technology structures. Bjørn and Ngwenyama (2009) affirm that the risk of communication errors is increasing due to cultural and organisational differences based on the geographical distribution of the participants (Bjørn & Ngwenyama, 2009). Furthermore, they suggested that a process for building shared meaning is needed for mitigating the risk of miscommunication within

virtual teams (Bjørn & Ngwenyama, 2009). Jeyaraj et al. (2006) provides in-depth assessment on predictors, linkages, and biases in individual and organisational IT adoption research. Furthermore, he argued that the best predictors of individual IT adoption are perceived as usefulness, top management support, computer experience, behavioural intention, and user support (Jeyaraj, Rottman, & Lacity, 2006). Moreover, organisational and innovation characteristics were found to be significant predictors of IT adoption. This is in line with Rogers Diffusion Theory, which suggest the characteristics of people such as knowledge and attitudes influence their decision to adopt an innovation (Rogers, 2003). For the past few years, the proliferation of digital technologies has introduced a new paradigm in manufacturing and production, referred to as I4 (Pereira & Romero, 2017). The relatively rapid adoption of digitalisation opens new opportunities across companies to produce more efficiently and profitably (Autio, Nambisan, Thomas, & Wright, 2018). However, these same opportunities might not be equally accessible for SMEs, given their country and company specific characteristics (Psillaki & Daskalakis, 2009). Horvath et al. (2019) conducted 26 semi-structured interviews with management, including chief digital officers and chief executive officers. Furthermore, they developed the driving forces and barriers that might influence the adoption of digital technology by multinationals and SMEs. Moreover, they emphasised the role of organisational culture in transformation. They concluded that the organisational culture was usually not identified, even though managing organisational resistance and achieving cultural acceptance of innovations were generally a priority during I4 projects (Horváth & Szabó, 2019). Wejnert (2002) provides the conceptual framework for diffusion of innovations through society over time (Wejnert, 2002). Furthermore, it has been outlined the study diffusion of innovations by various branches of sociology, including economics, sociology, psychology and political science. Moreover, it has been presented a unified conceptual framework for integrating various economic and sociological models of diffusion (Wejnert, 2002). However, one perspective is that the variables in the diffusion process interact with each other and have a reinforcing or mitigating effect may be vague and lacks of rigor.

According to Andriopoulos and Lewis (2009), the mix of exploitative and exploratory organisational behaviors enables the success and persistence of the organisation in adopting innovations, but also creates a challenging relationship between them (Andriopoulos & Lewis, 2009). Furthermore, The organisational challenge is to maintain a balance between leveraging existing technologies to enable incremental innovation and exploring new potential to drive more profound innovation. (Martini, Laugen, Gastaldi, & Corso, 2013).

Lin et al. (2011) examine the role of strategic leadership in creating an organisational culture in which conflicting capabilities for exploration and exploitation are competing (Lin & McDonough III, 2011). Furthermore, it has been examined the role of the organisational culture in mediating the relationship between strategic leadership, knowledge-sharing and innovation ambidexterity. Moreover, it could be pointed out that strategic leadership shapes the desired behaviour of employees by establishing norms

and values in organisation that are critical to creating organisational culture (Lin & McDonough III, 2011).

2.4.3 Manufacturing Strategy in SMEs During Adoption of Industry 4.0

Platts et al. (1998) outline the manufacturing strategy as a pattern of decisions, each structurally and infrastructural, that verify the capability of a manufacturing system and operations to realize the manufacturing goals aligned with the overall business goals (Platts et al., 1998). Barnes (2002) examines the manufacturing strategy formation process in SMEs and concludes that organisational culture, politics and powerful individuals are not neutral to the formation of manufacturing strategy, and that a top-down planning mode linked to a business planning regime is unlikely to be effective in determining the manufacturing strategy (Barnes, 2002). Porter (1996) argues that employees require guidance from management to deepen its strategic position and foster the company's uniqueness (Porter, 1996). Furthermore, establishing a sustainable strategy requires practicing operational effectiveness by performing similar activities better than competitors, and strategic positioning by performing similar activities in different ways than competitors (Porter, 1996, p. 3). Tracey (1998) argues that organisations which invest in advanced manufacturing technologies (AMT) and establish mechanisms for involving manufacturing managers in strategy formulation achieve better competitive advantage and business performance than firms fail not taking these measures (Tracey, Vonderembse, & Lim, 1999). Quinn and Rohrbaugh's (1981) competing value model (CVM) conceptualizes organisational effectiveness as the result of the interaction between organisational focus, organisational structure, and differentiated focus on key organisational processes and outcome (Quinn & Rohrbaugh, 1981). Moreover, an effective manager would be expected to play different roles concurrently to achieve optimal organisational effectiveness by focusing on organisational output (short term) and outcome (long term) same time, even if these are in opposite directions in the context of CVM.

2.5 Adoption of Industry 4.0 in Organisations

Industry 4.0 (I4) is referred to as a strategic initiative introduced by the German government in 2017, which aims to transform industrial manufacturing through digitalisation and exploitation of the potential of advanced technologies, which enables an individualised and customised product (Rojko, 2017). These advanced Technologies include the Internet of Things (IoT), artificial intelligence (AI), big data analytics, cloud computing, robotics, and 3D printing, which enables manufacturing companies to achieve flexible, smart manufacturing processes to address the fast-changing market requirements ((Zhong, Xu, Klotz, & Newman, 2017). The definition of SMEs varies from country to country (Simpson, Padmore, & Newman, 2012). The European Commission (European Commission, EU recommendation 2003/361) defined SMEs based on their income, number of employees, and

annual turnover. Moreover, they stipulate that classification as a small or medium-sized enterprise depends on companies meeting thresholds for annual turnover of less than €50 million, employee headcount of fewer than 250, or total balance sheet amounts of less than €43 million. In this research all the included firms were satisfying these criteria. A successful SME is broadly defined as an independent business that is generating profits, demonstrating steady growth in financial performance indicators like revenues and profits, gaining larger market share within their industry, and executing strategies effectively to remain competitive and continuously adapt to changing market conditions (Laforet & Tann, 2006; Simpson et al., 2012). Specific metrics indicating SME success may include increased sales, job creation, innovation of products/services, ability to attract investment and talent, and potential for long-term sustainability and survival in the face of disruption. Additionally, a successful SME would have a supportive organisational culture aligned with its business strategy (M. H. Smith & Smith, 2007). Within the context of Industry 4.0, a successful SME would be effectively leveraging advanced technologies to enhance productivity, quality control, flexibility, reduce costs, and better meet diverse customer requirements (Mittal, Khan, Romero, & Wuest, 2018).

2.5.1 Effects of Organisational Factors on Innovative Work Behaviour

DeJong et al. (2008) developed a measure of innovative work behaviour of individual employees based on four dimensions: opportunity exploration, idea generation, championing, and application, as well as examining its relationships with participative leadership, external work contacts, and innovative output (De Jong & Den Hartog, 2008). Furthermore, they found that a positive relationship between innovative work behaviour and innovative output exists. Moreover, this confirmed that innovative work behaviour among employees favours organisation's ability to innovate and achieve better outcome. Pulakos et al. (2000) conducted empirical studies to develop the taxonomy "Job Adaptability Inventory (JAI)" of adaptive work performance and assess its impact on comprehending, predicting, and training adaptive behaviour in work environments (Pulakos, Arad, Donovan, & Plamondon, 2000). Moreover, it can be concluded that the JAI data based on the exploratory and confirmatory analysis in this study indicated that adaptive performance is a multi-faceted phenomenon. This was demonstrated by the emergence of an eight-dimension taxonomy: (a) handling emergencies or crisis situations, (b) handling work stress, (c) solving problems creatively, (d) dealing with uncertain and unpredictable work situations, (e) learning work tasks, technologies, and procedures, (f) demonstrating interpersonal adaptability, (g) demonstrating cultural adaptability, and (h) demonstrating physically oriented adaptability (Pulakos et al., 2000).

Leonardi (2009) conducted a qualitative and quantitative analysis and use of a computer simulation technology at a major automotive firm to examine the relationship between user expectations of new technology and the failure of organisational change (Leonardi, 2009). Furthermore, the study suggests that people shape their interpretations of new technologies through social interactions and

direct material interactions with technology, and that technology adoption can lead to organisational change failure depending on the degree of misalignment between these two factors. According to Giddens structuration theory, structure (sum of rules and resources, organised as properties of social systems) and agency (actions and intentions of individuals) are interrelated and mutually dependent, with structure shaping agency and vice versa in a recursive process (Giddens, 1984). Furthermore, he pointed out that on the one hand structure enables and limits the individuals action and on the other hand agency shape and transform the structures. However, although structuration theory offers an alternative view of aforementioned agency and structure, some argue that structuration theory falls short in attempting to explain how social action is produced (Macintosh & Scapens, 1990). DeSanctis (1994) suggest the adaptive structuration theory (AST) approach to analyse the role of advanced information technologies in structure change (DeSanctis & Poole, 1994). Furthermore, the AST approach views structure from two perspectives: (1) the structures provided by advanced technologies, and (2) the structures that emerge in human actions when people interact with these advanced information technologies. However, the mapping of structure and agency and tracking of their mutual effects can provide a deeper understanding of technology implementation that foster productive adaptations. Orlikowski (2000) proposes a practice-oriented approach to comprehend the complex construct of social interaction and technologies in the organisation (Orlikowski, 2000). Furthermore, it could be contented that such a practice orientation can better explain the emergence and change of both technologies and their use. Moreover, it has been suggested the extent and quality of the existing structures in the organisation, including resources, support groups, infrastructure, and tools, impact the decision to adopt new technology. Jaspersen et al. highlighted the disparity between aforementioned agency and structure, and argued that the functional capabilities IT applications in organisations are underutilised, as most employees exhibit limited utilisation of the available technology (Jaspersen, Carter, & Zmud, 2005). Moreover, it has been proposed a two-level conceptualisation of post-adoptive behaviours that contributes for the understanding of IT adoption at the individual level of analysis, use, and diffusion.

I4, characterised by the proliferation of new and advanced technologies, has a faster pace and greater scale of innovation than the previous industrial revolutions (Schwab, 2017, p. 12). Furthermore, it could be stated that the magnitude and extent of the technological revolution are expected to lead to economic, cultural, and social changes, whose extent can be hardly predicted (Schwab, 2017, p. 31). Moreover, the barriers to the full integration of I4 solutions are mentioned as the inability of companies to identify capabilities they need and the lack of understanding of how to develop these capabilities effectively. Specifically, it has been emphasised the necessity of rethinking culture in light of new skill requirements and attracting and retaining the right employees (Schwab, 2017, p. 59).

2.5.2 Current State of Adoption of Industry 4.0 in Manufacturing SMEs

The development of manufacturing companies in the automotive industry is characterised by a mixture of old and new technologies, which have created new challenges for the companies (Morel, Valckenaers, Faure, Pereira, & Diedrich, 2007). The adoption of I4 poses a challenge for manufacturing SMEs as it offers new technical possibilities for leveraging existing resources and may require a new work organisation that features a greater extent of human-machine technology interactions (Piccarozzi, Aquilani, & Gatti, 2018). Furthermore, the adoption of I4 represents a holistic approach to manufacturing that encompasses the involved value chain, from sales and procurement to after-sales, and operates as a collaborative ecosystem based on economic and social relationships across the stakeholders (Piccarozzi et al., 2018). According to Xu (2018), many manufacturing SMEs that have implemented I4 are not currently exploiting the advanced and novel technologies developed under the umbrella of I4. Moreover, the successful implementation of I4 depends on more sophisticated technologies than those currently available (Xu, Xu, & Li, 2018). The High-Tech Strategy 2025 (HTS2025) represents the guideline for creating smart production in the manufacturing SME sector by the German industry (BMBF, 2018). Furthermore, HTS2025 covers the most important aspects of the I4 agenda, which focuses on developing and promoting new technologies. Moreover, Platform I4's aimed to advance innovation and structural change in the manufacturing industry, focused on small and medium-sized enterprises (BMWK, 2016). Hence, SMEs tend to undertake fewer initiatives to adapt to changing business models than larger companies, thus the I4 platform foster collaboration between the stakeholders to support SMEs in particular in the adoption of I4 (BMWK, 2016).

The Reference Architecture Model I4 (RAMI 4.0) supports a shared understanding and common standards of the I4 concept among the stakeholders across the value chain, it was developed by the aforementioned I4 platform based on the smart grid architecture model introduced in 2014 (Döbrich, Heidel, Hankel, & Hoffmeister, 2017). The European Commission conceptualises Digital Transformation as an integration of advanced technologies that seamlessly connect physical and digital systems, resulting in the formation smart products and services, along significant improvement in productivity (EISMEA, 2021, p. 74). The utilisation of technology represents a complex and multi-dimensional phenomenon (M. M. Crossan & Apaydin, 2010), influenced by various internal and external factors, such as lack of managerial initiatives to initiate organisational change activities and human resources to implement the technology, positive examples of exploiting the opportunities presented by the technology (Damanpour & Schneider, 2006; Van de Vrande et al., 2009), and by exogenous factors, such as the worldwide outbreak of the Covid-19 pandemic (EISMEA, 2021). North et al. (2018) investigate how knowledge management effect value creation, and note that value creation through digital technology is intrinsically linked to the cultural values that drive the organisation in a digital economy (North, Maier, & Haas, 2018). Moreover, they proposed the model

“knowledge ladder 4.0” to relate to enabling digital technologies, such as intelligent systems leveraging human performance, to organisational changes and new forms of managing knowledge work. Manufacturing SMEs in the automotive industry need find a suitable strategy for the integration of developing and fabricating new digital technology to adapt the requirements of larger size organisations such as the OEMs and Tier 1 suppliers, while ensuring not running into the risk of losing sight of their core competencies (Martinsuo & Luomaranta, 2018). I4 presents for SMEs a continuous process to reflect business needs operationally and economically, while focusing on maintaining and developing manufacturing systems (J. Lee, Bagheri, & Kao, 2015).

Chowdhury and Iqbal (2014) contend that a critical aspect of any modernisation process is the acknowledgement of its strength and weaknesses for selecting a suitable strategy for successfully adopting new technologies (Chowdhury & Iqbal, 2004). Ramage et al. (2000) suggest in the context of business process change a broader view of organisation's operating system, encompassing balanced interaction of people, hardware, data, business processes, organisational strategy, the maintenance process, and development cultures, as well as the system's relationship to the environment, in order to achieve an optimal outcome (Ramage & Munro, 2000).

Zhong et al. (2017) present in a comprehensive study the impact of I4 on manufacturing systems. Furthermore, they highlighted its potential to increase the flexibility, ability for mass customisation, productivity in manufacturing, while enabling manufacturing firms to meet the challenges of fabricating customised products with a shorter lead-time to market and improved quality (Zhong et al., 2017).

Arnold et al. (2016) examined the impact of the Industrial Internet of Things (IoT) in the context of the value proposition and its impact on the business models of established manufacturing companies in various industries and stated that the employees role has shifted from operators to problem solvers, indicating an increased complexity of employee tasks and fewer hierarchies in the organisational structure (Arnold, Kiel, & Voigt, 2016). Despite previous research in the area, understanding the impact of decentralised authority in manufacturing SMEs during adoption of I4 in the automotive industry remains limited. Lee and Edmondson (2017) note an upward trend in organisations opting for flatter structures with fewer hierarchy to increase flexibility (M. Y. Lee & Edmondson, 2017).

2.5.3 Integration of Organisational Culture

Winkelhage (2017) argues that, since digitalisation initiatives permeates all critical business processes, a comprehensive digitalisation roadmap covering all business areas must be integrated into a long-term strategic planning process (Winkelhake, 2017, p. 139). Furthermore, it has been posited that an isolated consideration of information technology and organisational culture in the process of digital transformation in the automotive sector is not expedient, and that instead the dovetailing of these two elements should be viewed as a key factor for the successful implementation of the digital

roadmap or I4. Samaranayake et al. (2017) evaluate the importance of key factors for implementing I4 from a technological readiness perspective (Samaranayake, Ramanathan, & Laosirihongthong, 2017). Furthermore, it has been identified a strong relationship between technological readiness and I4 design principle, arguing that process-related objectives are more crucial than economic and environmental objectives in the adoption of I4. Moreover, they emphasised the importance of human knowledge in technology and machine connectivity to the internet as the key factors for achieving all measures. Ajzen (1991) study mapping the determinants of organisational behaviour resulted in the Theory of Planned Behaviour (TPB), which posits that an individual's intention to perform a particular behaviour is a function of attitude towards that behaviour, subjective norms, and perceived behavioural control, including changes in the intention of individuals in response to changes in the surrounding environment (Ajzen, 1991). Moreover, the TPB suggested that the spread or diffusion of new products being influenced by early adopters within an organisation, and potential adopters who initially hold differing attitudes towards new products or technologies in the beginning and experience a shift in their attitudes after the adoption. Karahanna et al. (1999) combine the concepts of innovation and attitude theory in a theoretical framework to investigate the disparities in pre-adoption (early adopters) and post-adoption (potential adopters) beliefs and attitudes, utilising the “Theory of Reasoned Action (TRA)” and incorporating “Technology Acceptance Model (TAM)” to apply technology adoption models in the research area of information systems, unveiling that early and potential adopters of information technology exhibit differences of behavioural intention, attitude, and subjective norm (Karahanna, Straub, & Chervany, 1999). Moreover, it could be stated that early adopters attitudes are grounded in perceptions of usefulness, ease of use, demonstrability of results, visibility, and trialability, whereat potential adopters- attitudes are based only on instrumentality beliefs of usefulness. Thong (1999) developed an integrated model of information systems (IS) adoption in small businesses that identified the decision-making characteristics, IS characteristics, organisational characteristics, and environmental characteristics as the primary determinants of IS adoption (Thong, 1999). Furthermore, the results from a sample survey of 166 SMEs showed that CEO characteristics, innovation characteristics, and organisational characteristics influence the likelihood of IS adoption, whereat CEO and innovation characteristics were significant determinants of the decision to adopt but not impacted the extent of IS adoption, which was primarily influenced by organisational characteristics. Thong's (1999) study might have several limitations, which include the possible inaccuracy in gauging CEO perceptions, the cross-sectional nature of the study leading to causal relationships that can only be conjectured, and the examination of only a subset of critical variables in the technological innovation literature.

2.6 Manufacturing SMEs in the Automotive Industry

2.6.1 Paradigm Shift in the Automotive Industry

The automotive industry employs approximately 50 million people worldwide, including 13.8 million in the European Union (EU), with 2.6 million directly employed in automotive production, accounting for 8.5% of industrial employment in the EU (EISMEA, 2021; Manufacturers, 2006). Mittal et al. (2018) conducts a critical evaluation of the available smart manufacturing (SM) and I4 maturity models with regards to the requirements of manufacturing SMEs, identifies characteristic features and research gaps need to be addressed to successfully support manufacturing SMEs to adopt I4, and finds that a limited number of these models address the specific needs and challenges of SMEs (Mittal et al., 2018). Moreover, it could be contended that limited studies focus on supporting SMEs in their paradigm shift toward I4, and that organisational culture may hinder the ability or is not sufficiently flexible to experiment and implement advanced technologies, leading to uninformed decisions based on the managers' 'gut feeling'.

Almeida et al. (2020) argue that the Covid 19 pandemic has exacerbated the necessity for organisations to establish a culture of innovation and embrace digital transformation, which requires active management engagement to maintain operational continuity in a volatile business environment (Almeida, Santos, & Monteiro, 2020). Moreover, it has been pointed out that the adoption of telework and rework models that embrace interactivity and cooperation among employees constituted a challenge in the progression of digital transformation. Grözinger et al. (2020) conducted a study to assess the effect of different communication media on creative performance in virtual teams during a highly visual task, prompted by the need for new routines and digital technologies as a result of Covid-19, which necessitated remote collaboration. Furthermore, they concluded that communication through chat had a mitigating effect on performance than face-to-face communication, but communicating via videoconference alleviated the creativity in virtual teams (Grözinger, Irlenbusch, Laske, & Schröder, 2020). The ability to handle the new technological capability properly posed new challenges for manufacturing companies (Ameri & Dutta, 2005). The use of technology in manufacturing companies has significantly increased the need for social knowledge to enhance employee collaboration and knowledge sharing (Evans, Gao, Martin, & Simmonds, 2015). Thus, employee knowledge has been identified as key to leveraging technology to ensure competitiveness, such as developing innovative products. Computer systems were widely used to support creation, simulation, modification, and optimization of new products and manufacturing processes. Modern factories made considerable use of industrial robots and automated machinery (Tao, Qi, Liu, & Kusiak, 2018). However, I4 focus lies primarily on information technology, automation technologies smart products and the processing of Big Data (Tao et al., 2018). Frank et al. (2019) examines the implementation patterns of these technologies for a greater understanding of how manufacturing companies are adapting their organisational processes to emerging technologies to achieve higher

productivity and efficiency. They do this by conceptualizing a framework based on four dimensions (Smart Manufacturing, Smart Products, Smart Supply Chain, and Smart Working) and base technologies (IoT, Cloud Services, Big Data, and Analytics). They suggest that I4 is associated with a systematic adoption of front-end technologies, in which Smart Manufacturing plays a key role (Frank, Dalenogare, & Ayala, 2019). Winkelhake (2017) elucidates the increasing challenge of competition in the market arising from the increasing globalisation and asserts that manufacturers must continuously optimise their processes, rectify weaknesses in the value chain, and adopt I4 solutions in order to maintain their competitiveness. Furthermore, he emphasised the significance of re-evaluating the organisational culture of the manufacturing SMEs, which is rooted in the company's core values and reflected in the behaviour of employees, as a critical factor for the comprehensive adoption of I4 (Winkelhake, 2017, pp. 117-119; 200). According to Vival (2021), the increasing complexity of the business environment brought about by advances in digital technologies that enable greater access to information, computing, communications, and connectivity has led to a new reality in which the collaboration of different networks of actors creates interdependencies that do not always align (Vial, 2021). Moreover, this complexity offers significant potential for innovation and improved performance in organisations and has implications beyond the boundaries of a single company to individuals, industries, and society as a whole.

2.6.2 Characteristics of the Manufacturing Processes

Goerzig et al. (2018) propose an "Agile Enterprise Architecture for Digital Transformation" model consisting of a macro cycle defining the architecture of the entire SME and a micro cycle for implementing and testing individual functions, with the business strategy serving as the starting point for deriving the digital transformation strategy. (Goerzig & Bauernhansl, 2018; Matt, Hess, & Benlian, 2015).

Dubey and Gunasekaran (2014) propose a framework for Agile Manufacturing (AM) that encompasses technologies, workforce empowerment, customer focus, supplier relationship management, flexible manufacturing systems and organisational culture (Dubey & Gunasekaran, 2015). Furthermore, it can be seen that a positive correlation between organisational culture and the successful implementation of AM. Moreover, they emphasised the importance of certain dimensions of the organisational culture, namely attention to detail, team orientation, employee orientation, innovation and risk-taking, and stability, for a successful AM environment. These findings are in line with previous studies, Christopher et al. (1999) contributed to the body of knowledge by examining the relationship between organisational culture and effectiveness of Agile Manufacturing Technology (AMT) implementation and found evidence for the connection between organisational culture and AMT implementation effectiveness (Christopher M. McDermott a, Technology, & General Business, 1999). Ching-Ming and Hang-Yue (2004) highlight the critical role of organisational culture in the

link between the Human Resources (HR) system and the development of product innovation (Chung-Ming & Hang-Yue, 2004). Furthermore, it can be seen that a developmental culture served as the missing link between the HR system and innovation outcomes, with an HR system emphasising extensive training, performance-based reward, and team development being necessary to foster a culture that support product innovation. Gordon and DiTomaso (1992) assert that, in the event of environmental change, organisations with an appropriate organisational culture are more likely to endure and prosper, compared to organisations with inconsistent organisational cultures (Gordon & DiTomaso, 1992).

2.6.3 Readiness of SMEs to Adopt Industry 4.0

Gassmann et al. (2010) content that in the automotive industry, creativity, and the ability to innovate are becoming increasingly important with the growing popularity for open innovation and need for new product innovations (Gassmann, Enkel, & Chesbrough, 2010). Lukes and Stephan (2017) propose a model of employee innovative behaviour that assesses individual employee innovative behaviour as a micro foundation of corporate intrapreneurship, influenced by contextual factors such as managerial, organisational, and cultural support for innovation, and validated the Innovative Behaviour Inventory and Innovation Support Inventory as reliable cross-culturally applicable measures. However, the study's limitations include its cross-sectional research design, which limits the ability to determine causality, and its focus on European countries only (Lukes & Stephan, 2017). Moeuf (2018) argues that SMEs limit their implementation of I4 to adopting Cloud Computing and the Internet of Things and primarily use these technologies for monitoring industrial processes, lacking actual applications in manufacturing planning. Moreover, it has been pointed out that I4 projects in SMEs continue to be cost-driven initiatives with no evidence of genuine business model transformation (Moeuf et al., 2018). Hozdic (2015) argues that technological development in smart manufacturing plants adopts I4, the most crucial factor and a significant prerequisite of general development, requires the development and application of new technologies, necessitates the restructuring of existing and the design of new manufacturing plants with the latest configurations. Furthermore, he suggested an immediate change in the current situation, with the need for general support in defining development strategies and policies and industrially organised development of new scientific knowledge for direct transfer into the region's economy (Hozdić, 2015). Brauner and Ziefle (2015) highlight the significance of human factors in the development of applications for Smart Factories and enterprises in the era of I4, proposing guidelines for a user-centred development approach. Furthermore, it has been argued that the rapid pace of miniaturisation and advancement of Information and Communication Technology (ICT) in manufacturing technology created significant challenges in decision-making as humans must still conceive and process complex multi-dimensional data sets to make an informed decision. Moreover, it could be concluded that the relationship between

managers and employees needs to be re-structured to foster efficient teams characterised by transparent group communication, a shared information policy, appreciation of team-generated ideas and innovations, and trust in both the manager and employees, which could drive sustained high-performance cultures in manufacturing industry in the long run (Brauner & Ziefle, 2015, pp. 187-199). The European Commission report and the SME survey indicate that technology adoption among SMEs has increased, with the digital sector growing faster than the non-digital sector, and 71% of SMEs considering further adoption of advanced technologies, highlighting the importance of understanding the organisational culture of SMEs and its role in the competent handling of I4 challenges. Furthermore, the results of the SME survey indicated that those SMEs who have already extensively digitalised before the Covid-19 pandemic accelerated their use of advanced digital technologies such as AI, Big Data analytics, IoT, and robotics during the pandemic (EISMEA, 2021, pp. 2, 4, 38).

2.6.4 Gaining a Competitive Advantage through the Organisational Culture

Barney (2000) proposes a framework for linking a firm's resources to sustained competitive advantage, identifying four empirical indicators, value, rareness, imitability, and substitutability, to assess the potential of these resources to generate competitive advantage (Barney, 2000). Furthermore, it is postulated that, given the understanding of the company's sources, the competitive advantage lies in the firm's possession of rare, imperfectly, imitable and non-substitutable resources. Hall (1993) examines the role of intangible resources in business strategy, with a focus on identifying intangible sources of sustained competitive advantage, and states that cultural capability, encompassing the collective habits, attitudes, beliefs, and values of an organisation, can contribute to competitive advantage through its impact on factors such as high-quality standards, agility in response to change, and organisational learning (Hall, 1993). Moreover, it could be concluded that culture, as demonstrated in survey and case study data, is a key contributor to the competitive advantage. Nikolic et al. (2017) present an overview of the manufacturing industry's challenges in creating intelligent production systems with self-awareness, self-prediction, and self-maintenance capabilities, including converting data into information through data mining, with a particular emphasis on success factors of I4 (Nikolic, Ignjatic, Suzic, Stevanov, & Rikalovic, 2017). Moreover, it has been suggested that implementing predictive manufacturing systems offers numerous advantages, including cost reduction, improved operational efficiency, enhanced product quality, and reduced production time, thereby enhancing the competitiveness of companies. Lee et al. (2013) delve into the principles of predictive manufacturing systems to enhance competitiveness in the manufacturing industry through a transparent and seamless manufacturing process (J. Lee, Lapira, Yang, & Kao, 2013). Moreover, it has been concluded that the predictive manufacturing system represents the next stage in the evolution of manufacturing and offers increased factory transparency through predictive tools to anticipate

unseen uncertainties in processes, equipment, and systems. Fitz-Enz and Mattox (2014) contend that with the growth of internet-based and network communications in the manufacturing industry, it is necessary to analyse “hybrid data” for optimised business practices, requiring a dual examination of both structured and unstructured data, including an assessment of company’s internal standards and capabilities such as vision, leadership, brand, culture, and financial strength, to make an informed decision about the company’s offerings (Fitz-Enz & John Mattox, 2014).

Lu et al. (2016) examine the opportunities and challenges associated with new standards in manufacturing, highlighting emerging efforts to integrate standards across three dimensions of the manufacturing lifecycle: product, production system, and business. Moreover, they suggested that existing manufacturing standards are insufficient to fully support smart manufacturing, particularly regarding to cybersecurity, cloud-based manufacturing services, supply chain integration, and data analytics (Lu, Morris, & Frechette, 2016). Müller et al. (2018) analysed the impact of I4 on the business models of manufacturing SMEs and identified three dimensions of I4 high-grade digitization of processes, smart manufacturing, and inter-company connectivity (Müller, Buliga, & Voigt, 2018). Furthermore, they evaluated its effect on value creation, value capture, and value offer and categorised SMEs into four categories, craft manufacturers, preliminary stage planners, I4 users, and full-scale adopters, to assist managers in evaluating their company's positioning towards I4. However, they suggested that business model innovation can generate benefits for SMEs to counteract perceived challenges and accelerate I4 implementation. Lee et al. (2012) examined the determinants of successful adoption of a Manufacturing Execution System (MES) in manufacturing SMEs, revealing that top management support, the sufficiency of investment, the competency of the system developer, and user involvement are crucial factors, and emphasised the pivotal role of top management in the decision-making process regarding IT implementation in SMEs (S. M. Lee, Hong, Katerattanakul, & Kim, 2012). Halim et al. (2015) proposed a conceptual framework that links organisational learning, innovation culture, and innovative performance to guide SMEs in aligning their business strategies and practices with the dynamic market, based on a study featuring five SME entrepreneurs from Malaysia, who were interviewed to obtain their views on innovation culture (Halim et al., 2015). Furthermore, it has been found that the respondents emphasised the significance of innovation culture through organisational learning in their business activities, recognised the challenges of nurturing it, and considered it a crucial factor in shaping their innovative performance. Moreover, they concluded that organisational culture can either foster or inhibit creativity and innovation, as evidenced by the relationship between organisational culture and organisational learning with innovation, and that innovation culture encompasses the cultural emphasis necessary to attain innovative performance. Ardichvilli and Polesello (2016) state that the organisation's capability to innovate, enhance operational efficiencies, and remain competitive in a rapidly changing environment is mainly dependent upon its capacity to learn and argue that organisations that acknowledge the significance of

the learning organisation concept should foster practices such as building and communicating a shared vision to employees at all levels, fostering collaboration, interaction, and teamwork, empowering employees through participatory work practices, promoting and providing opportunities for continuous learning, and utilising relevant technologies in the workplace (Rana, Ardichvili, & Polesello, 2016). Hence, it has been suggested that organisations adopt related workplace technologies that facilitate open communication, offer opportunities for collaboration and teamwork, and provide platforms for individual learning.

2.7 Summary and Findings of the Literature Review

This section summarises the findings from the literature review and outlines their significance to this thesis. The research on organisational culture in the context of I4 in the automotive industry is primarily limited to samples from management. The literature review reveals a persistent dominance of an isolated perspective of organisational culture and technological development, with varied terminology used to describe the concept of I4, including digitalisation, digital manufacturing, and smart factory. The study reveals a lack of consensus on the definition of I4 (Fettermann et al., 2018), and the variance in the interpretation of the state-of-the-art across manufacturing SMEs in the automotive industry (Da Costa et al., 2019). The study reveals numerous assumptions regarding the impact of technology adoption on organisations across industries and regions, which are frequently based on theoretical considerations rather than practical perspectives from managers or real-world experiences. Despite extensive examination of strategies for SMEs to overcome obstacles in implementing new technologies (Darbanhosseiniamirkhiz & Wan Ismail, 2012; Rana et al., 2016), the body of knowledge of the existing literature falls short in addressing the key factors of organisational culture for the diffusion of management and technology innovations for effective adoption of I4 in the automotive industry. The absence of a systematic approach to addressing these knowledge gaps constitutes a formidable challenge in determining the impact of the organisational culture on adopting I4 concepts within manufacturing SMEs in the automotive industry (Frank et al., 2019; Mittal et al., 2018). An isolated approach poses the risk of deficiencies in manufacturing SMEs' organisational culture remain unrecognised when adopting I4 in the automotive industry. Another argument in the literature is the ambiguity and diversity attributed to organisational culture, which complicates the practical application of the concept. Implementing a concept of organisational culture in manufacturing SMEs during the adoption of I4 in the automotive industry remains a prevalent and unresolved problem. The correlation between organisational culture and the effective diffusion of management and technology innovations is in the literature largely undefined and neglected. Therefore, from an academic and managerial perspective, there is a need to further explore the key factors of organisational culture for effective diffusion of management and technology innovations in manufacturing SMEs in the adoption of I4 in the automotive industry.

Furthermore, this literature review has highlighted a significant research gap: the absence of practical guidance for aligning organisational culture with the requirements of manufacturing SMEs in the automotive industry for successful diffusion of management and technology innovations. Moreover, there is a clear need for a framework that identifies the key factors of organisational culture, which are most and least preferred in the context of I4, enabling manufacturing SMEs in the automotive industry to strategically shape their cultural environment to adopt I4 successfully. The research objectives aim to analyse the organisational culture and how it's shaped by management during the adoption of I4, evaluate how organisational culture influences the adoption process, identify key factors of organisational culture that enable effective diffusion of management and technological innovations, and finally propose a strategic framework of key factors, guiding manufacturing SMEs in the automotive industry for the successful adoption of I4.

Chapter 3 Research Methodology and Design

3.1 Introduction

This chapter presents the research methodology and design and is organised into three sections: the research philosophy, the research methodology and the methods for data collection and analysis. In section 3.3, outlines a mixed-method research approach, interpretive and post-positive research philosophy and utilising semi-structured interviews and a sample survey. Section 3.4 and 3.5 presents the methods for data collection and data analysis, informed by the literature review, suggesting the suitability of a mixed-method research approach. Finally, ethical considerations are presented in section 3.6. Section 3.7 summarise this chapter.

3.2 Research Philosophy

A paradigm refers to a conceptual framework consisting of an underlying framework of ideas and assumptions about reality, including metaphysical, moral, methodological, and epistemological thinking (Collins & Stockton, 2018; Goulding, 2002; Hassard, 1994; Howell, 2012). Paradigms significantly shape individuals' perception of the world, behaviour, and knowledge acquisition (Hwang, 2015; Van Merriënboer & De Bruin, 2014). Furthermore, paradigms determine how they view people and the environment and provide a social context for their workplace that determines what is deemed sensible and what is not. Moreover, paradigms are subject to change in response to shifts in an innovative organisation's values, beliefs, and technological advancements over time. An interpretive paradigm approach involves the utilisation of hypothetical scenarios to identify how individuals within organisations would behave in a given situation and to make predictions about organisational operations (Flynn, Sakakibara, Schroeder, Bates, & Flynn, 1990; Meredith, Raturi, Amoako-Gyampah, & Kaplan, 1989). Hatch's (1993) cultural dynamics model outlines the processes of manifestation, realization, symbolization, and interpretation to explain the dynamism of organisational cultures, providing a framework for analysing the culture's dynamics within an organisation and emphasising the importance of activities in shaping cultural consciousness and promoting reflexivity (Hatch, 1993). Interpretivism as a paradigm has been selected for this study as it enables the exploration of participants' thoughts, experiences, and perceptions. Through interpretive methods, such as hypothetical scenarios, insights can be gained into how individuals within organisations behave in specific situations and enable predictions about organisational operations. In addition, interpretivism aligns well with the study's aim of exploring the impact of organisational culture on the diffusion of management and technology innovations during the adoption of I4 in manufacturing SMEs in the automotive industry. By focusing on participants' subjective experiences and interpreting them within a framework of cultural dynamics, the study seeks to provide a nuanced understanding of how organisational culture can impact the adoption of I4.

The data collection of this thesis was conducted from 2019 to 2021, coinciding with the global pandemic, and as argued by Kunovjanek et al. (2020), there has been a significant paradigm shift in the workplace, requiring organisations to align with these changes to avoid potential survival issues, and necessitating the adoption of technology-enabled culture and ‘tech-savvy’ personnel as a result of increased engagement with technology brought about by the widespread implementation of remote work (Kunovjanek & Wankmüller, 2020). Monostori and Váncza (2020) assert that the worldwide pandemic Covid-19 has exposed the shortcomings of existing manufacturing processes, focusing on the possibility of significant changes and new paradigms that could enable the manufacturing industry to respond effectively to similar or more severe future scenarios while acknowledging the uncertainty of whether the impact of the COVID-19 pandemic and the paradigm shift in manufacturing will lead to an acceleration of the development or continue on the established trajectory (Monostori & Váncza, 2020). Rowlands (2005) provides guidance for conducting research utilising an interpretive framework to construct a theory of information systems practice, highlighting the factors that influence the selection of interpretive methods, the development of a theoretical framework, the specifics of data collection and analysis, and the application of evaluative criteria relevant to interpretive research (Rowlands, 2005). Moreover, it can be concluded that the inductive, interpretive, and grounded theory approach a suitable choice for his research. Schwartz and Bilsky (1987) propose a theory of universal types of values based on the universal requirements: (a) biological needs, (b) interactional requirements for interpersonal coordination, and (c) societal demands for group welfare and survival, and define eight motivational domains of values: enjoyment, security, social power, achievement, self-direction, prosocial, restrictive conformity, and maturity. Furthermore, mapped these according to interest and goals to argue that the structural organisation of value systems reflects the degree of feasible and contradictory values. Moreover, it could be argued that this research approach enabled hypotheses about the structural organisation of values, conducted a survey in Israel and Germany with the outcome of largely supportive results for the dynamic relations of human values, and suggested the possibility of identifying universal or unique aspects of cultural values through their approach (Schwartz & Bilsky, 1987). Organisational scholars have increasingly argued that technology's effects on organisations are socially constructed, and constructivists who study technology implementation suggest that organisational change emerges from an ongoing stream of social action in which people respond to a technology's constraints and affordances as to each other (Leonardi & Barley, 2010). Moreover, it has been suggested that research on the social construction of implementation clusters into five coherent perspectives, including perception, interpretation, appropriation, enactment, and alignment, which focus on different phases of the technology implementation process. The research aim is to identify the key organisational culture factors that are important for the effective diffusion of management and technology innovations in manufacturing SMEs in the automotive industry to facilitate the adoption of I4. The research question in 1.2.2 is to

explore how organisational culture can interact with I4 technology to propel the adoption of I4 in SMEs in the automotive industry. A significant methodological challenge faced by this thesis was selecting appropriate research methods to investigate the impact of organisational cultural in manufacturing SMEs for effective diffusion of management and technology innovations for effective adoption of I4 in the automotive industry, leading to an interpretivist and post-positivist stance that recognises the socially constructed nature of reality and the existence of multiple perspectives on a given phenomenon. Moreover, adopting the interpretive paradigm utilises methods that produce qualitative data, while numerical data may also be incorporated, at which data collection methods that produce qualitative data include a range of open-ended interviews with varying levels of structure, such as standardised open-ended interviews, semi-standardised open-ended interviews, and informal conversational interviews, as well as observations, field notes, personal notes, and document analysis (Rehman & Alharthi, 2016).

3.3 Research Methodology

This thesis employs a mixed-methods research design that combines sample survey and semi-structured interviews with quantitative and qualitative research strategies to gain a comprehensive understanding of the complex phenomenon of organisational culture for the successful adoption of I4 in the automotive industry. The primary purpose of the sample survey and semi-structured interviews is to investigate the existing and preferred organisational culture in the post-Covid era in manufacturing SMEs in the automotive industry and to obtain a comprehensive dataset and perspective of the industry experts on the research topic. Adopting a sequential data collection approach, the semi-structured interview balances structure and flexibility (H. Kallio, Pietilä, Johnson, & Kangasniemi, 2016), enabling the collection of relevant and important data while allowing for the exploration of more nuanced and complex aspects of organisational culture in manufacturing SMEs in the automotive industry that emerged during the interview.

The participants of the sample survey or semi-structured interviews were managers and employees of manufacturing SMEs in the automotive industry who possess I4 adoption experience. The sample population carefully selected based on specific criteria of the size of the company and the level of expertise in the industry. Aligned with the research philosophy outlined in section 3.1, this thesis explores the socially constructed nature of organisational culture and its impact on the effective diffusion of management and technology innovations for successful I4 adoption in the automotive sector while addressing the research objectives outlined in section 1.2.3. The first phase of data collection focuses on acquiring quantitative data from a sample of 84 participants involved in manufacturing SMEs in the automotive industry, utilising online professional networks such as LinkedIn to recruit participants for the sample survey or semi-structured interviews. The data collected in the first phase of the research will serve as the basis for the second phase of data collection, comprising semi-structured interviews with a random selection of 15 individuals from the

original pool of 84 participants. Following the collection of qualitative data through thematic analysis approaches such as grounded theory to explore the respondent's views and experience concerning the research topic, quantitative and qualitative data will be analysed to address the research objectives outlined in section 1.2. Given that multiple dimensions, personal values, beliefs, stereotypes and individual experiences might influence organisational culture (Sue, 2001), it can be challenging to identify a single research methodology that comprehensively captures the diverse aspects of organisational culture (S. K. J. Lee & Yu, 2004). In the realm of knowledge management research, significant emphasis has been placed on the multifaceted constituents of organisational culture as a key element in the effective management of learning, knowledge, and innovation (Al Saifi, 2015). Gerring (2011) contends that the discipline of social science methodology has experienced an exceptional level of activity in recent decades, with increased growth in methods, models, and paradigms, sparking renewed interest in the field once thought to be dormant (Gerring, 2011). Furthermore, natural scientists often attempt to explain patterns at the population level by extrapolating results obtained from a subset of the population, whereas an anthropologist who conducts an ethnographic study of a single cultural group would be reluctant to extend those observations to other cultural groups (Moon & Blackman, 2014). According to Gibson et al. (2014), the issue of propagating an organisational culture of innovation throughout the entire organisation is a significant challenge for companies (Gibson, Ivancevich, & James, 2014, p. 246). Furthermore, they contend that management science explores the link between the human mindsets of advancing an existing entity and the organisational culture, aiming to foster the achievement of the organisational goals. Conceição et al. (2001) suggest that the success of knowledge-intensive competitive ecosystems depends on the quality of human resources in terms of skills, competencies, educational attainment, and learning capacity or human mindsets of advancing an existing entity, as well as activities and incentives aimed at knowledge creation and diffusion, given the concept of the learning economy and the associated impetus to promote innovation systems and competence building (Conceição, Gibson, Heitor, & Sirilli, 2001). The choice of research methods can be a complex exercise, as various approaches depicted in Table 3.1 must be purposive within the framework defined by the research methodology (Blanche, Blanche, Durrheim, & Painter, 2006, p. 189; Bradley, 1993).

Table 3.1: Comparison of Qualitative and Quantitative Approaches to Research

	Qualitative	Quantitative
Purpose	Description	Prediction
Focus	Generalize to large population	Give voice to silenced people and groups
Methods	Inductive analysis of "texts"	Deductive analysis of units (individual corporations, etc.)
Criteria for Truth	"Aha" criterion; adequate and realistic	Statistics, replication, and cumulative findings

Note: Based on Blanche et al. (2006)

3.3.1 Industry 4.0 Design Principles

Hermann et al. (2016) employed a mixed-methods approach, including quantitative text analysis and qualitative literature review, to describe I4 design principles by identifying, describing, and selecting I4 scenarios, to clarify practitioners' basic understanding of the term "Industry 4.0," and to provide guidance on I4 implementation. They identified four key design principles as shown in Figure 3.1, technical support, decentralized decision-making, networking, and information transparency. They acknowledged that the research was limited to German- and English-language publications and thus may have neglected relevant contributions in other languages (Hermann, Pentek, & Otto, 2016). However, The current literature review in section 2.7 highlights a lack of a widely accepted methodology for I4.

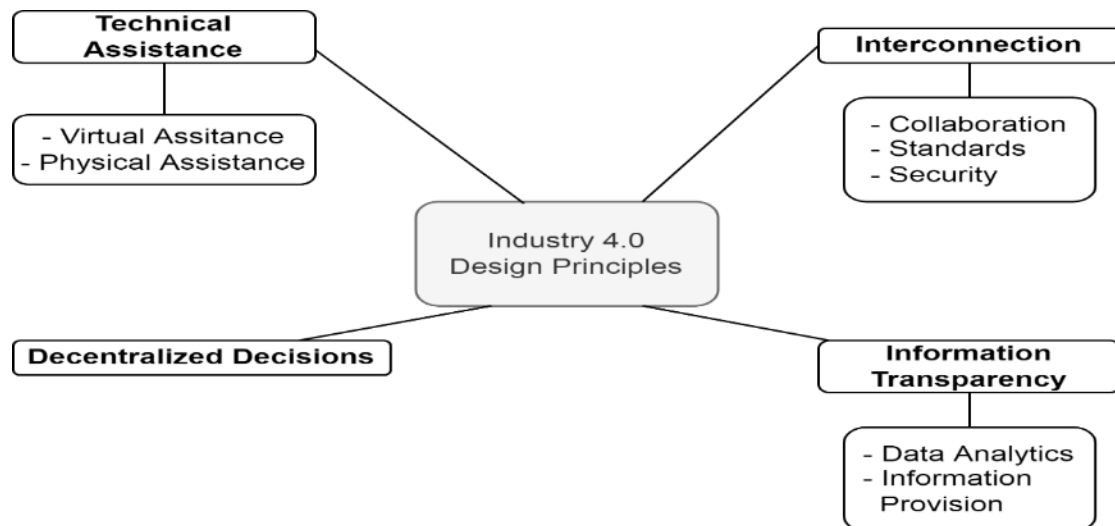


Figure 3.1 Industry 4.0 Design Principles, Note: Adopted from Hermann et al. (2016)

3.3.2 Limitations of Quantitative and Qualitative Analysis in Social Science

Steudel and Yauch (2003) employed both qualitative and quantitative methods to examine the organisational cultures of two manufacturing SMEs, using triangulation to enhance the validity of the

results and found that the complementary use of these paradigms allowed for a comprehensive understanding of cultural artefacts, behaviours, underlying values, and assumptions (Yauch & Steudel, 2003). Moreover, they authors concluded that mixed methods were necessary for a more robust cultural assessment, acknowledging the potential limitation of the Organisational Culture Inventory (OCI) results due to the possibility of cultural change during the 11-14 months gap between qualitative analysis and administering the OCI.

Lohfeld, and Brazil (2002) indicate that the qualitative paradigm is rooted in interpretivism and constructivism (Sale, Lohfeld, & Brazil, 2002), with interpretive researchers focusing on the contextual factors that shape human actions and interpreting the meaning of these actions to generate a distinctive theory that is grounded in the social world's reality. Ritchie et al. (2013) contend that when employing a mixed-method approach, it is crucial to acknowledge that each approach a distinct epistemological lens for comprehending the world, and the evidence produced by both methods is not expected to produce identical results, rather the benefits of combining methods may stem from the ability of each approach to contribute to a more intricate understanding of complex phenomena (Ritchie, Lewis, Nicholls, & Ormston, 2013, p. 45). Moreover, the authors describe the ethnography approach as an approach that involves understanding the social world of culture, shared behaviours, beliefs and values of particular groups, typically via immersion oneself in the community (Ritchie et al., 2013, p. 39), while positivism is the epistemological assertion that the principles governing the natural world are also regulate the social world (Beuving & Vries, 2015; Turner & Roth, 2003). In contrast to positivism, qualitative purists reject the notion in positivism that the social world adheres to law-like patterns observed in the natural world and instead argue that social order emerges from human understanding and action in response to their circumstances (Athens, 2010; Beuving & Vries, 2015, p. 28). Post-positivism offers an alternative approach to the conventions and tenets of positivism in conducting a rigorous inquiry, where according to Crossan (2003), the post-positivist researcher perceives reality not as an immutable entity but as a creation of the individuals involved in the research, influenced by its context, and thus, multiple constructions of reality are conceivable (F. Crossan, 2003). Carminati (2018) argues that the issue of generalizability in qualitative research has been controversial as interpretive scholars have resisted the dominant role of positivism in the social sciences, but through a comprehensive examination of empirical and theoretical studies, it has been demonstrated that qualitative research can pursue theoretical generalizability or transferability in addition to providing an in-depth comprehension of contextualized human experience (Carminati, 2018)

Given the complexity and dynamic nature of organisational culture in manufacturing SMEs for effectively diffusing management and technology innovations for holistic approach to I4 , they employed a combined research method that involved both sample surveys, which provided a quantitative foundation for generalizations about cultural influences, and semi-structured interviews,

which offered insight into the subjective experiences and perceptions of industry experts, resulting in the identification of key factors of the organisational culture necessary for successful adoption of I4 in manufacturing SMEs in the automotive industry.

3.3.3 Grounded Theory as Underlying Research Methodology

Grounded theory approach, a qualitative research methodology developed by Glaser and Strauss in the 1960s, prioritises the iterative collection and analysis of data to develop emergent theories grounded in the experiences and perspectives of participants, thereby facilitating a deeper understanding of complex social phenomena. (Glaser, Strauss, & Strutzel, 1968). This approach aligns with the focus of the research on understanding the key factors that contribute to the smooth adoption of I4 in manufacturing SMEs in the automotive industry. The claim of this thesis is to underpin an abductive approach to generate novel and creative theoretical insights in the context of understanding the key factors of organisational culture that contribute to the proficient execution of I4 initiatives in manufacturing SMEs in the automotive industry (Timmermans & Tavory, 2012). Moreover, by adopting the methodological precepts of grounded theory, particularly through the process of revisiting, defamiliarizing, and alternative casing in light of theoretical knowledge, this research aims to exercise abductive reasoning and propose innovative theoretical insights that offer plausible explanations for complex empirical phenomena related to the key factors of the organisational culture that enable the effective diffusion of management and technology innovations for successful adoption of I4 in the automotive industry. The grounded theory approach facilitates the development of a theory based on the views and experiences of the research participants (Bluff, 2005), which is particularly important in this thesis as it seeks to understand industry experts' perceptions of organisational culture in manufacturing SMEs during the adoption of I4 in the automotive industry. Grounded theory is a qualitative research strategy that stresses on the importance of theory-building based on empirically collected data (Binder & Edwards, 2010). Furthermore, the research participants for the semi-structured interviews will be selected based on their knowledge and experience related to the adoption of I4 in manufacturing SMEs, while the data analysis will be conducted through grounded theory methodology, involving iterative procedures of coding, categorising, and theorising (Bringer, Johnston, & Brackenridge, 2004). Moreover, by employing a rigorous and systematic approach that includes transcription of interview data, use of open coding to identify key concepts and themes, use of axial coding to link codes and establish relationships, and use of selective coding to identify the core category that represents the overall findings of the study, this research aims to develop themes based on the perspectives and experiences of research participants to understand the research topic.

3.3.4 Mixed Methods

Yauch and Steudel (2003) utilised both qualitative and quantitative assessment methods to analyse the organisational culture of two small manufacturers and found that the combination of these approaches can lead to more robust results than relying on a single approach for cultural assessment, highlighting the significance of employing multiple methods for a comprehensive understanding of organisational culture (Yauch & Steudel, 2003). Since that organisational culture is a multifaceted and multi-layered phenomenon, exploring its various dimensions and layers necessitates employing multiple methods (Janićijević, 2011). Furthermore, the interrelationship between people and technology has been extensively debated in the management sciences, with the contextual research approach as a means to construct the reality of the organisational relationships in a human-technical environment; to this end, Price et al. (2013) contend that critical theory of technology cannot be viewed as separate from society, but rather adapted to their social and political context, thereby highlighting the significance of investigating this relationship in a more comprehensive matter (Price, Jewitt, & Brown, 2013, p. 121). Moreover, it has been proposed that an innovative and practical framework for applying the contextual research approach as a basis for mixed methods research involving digital technologies to offer a more comprehensive understanding of the interplay between human and technological factors within organisational settings (Price et al., 2013, pp. 121-129). Mixed methods research is widely recognised as a process that combines qualitative and quantitative approaches to provide a more comprehensive and in-depth analysis of complex phenomena, thereby offering a more nuanced understanding of the research problem (Morse, 2016). Moreover, mixed methods research provides a way to harness strengths that offset the weaknesses of both quantitative and qualitative research; and more evidence for studying a research problem than quantitative or qualitative research alone (Creswell & Clark, 2018, p. 53).

3.4 Methods for Data Collection

3.4.1 The Rationale for Selection.

Obtaining a comprehensive understanding of the research topic that leads to valid results was an essential part of the research method selection process. Johnson and Turner (2007) suggest that employing diverse research methods can offer multiple perspectives and illuminate various aspects of the research topic, leading to a more comprehensive understanding of the phenomenon under investigation (Johnson, Onwuegbuzie, & Turner, 2007). Hence, a mixed-methods approach was employed to capitalise on the strength of quantitative and qualitative research methods while ensuring that the findings are robust and enhancing the overall rigour of the research. Queirós and Almeida (2017) assert that in selecting a research method, a researcher ought to consider each method's advantages and disadvantages, the questions, specificities and the nature of the research study (Queirós, Faria, & Almeida, 2017). This included a critical evaluation of each research method in

terms of its strengths, limitations, and complementarity. In this thesis, a sample survey was conducted with 84 participants, and semi-structured interviews were conducted with 15 respondents to gather empirical data addressing the research questions outlined in 1.2.2. The first data collection phase focused on acquiring quantitative data from a sample of participants involved in manufacturing SMEs in the automotive industry that have adopted Industry 4.0 (I4). Participants were recruited utilizing online professional networks such as LinkedIn. The initial aim was to have a sample size of 124 participants. However, due to the complex and specialized nature of I4 adoption, it was difficult for the researcher to determine the level of expertise of potential participants solely from their professional profiles. To address this limitation, the researcher established inclusion criteria to identify industry experts with a reasonable degree of relevant experience in I4 adoption. Specifically, participants were required to have at least 3-5 years of experience as managers directly involved in adopting I4 in manufacturing SMEs in the automotive sector. While this threshold does not guarantee expertise, it helped ensure participants have sufficient hands-on experience with I4 implementation to provide meaningful perspectives. Of the 124 managers contacted based on the inclusion criteria, 84 respondents successfully completed the quantitative sample survey.

According to DiCicco-Bloom and Crabtree (2006), semi-structured interviews allow for unplanned follow-up questions or other spontaneous discussions of issues as they arise. Moreover, it allows for a conversational and agile approach, as participants can explore topics they consider important. This flexibility was necessary for the context of this thesis, as it provides for exploring the complex and dynamic nature of organisational culture in SMEs during the adoption of I4 (DiCicco-Bloom & Crabtree, 2006). This was particularly useful in gaining a comprehensive understanding of the specific challenges and successes SMEs experience in fostering their organisational culture during the adoption of I4. While sample surveys are well suited to collect data from broader perspectives and allow for the generalisation of the results to larger population (Lucas, 2003), semi-structured interviews are a complementary method that can provide in-depth information on specific research questions topics (Ahlin, 2019). Semi-structured interviews enable the interpretation of non-verbal cues through observation of body language, facial expression and eye contact, thereby enhancing the comprehension of what is being said (Ryan, Coughlan, & Cronin, 2009). A sample survey with 84 participants, and semi-structured interviews with 15 respondents was utilised to address the research objectives. The sample survey allowed for the collection of quantitative data that can be used to supplement the qualitative data collected through semi-structured interviews. Thurmond (2001) contends that triangulation in qualitative research can enhance the completeness and confirmation of data, incorporating both quantitative and qualitative methods in the same study is a viable approach for obtaining complementary and robust research findings (Thurmond, 2001). In this thesis, the discussion of the collected sample survey data with the interview data will be presented in Chapter 6,

with the aim of triangulation of both types of collected data to enhance the reliability and validity of the research findings.

In sum, the semi-structured interview and sample survey methods allow for a balance between standardisation and flexibility, provide complementary data that can be used to triangulate the results and can be used to apply a mixed-methods approach. This will provide a comprehensive understanding of the key organisational culture factors important for the successful diffusion of management and technology innovations in manufacturing SMEs in the automotive industry during the adoption of I4.

3.4.2 Qualitative Research Interviews

According to Hannabuss (1996), qualitative interviews are a widely and frequently used research method in the social sciences, including information and library studies to elicit respondents experiences, meanings and perspectives (Hannabuss, 1996). Hammarberg and de Lacey (2016) further note that these interview questions about experience, meaning and perspective are typically asked from the participant's standpoint (Hammarberg, Kirkman, & de Lacey, 2016). The interview is probably the most commonly used method in qualitative research (Bryman, 2012, p. 469). By examining the discourse within an interview, they can gain valuable insight into the linguistic and cultural resources that participants draw upon to create meaning and make sense of the world around them (Magnusson & Marecek, 2015, p. 7). In addition, qualitative interviews are a potent research method for eliciting the voices and experiences that may have been underrepresented or silenced in the past. (Seale, 2018, p. 469). Rowley (2012) states that conducting interviews is an evolving process, for which novice they need to conduct some research interviews to start developing their interviewing skills describes the following preparing questions for the interview process. Preparing and planning the qualitative interviews was an integral part of the qualitative research process. It involved clarifying the scope of the interview questions and then establishing appropriate series of questions to be asked during the interviews. This data would then need to be analysed via a process of coding text and developing themes and descriptions based on these codes; to strive for credibility, trustworthiness, and common validation strategies (Creswell, 1999, p. 56).

3.4.3 Confidentiality in Interviews

The purpose of the General Protection Regulation (GDPR), which became effective on of May 25th, 2018, is to prevent the unauthorised processing of individuals personal data, this also applies to data processing in research activities undertaken by private companies, public universities and other research institutions. The implications of the GDPR on research practice remains unclear, as it poses challenges in conducting research on social network data, where the process of anonymising the

collected data is more difficult than in other research domains (Kotsios, Magnani, Vega, Rossi, & Shklovski, 2019).

Informed Consent was obtained from each participant, confirming their understanding of the research project and providing the opportunity for questions while ensuring that participation was voluntary and allowing withdrawal or refusal to answer questions, with the assurance that participants' names would not be linked to research materials and would not be identifiable in the research.

3.4.4 Bias in Interviews and Sample Size

Bias can occur at different phases of a research study, including selecting the research design or analysis strategy, selecting participants and sampling methods, data collection, interpretation and analysis of the findings (Simundic, 2013). Morse (2016) proposes that the number of interviews required for a qualitative research study can be estimated by considering factors such as the quality of data, study scope, nature of the topic, information obtained from each participant, the use of shadowed data, and the chosen qualitative method and study design. By considering these factors, they can determine the appropriate number of interviews necessary to achieve the research objectives (Morse, 2016). Mason's (2010) study explores the important factors of sample size and saturation in qualitative research, with a specific focus on doctoral studies (Mason, 2010). In addition to exploring the importance of sample size and saturation in qualitative research within the context of doctoral studies, Mason's (2010) study also offers guidance on determining an appropriate sample size that is based on various factors such as the projected time frame of the study, the availability of resources, and any other potential limitations. Moreover, it has been posited that there is a lack of logical rationale for the prevalence of samples ending in specific integers within qualitative PhD studies utilising interviews. Furthermore, the study also asserts that a minimum sample size of fifteen is deemed acceptable for qualitative interviews (Mason, 2010). In common interview studies, the amount of interviews tends to be around 15, with a margin of plus / minus 10 (Kvale, 2007, p. 44). Taylor (2007) points out that if there are more than 20 interviews, this could yield to excessive data, which could be too much to process. (Taylor, 2007, p. 158). Ando et al. (2014) concluded in their study, which consisted of a sample of 39 interviews, that 12 interviews were sufficient to generate codes for thematic analysis. The additional interviews after the 12 interviews would mainly be used to modify the codes, as the modified codes and definitions would be more inclusive and general (Ando, Cousins, & Young, 2014). The selection of a sample size of 15 participants for the semi-structured interviews and a sample survey in this study was guided by the principle of maximizing the sample's representativeness while being mindful of the limitations of resources and time available. The sample size was chosen based on a review of the existing literature and pilot testing, which provided evidence that a sample size of 15 participants would be adequate to provide a comprehensive understanding of the key factors of the organisational culture for effectively

diffusing management and technology innovations for successful adoption of I4 in manufacturing SMEs in the automotive industry. Furthermore, the recruitment of participants was affected by the ongoing Covid-19 pandemic, which made it more challenging to secure a larger sample size than 15 participants. In light of these factors, the sample size of 15 participants was deemed appropriate as it represents a balance between the need for representativeness and the practical considerations of the study. Furthermore, a sample survey will be used to assess the manufacturing SMEs' existing and preferred organisational culture. It is important to note that the sample size selected is not intended to be generalizable to the entire population of manufacturing SMEs in the automotive industry that has adopted I4 but rather to provide a deeper understanding of the specific research questions being investigated in this thesis. Fifteen interviews were conducted, which were considered sufficient to answer the first research question.

3.4.5 Quality, Reliability, and Validity in Interviews.

Kallio (2016) proposes a five-phase process for developing a high-quality, qualitative semi-structured interview guide, which involves identifying prerequisites, retrieving previous knowledge, formulating a preliminary guide, pilot testing, and presenting the complete guide. It has been highlighted that the significance of a well-developed guide in ensuring objectivity, trustworthiness, and plausibility of research results, which is crucial for the credibility of the research findings (H. Kallio et al., 2016). The approach to formulating pre-determined interview questions with clear and unambiguous wording and structure aligns with Kallio's (2016) emphasis on the importance of rigorously developing a high-quality, qualitative semi-structured interview guide. Ensuring that each question is explicit in its intent minimises the potential for ambiguities and inconsistencies in responses, leading to more trustworthy and plausible research results that contribute to the credibility of the research findings. Compared to structured interviews, semi-structured interviews can better use the knowledge-producing potentials of dialogues by allowing much more leeway for following up on whatever angles are deemed necessary by the interviewee (Brinkmann, 2014, p. 286). A comprehensive understanding of the perspectives of industry experts was achieved, allowing for a comprehensive grasp of their viewpoints. However, validating cultural data in respondents answers, which can be crucial for uncovering underlying cultural phenomena, can pose a significant challenge, as discerning individual opinions from cultural data can be difficult (Sackmann, 1991, p. 301). Hence, the quality, reliability, and validity of the semi-structured interviews and sample survey conducted in this thesis were crucial in ensuring the credibility and trustworthiness of the data collected. Furthermore, all interview data were reanalysed one month later regarding the condensed interview format to validate the data. The iterative process of reviewing the interview questions, utilising the semi-structured format, and implementing various validity measures, such as content and criterion validity, ensured that the study's results accurately reflected the underlying construct of the organisational culture of manufacturing SMEs in the

automotive industry. The concept of content validity refers to the extent to which a survey or measurement instrument adequately covers the construct or concept it aims to measure (Kimberlin & Winterstein, 2008). In this thesis, content validity was established by conducting a thorough literature review on organisational culture for effectively diffusion of management and technology innovations and its relationship with the effective adoption of I4 in manufacturing SMEs in the automotive industry, and ensuring that the survey questions were aligned with the key themes and concepts identified in the literature. Further, the sample questions were pilot tested with a small group of industry experts to ensure that they were clear and unambiguous in capturing the existing and preferred organisational culture in automotive SMEs in the post-Covid-19 outbreak period. On the other hand, criterion validity referred to the extent to which a survey or measurement instrument is related to external criteria, such as other measures of the same construct or outcomes that the construct is expected to be related to (Taherdoost, 2016). In this thesis, criterion validity was established by conducting semi-structured interviews with a sample of 15 industry experts in manufacturing SMEs who were involved in the adoption of I4 in the automotive industry. These experts were asked to provide their perceptions of the existing and preferred organisational culture in their organisations, and their responses were compared to the survey results to establish the criterion validity of the sample survey results. Additionally, the semi-structured interviews provided rich qualitative data that helped to triangulate and validate the quantitative survey results.

3.4.6 Preparation and Design of Research Interviews

The selection of participants for the sample survey was based on their expertise in adopting I4 within manufacturing small and medium-sized enterprises (SMEs) in the automotive sector. This group was deemed representative and influential in adopting I4. Additionally, they considered potential interviewees' cultural backgrounds, attitudes, and skillsets to promote insightful and nuanced responses regarding the challenges associated with the research problem. Moreover, fifteen managers were selected from diverse manufacturing SMEs in the automotive industry based on their respective roles within their organisations during the adoption of I4. Section 3.4.1 discusses the rationale for selecting semi-structured interviews in detail. However, the use of face-to-face interviews offered several benefits, including the ability for interviewees to share relevant cultural experiences and perspectives on the adoption of I4 and provide examples from previous projects and solutions they have adopted. To ensure a suitable sample, specifically managers in the manufacturing SME sector of the automotive industry who held, or currently hold, the position of Digital Transformation Manager (DTM) or similar leadership roles were targeted. The selection of DTM interviewees was based on their professional backgrounds, extensive experience in implementing I4 strategies, and their profound understanding of the ongoing changes in their industry and the potential value-creation opportunities associated with these changes.

3.4.7 Selection of the Qualitative Research Method

A qualitative analysis approach was employed by utilising semi-structured interviews with 15 respondents. To test the approach's effectiveness, it was decided to use the piloting technique. To ensure a comprehensive and focused discussion on the research problem of key organisational culture factors enabling successful diffusion of management and technology innovation for I4 adoption in the automotive sector's manufacturing SMEs, it was decided to develop an interview guide comprising 15 predetermined questions and three optional questions, based on the sample survey questions. The interview guide's thematising and design involved creating a series of questions suitable for semi-structured interviews. The selection of participants for the interviews was limited to 15, with a schedule created for conducting the interviews. During the rollout phase, individual scheduling with each participant was necessary. After confirmation of attendance, all the required materials for participating in the research were prepared. In light of the Covid-19 pandemic, the semi-structured interviews were conducted remotely, leveraging advanced video conferencing technologies. The ability to transcribe the interviews in a timely manner is crucial as it facilitates a comprehensive understanding and analysis of the collected data. Video conferencing was chosen as the recording and transcribing medium to capture all aspects of the interview, including body language and speech, which are valuable research data. The aim is to identify universal themes across all participants and draw up a list of key concepts from the data analysis. Thematic coding will be used to interpret the interview data from each respondent, enabling new content to be identified in a meaningful manner. The conclusion will be presented, outlining the key concepts of the organisational culture factors that enable successful diffusion of management and technology innovation for I4 adoption in the automotive sector's manufacturing SMEs. The coding of the key concepts for each theme will be meaningfully arranged to form a framework that will serve as a basis for identifying new concepts and guiding future research studies.

3.4.8 Research Method: Sample Survey

This research study aims to identify the key organisational culture factors that facilitate the effective diffusion of management and technology innovations, leading to the mastery of I4 in the automotive industry. The Diagnosing Organisational Culture survey instrument developed by Roger Harrison and Herb Stokes (1992) was deemed an appropriate data collection method for this research to measure the organisational culture (Harrison & Stokes, 1992). The Harrison Culture model categorises organisational culture into four dimensions (Harrison & Stokes, 1992): Power Orientation: It concerns the ability to exert influence, control resources, and determine the rules by which members operate. This is highly relevant for SMEs adopting Industry 4.0 as the power dynamics and decision-making processes may shift with new technologies.

Role Orientation: Pertains to how employees carry out their work. Role clarity and flexibility are important considerations as jobs and processes changes with Industry 4.0 adoption. Achievement Orientation: Centres on motivation derived from intrinsic factors. An achievement-oriented culture can ensure that employees remain focused on goals, timelines, and quality standards. This study explores how SMEs can foster a sense of ownership, accountability, and drive among employees to navigate these challenges effectively. Support Orientation: Involves motivation derived from both intrinsic and extrinsic factors. Providing the right support, resources and incentives is key to successfully navigating the complexities of Industry 4.0 implementation in SMEs. These four dimensions comprehensively reflect the cultural aspects that manufacturing SMEs must consider and manage during adopting Industry 4.0. The model provides a holistic framework to diagnose the existing culture and identify gaps from the preferred culture conducive for Industry 4.0 success. Moreover, the Harrison Culture model can be effectively expanded upon in the semi-structured interviews to delve deeper into the nuances and contextual factors influencing each dimension in the specific setting of Industry 4.0 adopting manufacturing SMEs in the automotive industry. This two-pronged approach of leveraging a well-established model in the survey and building upon the dimensions through rich qualitative insights makes it highly suitable for the research objectives of this study. Moreover, the survey instrument's selection was based on its suitability for measuring organisational culture and its widespread use in previous research studies. Harrison and Stokes (1992) developed the Diagnosing Organisational Culture survey instrument using a carefully planned model tested with a sample of 190 first-line and middle managers from organisations of varying sizes, types, and industries. However, the present sample survey as outlined in Appendix B aimed to assess the prevalent and preferred organisational culture after the outbreak of the Covid-19 pandemic of a sample population of manufacturing SMEs adopting I4 in the automotive industry. The survey was distributed via questionnaires to 121 selected manufacturing SMEs in the automotive industry, resulting in 84 responses from SMEs with an operational existence in 2021. Of these respondents, 15 were randomly selected to participate in semi-structured interviews conducted in 2021. The Diagnosing Organisational Culture survey instrument, developed by Harrison and Stokes (1992), categorises organisational culture into four dimensions: Power, Role, Performance, and Support (Harrison & Stokes, 1992).

These dimensions are considered appropriate to cover all pertinent aspects of manufacturing SMEs adopting I4 in the automotive industry.

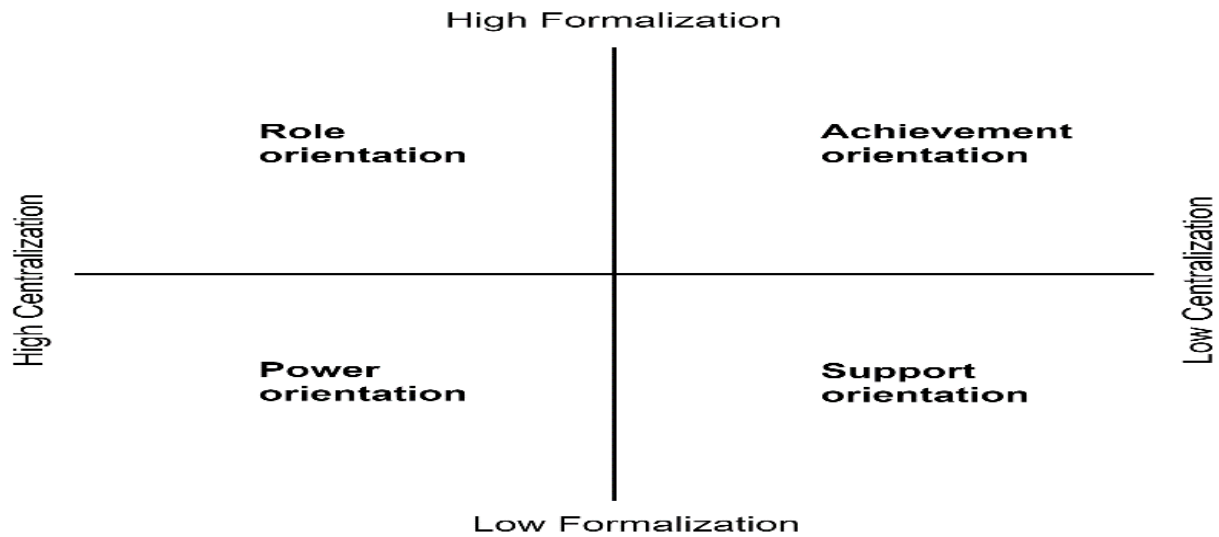


Fig. adopted by researcher Harrison's culture model (Based on Harrison 1972, 1987)

Figure 3.2: Harrison's Culture Model, Note: Adopted from Hermann et al. (2016)

The Power culture dimension concerns the ability to exert influence, control resources, and determine the rules by which members operate. The Role culture dimension pertains to how employees carry out their work. The Performance culture dimension centres on motivation derived from intrinsic factors, whereas the Support culture dimension involves motivation derived from both intrinsic and extrinsic factors. Based on the sample population, the present survey aims to provide a cross-sectional distribution of organisational culture in I4 manufacturing SMEs in the automotive industry, offering valuable insights for the subsequent semi-structured interviews post-Covid-19. Additionally, the survey results can be utilised to compare existing and preferred organisational cultures, providing insights into any cultural shifts and the impact of Covid-19 on organisational culture during the adoption of I4 in the automotive sector.

3.5 Methods for Data Analysis

3.5.1 Using Statistical Program for Qualitative Analysis

The statistical program NVivo will be utilised to retrieve the information from the interviews. To do this, one of two coding methods can be used: theoretical coding and thematic coding.

3.5.2 Thematic Coding

This study's findings were obtained using an interview guide as outlined in section 3.4.2, followed by an analysis of the results. It was decided to employ a thematic coding approach, analysing the semi-structured interview data from industry experts. This method involved categorising information into

more prominent themes, thereby enabling the identification of potential future patterns and the reduction of errors in data collection. As outlined in section 3.4.1, the findings obtained from this analysis were rigorously verified to guarantee their accuracy and to avoid any false claims in the reporting phase.

3.5.3 Verifying Phase

Measures will be taken to ensure the accuracy and reliability of research findings and conclusions. These include verifying that all obtained information and transcription accurately reflect the beliefs of the respondents, comparing the data with previous research, conducting a thorough check of the output for errors, analysing data for patterns and trends, and providing a detailed description of the research design and findings during the reporting phase.

After completing the three-stage coding process of open, axial, and selective coding, the researcher manually reviewed the codes multiple times to verify their accuracy and ensure they comprehensively captured key themes emerging from the interview data. Additionally, the qualitative analysis software NVivo was utilised to run word frequency queries of the interview transcripts, comparing the output against the codes to validate that frequently discussed topics were adequately reflected. They also conducted a thematic analysis across interviews to verify consistency. To further authenticate the interview findings, they re-examined all condensed interview transcripts a month after the initial analysis to check that the essence of participants' viewpoints was accurately conveyed through the codes and emerging themes. Moreover, triangulation was employed by collecting quantitative survey data, as presented in Section 3.4, to corroborate the interview results. By thoughtfully evaluating the codes and themes through manual review, software NVivo analysis, cross-interview thematic analysis, participant data re-examination, and survey data triangulation, the researcher aimed to establish robust verification procedures that lent credibility and trustworthiness to the study's conclusions from the researcher's standpoint.

3.6 Ethical Issues

Adhering to the ethical principles outlined by the University of Gloucestershire's "Research Ethics - The Principal Issues of Research Ethics: A Handbook of Principles and Procedures," these guidelines have been meticulously integrated throughout the research process. This integration involved obtaining informed participant consent, clearly communicating research objectives and data collection methods, and diligently observing data management protocols. Furthermore, the researcher prioritised participant privacy and autonomy, enabling participants to abstain from answering specific questions or to withdraw from the study without any adverse effects. Appendix D includes exemplars of the participant consent form and informational package demonstrating the practical embodiment of these ethical guidelines.

3.7 Chapter Summary

This chapter has shown how the research methodology and design were constructed to achieve the research objective while ensuring that the research approach upholds validity and ethics. The research design of this thesis is conclusively shown in Figure 3.3. It depicts the sequence of this research, which includes the key points leading to the research objectives, the research methods, the analysis and results, and the research conclusions. The solid line represents the process flow. The dotted line represents the feedback on the findings that answer the research questions and provide the theoretical conclusions.

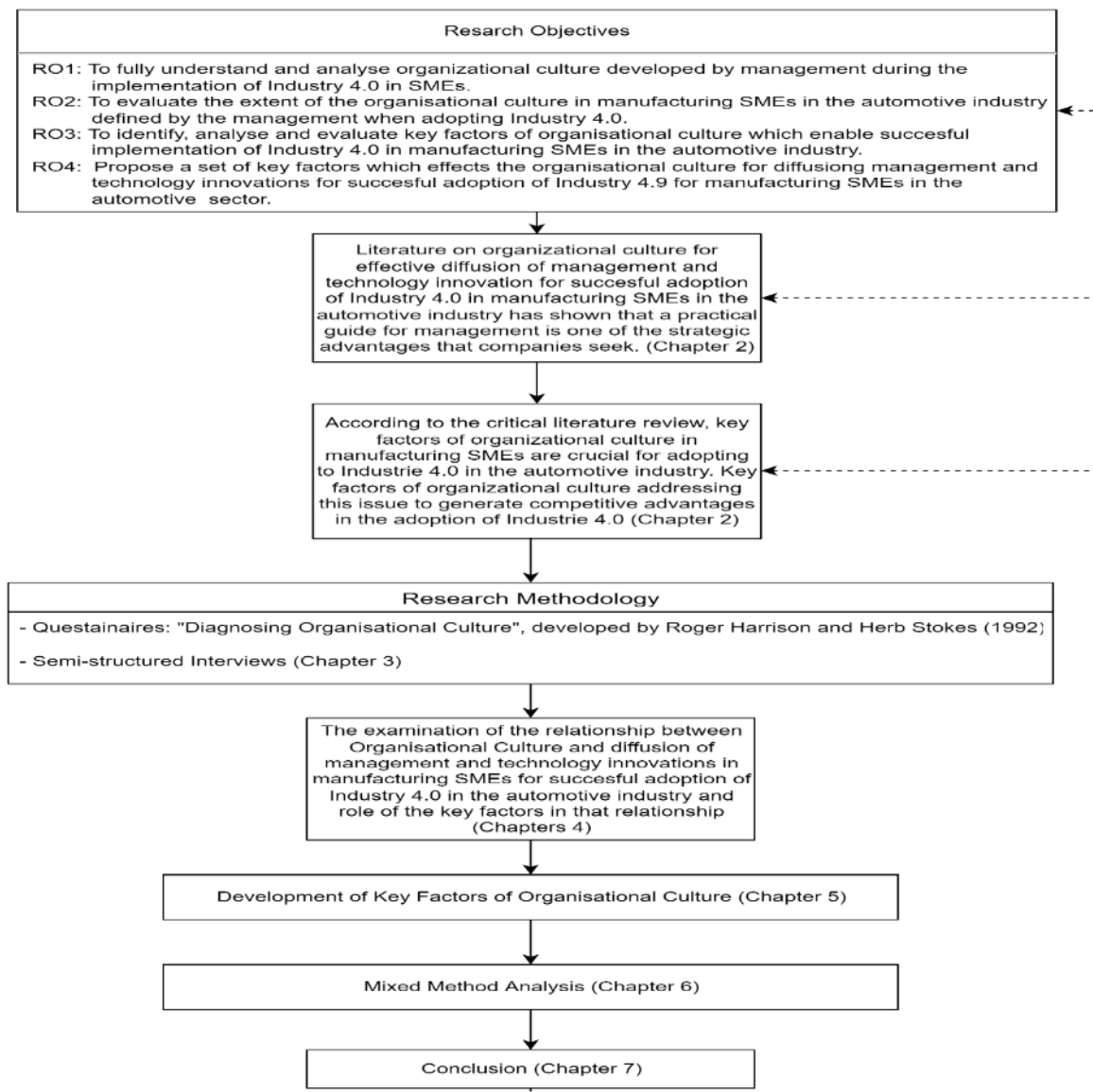


Figure 3.3 Applied Research Design, Source: By the researcher

Chapter 4 Initial Data Collection, Presentation and Data Analysis

4.1 Introduction

This chapter provides a comprehensive data analysis of the data collected through a sample survey of 84 participants, and fifteen semi-structured interviews with industry experts from manufacturing SMEs in the automotive industry who have adopted I4. This chapter aims to establish a fundamental basis for the subsequent Chapters 5 and 6.

4.2 Data Collection

In this thesis, qualitative and quantitative data analysis methods were employed, as outlined in section 3.5. The methods for data collection are presented in section 3.4, which includes two components: Fifteen semi-structured interviews were conducted to investigate the key factors of the organisational culture for the successful diffusion of management and technology innovations during the adoption of I4 in the automotive industry. A survey study was conducted, which collected data from 85 participants. The data collection was designed sequentially, with the quantitative data collected from the survey study informing the second phase of data collection, which involved the semi-structured interviews conducted with 15 participants. The results of the quantitative data analysis were utilised to examine the qualitative findings. This approach allowed for a comprehensive data analysis, which provided valuable insights into the research topic.

4.3 Presentation and Analysis

4.3.1 Survey Results

In this thesis, as outlined in Section 3.4.8, the Harrison and Stokes survey instrument was employed to evaluate organisational culture in terms of four different cultural dimensions, including Power, Role, Achievement and Support orientation, with a focus on the cultural manifestation in the a manufacturing SME's daily operations.

The present research employed a quantitative sample survey featuring a ranking scale illustrated in Figure 4.1 that comprised fifteen main questions, each comprising four statements of typical daily business operations containing options for both existing and preferred Organisational Culture, to which 84 participants from manufacturing SMEs responded, by rating their existing and preferred organisational culture post-COVID-19 using a ranking method wherein they were required to rank the given options from 1 to 4 for each. The following is an example of the ranking of the survey questions:

Hello!

You are invited to participate in our survey which is based on organizational culture. It will take approximately 15 minutes to complete the questionnaire.

Ranking Key :

4 = The dominant view, or your most preferred alternative.

3= The next most dominant view, or your most preferred alternative.

2= The next most dominant view, or your most preferred alternative.

1= The least dominant view or least preferred alternative.

Please refer your ratings "Preferred Culture" post COVID-19.

Please rate in the order of 4,3,2 and 1, and avoid duplicate ratings within each column.

Thank you very much for your time and support.

Q1. Members of the organization are expected to give first priority to *

	Existing Culture	Preferred Culture
a. meeting the needs and demand of their supervisors and other high-level people in the organization.	▼	▼
b. carrying out the duties of their own jobs; staying within the policies and procedures related to their jobs.	▼	▼
c. meeting the challenges of the task, finding a better way to do things.	▼	▼
d. cooperating with the people with whom they work, to solve work and personal problems.	▼	▼

Figure 4.1: Survey Diagnosing Organisational Culture, Source: Harrison and Stokes (1992)

The data collected through ranking survey were then analysed using ranking frequency method which resulted in the count of 1, 2, 3, and 4th rank of each given option. These options represented the following statements:

4 = The dominant view, or your most preferred alternative.

3= The next most dominant view, or your most preferred alternative.

2= The next most dominant view, or your most preferred alternative.

1= The least dominant view or least preferred alternative.

Quantitative analysis results are presented in the form of tables and diagrams. The analysis of the ranking survey has clearly reflected the view of the participants on the given statements, which can be interpreted, for example, as the choice of people in relation to various cultural and technological aspects within an organisational environment that intends to adopt I4 technology. Table 4.1 demonstrates the results of the sample survey in percentage according to the 15 statements representing typical business activities in organisations sorted by the four organisational dimensions Power, Role, Achievement and Support oriented:

Table 4.1: Survey Results of 84 Manufacturing SMEs in the Automotive Industry

A1. Members of the organisation are expected to give first priority to								
	A		B		C		D	
	meeting the needs and demand of their supervisors and other high-level people in the organisation.		carrying out the duties of their own jobs; staying within the policies and procedures related to their jobs.		meeting the challenges of the task, finding a better way to do things.		cooperating with the people with whom they work, to solve work and personal problems.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	10%	4%	71%	88%	2%	2%	6%	1%
2	73%	83%	8%	2%	15%	10%	1%	2%
3	5%	12%	12%	0%	79%	77%	4%	12%
4	13%	1%	8%	10%	4%	11%	89%	85%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A2. People who do well in the organisation tend to be those who								
	A		B		C		D	
	know how to please their supervisor and are able and willing to use power and politics to get ahead.		play be the rules, work within the system, and strive to do things correctly.		are technically competent and effective, with a strong commitment to getting the job done.		build close working relationship with others by being cooperative, responsive, and caring	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	12%	7%	77%	86%	1%	2%	12%	6%
2	79%	87%	7%	4%	13%	10%	0%	0%
3	1%	5%	6%	2%	82%	82%	11%	11%
4	8%	1%	10%	8%	4%	6%	77%	83%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A3. The organisation treats individuals								
	A		B		C		D	
	as "hands" whose time and energy are at the disposal of persons at higher levels in the hierarchy.		as "employees" whose time and energy are purchased through a contract, with rights and obligations for both sides.		as "associates" or peers who are mutually committed to the achievement of a common purpose.		as "family" or "friends" who like being together and who care about and support one another.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	95%	95%	2%	1%	1%	1%	0%	0%
2	1%	2%	92%	7%	7%	4%	4%	2%
3	1%	1%	0%	0%	0%	4%	95%	95%
4	2%	1%	6%	92%	92%	92%	1%	2%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%

A4. People are managed, directed, or influenced by								
	A		B		C		D	
	people in position of authority, who exercise their power through the use of rewards and punishments.		the systems, rules, and procedures that prescribed what people should do and the right ways of doing it.		their own commitment to achieving the goals of the organisation.		their own desire to be accepted by others and to be good members of their work group.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	1%	7%	86%	87%	0%	0%	12%	5%
2	86%	87%	6%	7%	8%	8%	0%	0%
3	4%	6%	6%	2%	7%	5%	86%	88%
4	10%	0%	2%	4%	85%	87%	2%	7%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A5. Decision-making processes are characterised by								
	A		B		C		D	
	directives, orders, and instructions that come down from higher levels.		the adherence to formal channels and reliance on policies and procedures for making decisions.		decisions being made closed to the point of action, by the people on the spot		the use of consensus decision-making methods to gain acceptance and support for decisions.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	5%	4%	2%	10%	6%	7%	86%	77%
2	2%	10%	11%	5%	81%	80%	7%	8%
3	75%	86%	11%	1%	7%	2%	7%	13%
4	18%	1%	76%	85%	6%	11%	0%	1%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A6. Assignments of tasks or jobs to individuals are based on								
	A		B		C		D	
	the personal judgments, values, and wishes of those in positions of power.		the needs and plans of the organisation and the rules of the system (seniority, qualifications, etc.)		matching the requirements of the jobs with the interests and abilities of the individuals		the personal preferences of the individuals and their needs for growth and development.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	6%	12%	83%	86%	0%	1%	11%	2%
2	83%	83%	10%	7%	6%	6%	1%	4%
3	0%	2%	4%	2%	12%	10%	87%	87%
4	11%	2%	4%	5%	82%	83%	1%	7%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%

A7. Employees are expected to be								
	A		B		C		D	
	hard-working, compliant, obedient, and loyal to the interests of those to whom they report.		responsible and reliable, carrying out the duties and responsibilities of their jobs and avoiding actions that could surprise or embarrass their supervisors.		self-motivated and competent, willing to take the initiative to get things done; willing to challenge those to whom they report if that is necessary to obtain good results .		good team workers, supportive and cooperative, who get along well with others.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	1%	2%	94%	94%	1%	0%	2%	2%
2	95%	94%	2%	4%	5%	4%	1%	1%
3	1%	1%	1%	1%	1%	4%	95%	93%
4	2%	2%	2%	1%	93%	93%	1%	4%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A8. Managers and supervisors are expected to be								
	A		B		C		D	
	strong and decisive; firm but fair.		impersonal and proper, avoiding the exercise of authority for their own advantage.		democratic and willing to accept subordinates' ideas about the task.		supportive, responsive and concerned about the personal concerns and needs of those whose work they supervise.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	1%	0%	5%	6%	92%	90%	1%	0%
2	5%	7%	4%	1%	4%	5%	92%	92%
3	93%	93%	1%	2%	0%	1%	4%	5%
4	1%	0%	90%	90%	5%	4%	4%	4%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A9. It is considered legitimate for one person to tell another what to do when								
	A		B		C		D	
	he or she has more power, authority, or "clout" in the organisation.		it is part of the responsibilities included in his or her job description.		he or she has greater knowledge and expertise and uses it to guide the other person or to teach him or her to do the work.		the other person asks for his or her help, guidance, or advice.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture

1	83%	82%	10%	15%	2%	4%	8%	2%
2	7%	13%	80%	80%	11%	4%	1%	2%
3	2%	5%	7%	1%	5%	5%	86%	89%
4	7%	0%	4%	4%	82%	88%	5%	6%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%

A10. Work motivation is primarily the result of								
A		B		C		D		
hope for rewards, fear of punishment, or personal loyalty to the supervisor.		acceptance of the norm of providing a "fair day's work for a fair day's pay".		strong desires to achieve, to create, and to innovate and peer pressure to contribute to the success of the organisation.		people waiting to help others and to develop and maintain satisfying working relationships.		
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	95%	93%	1%	2%	1%	1%	1%	1%
2	1%	4%	94%	92%	1%	1%	4%	5%
3	2%	2%	2%	2%	4%	6%	94%	92%
4	1%	1%	2%	4%	94%	92%	1%	2%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A11. Relationship between work groups or departments are generally								
A		B		C		D		
competitive, with both looking out for their own interests and helping each other only when they can see some advantage for themselves by doing so.		characterised by indifference toward each other, helping each other only when it is convenient or when they are directed by higher levels to do so.		cooperative when they need to achieve common goals. People are normally willing to cut red tape and cross organisational boundaries in order to get the job done.		friendly, with a high level of responsiveness to requests for help from other groups.		
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	5%	5%	86%	93%	1%	1%	10%	2%
2	86%	93%	5%	4%	8%	0%	1%	4%
3	2%	2%	7%	1%	1%	2%	89%	94%
4	7%	0%	2%	2%	89%	96%	0%	0%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A12. Intergroup and interpersonal conflicts are usually								
A		B		C		D		
dealt with by the personal intervention of people at higher levels of authority.		avoided by reference to rules, procedures, and formal definitions of authority and responsibility.		resolved through discussions aimed at getting the best outcomes possible for the work issues involved.		dealt with in a manner that maintains good working relationships and minimizes the chances of people being hurt.		
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	2%	2%	87%	88%	0%	0%	10%	8%
2	5%	7%	5%	4%	10%	10%	81%	80%

3	88%	90%	2%	0%	4%	2%	7%	8%
4	5%	0%	6%	8%	87%	88%	2%	4%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%

A13. The larger environment outside the organisation is responded to as though it were								
A		B		C		D		
a jungle, where the organisation is in competition for survival with others.		an orderly system in which relationships are determined by structure and procedure and where every one is expected to abide by the rules.		a competition for excellence in which productivity, quality, and innovation bring success		a community of interdependent parts in which the common interests are the most important.		
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	88%	88%	5%	7%	1%	1%	5%	2%
2	8%	7%	8%	10%	85%	83%	2%	4%
3	2%	2%	80%	81%	6%	7%	11%	8%
4	1%	2%	7%	2%	8%	8%	82%	86%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A14. If rules, systems, or procedures get in the way, people								
A		B		C		D		
break them if they have enough clout to get by with it or if they think they can get away with it without being caught.		generally abide by them or go through proper channels to get permission to deviate from them or have them changed.		tend to ignore or bypass them to accomplish their tasks or perform their jobs better.		support one another in ignoring or bending them if they are felt to be unfair or to create hardships for others.		
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	89%	88%	1%	4%	0%	0%	8%	7%
2	5%	5%	2%	5%	8%	7%	88%	87%
3	0%	4%	7%	2%	88%	89%	4%	5%
4	6%	4%	89%	89%	4%	4%	0%	1%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%
A15. New people in the organisation need to learn								
A		B		C		D		
who really runs things; who can help or hurt them; whom to avoid offending; the norms (unwritten rules) that have to be observed if they are to stay out of trouble.		the formal rules and procedures and to abide by them; to stay within the formal boundaries of their jobs.		what resources are available to help them do their jobs; to take the initiative to apply their skills and knowledge to their jobs.		how to cooperate; how to be good team members; how to develop good working relationships with others.		

Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
1	85%	81%	7%	11%	1%	4%	8%	6%
2	6%	10%	75%	76%	18%	12%	1%	1%
3	4%	6%	7%	4%	1%	2%	87%	89%
4	6%	4%	11%	10%	80%	82%	4%	4%
Total Obs	100%	100%	100%	100%	100%	100%	100%	100%

4.3.2 Semi-Structured Interview Analysis

Given the qualitative nature of the research questions related to the 15 statements in the sample survey instruments, grounded theory techniques were applied to analyse the interview data and document reviews. As part of this research, 15 semi-structured interviews were conducted, resulting in a total word count of 251.259 words. The initial phase of the data involved coding, followed by a grouping of codes and the creation of themes. Then, these themes were associated with the relevant quotes and sections of the interview transcripts. In the final phase, the themes were discussed and described in detail. The process involved the use of NVivo for qualitative analysis.

4.3.3 Grounded Theory Process

Grounded theory analysis, as outlined in section 3.3.3, was utilised in this study due to the qualitative nature of the research questions. The data analysis process involved three coding stages as a standard procedure, with NVivo being used for coding, analysing, and storing data as shown in Figure 4.1. The first step was open coding, where first-level categories were identified from the data, while in axial coding, the categories were connected and grouped based on similarities and differences. In the third stage, selective coding was used to further group and connect the categories to create the main themes that emerged from the data. The transcripts were repeatedly reviewed to ensure the accuracy and completeness of the data analysis.

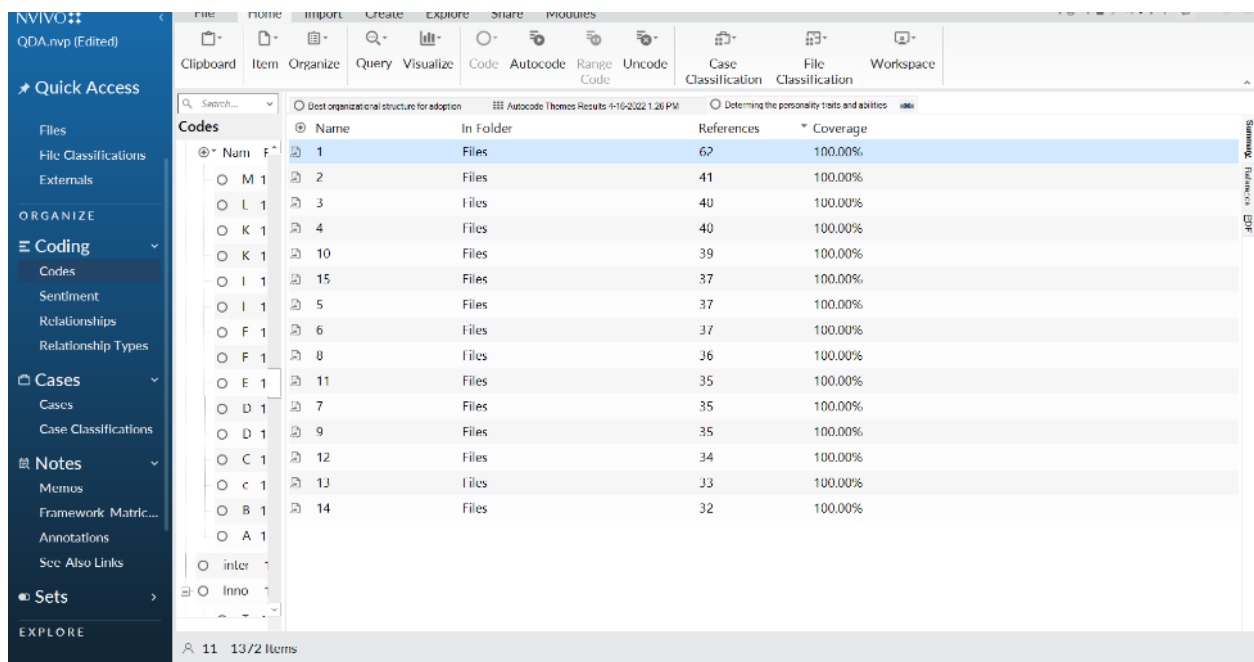


Figure 4.1: NVivo being used for Thematic Analysis, Source: By the researcher.

4.3.4 Multistage Coding Process

The coding process illustrated in Figure 4.2 involved three stages to code data as part of the grounded theory application. These include open coding, Axial Coding and Selective Coding.

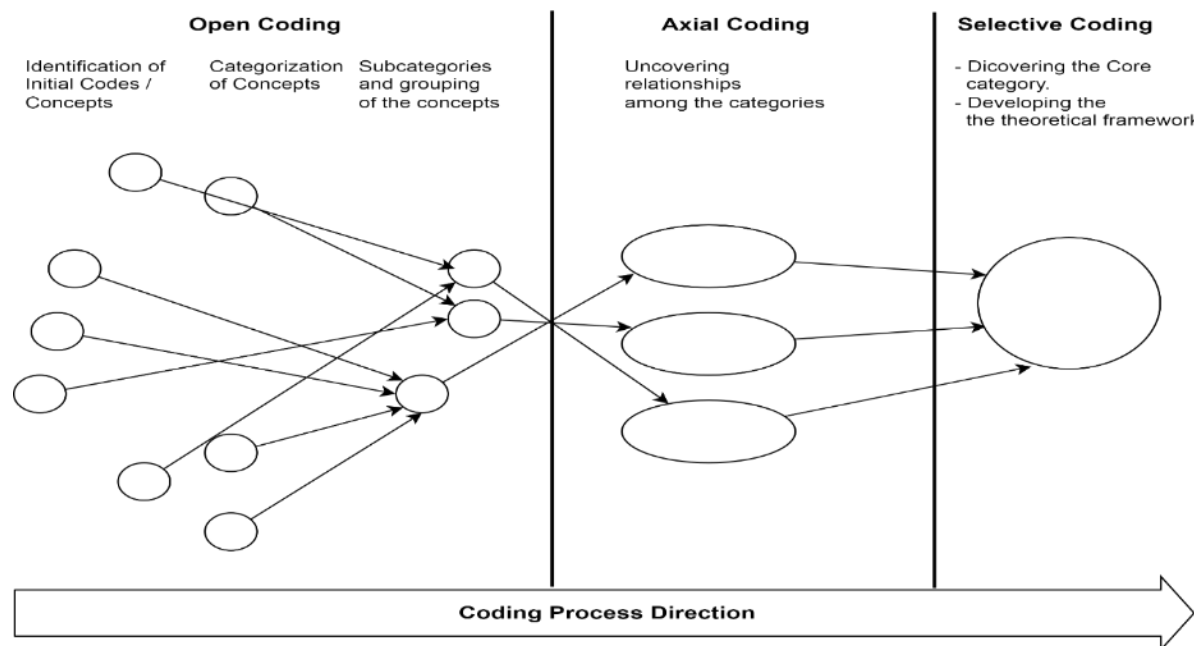


Figure 4.2: The Three Coding Levels of Data Analysis in Grounded Theory Research

Source: Adopted from Harwood (2001)

4.3.5 Open Coding

Open coding, illustrated in Figure 4.3, is the first data coding step while applying the grounded theory approach in qualitative research. Scholars define it as the analytical process of recognizing the concepts and their properties and dimensions in data (Holton, 2007; Tie, 2019). In this coding phase, the focus was on identifying codes that represented actions open to various directions or further processing, which were then assigned to categories.

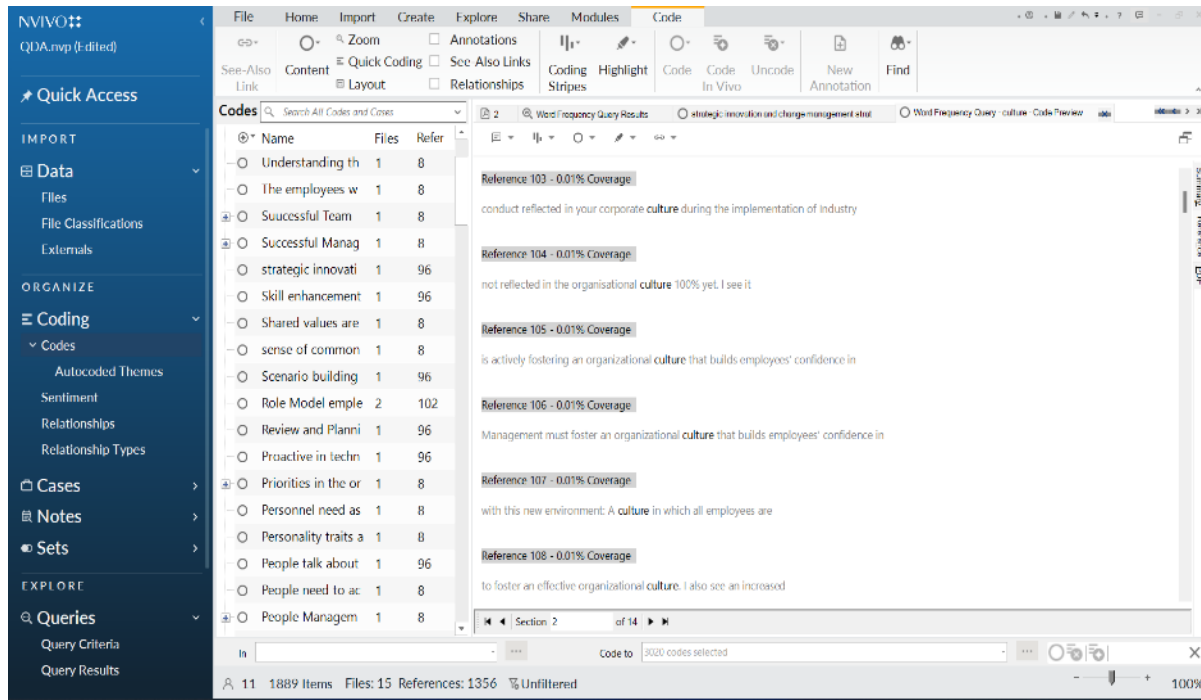


Figure 4.3: Open Coding Process for the Research, Source: By the researcher

The open coding process was used to identify the properties and dimensions that were used to determine the nodes of the conceptual framework. Open coding was employed to analyse the existing research work, starting with identifying incidents and assigning a name or code to them. The codes were then grouped into concepts, and the grouping process was repeated until the incidents could be placed in a relevant category. Data collection was done from 15 participants until the saturation level was reached, with a review conducted after each step to improve question wording and the flow of discussion. The review process helped determine and define categories for the data, which were then organised into themes and models. These themes and models were used to form the theoretical framework described in the next section. The use of NVivo facilitated the coding and analysis of the data.

4.3.6 Axial Coding

Axial coding was the second stage for applying grounded theory in qualitative research. This phase linked the concepts and categories to their subgroups and subcategories. Moreover, it also contributed to identifying various incidents, interactions, and actions, including their consequences. Axial coding

was the phase in grounded theory to build linkages between data. Figure 4.4 below demonstrates the text query and illustrates the interlinked words and codes group.

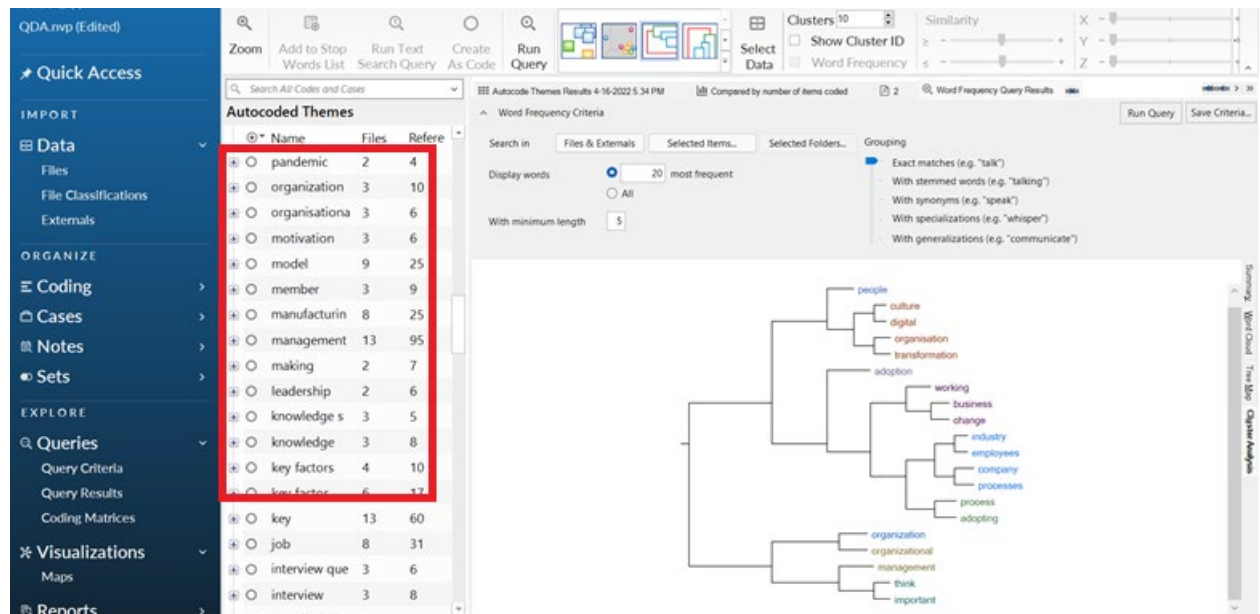


Figure 4.4: Axial Coding Process for the Research, Source: By the researcher

The coding relationships were constructed in the interview data based on similarities and differences identified in the initial stages of open coding. This was done by repetitively reviewing the initial codes list.

4.3.7 Selective Coding

Selective coding formed the third stage of the coding process, providing for further groupings, classifications, additions, and modifications to the already structured codes. The selective coding process enabled the development of a new theory or model. In this research, eleven models were developed, representing various key organisational culture factors for the effective diffusion of management and technology innovations for the successful implementation of I4 in SMEs in the automotive industry as a result of using grounded theory in all stages of coding. Figure 4.5 illustrates the grouping of codes, where all subcategories associated with the main code Transformation are displayed in the chart. The diagram includes 15 subcategories, each highlighted with the reference text from the transcripts.

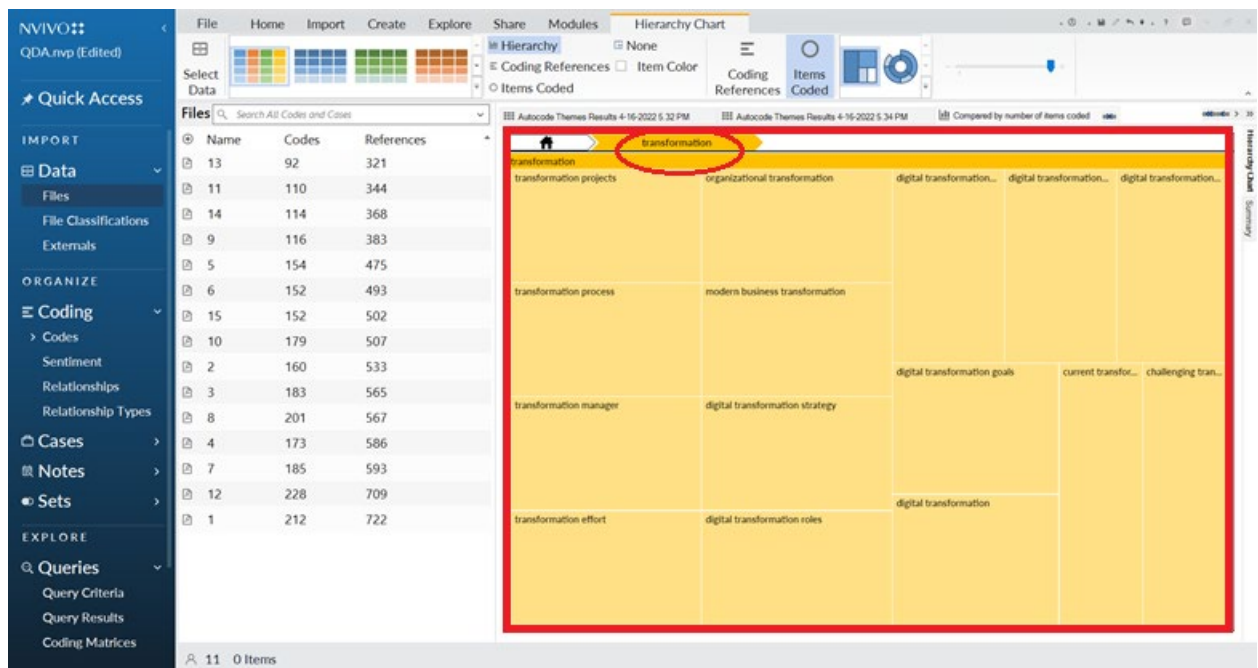


Figure 4.5: Selective Coding for the Research, Source: By the researcher

4.3.8 Word Frequency Query

The utilisation of NVivo's word frequency query facilitated the generation of a list of words based on the transcripts, providing the count and weight of each word contained. This tool offers various options, including total word list creation, selective word list, top word list, and more, enabling word lists of specific documents and data and generating diverse visual representations. In this study, the word query functions were used to identify illustrates the word frequency query in NVivo (Figure 4.6).

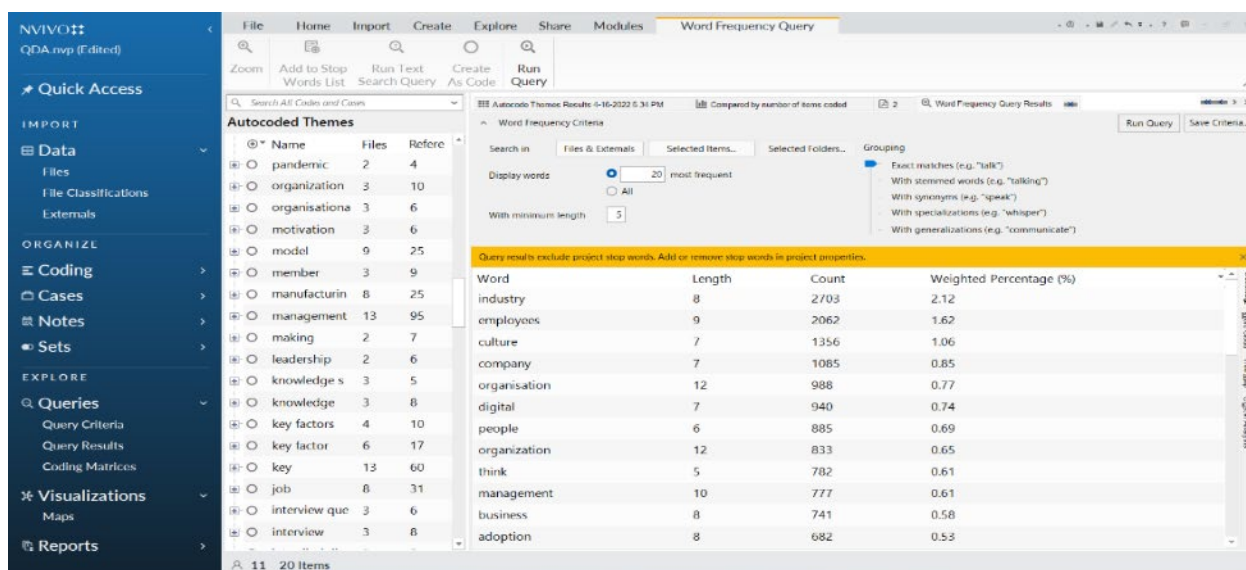


Figure 4.6: Word Query for Interview Nodes, Source: By the researcher

4.3.9 Word List

A word frequency query was conducted in NVivo to create a wordlist for the interview nodes. Although a long list of approximately 1000 frequently used words were generated, only the top 202 were selected and added to the study. Table 4.1 presents the top 20 words that appeared in the search. The word list reflects the subjects covered in the interviews and highlights the words that the participants frequently discussed. It also provides insight into the significance and weighting of each word. The most commonly mentioned word in the data was "industry."

Table 4.1: Word Query in NVivo for Interview Nodes

Word	Length	Count	Weighted Percentage (%)
Industry	8	7965	2,18
Employees	9	5491	1,50
Culture	7	4015	1,10
Organisational	14	3655	1,00
Digital	7	3359	0,92
Company	7	2866	0,78
Organisation	12	2816	0,77
Management	10	2553	0,70
Business	8	2355	0,64
People	6	2177	0,60
Think	5	2089	0,57
Processes	9	1944	0,53
Adoption	8	1934	0,53
Process	7	1895	0,52
Transformation	14	1891	0,52
Working	7	1686	0,46
Important	9	1634	0,46
Adopting	8	1622	0,44
Employee	8	1598	0,44
Change	6	1514	0,41
Environment	11	1338	0,37
Factors	7	1324	0,36
Technologies	12	1323	0,42

Source: By the researcher

Other visualizations used in this research included the Word Tree Map (Figure 4.7), Cluster Analysis of Word Frequency Query (Figure 4.8) etc.

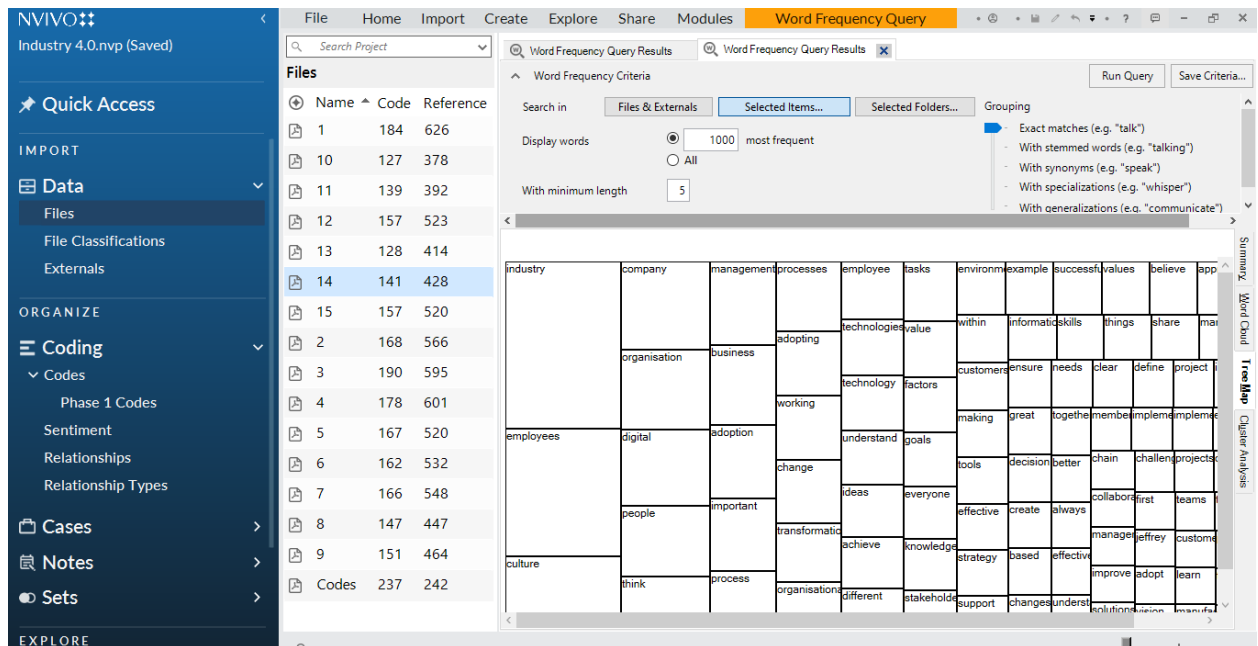


Figure 4.7: Word Tree Map of Word Frequency Query based on NVivo, Source: By the researcher

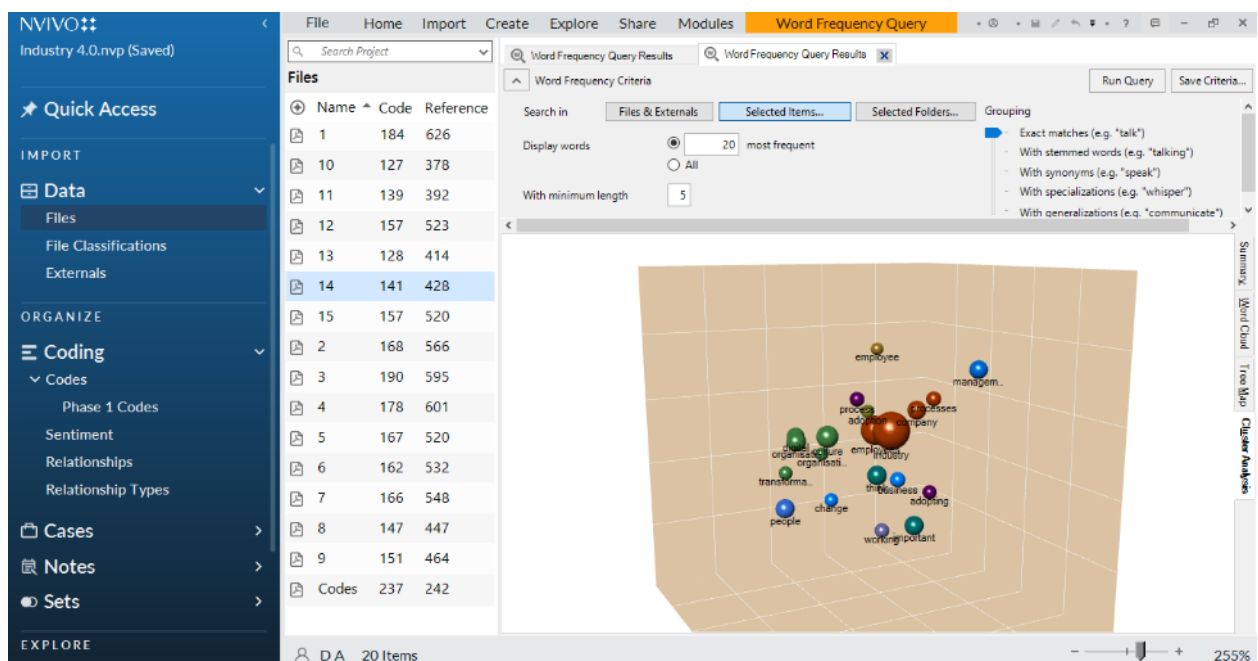


Figure 4.8: Cluster Analysis of Word Frequency Query based on NVivo, Note: By the researcher

4.4 Chapter Summary

The presentation of the collected data in this chapter 4 has shown that the composition of the assessment of the prevailing and preferred organisational culture and the experts' experiences with the diffusion of management and technology innovations for the successful introduction of I4 in SMEs in the manufacturing sector in the automotive industry permits an adequate and reliable mix of quantitative and qualitative data. The sequence of sample surveys and semi-structured qualitative expert interviews was proven as an appropriate dimension of the research design. The collected data were presented and serve as the basis for data analysis and theory building in Chapters 5 through 7.

Chapter 5 Findings and Evaluations

5.1 Introduction

This chapter discusses the development of key factors of organisational culture for SMEs in the automotive industry. The chapter starts with the survey results of 84 manufacturing SMEs. Table 5.1 summarises the results and compares the most and least relevant aspects of existing and preferred organisational culture in the participating SMEs. As delineated in Section 4.3.2, the data analysis approach utilised in this research involved grounded theory techniques, which ultimately led to the emergence of eleven salient themes. NVivo software was utilised to analyse interview data collected from 15 participants, consisting of 15 interview transcripts (Tr.) with total word count of 251,259, resulting in the creation of 1123 codes. The initial coding of the interview data yielded around 230 codes, which were then associated with the relevant quotes and sections of the interview transcripts. Through a process of a iterative refinement, these codes were subsequently grouped and organised into coherent themes. This iterative process culminated in the emergence of the eleven key factors. The chapter presents the themes, subthemes and codes of each key factor of organisational culture, including openness to employee input, practical strengths of the organisational environment, people management strategies, perceived methodologies of decision-making, task assigning and performance management, good team players, good managers, learning and knowledge sharing culture, motivational work environment, managing organisational differences, and survival and sustainable strategies. For each theme, the chapter presents a table of codes and a figure of grouped codes to support the presentation of the results.

5.2 Survey Results of 84 Manufacturing SMEs in the Automotive Industry

Table 5.1 above depicts the extent of existing and preferred organisational culture based on the conducted survey, organised by the organisational activities 1-15, and sorted into the four organisational culture dimensions A=Power Oriented, B= Role Oriented, C=Achievement Oriented and D=Support Oriented organisation, that are most or least applicable to the way things are in the involved organisations (Harrison & Stokes, 1992).

Table 5.1: Comparison of the Existing and Preferred Organisational Culture

Activities	most applicable (rated a "4")		least applicable (rated a "1")	
	Existing Organisational Culture	Preferred Organisational Culture	Existing Organisational Culture	Preferred Organisational Culture
A1.	D	D	B	B
A2.	D	D	B	B
A3.	C	C, B	A	A
A4.	C	C	B	B
A5.	B	B	D	D
A6.	C	C	B	B
A7.	C	C	B	B
A8.	B	B	C	C
A9.	C	C	A	A
A10.	C	C	A	A
A11.	C	C	B	B
A12.	C	C	B	B
A13.	D	D	A	A
A14.	B	B	A	A
A15.	C	C	A	A

Table 5.1 depicts the survey results in existing and preferred organisational culture across activities A1-A15, categorised into four cultural dimensions: power-oriented (A), role-oriented (B), performance-oriented (C) and support-oriented (D). The table shows for each activity the most (rated a "4") and least applicable (rated a "1") cultural dimensions for each existing and preferred organisational culture. For most activities, the preferred organisational culture aligns with the existing culture, indicating a good fit between the existing and preferred organisational culture. Supportive (D) and achievement-oriented (C) cultures are the predominant dimensions across activities for both existing and preferred organisational cultures. The two dimensions power-oriented (A) and role-oriented (B) seems to be the least dominant dimensions for most of the activities.

5.3 Description of themes and codes

NVivo gave 1123 codes which were reviewed manually. The initial coding of the collected interview data yielded around 230 codes (Appendix C, "List of Codes"), grouped and labelled according to their similarities and differences as outlined in the following Sections 5.4 – 5.14. These Codes have been

grouped together into sub-themes, such as “shared value system” and “Data sharing” as outlined in Figure 5.1. The sub-themes were then further grouped together into themes, such as “Transparent system”. Ultimately, through an iterative process of refining and consolidating themes, eleven main themes have been identified as the most significant findings in the interview data to address the research questions accordingly. Although the data was vast and detailed, the findings include all the data's core and crux. Following are the key areas of discussion that emerged from the analysis. The descriptions of themes are arranged to respond to the research questions considering collected interview data.

5.4 Openness To Employees Input

The first organisational key factor characterises an open and welcoming organisation. Different management styles are considered to bring forth such an organisation in the corporate world. Increasingly, the managers interviewed from manufacturing SMEs in the automotive industry characterised the management style as effective in producing high organisational output and employee engagement levels. The manufacturing SMEs in this study are also engaged in shaping and enacting organisational policies, plans, and strategies that they believe could help in aligning the technological and organisational culture to enhance competitiveness and customer satisfaction. The participants' responses can be structured into two types of texts: Firstly, they shared their experiences with the technological transformation related to I4, and secondly, they recommend initiatives, activities and strategies that could be employed to improve how the whole organisation is being transformed. The difference between the statements made by these interviewees reflects either their hands-on engagement and others who are still in the planning stage and have not yet been able to embrace the transformation processes in organisations fully. Figure 5.1 illustrates the first key theme, "Openness to Employee Input," divided into several subthemes that emerged from the interview data.

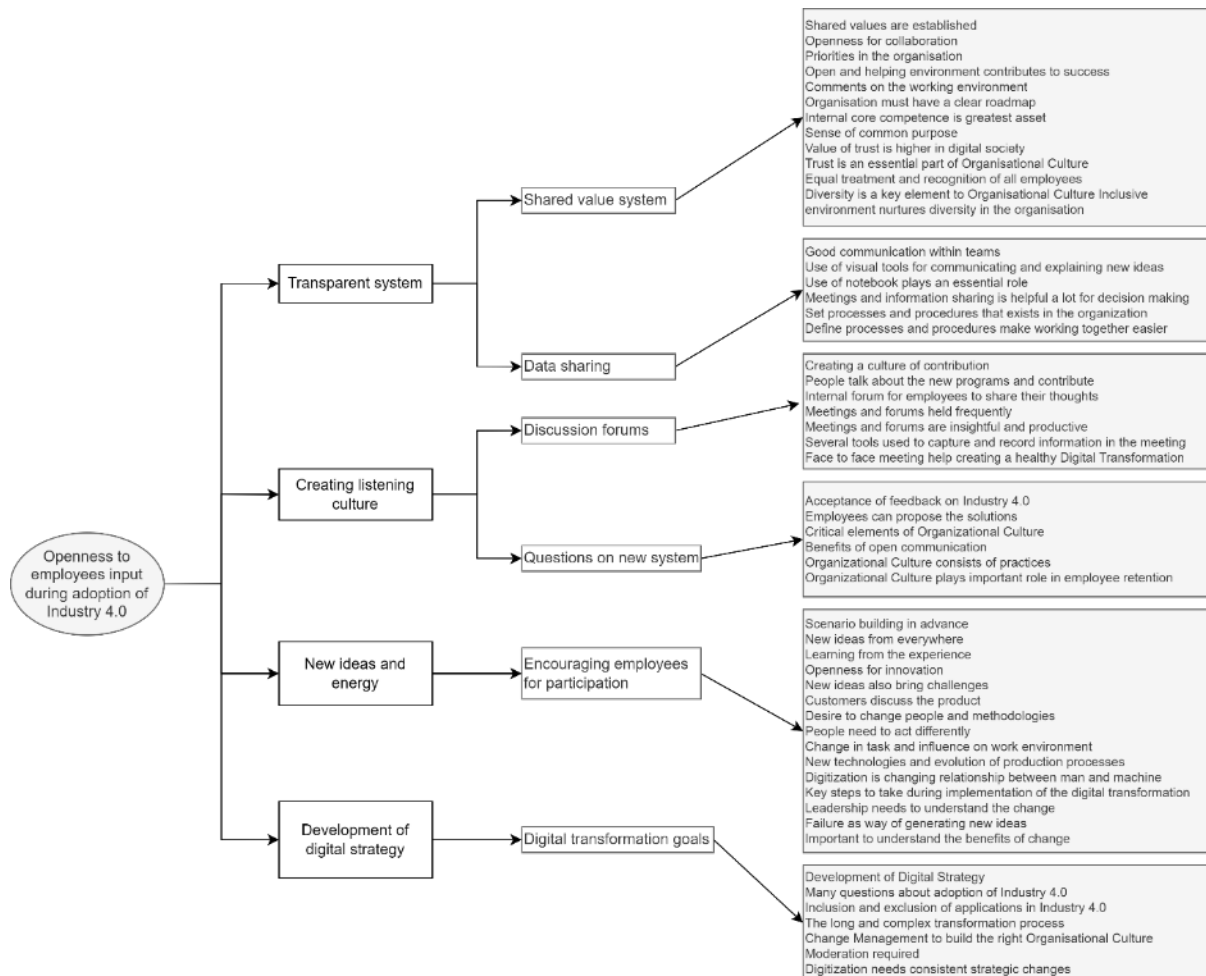


Figure 5.1: Openness to Employees Input during Adoption of Industry 4.0 - Grouped Codes, Source by the researcher

5.4.1 Transparent System

Transparency in information system (IS) is another indicator to assess the openness of the organisation along with the level of trust and communication between the employees and the organisation. The level of transparency in IS was not equal in all organisations. Some organisations provided employees with better access to data, and most information had been shared with employees, with the notion that efficiency is much dependent on access to data. A participant described the role of transparency in organisational culture leading to effective information sharing:

“Management must be well informed about the organisational culture of communication, collaboration, integration and information sharing between the different sections of the company to support the implementation of I4 technologies across different groups within the organisation”. (Tr 6).

Employees engagement in strategic decisions played a critical role in the success of the implementation of I4 technologies, which a participant stated as follows: *“Our main challenge is to integrate all employees into the digital transformation strategy. The success of this will depend on how transparent and participatory we make the process”. (Tr 2)*

Therefore, organisations need to identify employees' significant challenges and find ways to address them by involving employees in the digital transformation strategy in a transparent and participatory manner. This will ensure that employees understand what needs to be done and feel empowered to contribute to achieving I4 goals in automotive manufacturing SMEs. These goals can be achieved by an Organisational Culture that fosters open access to information, openness for collaboration, trust and a common sense of purpose.

When done effectively, this approach yielded the organisation to several benefits, including equal treatment and recognition of employees, and alignment of organisational priorities with the manufacturing SMEs goals.

Manufacturing organisations should be well informed on the change they are bringing forth and ensure that they have clear policies and roadmap that ease employee transition into I4. Management must ensure that their adoption strategy is transparent and communicated to ensure that employees feel comfortable and updated with everything, whether it's asking questions or joining their organisation to learn more about what their next steps will be. A participant described the importance of the management being approachable and willing to listen to employees concerns and suggestions:

“Management would also consider that they should be transparent with the employees about what is going on. We have transparent management that we can talk to about our issues and concerns”. (Tr 3)

The shared value system (SVS) and data sharing as shown above in Figure 5.1 was highly weighted in all organisations with a belief that it puts all people in a similar position of respect, rightfulness, and responsibility for contributing to organisational growth. SVS define an organisational culture where equality prevails, and the managers and employees are committed to working for a shared vision, goals, and objectives. It emphasises that the individual contributions to the I4 adoption are inextricably linked with the success of the whole organisation. In this respect, the shared value system provides employees with a platform to build trust, establish a community of shared interests and thereby enhance the organisational performance during the adoption of I4. Employee participation emanates from the SVS. As a participant described, the SVS defines an organisational culture of equality, commitment, and mutual respect towards a common vision, goals, and objectives:

“I also like the values, as they have defined a culture where we are all equal and committed to working together. Sharing a common vision with a strong focus on customer service, quality, safety, and continuous improvement is at the core of the company's philosophy”. (Tr 2)

Moreover, the organisational culture of the SVS refers to a specific strategy of an organisation that is validated by the shared values, an organisational network, and shared identity. The companies endeavoured to implement the organisational culture of shared values by restructuring the hierarchical structures and setting targets for the future development of functional units. This approach takes people beyond business relationships and employees feel connected to their organisation and support adopting I4 collectively. As a participant described, the company's shared value of “courage and dedication

“encouraging risk-taking, experimentation, and responsibility, ultimately promoting an organisational culture of openness and adaptability to change:

“This value defines a sense of security and optimism, and it encourages everyone to take risks, experiment with new ideas and be open to change. It's essential to be courageous and take responsibility for everything that happens in the company”. (Tr 10)

Akin to the preceding statement, shared values such as courage and dedication enable employees to take risks and feel confident in doing so as they have the feeling they are supported by the organisation. As a result, the process of implementing I4 was effectively driven with an awareness of shared values, courage, dedication, and commitment and data sharing among all employees. A participant highlighted the role of organisational culture in building the foundation of shared values and principles of the organisation:

“I believe that an excellent organisational culture serves as the core that defines the values and principles on which the organisation stands”. (Tr 2)

As described by a participant, shared values can extend beyond the organisations to include suppliers through programs, performance management systems and dialogue:

Shared values also include the recognition for excellence on behalf of suppliers through innovative supplier programs, transparent performance management systems and dialogues. Shared core values facilitate change by encouraging collaboration, motivating employees, and actively involving all stakeholders in strategic decision making”. (Tr 5)

In addition to the recognition of the role of shared values in organisational culture, participants also highlighted the importance of trust and information sharing in the implementation of information systems. A respondent pointed out the importance of trust, especially in organisations where implementation of IS had failed:

“Trust is an essential factor for successfully implementing any new system, particularly in organisations where there is a history of failed implementations. The main reason is that trust is related to information or data sharing. The more information the team shares with the organisation, the more trust it will earn”. (Tr 10)

5.4.2 Creating a Listening Culture

In the automotive industry, successful manufacturing SMEs recognised the importance of employee input and established a listening culture to facilitate discussion forums where employees could voice their opinions and question the new information systems related to I4 technology. This enabled a free flow of ideas and suggestions for improvement, leading to an Organisational Culture of contribution. A participant described the role of acceptance of employees' feedback in organisational culture, leading to a strong leadership:

“Management is waiting for input from the teams. This shows a lot about the organisational culture and leadership. It also shows that we want to do things right as soon as possible”.

(Tr 2)

Participants reported various methods for creating a culture of listening used by their respective organisations. Some organisations utilise digital platforms for dialogue, while others encourage direct outreach to senior leaders, providing opportunities for employees to share their opinions and thoughts in the context adoption of I4. In line with this, a participant highlighted the importance of considering all employees contributions in the decision-making process and the value of listening and learning from the employees:

“It is crucial that everyone can contribute, and we must consider their suggestions and ideas when making plans for the future. I also like to listen and learn from what our employees have to say, whether they are from our departments or not”. (Tr 3)

A participant shared that developing a listening culture is critical to unleashing the potential of I4 technologies in manufacturing SMEs. This includes empowering employees to propose innovative solutions and encouraging dialogue about new software programs and systems, which leads to greater innovation and organisational planning:

“If there are no obstacles preventing team members from proposing novel ideas, there will be many innovative ideas for use. I am thrilled now that my organisation is open to listening”.

(Tr 2)

Organisational planning is a dynamic process that changes according to internal and external necessities. Similarly, technological change has been becoming a compulsory prerequisite for organisations to be consistent across their business landscape. These decisions are taken by the management, while the team and the employees are consulted as well. The dialogue between leadership and the team, focuses more to questions on the novel technologies deployed in the organisation during the adoption of I4. The discussion focused on the obstacles and complications in adopting I4, and whether managers and leaders have adequately communicated and convinced employees about the challenges that come with the adoption. Although the adoption of I4 can be challenging, a participant referred to the process of coping with change as a maturing process that leads to organisational growth:

“People need to be aware that changing their organisation is the way to professional growth and personal development. They learn by doing, by exploring and by questioning”. (Tr 2)

Employees have both immediate and tacit objections to adopting technologies in the course of adopting I4. The majority of questions are raised by employees to managers, inquiring about the nature of the technology and information system, and the rationale for its adoption. These inquiries are usually answered by the managers and team leaders explaining the significance of I4 and the benefits for the manufacturing industry. Therefore, a listening organisational culture, which encourages open dialogue, can help address these concerns and foster a sense of team spirit that is vital to the success of adoption

of I4. As a participant described the importance of a clear mission, vision, and values in enabling organisation to grow and remain competitive. A participant pointed out that various internal forums have been created to allow employees to share their ideas and concerns about the digital transformation process, leading to a good team spirit and healthy collaboration within the organisation:

“The organisation has a clear mission, vision and values that help us to grow and compete in a global digital world. For example, we have set up various internal forums for employees to share their ideas and concerns concerning the digital transformation agenda. These meetings help create a team spirit within the organisation.” (Tr 1)

With this said, organisations need to establish practices, such as regular surveys, focus groups, and face-to-face meetings, that promote a listening culture, alongside discussion forums, to facilitate healthy collaboration and optimised use of i4 technologies.

5.4.3 New Ideas and Energy

This section highlights the importance of the diffusion of innovation in a rapidly changing technological landscape for manufacturing SMEs in the automotive industry during the adoption of I4. It highlights the need for an organisational culture to facilitate proactive measures in generating novel ideas and promoting employee participation to maintain a competitive edge. However, interviewees shared insights about the emergence of new ideas, interestingly not all ideas were successful, and failure could be a valuable tool in generating new and improved ideas. Employees are more likely to feel comfortable taking risks and proposing new innovative ideas by creating an environment that accepts failure as part of the learning process. As a participant stated:

“Not all ideas are good, but we learn new things and develop ourselves in the process. I can say that working in an open organisation is a pleasant and confidence-building experience for creativity, learning and development oneself”. (Tr 2)

An open-minded organisational culture enables management to leverage various ideas from employees, customers and other stakeholders. By evaluating the potential impact of each idea on I4 adoption, manufacturing SMEs can identify the most appropriate solution that will enable them to adapt to changing market trends, customer demands and technological advances. As one participant pointed out:

“Ideas are always welcome, and we keep an open mind. We evaluate each idea and see what impact it can have in the development of our business strategy”. (Tr 3)

At most of the involved organisations, management welcomed suggestions and new ideas from the employees in the team. However, the decision-making authority to collect and implement the selected ideas lied with the management. Nonetheless, the sharing of new ideas and thoughts was widespread among all age groups of employees. In a few organisations, activities are conducted to evaluate the ideas before they are implemented. In comparison, some manufacturing SMEs have established digital platforms, including on-site and online meetings, workshops, and informal discussion forums, to gather

new ideas within the organisations. These forums and digital platforms offer employees the opportunity to share ideas on specific topics or agendas, who are the primary drivers of change with an organisation. As a participant commented: *“Employees are the primary driver of change, and their involvement in adopting I4 is fundamental. Of course, there are processes and procedures for this”*. (Tr 2)

This enabled manufacturing SMEs to leverage collective knowledge related to I4 and foster innovation and business growth.

Encouraging employees to generate new ideas and energy is a critical aspect of organisational culture for the successful diffusion of management and technology adoption. Effective leadership is necessary to understand the impact of these ideas. However, the worldwide pandemic Covid-19 has highlighted the need for even greater flexibility in organisational culture due to its impact on change in tasks and influence on the work environment. As a participant described the challenges related to the recent Covid-19 pandemic to adopt future scenarios:

“I believe that the challenges of the recent pandemic have shown us that we need more flexibility in our organisations. We are facing new forms of work organisation, and new challenges are arising with them. This is why managers need to review their job descriptions so they can adapt to new scenarios. It's essential to have a flexible approach towards your employees, so I encourage them to share ideas and listen to each other to come up with workable solutions.” (Tr. 14)

5.4.4 Development of Digital Strategy and Transformation Goals

Organisational culture played a crucial role in developing a digital strategy in the context of adopting I4. The values and principles that shaped the organisational culture were essential in driving the change process. A digital strategy defines the goals and objectives of the change process to meet the goals for adopting I4 technologies and outlines the necessary measurements to achieve them. The success of this change or digital transformation process depends on openness to employees' input, inclusion and exclusion of I4 technologies, and effective change management to build the right organisational culture in manufacturing SMEs in the automotive industry. A participant emphasised the significance of integrating the organisational culture with the digital strategy:

“I consider it very important to incorporate this culture in the digital transformation plan because we can create a shared vision for everyone who will work within the organisation”. (Tr 2)

The digital transformation process is the phenomenon that has caused rapid changes to the manufacturing SMEs in the automotive industry and is having a significant impact across industries. Most SMEs are aligning their digital strategy with business strategy as indicated in most of the interview transcripts. It is believed that the overall business strategy encompasses the component of the digital strategy. The adoption of I4 is an evolving process for intended business growth, guided by a digital strategy in the manufacturing SMEs discussed here. The key features mentioned as part of the digital transformation strategy included the smart factory, corporate strategy, business strategy, innovation

strategy etc. Most respondents indicated that organisations typically follow either a business strategy or a digitalisation strategy during the process of technological transformation. It can be seen that the organisational culture is deeply affected by transparency, listening culture, new ideas and energy, and development of digital strategy in the context of I4 adoption, as they play a critical role in enhancing communication, collaboration, integration, information sharing, and ultimately, the successful adoption of new technologies in automotive manufacturing SMEs.

5.5 Practical Strength of Organisational Environment

A Practical strength of the organisational environment during the adoption of I4 is key to successful adoption of I4 in the automotive industry. This Section explores several themes such as flexible organisational culture, employee monitoring, automation and efficiency linkages, customer centric approach, business analysis and the market responsive organisational growth that contribute to the practical strength of the organisational environment. Each theme is further explored through respective sub-themes such as focus on outcome and employee motivation, performance monitoring and attitude monitoring, enhanced productivity and skills development, customer surveys and customer satisfaction, business strength and weaknesses, and role models and healthy collaborations. These themes and sub-themes are underpinned by the respective codes, as outlined in Figure 5.2. It outlines the grouped coding of the interview data to practical aspects of organisational environment involved in adopting I4. However, this section also encompasses the supervision or monitoring of the employee engaged in manufacturing processes, which aims to measure the efficiency and performance of the employees during the adoption of I4. The automation in manufacturing SMEs and the impact on efficiency is also highlighted in this section, specifically how technology has been shaped to integrate into business operations and create a more efficient work environment for employees adopting I4. Further, this section outlines the customer-centric approach, focusing on customer satisfaction and manufacturing solutions. By prioritising these themes and sub-themes, organisations can create a robust organisational culture that increases productivity and customer satisfaction while addressing the strengths and weaknesses of the business. In addition, an agile and collaborative approach to adopting I4 technologies will also enable market-driven business growth that leads to long-term success.

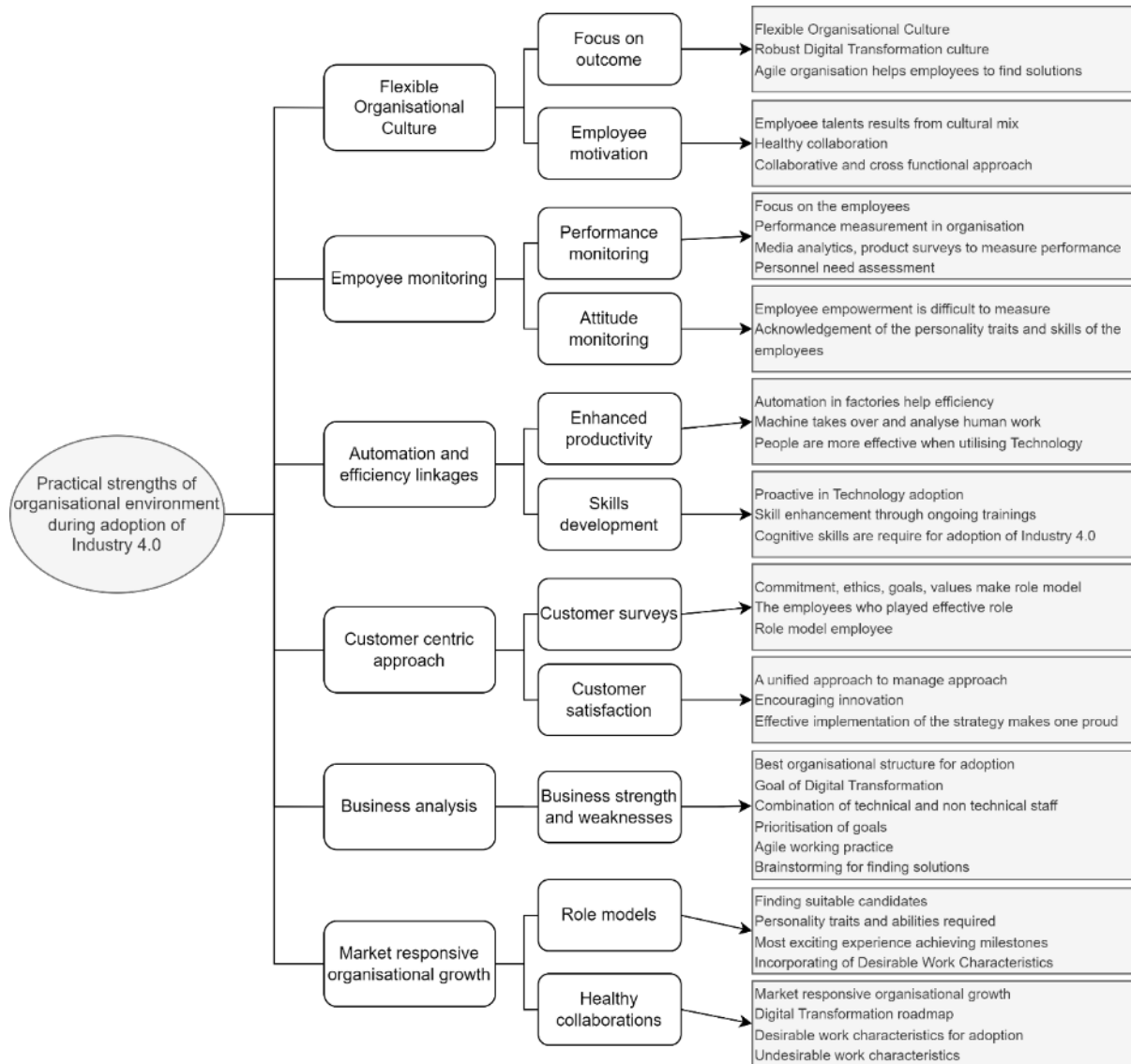


Figure 5.2: Practical Strengths of Organisational Environment during Industry 4.0 – Grouped Codes

Note: By the researcher

5.5.1 Flexible Organisational Culture

A flexible organisational culture is characterised by a focus on outcomes and employee motivation. It refers to manufacturing organisations with agile organisational structure and responsive to changing market conditions. This includes the empowerment of the employees to find solutions through a collaborative and cross functional approach during the adoption of I4 in the automotive industry. Furthermore, a flexible organisational culture combined with agile organisational structure can improve employee engagement in adopting I4, provide the opportunity for the growth and development of individual employees, and encourage teamwork. The survey results indicate a strong preference among participants for a support-oriented organisational culture that prioritises cooperation and problem-solving over a more rigid, role-oriented approach. It can be said that his preference aligns with the need for flexibility and agility in adapting to the dynamic environment of Industry 4.0 in the automotive

manufacturing sector. However, not every organisational structure is effective in all situations. For example, some structures require that everyone be accountable to someone - like a supervisor or manager who gives direction to the employees - while others are involved more in horizontal structure, where there is no leadership figure at all except for the team members who share decision-making responsibilities, so everyone has equal power and input into how things go. It has been a common belief among the respondents that strong organisational culture is defined in a variety of ways, but the common feature of such culture includes the effective and concrete communication between employees and the management, between teams, internal and external stakeholders etc. This includes relaying information or data to the proper entities of concern while adopting I4. A participant described an agile organisational structure as to all members of the team are considered equal, ensuring that everyone's opinion is given due consideration when working on solutions:

"We try to maintain a flat hierarchical structure where everyone is an equal member of the team. Everyone's opinion must be considered when coming up with a solution". (Tr.2)

Another participant suggested that manufacturing SMEs need to have a high level of flexibility in the products and services they offer to meet the changing market demands:

"The market requires us to be very flexible with our products and services". (Tr.2)

Strong, young, and flexible organisational cultures are essential terms used by the respondents to represent and demonstrate their company's culture positively. For instance, the strong ownership of employees was seen as an active factor in adopting I4 in manufacturing SMEs. By "strong ownership" and "active factor", a participant meant that the success of the adoption process is higher among employees performing a bundle of I4-related tasks:

"By strong ownership and active factor, I mean that the success of the implementation process is high among those employees who represent a bundle of I4-related activities". (Tr.3)

When adopting I4, organisations strive to establish an organisational culture in which the respective tasks of employees are clearly communicated. The technical and business aspects of the respective job should be supported by a learning culture and a culture of knowledge sharing. The young culture mentioned in the transcripts is synonymous with a dynamic organisation. A participant noted that their company has a flexible culture regarding working hours, new initiatives and openness to change, which has enabled them to adopt I4 eagerly.

"Our company has quite a young culture because it was established in 2011. We are flexible in working hours, providing support for new initiatives and being open to change. This is why we are embracing I4 so eagerly". (Tr.10)

5.5.2 Employee Monitoring

Another important aspect of the practical strengths of the organisational environment is the supervision or monitoring of employees in terms of their performance and their attitudes toward adopting I4.

Performance monitoring is an essential tool for ensuring that employees can achieve organisational goals and adapt to technological change, while attitude monitoring helps to identify and leverage the individual personality traits and skills of each employee.

A participant characterised the organisational culture as collective consciousness and collaborative engagement among members of the organisation, which played a vital role in envisioning, planning, implementing, and measuring the success of adopting I4. In this context, the role of managers includes monitoring employee performance which is influenced by various human factors, including behavioural and attitudinal aspects:

“This sense of ownership is attributed to the organisational culture. The collective consciousness was another factor that contributed to this success. Employees share a vision for the implementation of I4 and are engaged with the implementation process”.

(Tr 3)

Monitoring employees represents an essential aspect of adopting I4, particularly when new work tasks are assigned with corresponding technical systems and skill requirements. The monitoring not only pays attention on progress, but also includes learning support for the employees. They are guided and supported with information wherever they need it. Therefore, it is also linked to the mentoring process. The adoption of the new system is not sudden and quick, but gradual and accompanied by continuous training and guidance from the experienced members of the organisation. Monitoring employees is more about motivating them to work with new technologies than pressuring them to complete the tasks assigned. A participant described their responsibility of ensuring consistency between the organisational plans and actions, defining performance metrics making recommendations for performance tracking, which is necessary for identifying areas of improvement and aligning organisational goals with objectives.

“My duties include but are not limited to making sure that our statements and plans are consistent with what we do, defining the key indicators for monitoring and measurement, analysing the data, making recommendations to management to track performance against objectives”. *(Tr 12).*

By focusing on the employees, measuring their performance, and acknowledging their personality traits and skills, organisations can ensure a smoother adoption of I4 in the automotive industry.

5.5.3 The Automation and Efficiency Link

Automated manufacturing processes can significantly increase productivity by streamlining operations and allowing machines to take over more sophisticated tasks and analyse human work. People are more effective working together when utilising technology, as it can help them work more efficiently and accurately during adoption of I4 in the automotive industry. Skill development is an essential aspect of I4 adoption. By focussing on skills development and proactively technology adoption, organisations

can stay ahead of the curve and ensure that they are prepared for the changes that come with the adoption of I4 technologies.

As a participant described the importance of teamwork and collaboration in achieving organisational goals, as organisations can equip their employees with the skills required for I4 adoption while fostering a culture of teamwork and cooperation to enhance productivity:

“I can say that being a team player is one of the most critical factors. The team members work together to accomplish tasks and sometimes give up their time to help someone else, even if it's not in their job description” (Tr.2)

The learning process is lateral also, and employees learn from each other as well. It is an outcome of the collaborative work environment and can be referred to as positive cultural change. The learning process is not entirely dependent on the senior team members and managers but also on the co-workers who collaborate to extend their information and knowledge to other team members. The collaborative environment helps faster automation and efficiency. Once again it is linked with a positive cultural change within the organisation reflecting a collaborative work environment.

5.5.4 Customer-Centric Approach

The customer-centric approach during the adoption of I4 can be enhanced by focusing on role models who demonstrate commitment, ethics, goals, and values and employees who effectively meet customer demand. Moreover, a unified approach to encourage innovation can lead to the effective implementation of management strategies toward customer satisfaction.

The automotive industry highly valued customer experience, so organisations ought to adopt new technologies to remain competitive in the market. The participants proposed a customer-centric approach to align with the technological shift and enhance organisational competitiveness and growth. Organisations should focus on their organisational culture to develop a customer-centric approach. This will be achieved by aligning the different components of organisational culture, including the human, social, and technological elements. Notably, the differences among the approaches shared by the participants related to customers are not mainly about the purpose and strategy to deal with the customers, but the size, age and scale of the business, methodologies of customer satisfaction and diversity of the customers. A participant described their organisation as a learning organisation that focuses on the customer experience in the automotive industry:

“I would describe we as a learning organisation that focuses on the customer experience. We tried to find effective ways to satisfy our customers by creating more efficient and effective solutions and processes”. (Tr 2)

While another participant pointed out the need for manufacturing companies to define a roadmap for staying customer-centric in the competitive marketplace:

“Since customer-centricity is one of the key dimensions of the manufacturing business, I also define a road to deliver on this dimension”. (Tr 7)

The organisation’s business objectives seem to revolve around the customers whereas the organisation’s representatives stay in regular contact with customers, receive their feedback and include them in planning and improvement strategies. According to a participant, the involvement of customers in the manufacturing planning process is considered important, representatives maintain regular contact with customers to receive their feedback:

“To achieve our objectives, it is also important to follow up regularly with customers and other stakeholders to get feedback on what they want from us” (Tr 12)

One participant shared that cultural diversity in a company is also part of the customer-centric approach. The adoption of I4 by manufacturing SMEs across the value chain requires people from different cultural backgrounds and countries to work in concert across the globe. The I4 customer-centric approach calls for extended collaboration between employees of manufacturing SMEs and their suppliers, as well as between people from different cultural backgrounds and from different countries. According to a participant, a successful customer-centric approach implied that the manufacturing SMEs not only have a mastery of the core technical competencies of I4 but are also sensitive to cultural diversity to be able to collaborate globally:

“Cultural diversity makes me better for my job because it helps me be more effective at communicating with customers, customers who come from different countries, different cultures and speak different languages”. (Tr 13)

Respondents repeatedly mentioned their organisation’s culture and values. Furthermore, a participant related their organisation’s value chain to their customers, with customer satisfaction at the core of the organisation’s value chain:

“Our most important core value is we are committed to our customers” (Tr 11)

At many points in the interviews where the respondents talked about digital strategies, technological and cultural change, and the importance of stakeholders, they vigorously mentioned the customer-centric approach.

5.5.5 Business Analysis and Growth

Business analysis is a critical theme in the adoption of I4, which is characterised by business strengths and weaknesses. A clear and comprehensive understanding of the I4 adoption process is necessary to conduct an effective business analysis. To ensure a successful I4 adoption, it was important for organisations to have a suitable organisational structure in place. This included a combination of technical and non-technical staff working in an agile environment that prioritises business goals. As a participant described, this involved the integration of digital capabilities into various departments, such as finance, marketing, engineering, manufacturing, and after-sales-sales services:

Digital capabilities are integrated into our finance, marketing, engineering, manufacturing, and after-sales service departments. (Tr 2)

Business analysis is crucial in facilitating stakeholder communication by mapping and analysing the impact, risks, and benefits of I4-related technological innovations to present them to the management and support their informed decision-making. The business analyst is tasked with understanding what departments are impacted by I4 as well as understanding how each organisation will be affected by the adoption process within their area of expertise. Therefore, the role of business analysis is crucial in understanding the potential of I4 to transform the business landscape and enhance competitiveness among manufacturing SMEs in the automotive business. Support and guidance of business analysis can help SMEs to navigate through an environment where the traditional models have fallen away and changed. Managers responsible for adopting I4 are encouraged by participants to develop a business scenario to analyse the long-term impact it will have on the organisation's success. Participants felt that analysing, planning and managing a business is not easy, but requires business leaders to have a comprehensive knowledge of the business and technologies, as illustrated in the following quote of a participant:

“I believe that a good Digital Transformation Manager must possess an understanding of technological developments and knowledge of business-oriented technological solutions that can be utilised to create new business opportunities”. (Tr 10)

The business analysis work focuses on understanding the needs and limitations of SMEs in the automotive industry to guide and promote the adoption of I4. The process involves identifying the challenges faced by manufacturers and formulating recommendations for strategies to integrate manufacturing with I4 technologies. The convergence of digitalisation with traditional technologies in manufacturing SMEs in the automotive industry is not occurring at the same rate as in larger companies. Current investment levels and perceived benefits are lower in SMEs than in larger companies. In contrast to the experience of larger companies, systematic business analysis has not yet been widely adopted in SMEs. The current level of adoption of IoT solutions and the perceived benefits are found to be lower in SMEs than in larger enterprises. It is assumed that SMEs are less informed about the potential developments in I4 and IoT compared to large enterprises. A participant emphasised the significance of establishing close relationship with managers and aligning IT infrastructure with the organisations specific needs, goals and strategies for effective adoption of I4 technologies:

“I believe it is important to build a close relationship with managers and implement IT infrastructure on the ground. Our organisation has unique needs, so an IT strategy should be based on its visions and strategies”. (Tr.3)

The role of business analysis in adopting I4 is to assess the impact, risks, and benefits of technological innovation and simulate them to decision-makers while considering the unique business needs and visions of the manufacturing organisation.

5.5.6 Market Responsive Organisational Growth

The theme of market-responsive organisational growth is critical to the practical strengths of the organisational environment during the adoption of I4. It is underpinned by the sub-themes of role models and healthy collaborations. Role models are about finding suitable candidates with the required personality traits and skills, creating rewarding experiences as they reach milestones, and incorporating desirable work characteristics. In addition, healthy collaboration can be fostered through a market-driven organisational growth approach with a digital transformation roadmap that includes stakeholders and desirable work characteristics for I4 adoption.

Organisations' ability to adjust their market responsiveness strategy is critical to ensuring competitive advantage. To do this effectively, an organisation needs a customer-centric approach that can enable a faster flow of information from the field and more rapid adjustment of processes during the adoption of I4. However, the growing emphasis of manufacturing SMEs on retaining and recruiting employees in a highly competitive market calls for increasing the wages paid to employees based on market rates. The dilemma for organisations is how to achieve this objective and avoid seeing their competitive advantage in the labour market erode by increasing wages, resulting in a fall in productivity. A participant shared that their organisation offered market-rate wages to its employees and took this as an opportunity to reward and motivate them:

“Wages are following the market rate, and I take this opportunity to reward and motivate employees”.
(Tr 4)

The external factors that affect organisations adopting I4 and its impact on business performance indicators are profitability, productivity, and market growth rate. A major determining factor of organisational success is that “the voice of customers” is heard by manufacturing SMEs during the adoption of I4. Monitoring market trends with the employment of big data analytics is a way not to lose sight of customers' needs during the adoption of I4. A participant noted that external factors that impact an organisation are endogenous as they are related to organisations market power that is influenced by its competitive strategies:

“The external factors that affect organisations are endogenous because they are part of the market power of an organisation, which depends on its competitive actions”. (Tr 11)

Acquiring knowledge of I4 and how to utilise it is one of the priorities for organisations to remain competitive in the market. Participants consider this an indispensable requirement, without which the company's market position may diminish and which may also have an impact on the sustainability of the manufacturing SMEs. One key insight from a participant is that a lack of passion or vision for I4 can hinder an organisation's ability to adapt to the market changes necessitated by the I4 technologies in manufacturing SMEs in the automotive industry:

“If there is no passion or vision for I4, it will be complicated for the organisation to adapt to the market changes required by I4 effectively”. (Tr 11)

Market dynamics can change how organisations and individuals perform, both because of the direct effect on revenue, and through other indirect effects. It is imperative that manufacturing SMEs understand these market dynamics to incorporate this into I4 adoption. The key question is not how companies can tap into new markets but how they can best orchestrate processes within their I4 adoption so that they produce the most value for their customers. Organisational performance is directly linked with their market adaptability and position as stated by a participant:

“Since the performance of organisations, today is directly related to how well they can operate inside their respective markets”. (Tr 12)

I4 is viewed as a technological change that increases the efficiency of organisations. It is believed that enhanced organisational efficiencies represent a key factor in sustaining the competitiveness of a company in the marketplace. A participant emphasised the need for increased efficiency in operations to maintain competitiveness with other companies in the manufacturing business:

“We need more efficiency in our operations to remain competitive with other companies in the market”. (Tr 13)

The participants, whose backgrounds are in the automotive industry, suggest that automotive SMEs should adopt new paradigms and innovative practices in manufacturing if they are to remain competitive in their respective markets. Respondents identified role model managers and employees as indicators of organisational strength in adopting I4 in the automotive sector. Role model managers have been perceived as individuals who deeply understand digital technologies and I4 concepts and pursue a clear vision. Similarly, role model employees are more than just contributors. They are active contributors and advocates of change. They have influence and are always looking for ways to improve the way things are done. Although several characteristics of such leaders and contributors were mentioned, the discussion focused on the points made. One participant noted the term "leading from the back," which meant the manager's strategy of monitoring the work and the employees. Such managers strictly stick to their tasks, monitor progress, understand employee dynamics, and provide unsolicited support. Healthy collaboration can be understood as a form of efficient and effective teamwork in achieving I4 objectives. Therefore, it is key to the success of organisations that rely on responsive interaction with the stakeholders involved when adopting I4 by SMEs in the automotive industry. Frustration among employees can negatively impact collaborative processes, thus hindering the successful adoption of innovative manufacturing digital technologies. Respondents indicated that success factors such as good internal communications practices, supportive leadership, and good employee training in digital technologies could be critical to the adoption process. They also think the team must be in the mindset that they will try to solve problems together instead of just doing tasks alone. A participant mentioned that due to the lack of support, several tasks were not completed on schedule, leading to adverse effects on the organisational performance:

“Since I couldn’t find help, many tasks weren’t achieved on time, which negatively impacted the business performance”. (Tr.2)

As I4 emerges, new challenges and opportunities are being created. One important challenge is how to approach the adoption of this new technology in a group with different functional profiles and skillsets. A participant emphasised the importance of diversity in working groups during the adoption of I4, stating that collaboration with individuals from varying backgrounds can lead to the development of optimal solutions:

“I think it is very important to work with a diverse group of people to reach the best solution during the adoption of I4”. (Tr 3)

A holistic approach to manufacturing aims to understand and leverage all the capabilities that exist within and outside the organisation, rather than limiting the view on individual functions. It is crucial to consider the big picture, understand the employee's role from a different part of the organisation, and know how they can work together. The holistic approach is even more important in times of disruptive technologies stemming from I4, which can impact organisations by changing market structures, product traits, work processes and business models. A participant emphasised the importance of taking a step back and considering the bigger picture, understanding the roles of individuals from other departments and how collaboration among them can be beneficial:

“I believe that it is important to step back and look at the big picture, understand the role of a person from another department, and how they can collaborate”. (Tr 3)

It can be seen that adopting I4 in the automotive industry requires a flexible organisational culture, effective employee monitoring, an automation and efficiency link, a customer-centric approach, and market-responsive organisational growth. These themes are interrelated and critical to ensuring the successful adoption of I4, which can lead to increased productivity, competitiveness, and customer satisfaction. Additionally, role model managers and employees, healthy collaborations, skill development, and market analysis are essential factors that can facilitate the adoption of I4 in the automotive industry.

5.6 People Management Strategies and Approaches of Organisations

The third key theme people management strategies and approaches of the organisations during adoption of I4 emerged from the analysis of the interview data, involving a range of themes such as skill development, organisational priorities, on-job training, assessment of personal traits, management of onsite and offsite employees, and restructuring management strategy. Figure 5.3 outlines the associated codes to these themes, leading to the aforementioned key theme.

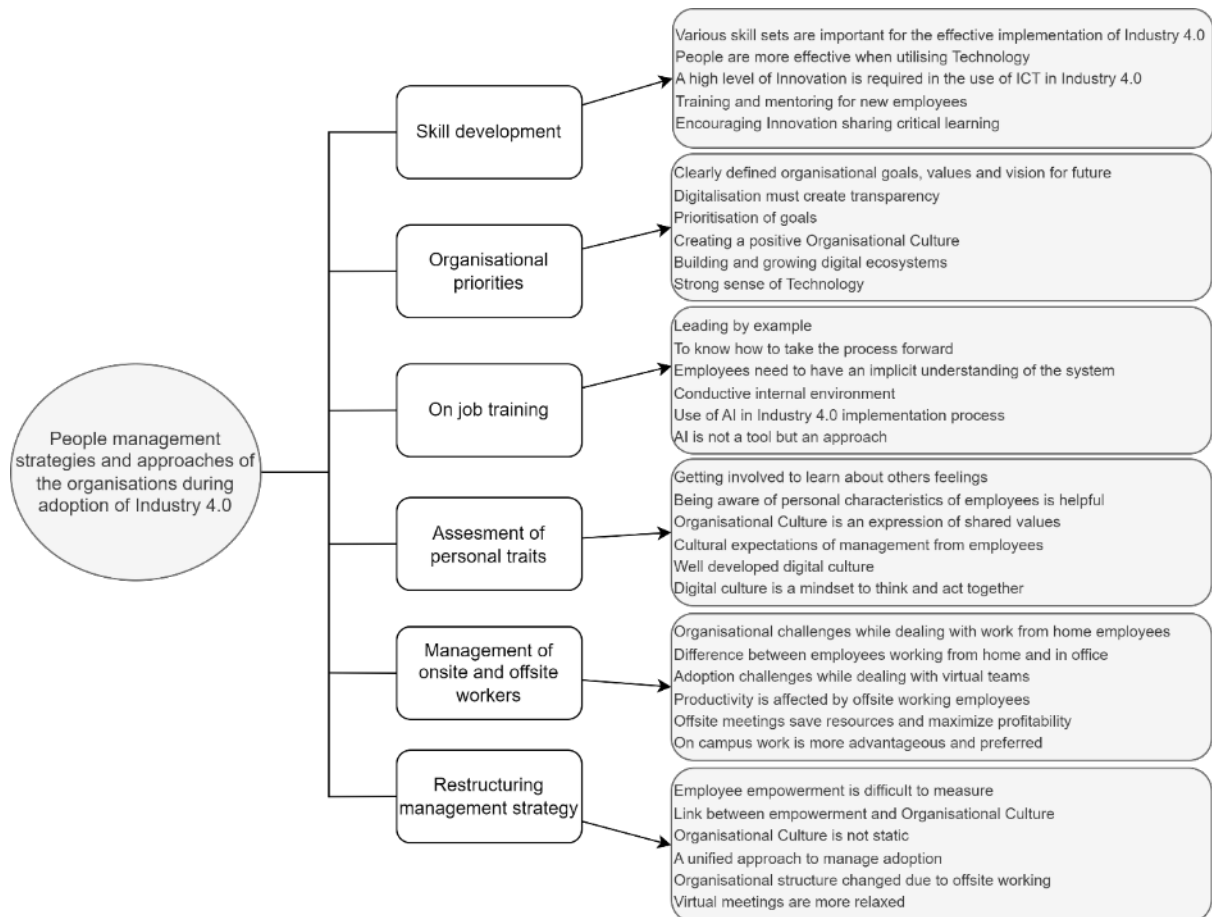


Figure 5.3: People Management Strategies and Approaches of the Organisations during Adoption of Industry 4.0 – Grouped Codes, Source: By the researcher

5.6.1 Assessment of Personal Traits and Skill Development

Skills development is critical to the effective adoption of I4, and companies need to provide training and mentoring to new employees to develop the necessary skills. Innovations and information and communication technology (ICT) are essential in adopting I4. Employees proficient in these areas are more effective. In addition, promoting innovation and sharing know-how can help the organisation to stay in tune with the latest trends and developments in the manufacturing industry.

Most of the involved organisations prioritised identifying and cultivating employees with necessary skills and traits. As a participant explained:

“Completing my staff analysis process to identify the specifics such as skills, personality traits and abilities that are most valuable for the role and how these qualifications are associated with the particular task. I then match these accordingly to ensure that I have a qualified candidate who will be effective in their role.” (Tr.1)

Testing skills is another aspect of recruiting, but a greater emphasis is placed on identifying and assessing people's personality traits by the time of selection. According to managers, many people can have skills, but the right attitude contributes to using those skills for a positive outcome for the

organisation. If qualified people lack the right organisational culture, the ability to communicate with others properly, accept and respect others, and lack team spirit, their potential is unfavourable towards adopting I4, where much collaboration and mutual support is demanded. Therefore, companies are looking for people with a positive attitude, who are committed and passionate, who can change and adapt flexibly, and who are willing to learn.

A participant described how various skill sets and traits are crucial in adopting I4:

“Each role has its personality traits and most valuable abilities to achieve a successful implementation. In my case, I consider the personality traits and skills essential for the adoption of I4.” (Tr.1)

The right personal traits are critical for enabling technological change, as it requires a willingness to learn and change, deal with different people, switch from old to new skills, understand business acumen, and perform in a given time. To find the right employees, recruiters consider evaluating candidates' characteristics when selecting a new employee since work attitude is a key factor in performance and adoption of the organisational culture.

Most respondents emphasised the importance of selecting suitable employees with the necessary skills and traits. One respondent stated that a suitable employee should own good personal skills, be a quick learner, and have an open-minded and flexible approach towards new ideas and practices:

“A suitable employee has good interpersonal skills, can learn quickly, is open-minded, flexible when it comes to new ideas and practices.” (Tr.2)

5.6.2 Management of Employees and on Job Training

Effective people management strategies and approaches emerged from the interview analysis in the context of the research objectives of this thesis, involving the themes of management of onsite and offsite employees and on job training. As shown in Figure 5.3, the former theme is underpinned by the codes related to challenges and differences in dealing with remote and onsite employees. The latter theme, on job training, is supported by codes, such as leading by example and developing an implicit understanding of the system. These themes and codes highlight the significance of human resource management in the I4 adoption and call for appropriate strategies and approaches to manage and train employees effectively. A participant emphasised the importance of employees' performance in the success of I4 adoption and stated that comprehensive training programs, which combine various training methods such as classroom training, eLearning, simulation, and on-the-job training, are necessary to ensure that employees working onsite or remotely have the proper knowledge and skillsets to employ I4 capabilities fully:

“I think that people's performance will be key to success. We need the right people with the right knowledge and skillsets to take full advantage of I4 capabilities. We must create comprehensive training programmes that combine classroom training with eLearning, simulation, and on-the-job training to train them properly” (Tr.8)

Increasingly, manufacturing SMEs will not be able to compete without the appropriate human resources, including the right people with the right knowledge and skillsets. I4 demands all manufacturing methods be computerised and automated, which calls for new creative thinking in digital strategies. SMEs should create training programs that comprehend what the organisation need for employees to succeed in their I4 adoption processes. Another impactful factor is the Covid-19 pandemic, which has drastically altered SMEs work models. Training methods have also changed, since not all employees work in firms' office locations anymore. Participants explained that:

"Companies are facing challenges in providing 'face-to-face' interactions and sharing of information between remote workers and office-based employees and communication among different teams within a company who are working remotely". (Tr 2)

A participant mentioned the increased awareness of digitalisation among the general population, caused by the Covid-19 pandemic, has even accelerated the adoption of I4 in SMEs:

"Before the Covid-19 crisis, I worked in a large office with my colleagues and used to have frequent meetings. This approach increased delays and low-quality work because of not sharing information across teams. During and after the Covid-19 crisis, I had to change my work style and started working from a remote office. Overall, I can say that the adaptation to I4 has even accelerated in our organisation. The reason for this, in my opinion, is the increased awareness of digitalisation among the general population, caused by the Covid-19 pandemic."(Tr.2)

However, the changing work environment must be considered in the I4 adoption. A participant highlighted the increased significance of the role of supervisors during the adoption of I4, as the need for physical presence and face-to-face communication has decreased due to remote work arrangements. This has led to a shift in work and social relationships, as communication now occurs through virtual platforms such as Skype and Slack, creating a physical separation among colleagues:

"I believe that the Role of Supervisor has become more important than before as we do not have to meet physically or travel to each other. It has changed the way we work as it is the first time we have worked without physical presence. We communicate with each other via Skype and Slack, there is a physical separation among us now which has changed some aspects of our social and work relationships". (Tr 5)

Remote working can be quite challenging, especially when managers try to manage stationary and remotely working employees, who are often under pressure with deadlines and need more support. Participants believe that in the business landscape across industries, remote and stationary-based employees will be the norm in the coming decades in manufacturing SMEs in the automotive industry. However, challenges arise when managing teams with remote and stationary operating employees, as management may face challenges in creating an open environment that encourages creativity and collaboration. One way to do this when adopting I4 within the manufacturing SME sector is to institute a "blended" model of organisational structure aligned with the business objectives. This means that a

combination of centralization and decentralization works must be intertwined toward achieving the I4 objectives at any given time. It may also help delegate responsibilities to individuals, which can be done by planning. A participant expressed optimism towards the challenges posed by remote work by highlighting the importance of creating an environment that fosters innovative thinking and creative collaboration among employees:

“This is indeed challenging. However, I believe this challenge can be met by creating an environment that encourages innovative thinking and creative collaboration among employees, especially when working remotely”. (Tr 2)

5.6.3 Restructuring Management Strategies and Organisational Priorities

The theme of restructuring management strategy highlights the challenges of employee empowerment measurement and its link with organisational culture. The dynamic nature of organisational culture and a unified approach to managing adoption are also important. Furthermore, the shift towards offsite working has led to changes in organisational structure, and virtual meetings are becoming more popular. On the other hand, the theme of organisational priorities emphasises the importance of clearly defined goals, values, and visions for the future, as well as creating a positive organisational culture that prioritises digitalisation transparency and growing digital ecosystems.

Managers and leadership evolved methods and techniques to manage and supervise both remote and stationary work as part of the adoption of I4. Most organisations strive for results-oriented performance, whether remote or stationary work is involved. However, in any setting, there are hidden factors that can hinder performance or act as catalysts. Finding such factors, managers describe follow a participatory observation strategy. This strategy allows managers to become part of the work environment by providing hands-on support for incidents of a social or technical nature that arise within the team. This allows for a better understanding of the employee's perspective. At the same time, it allows them to access collaborative information stored in the back-end system or shared by other teams for their assignments during the adoption of I4. Managing remote teams and individuals comes with unique challenges. Data security is one such challenge managers face when managing remote workers. A participant shared that remote work poses a significant challenge as it may hinder the passing on new work instructions and support to remote workers. Hence, managers make additional efforts to establish appropriate tools such as BRAP for remote management:

“The company relies heavily on documents to hand down tasks to employees, such as the Business Process Redesign Action Plan (BPRAP), Digitalisation Guidebook, etc. However, our employees usually do not read these documents”. (Tr 2)

Managing remotely is a challenge for many reasons, including communication barriers, independent contractors and cultural differences. The complexity of managing remote employees increased during

the worldwide Covid-19 pandemic. This style of working results in conflicts around time management and scheduling, as well as clashes in work ethics and organisational culture. However, there are several strategies that organisations can use to successfully manage remote and stationary employees together. To create a shared organisational culture between remote and stationary employees, many factors need to be taken into account. A wide range of factors influences the cultural impact, including how the organisation is structured and how employees communicate. The mere act of working remotely does not mean that people will not develop a communal culture. For remote employees to fully integrate common values, norms, rituals and practices, they must have shared goals, perform their work the same way, and have a shared sense of purpose. In essence, the organisational culture must become more digital enabled to reach the existing work models in the manufacturing SMEs in the automotive industry, as stated by the participants:

“The most challenging aspect for me in implementing I4 is that it requires creating a new culture that is willing to change as the organisation becomes more digital-enabled.” (Tr.2)

“You can look at the culture as a digital “DNA” centered on the business model, vision, strategies, and values. If these are integrated, then the culture is also integrated”. (Tr 2)

The "new culture" needed for I4 is a challenge for manufacturing organisations, as it requires embracing new values and principles in order to adjust to the changing paradigms. This can be a particular challenge for SMEs. It is not straightforward to implement an organisational culture change within the context of a smaller organisation that lacks the means to hire and develop experts in new technology and innovation. Furthermore, it involves changing the mentality of every employee within an enterprise as well as introducing new business models to remove silos between departments. It is about organisational cultures going beyond traditional hierarchies, such as open-space work environments that are not motivated by competition but value collaborative work and cooperation. A participant stressed that successful implementation of I4 necessitates the promotion of cross-border collaboration between digital ecosystems and the adoption of digital technology to enable new roles and responsibilities for teams:

“We should look at I4 not as an economic or technological force but rather as a new business perspective which will require companies to have a new mindset, embrace digital technology and promote cross-border collaboration between digital ecosystems. The successful implementation of I4 requires a change of mindset, new roles and responsibilities for teams, flexible structures and a culture of learning and continuous development.” (Tr 9)

In the context of I4 adoption, it is striking that several factors strongly influence organisational culture, including assessing personality traits and skills development, employee management and on job

training, and restructuring management strategies and organisational priorities. The importance of human resource management and the need for appropriate strategies to effectively manage and train employees become apparent, especially when dealing with on-site and remote employees. Manufacturing SMEs in the automotive industry must also establish clear goals, values, and visions for the future and create a positive corporate culture that prioritises digitalisation transparency and the expansion of digital ecosystems. **It can be said that the adoption of Industry 4.0 technologies necessitates a significant shift in manufacturing SMEs' organisational culture and structure. Managers must develop strategies to manage onsite and remote employees effectively in this new paradigm while promoting an organisational culture that fosters the velocity of Industry 4.0 adoption, diffusion of innovation, and the implementation of new business models to navigate the transition to Industry 4.0 successfully.**

5.7 Methodologies of Decision-Making Process in Organisation

The fourth key theme perceived methodologies of the decision-making process in an organisation during the adoption of I4 emerged from the analysis of the interview data, involving a range of themes such as design thinking, transparency, input and ideas from team members, organisational culture and technology, shareholder onboarding, participatory process, interdepartmental collaboration, and customer feedback. Figure 5.4 presents an overview of the associated codes to these themes, which ultimately led to the emergence of the fourth key theme, perceived methodologies of the decision-making process in the organisation during the adoption of I4.

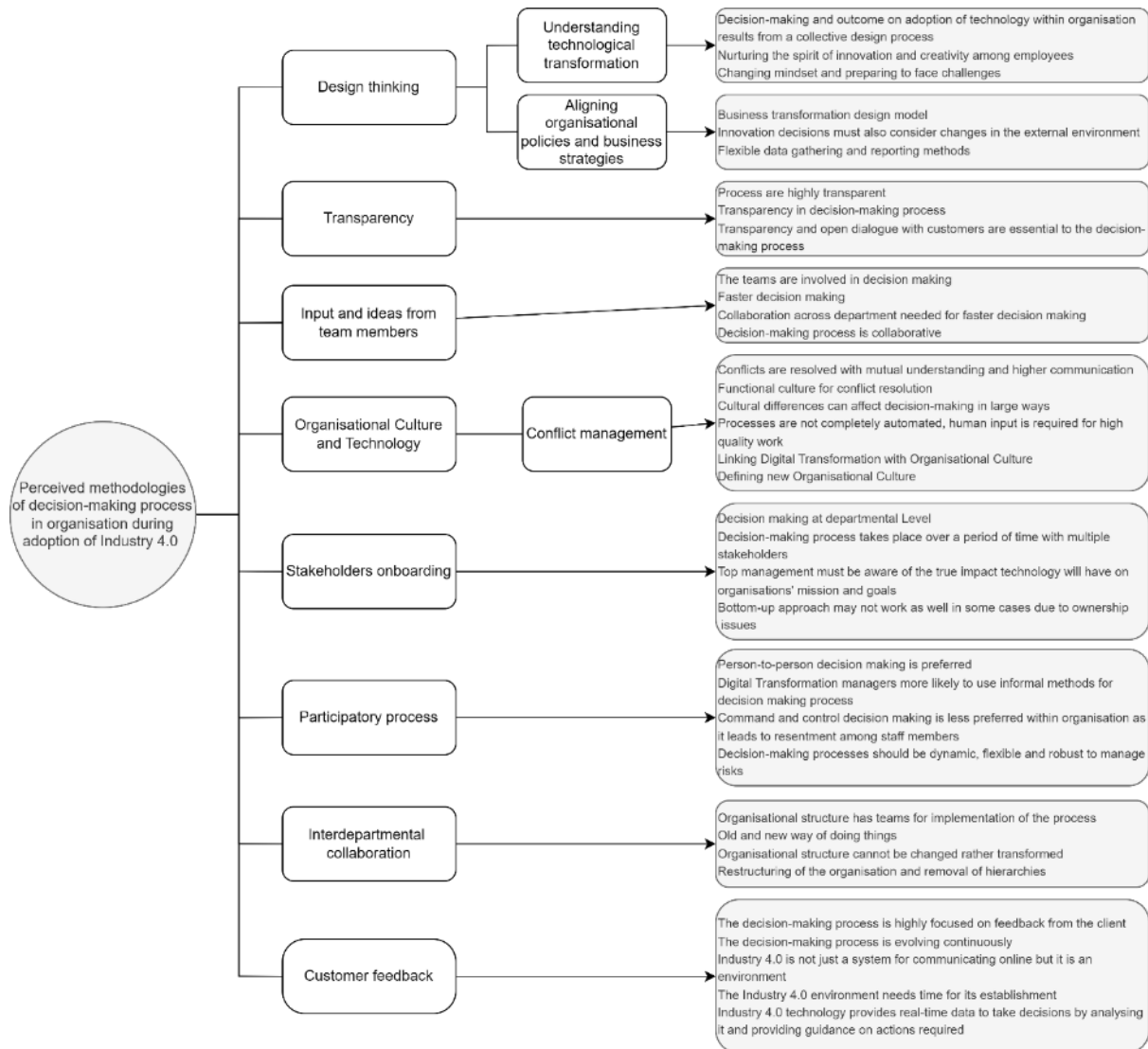


Figure 5.4: Perceived Methodologies of Decision-Making Process in Organisation during the Adoption of Industry 4.0 – Grouped Codes, Note: By the researcher.

5.7.1 The Design Thinking Process and Stakeholder Onboarding

Design thinking and stakeholder onboarding are critical components in the decision-making process during the adoption of I4. The design thinking method focuses on brainstorming ideas, reasoning and planning with a deeper understanding of the relationship between technology and business during the adoption of I4. It was used as a subcomponent of decision-making for business and technological change in adopting I4. Less than 40% of participants mentioned design thinking, at which planning and decision-making with consideration of technology knowledge, skills, experience, and understanding were mentioned by all participants.

The implementation of design thinking and stakeholder onboarding processes were effective in aligning tasks to the digitalisation strategy and improving employees' understanding of how digital tools can be leveraged to solve problems and enhance productivity. As a participant stated, the concept of design

thinking allowed the employees to gain a better understanding of how digital tools could help in problem-solving and delivering I4 technologies:

“We worked with the team in engineering to introduce the concept of design thinking throughout the company. The aim was to align their tasks to the strategy of digitalisation, which became a big success. As a result, our people now have better insight into how digital tools can help solve problems and deliver Industrial IoT products faster.” (Tr 1)

The purpose of stakeholder onboarding is to help stakeholders understand and engage in the design process, drawing out their needs and creating shared goals. It's a process of discovery and creation that brings customers and stakeholders together, adding value to all involved. According to the respondents, the stakeholder onboarding can be a complex process, as many different stakeholders are involved in adopting I4. There are many kinds of stakeholders to onboard, some of which may have their internal systems or techniques that you need to work around or interact with. For manufacturing SMEs, it can sometimes feel overwhelming and take longer than the actual design process it's trying to support. As a participant explained, a crucial aspect of stakeholder onboarding during adopting I4 involved helping individuals understand the meaning and potential impact of the I4 technologies. By providing this understanding, stakeholders are better equipped to make informed decisions and drive meaningful change for both the organisation and its customers:

“As part of the onboarding process, I help them understand what “I4” means and how it can make a meaningful difference for our customers and ourselves.” (Tr 12)

5.7.2 Participatory Decision-Making Process and Transparency

The most crucial task in the automotive industry was to create a high-quality product with long-term value. All levels of production and services are connected, using an advanced supply chain to coordinate efficiently during the adoption of I4. The participatory decision-making process (PDMP) is another crucial step in an organisation's strategy and is critical for successful I4 adoption. The PDMP ensures that decisions are best for employees, the company, shareholders, and the public. It must be transparent and have a step-by-step process including all stakeholders, from top management to frontline employees. At the end of the PDMP, employees provide suggestions that are most important to them. These ideas should be used to solve problems and identify new opportunities. As a participant highlighted, to ensure alignment with the overall company strategy, they have personally met with every employee to understand their current situation, desired outcomes, and expectations. This meeting proved valuable in identifying priorities for specific projects. Additionally, the participant conducted separate meetings with directly involved employees in strategic decision-making within their team:

“To establish alignment with the overall company strategy, I have met personally with every employee to understand their current situation, their desired outcomes and what they expected from us. This

meeting helped us to identify their priorities for specific projects ...I also met with the directly involved employees in taking strategic decisions within my team.” (Tr.9)

Transparency in decision-making has several benefits, such as increased transparency that reduces stress levels among team members, fosters positive morale and cohesion, creates a more educated understanding of each other’s needs, as well as an opportunity for dialogue that raises awareness and increases understanding. A participant emphasised the importance of employees’ understanding of the goals of I4, and how transparency and active involvement in the process can lead to successful adoption of the technology, as lack of clarity may hinder the digital transformation process:

“If employees do not understand the goals of I4, then they could be set to discourage change and slow down the process. If we approach it with transparency and make every effort to involve them in the changes, they will feel more comfortable and willing to participate.” (Tr.4)

5.7.3 Interdepartmental Collaboration and Input and Ideas from Team Members

Technology could change job requirements and cause a lack of resources to overcome the challenges of adopting I4. Remote and geographically separated employees and teams may lack opportunities for interaction, often making them feel disconnected. For example, four respondents indicated that organisations must thoroughly understand the relationship between technology and organisational culture. Otherwise, they may not be prepared for the changes technological progress offers. A participant highlighted that effective implementation of I4 requires technological capabilities and a supportive organisational culture that can diffuse conflict and manage resistance to change:

“I4 is more than just the use of sensors and the ability to interact and communicate online; it is also an environment that requires you as a manager to diffuse conflict when, at first glance, opposing approaches to I4 implementation get in your way. If the company culture is not sufficiently developed, some resistance maybe to a broader cultural change.” (Tr.1)

Disagreements can arise between the organisation and employees at various stages of adopting I4. Arguments between people often occur due to a lack of communication and relevant skills. Exchanging information and knowledge and involving employees in the skills development process are effective instruments for resolving discrepancies. By involving employees increasingly in the decision-making process, conflicts in manufacturing SMEs have been reduced and determined during the I4 adoption. Misaligned goals, priorities, and responsibilities among different groups during digital transformation projects can lead to conflicts and hinder collaboration, as noted by a participant in the study: *“When people are working against the goals of others because they have different priorities, the collaborative environment will collapse, causing conflicts between team members because they have different priorities. This is sometimes unavoidable, especially when implementing digital transformation projects because everyone needs certain skills, so it’s hard for them to all work on this project at once. Many*

companies have experienced conflicts because of the failure to align goals, priorities and responsibilities between different groups.” (Tr.11)

5.7.4 Organisational Culture and Technology, and Customer Feedback

According to the respondents, the role of customer orientation and organisational culture for small and medium-sized manufacturing companies in today’s rapidly changing environment is crucial. The respondents highlighted the challenges such companies face in meeting customers’ increasing service and quality expectations while adapting to technological advancements that impact their organisational structure. They emphasised that creating a unique, customer-centric organisational culture is essential in achieving customer centricity and that digital transformation allows companies to build a sustainable customer-centric culture and implement innovative business models. Overall, the respondents stress the need for companies to adapt to changing customer expectations and embrace digital transformation to succeed in the manufacturing sector. Understanding customer expectations is a crucial aspect of cultural transformation in successful digital transformation projects, as stated by a participant who emphasised the need for a clear vision and commitment to change:

“Digital Transformation requires not only a clear vision but also the commitment to make the changes. I believe that understanding your customer’s expectations is also part of your cultural transformation. This is really critical because to be successful with digital transformation projects; you need to know what you are building, why you are doing it and who will be using it.” (Tr. 7).

In context with digital transformation and the organisational culture, the future of the automotive industry is already in a place that leads to rethinking the organisation, its structure and organisational capabilities. As technological progress continues to accelerate, manufacturing SMEs find it challenging to accommodate the changes in the automotive business and maintain a competitive edge. Many SMEs have turned to lean manufacturing as part of their digital transformation strategy, but lean has primarily been used as a manufacturing strategy, not an organisational strategy. The lean approach should start from the top of the organisation and permeate the entire organisation by aligning the organisational culture. This is because lean cannot be adopted if it goes against existing organisational culture based on a top-down hierarchy, siloed departments and short-term performance. This requires a change of mindset and culture at the top if an organisation hopes to reap the benefits of lean within its processes. The advances made through the rapid adoption of I4 across the automotive industry inevitably contribute to this change in thinking for lean manufacturing strategies. One participant noted that implementing I4 technologies throughout the entire value chain, rather than solely within the core business, can significantly increase efficiency and value-added services:

“The production process is becoming more efficient and leaner due to the adoption of dedicated smart manufacturing solutions in combination with people-driven value-added services. According to my

views, it's not possible to adopt the I4 technologies only within the organisation's core business. The potential benefits are much bigger when you adopt these technologies to the whole value chain.” (Tr.10)

A new technology that creates a significant impact on the way work is done in organisations when adopting I4. Manufacturing SMEs have adopted new management models such as Agile and Lean practices, customer-centricity, and team-oriented culture. These approaches are believed to improve I4 adoption by stimulating innovation and increasing employee engagement and performance. According to a participant, their organisation's focus on modern management models and team-oriented culture makes it conducive to successful digital transformation projects:

“We try to improve our organisation's performance and efficiency by implementing modern management models such as Agile and Lean practices, customer-centricity, and team-oriented culture, which seem to be standard in some industries. So I think our working environment is very suitable for successful digital transformation projects.” (Tr.10)

This section, the perceived methodologies of the decision-making process in an organisation during the adoption of I4, highlights the crucial role of organisational culture and technology in successfully adopting I4 in manufacturing SMEs in the automotive industry. It can be seen that organisational culture is deeply affected by the adoption of I4 technologies, as evidenced by the need for a customer-centric culture, alignment with the overall company strategy, and adoption of modern management models and team-oriented culture. The chapter also emphasises that the organisational culture must support technological capabilities and diffuse conflict to manage resistance to change in successful I4 adoption.

5.8 Task Assigning and Performance Management

The fifth key theme that emerged from the interview data is task assigning and performance management during adoption of I4, involving a range of themes such as organisational behaviour, critical thinking, personal capabilities and new task new skill, which are further grouped into sub-themes such as ready to take risks, innovative minds, attitude of the employees, commitment and dedication, willingness to take new tasks and training on new technologies. These themes and sub-themes are underlined with the associated codes, as shown in Figure 5.5.

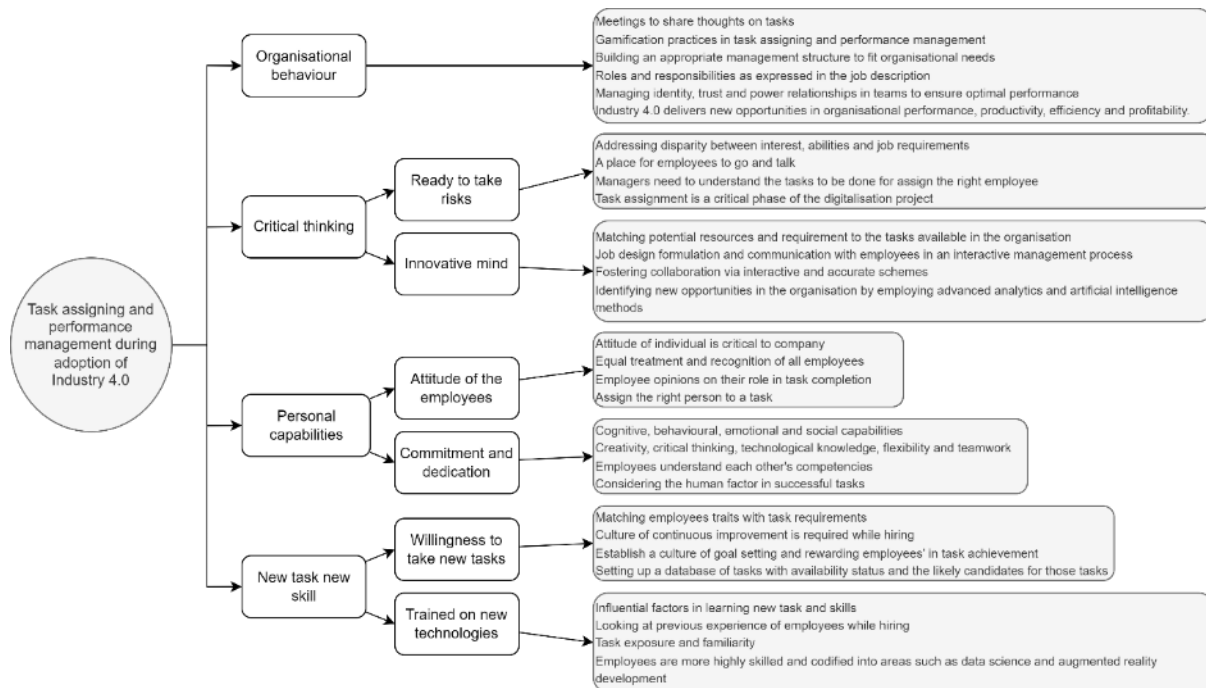


Figure 5.5: Task Assigning and Performance Management during adoption of Industry 4.0 – Grouped Codes, Note: By the researcher.

The insights gained from this Section shed light on the organisational culture facilitating practical task assigning and performance management to achieve successful diffusion of management and technology innovations for mastery of I4 in manufacturing SMEs in the automotive industry.

5.8.1 New Task New Skills

I4 has been characterised by advancements in information technology, automation systems, and robotics to achieve higher output levels while increasing the efficiency, quality, flexibility, and competence of employees in manufacturing processes if done correctly. There is a difference among companies regarding the accomplishment of implementation of I4. Those organisations that have completed the technology transformation have broken down I4 planning into actionable tasks, while others are in the process of change. Some organisations are using video conferencing to assign new tasks to employees. In adopting I4, the management ensures the breakdown of tasks and gives them to employees with relevant skills. One participant expressed the importance of continuous transformation and the need for employees to acquire new skills and undertake new tasks in the context of I4 adoption:

“The critical factors in this situation are the necessity for continuous transformation and the need for employees to take on new tasks and learn new skills”. (Tr 1)

Another participant shared that they gather data about task assignments by considering individual preferences and knowledge, and subsequently analyse the data to determine which category best suits each employee before assigning them to the appropriate class based on their preferences and expertise:

“We collect information about task assignments based on individual preferences and knowledge. I then analyse the data to determine which category best matches each employee and assign them to the appropriate class based on their preferences and expertise.” (Tr.2)

Whereat, one participant noted that some business leaders prioritise technological trends over the human factor, potentially neglecting the integration and alignment of new solutions with the company’s overall strategy:

“According to my experience, most business leaders focus too much on technological trends, and they do not really think about the influence of these trends on people. They tend to give a lot of responsibility to employees without really knowing how they will integrate these solutions into their working environment and if they can meet your company’s strategy.” (Tr.9)

One participant stated that business leaders are very technology-driven, and they do not think about the influence these have on employees. They tend to assign tasks to employees without knowing how they will integrate them into their work environment and if they can meet your company’s strategy. This can sometimes lead companies to neglect critical social aspects, such as how technology impacts their workforce’s values, knowledge, skills and behaviours.

Managers’ pushy behaviour in getting people to do things for them is typical in small and mid-sized automotive companies where meeting deadlines is a priority. Being pushed in the workplace creates a very uncomfortable work environment for employees because they feel they cannot make decisions because everything is dictated to them. One participant highlighted the importance of maintaining open communication with colleagues, rather than assigning tasks via email, to facilitate a two-way dialogue and support any questions or concerns:

“I never push my colleagues to do something or assign them tasks through email. Instead, I have two-way communication with them so they can always reach me if they have any questions”. (Tr 8)

5.8.2 Personal Capabilities

Participants stated that personal capabilities, attitudes and commitment and dedication of the employees are primary factors that play a role in successful task assignment and performance management across manufacturing SMEs during the adoption of I4. Participants stated that the personal capabilities of employees could be improved by supported on-the-job training, access to critical data and information, enhanced communication skills and instilling commitment and dedication towards the management of employees through improved feedback mechanisms. A participant highlighted the importance of matching employees’ strengths and interests with the prerequisites for task assignment in the optimised adoption of I4, allowing for personal growth and flexibility in changing responsibilities:

“We match each employee’s strengths and interests with the prerequisites for fulfilling the task for the successful adoption of I4. As I mentioned earlier, we have a clear procedure for assigning tasks, but we understand what is expected from each person and their level of expertise. In addition, we always assign

people to projects with their strongest focus as that helps them develop their own knowledge in different areas. That will also enable them to be better prepared when it is time to change directions in their area of responsibility.” (Tr 12)

The process varies from organisation to organisation and is evaluated by managers. Using project tracking to submit a task list is also critical to ensure team members have all the information they need when it's time to deliver. According to a participant, an employee with good interpersonal skills who is adaptable to change and open to new ideas is considered suitable for adopting I4:

“A suitable employee has good interpersonal skills, can learn quickly, is open-minded, flexible when it comes to new ideas and practices” (Tr 2)

One participant mentioned the “industrial fit” factor as a systematic, process-oriented process for matching a specific role (out of all other available functions) with a candidate. The evaluation of this employee is based on personality types and aptitudes. In addition, specific skills and personal dispositions are also considered. Other key factors that play a role in task assignment and selection of a candidate/employee for a specific task include the following:

- Assessing critical thinking during recruitment is also crucial, as it combines creativity and experience. The candidate must be able to look at things from a different perspective.
- Organisational behaviour is also assessed. An organisational culture focused on continuous improvement, and embracing technological innovation, is critical. Adapting quickly to new situations would be beneficial, and the candidate must be open-minded.
- Deliberation on tasks is done when it is found that employees are spending excess time on specific tasks. If they spend too much time on their projects, managers consult with the employee to find the best solution.
- Before assigning new tasks, some companies also follow the responsible accountable consulted and informed (RACI) chart process. Leadership informs the managers about the analysis results and reports on the progress of assigned tasks based on individual preferences and knowledge.

5.8.3 Critical Thinking and Organisational Behaviour

To increase productivity, employees must receive appropriate task assignments and have access to performance management strategies to stay on track with the manufacturing SMEs' goals. Respondents described critical thinking skills as a way of being innovative in the workplace. One participant emphasised the importance of critical thinking, innovation, adaptability, collaboration, and continuous improvement processes in effectively adopting I4 technologies and practices:

“I4 requires critical thinking, innovation, and adaptability based on the latest technologies and best practices. It also requires collaboration and iterative processes like continuous improvement, cooperative problem solving, and lean methodology.” (Tr 12)

Another participant highlighted the importance of aligning the organisational culture with the new business objectives to foster a positive environment for innovation and critical thinking:

“The culture must be aligned to the new business objectives and create a positive environment for innovation and critical thinking.” (Tr.15)

Employees who believe in their abilities and feel supported by their managers are likelier to enjoy greater job satisfaction, take on responsibility and generate innovative ideas. This is where performance management can be crucial in improving management practices. In line with generating innovative ideas, one participant expressed their dedication to contributing to the organisational transformation process by actively seeking out new tools, developing novel methods and strategies, and generating innovative ideas:

“They make sure that they contribute to the organisational transformation process by being innovative, taking advantage of new tools and developing new methods, strategies and ideas.” (Tr 3)

Organisational Culture influences employees’ level of motivation, creativity and risk-taking behaviour to perform innovation tasks successfully. One participant suggested that providing an environment where experimentation and risk-taking can be rewarded positively is crucial. Furthermore, this can be achieved through a commitment to supporting organisational culture and implementing robust feedback tools that allow employees to share their experiences, problems, and successes openly:

“Finally, we need to provide an environment where experimentation and risk-taking can be rewarded positively. This is only possible when there is a commitment to supporting Organisational Culture and strong feedback tools that can allow employees to share their experiences, problems and successes with an open mind.” (Tr 12).

According to the interviewees, there is a shift in how managers think and are willing to act. How they view working from home as a waste of time has changed drastically after the global Covid-19 pandemic. Considering the increasing number of remote workers in manufacturing SMEs, it may take some time to get used to the difference and adopt entirely new organisational behaviours that may not have been fully recognised. According to a participant, changes in managerial behaviour, including increased openness and willingness to share, have been observed in response to the growing number of remote workers:

“All the managers in the company have changed their behaviours. They have been more open and more willing to share. If you have a very closed division, you cannot expect them to change their behaviours too quickly. Some of the managers had thought that working from home was a waste of time in the past. This type of division worked from home for many years and had been doing well before the deadly pandemic happened.” (Tr 13)

It can be seen that the organisational culture is deeply affected by I4 adoption, as it requires matching employees’ strengths and interests with the prerequisites for task assignment, improving personal capabilities through training and feedback mechanisms, fostering critical thinking and innovation, and

promoting a positive environment that rewards experimentation and risk-taking. Additionally, adopting I4 requires aligning the organisational culture with new business objectives, fostering an environment of experimentation and risk-taking, and implementing robust feedback mechanisms to support organisational culture, diffusion of management and technology innovations in the automotive business.

5.9 Dynamics of Good Team Players

The sixth key theme that emerged from the interview data is the dynamics of good team players during adoption of I4, involving a range of themes such as on time task completion, passion for technology, accurate and result oriented, respect for others, learning and understanding new technologies, compliance with the code of conduct, dedication, motivation and commitment, good industrial knowledge, adherence to companies values and culture, and the acceptance of cultural diversity. These themes are underlined with the associated codes, as shown in Figure 5.6:

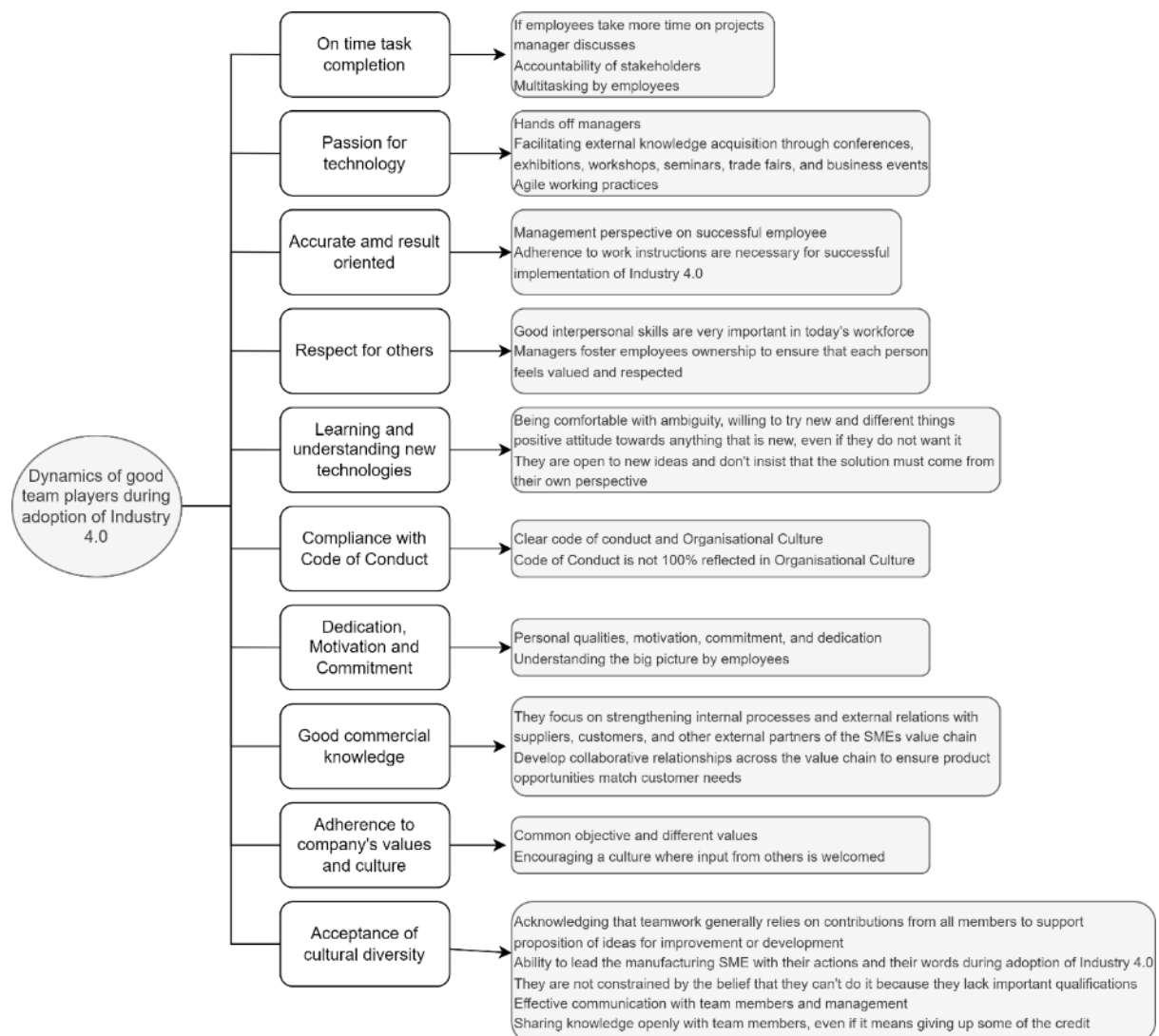


Figure 5.6: Dynamics of Good Team Players during the Adoption of Industry 4.0 – Grouped Codes, Note: By the researcher.

The successful implementation of I4 technologies depends on employees' commitment, motivation, and dedication. This Section highlights the importance of fostering an organisational culture that encourages the dynamics of good team players, promotes accountability, and facilitates agile working practices.

5.9.1 Compilation of the Themes that Contribute to the Sixth Key Theme

Through the analysis of the interviews conducted, the present study delved into the characteristics and attributes of influential team players and managers as perceived by the participants. A participant highlighted the importance of standardised methodology and a uniform approach in integrating solutions to promote effective collaboration and adoption of I4 technologies among stakeholder companies with different understandings of organisational culture:

“I notice a conflict among our stakeholder companies resulting from a different understanding of organisational culture and ineffective collaboration. In that case, I feel entitled to take the initiative and seek a joint solution. We will need to, for example, integrate our solutions by having a standardised methodology, a uniform approach to enable the best possible adoption to I4.” (Tr.1)

This methodology was based on loyalty, respect for the code of conduct, and the ability to accept cultural diversity, which is also seen as an opportunity to learn from each other to understand new technologies better. A participant highlighted the importance of fostering a positive work culture and developing a positive attitude towards change to move towards new technological and organisational models successfully:

“Our organisation has a code of conduct to foster a positive work culture. Our organisation must develop a positive attitude towards change because we are moving towards new technological and organisational models. A culture where people are open to change will lead to success.” (Tr.7)

More importantly, a good team player is also willing to take on tasks that are not only within the scope of their technical expertise but can also show initiative and a focus on results by carrying out their duties with passion and high motivation. Participants emphasised the significance of having passionate and committed stakeholders, including management and project managers, in the effective adoption of I4 technologies:

“It's important to ensure that management and all the stakeholders, such as users and project managers, share this will and passion for I4. An organisation implementing I4 should have a high-level strategy, vision, and industry knowledge to achieve desired results and a structured approach to delivering high-quality products and services, ensuring improved customer satisfaction. If there is no passion or vision for I4, it will be complicated for the organisation to adapt effectively to the market changes required by I4.” (Tr.11)

Commitment to the SME's values and loyalty to the development project's deadlines and deliverables can help ensure the company's goals are met without causing delays or unsatisfactory results. For teams,

commitment is essential as it contributes to customer satisfaction. These attributes allow different cultural backgrounds and skills to coexist, cross-fertilise, and enrich the knowledge. Completing tasks on time is a critical attribute for each of the teams. Team members see their responsibility for their assignments and shared responsibility for achieving project goals. They share their knowledge and are willing to learn new technologies as they are introduced to manufacturing. Maintaining mutual respect among team members is essential to fostering a good work environment in any organisation. Team members involved in manufacturing processes are typically responsible for using the right tools and techniques to meet customer requirements and I4 quality standards. Participants indicated that knowledge and understanding of new technologies are essential for implementing I4 in the automotive industry. It is necessary to grasp the basics of functions in different product areas to understand how things work and what is expected. One participant listed the following characteristics that make a “good” employee in the organisation during industry adoption:

“They are front runners in demonstrating our organisational culture:

- *reflecting high standards in behaviours and values,*
- *- demonstrating a commitment to our customers,*
- *working as a team player.” (Tr.11)*

An additional viewpoint states that a highly successful employee should deliver timely results and meet quality standards. Moreover, the employee should have a passion for technology, innovation, and good business skills. The participant noted that an essential characteristic of successful employees in adopting I4 is their willingness to learn and utilise new digital technology in their work: *“The successful employees should have an outstanding commitment and desire to learn and use new digital technology to be effective in their work” (Tr 2)*

While another respondent argued that a clear code of conduct and organisational culture could enhance employee performance:

“As an organisation, we prioritise a clear code of conduct and a strong organisational culture that fosters collaboration and equality while also striving to create an inclusive work environment that respects and promotes diversity and upholds mutual respect.” (Tr 1)

Two respondents argued that such strict regulations could stifle individuality and creativity, leading to a homogenous workforce that lacks innovation and may struggle to adapt to changing circumstances, thus a rigid organisational culture may discourage risk-taking and experimentation, further limiting opportunities for growth and development. A participant mentioned that their organisation has an informal, respectful, and goal-oriented work style, with open communication that encourages people to express themselves freely without fear.

We do have something similar, and it’s the way of working in our organisation that is informal, relaxed, respectful, goal-oriented and action-focused, with an open communication style where people feel free to talk without any fear. (Tr 2)

The managers perceived that knowing where to find the necessary information and having clarity of understanding is vital for success, otherwise, there will be challenges impeding the success of adopting I4. A participant highlighted the importance of providing employees with work instructions and job descriptions to ensure proper training and successful implementation of I4, emphasising the need for clarity in understanding goals:

“If there are no work instructions or job descriptions, employees will not be appropriately trained to do the right actions; therefore, a smooth implementation will be impossible”. (Tr 1)

An exciting characteristic mentioned by a participant is having a sense of humour. A sense of humour was seen as a valuable asset in team dynamics, helping to ease tension and promote a positive working environment. Additionally, providing constructive feedback on fellow employees' initiatives can help foster growth and development within the team. According to one participant, having a sense of humour can create a positive team dynamic during the adoption of I4, as it facilitates shared problem-solving and feedback exchange among team members: *“A good team member should have a sense of humour and arrive at a shared understanding of any problem with other people. They can give feedback on any initiatives that fellow employees are developing.”* (Tr 15). The participants mentioned multiple traits and characteristics which can determine the status of a team member as successful or less effective, including resilience to overcome obstacles, flexibility to respond to a dynamic environment quickly, self-motivated to find new ideas for tasks they are doing, the ability to learn new things in a changing environment, taking initiatives to get things done, adaptability to find new ways to get things done effectively when activities go out of the normal process, collaboration and collaborative thinking for creating better opportunities for innovation among teams, a strong work ethic to build trust to get the things done well, and being innovative to develop new products or methods that can be useful in manufacturing SMEs. It can be seen that the organisational culture is deeply affected by the dynamics of good team players during the adoption of I4, as it requires a standardised methodology, a positive work culture, and a commitment to the company's values and goals to successfully integrate solutions and promote effective collaboration among stakeholders with different understandings of organisational culture in manufacturing SMEs in the automotive industry. Moreover, it can be further seen that the ability of team players to complete tasks on time, share knowledge openly, and show a passion for technology and innovation contributes significantly to the organisational culture during the adoption of I4, allowing different cultural backgrounds and skills to coexist and enrich the knowledge base.

5.9.2 Dynamics of Good Managers

The seventh key theme that emerged from the interview data was the dynamics of good managers during the adoption of I4, involving a range of themes such as technology and business vision, encouraging teams on performance, team motivation, feedback and mentoring, leading through change and innovation, team management, establishing and maintaining collaborative work and diverse

management. These themes are underlined with the associated codes, as shown in Figure 5.5, which ultimately led to the emergence of the seventh key theme, the dynamics of good managers in manufacturing SMEs in the automotive industry during the adoption of I4. These themes highlighted the importance of effective management leadership in driving the seamless adoption of I4, particularly in manufacturing SMEs in the automotive industry with the emphasis on fostering an organisational culture of collaboration and innovation and empowering employees to reach their full potential.

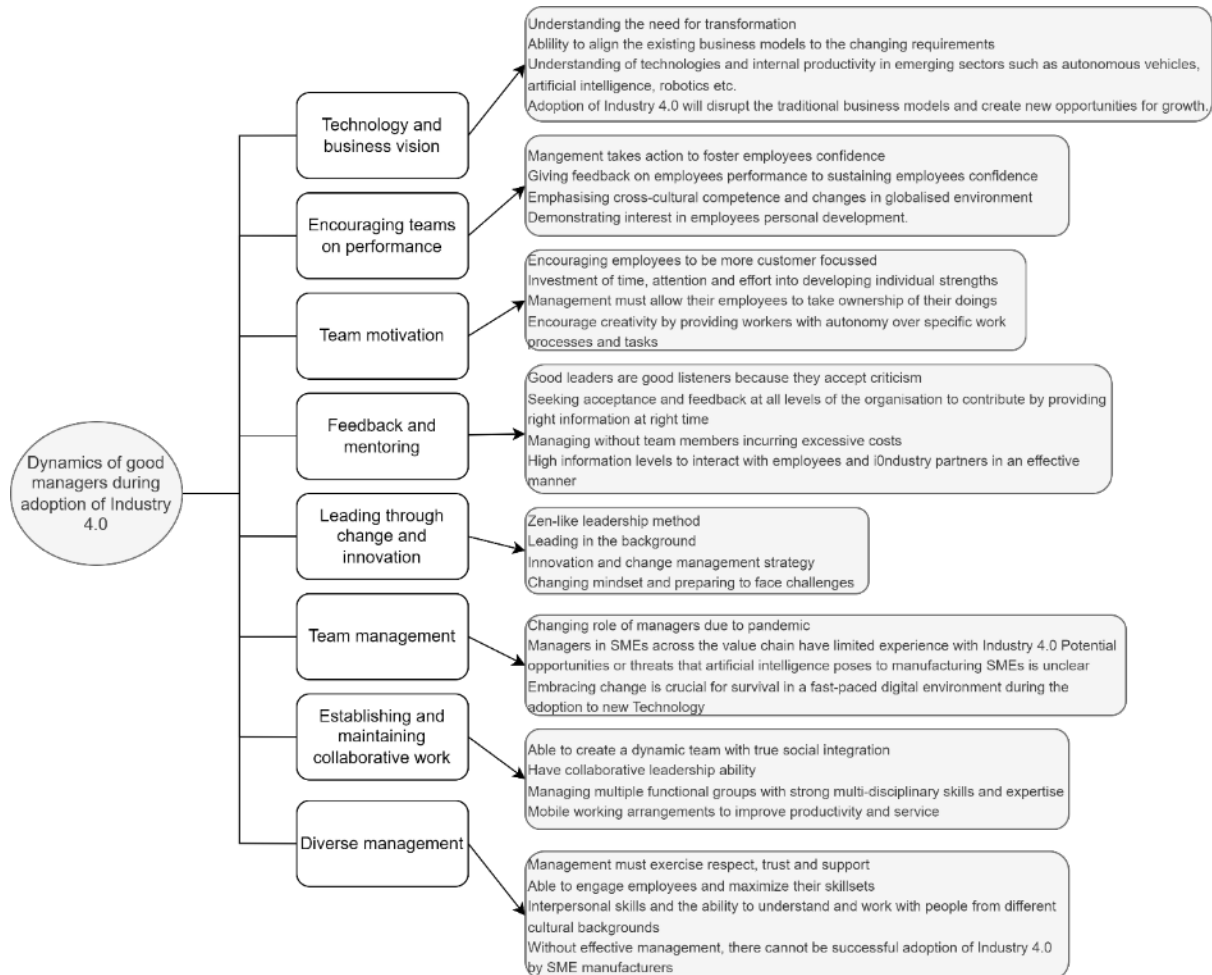


Figure 5.7: Dynamics of Good Managers during the adoption of Industry 4.0 – Grouped Codes, Note: By the researcher.

5.9.3 Leading Through Change and Innovation

Interviewees stated that the automotive manufacturing sector continues to get more competitive due to changes in the information technology landscape, which contributes to greater complexity in manufacturing processes and makes it more challenging to cope with innovation diffusion. Furthermore, when studying the I4 strategy, the automation and the adoption of new technologies in manufacturing, it was found that SMEs believe they should adopt the latest technologies to improve their competitiveness and efficiency. One participant highlighted their organisation's focus on modernizing

business processes while adopting I4 using big data and analytics tools to stay competitive and improve efficiency:

“Our purpose is to clarify business processes and to bring them up to date with the latest technologies. We use big data and analytics tools to generate innovative ideas and implement the best of them in our daily business.” (Tr.4)

Leading through change and innovation represents a set of capabilities for effectively engaging with employees in adopting I4 and is a process that operates at many levels, from the personal level to leadership teams and organisations. In this sense, "leading through change and innovation" refers to the ability of leaders to facilitate the adoption of technology at the right pace and scale. Hence, innovation diffusion was seen as a complex phenomenon influenced by many factors, including the characteristics of developing organisations, technological maturity, and the complexity of innovation.

5.9.4 Motivation and Encouraging Teams on Performance

Also, motivating teams through feedback and mentoring is key to achieving leadership impact in the adoption process. Therefore, the direct influence of leadership style in the adoption of technologies in manufacturing is crucial, as it is considered an essential reference for motivating and empowering employees to participate in the process so that they can adapt and adopt these new technologies, as well as promote their adoption in I4. A participant highlighted that for an organisation to transform digitally and adapt to new business models, leaders must prioritise leading through change and innovation as a core aspect of their leadership style:

“If leaders expect their organisation to transform digitally and change to new digital business models, they need to keep the focus on leading through change and innovation”. (Tr 1)

In this sense, it is about the framework that facilitates and enables team members to implement new learning and knowledge while contributing to the growth of the organisational culture. It is essential to point out a synergistic relationship between the diffusion of innovation and organisational culture, as the two are mutually dependent. A participant emphasised the importance of collaboration between various departments and business units, highlighting the synergistic relationship between the diffusion of innovation and organisational culture. By working together as teams, the full potential of Big Data Analytics can be leveraged in areas such as product design, manufacturing processes, and quality assurance. Ultimately, this type of collaboration requires a cultural expectation and commitment to a digitalised and collaborative approach in manufacturing:

“To collaborate across all departments and business units, we meet each other at a much higher level of collaboration – as teams – to fully leverage the value of Big Data Analytics. In the manufacturing sector, this translates to supporting each other in the design of products, manufacturing process, quality assurance of manufacturability, etc. In a nutshell, collaboration is a necessary cultural expectation if we want to run our manufacturing business in a digitalised and collaborative manner.” (Tr.8)

The key takeaway from this section is that it is critical to invest in leadership development, such as leading through change and innovation, team management, and mentoring, to influence and synchronise the entire organisation involved in the adoption process. High-performing teams are also more likely to impact organisational culture and goals positively.

5.9.5 Team Motivation and Customer Focus

Three respondents identified customer centricity as one of the essential attributes of the organisational culture that should be instilled in new employees. A participant emphasised the importance of instilling customer-centric values in new employees, describing to them the behaviours required of an employee at the company, such as punctuality, quality, customer focus, teamwork, and openness, which are integrated into the company's vision statement:

“I describe to them what behaviours are required of them as an employee at our company. These include aspects such as punctuality, quality, customer focus, teamwork, openness and so on. These values are often integrated into the company's vision statement.” (Tr.14)

A customer-centric organisation is a company whose overall business strategy, processes, and culture are designed to meet the customer's needs. The objective is to drive more excellent value from each customer by understanding how they want to work with the supplier and developing offerings that meet their needs. It creates a broader business model that satisfies more customers, increases profitability, and delivers sustainable growth. The respondents stated that the thinking behind a Customer-Centric manufacturing organisation in SMEs in the automotive industry has evolved over many decades because organisations have transformed from serving their shareholders as a means of producing long-term financial success into focusing on building stronger relationships for them to build stronger relationships with their customers. One of the respondents indicated that the organisational culture would need to be adapted to customer needs by creating a “roadmap for the business” to be more innovative and creative in all manufacturing processes, as well as to ensure that all stakeholders are involved and engaged in reaching informed strategic and operational decisions. A participant highlighted the need for their manufacturing SME in the automotive sector to evolve their organisational culture towards a customer-centric approach by empowering and involving employees in all business functions to foster creativity and innovation, which has led to the design of a new working method and roadmap for the business:

“We are a manufacturing SME in the automotive sector and need to evolve our organisational culture to the customer needs. To emphasise our customer-centric approach and maintain a competitive edge in the automotive sector, we prioritise empowering and involving our employees in all business functions while continuously fostering creativity and innovation throughout our processes. Our team has designed a new working method and defined a new roadmap for the business” (Tr. 1)

At the same time, automotive SMEs should manage and implement new production methods to enhance product value. Both manufacturing objectives need to be balanced so that quality and speed lead to high customer satisfaction. One participant emphasised the importance of being customer-focused and stated that implementing new production methods to enhance product values should always be driven by customer needs and preferences. They added that flexibility is key to building long-term trust with customers, even if it may result in missed deadlines or project delays:

“Being customer-focused on the other hand means always put your customers first and you can't do anything until you have asked them first. This may sometimes result in missed deadlines or even projects that are delayed but we need to be flexible otherwise, we don't gain their trust in the long term.” (Tr.1)

5.9.6 Diversity Management

The respondents suggested that manufacturing SMEs had changed their management structures due to the pandemic, and new management strategies have evolved. Working with on-site and remote teams was increasingly challenging for manufacturing SMEs. They noted that the pandemic has led to changes in management structures, with new strategies emerging. However, this has presented challenges for employees, especially regarding professional development and communication. Companies need help facilitating communication between remote and office-based workers and promoting collaboration among different teams:

“Many employees face significant challenges, especially in their professional development and day-to-day tasks performed within the organisation. Also, it is not easy for some employees to understand the communication styles of digital natives who work outside the office environment. Therefore, companies are facing challenges in providing ‘face-to-face’ interactions and sharing of information between remote workers and office-based employees and communication among different teams within a company who are working remotely.” (Tr.2).

Managing onsite and remote teams have become a key managerial skill and capability that future managers must master. Managers must develop the skills to manage onsite and remote teams effectively. The main benefit of managing an onsite team is that the manager can directly observe what is happening in their team. This is important for managers as they can give feedback when required for performance improvement. Onsite managers also can manage their employees more effectively, as workers can be observed if they misbehave in front of them. Onsite managers can deal with any issues that arise. The main benefit of managing a remote team is that the team can be located anywhere worldwide. This has many advantages, including encouraging the development of deep expertise in various fields. Remote teams can also work in anonymity, which can help foster creativity and innovation from employees. One of the challenges managers faces is managing an onsite team effectively when it is located in different places. Managers must be effective communicators, as they will have limited daily interactions with their workers. For virtual teams to succeed, there must be high

trust between team members. If individuals don't trust each other, making decisions and working together effectively isn't easy. A participant emphasised the crucial role of relationships and trust between remote and stationary workers in maintaining a robust organisational culture during the adoption of I4. Trust could impede effective decision-making and collaboration among employees, thereby hindering the development of a positive organisational culture:

"The relationships and trust between remote and stationary working employees are very important for maintaining a strong organisational culture in regard to the adoption of I4 since remote workers can have a negative effect on creating this type of culture both positively and negatively." (Tr.2)

5.9.7 Feedback and Mentoring

Key components for a better work environment included communicating with employees through multiple channels, receiving employee feedback, rewarding collaborative work, encouraging greater productivity, fostering a culture of innovation, and providing the necessary resources. Several attributes are revealed as necessary for facilitating this including the ability to adapt existing business models to I4 requirements, execute them, and improve organisational culture and communication skills to lead and supervise subordinate employees. Successful managers act as role models and inspire change, leveraging digital resources including technologies. However, I4 was challenging manufacturers to realign their manufacturing processes through automation and digitalisation. This requires not only productivity gains, quality improvements and cost control, extensive feedback and mentoring, and a changed approach to the organisation. A participant mentioned that their organisation had established a comprehensive measurement concept that allows managers to monitor and direct the alignment of its operations with its digital strategies. The "digital capability and solutions" statement aligns with the company's vision and business strategy. It provides a detailed understanding of their digital capabilities, defining operational and financial metrics for measuring organisational performance. Furthermore, the participant stated that digital capabilities are integrated into various departments, such as finance, marketing, engineering, manufacturing, and after-sales service:

"The "digital capability and solutions" statement of the company gives a detailed understanding of our digital capabilities. This statement is aligned with the company's vision and business strategy. It defines operational and 7 financial metrics for measuring performance throughout the organisation. Digital capabilities are integrated into our finance, marketing, engineering, manufacturing, and after-sales service departments." (Tr.2)

In I4, technology and people interact to realise new levels of production and quality standards. Therefore, success depends on the organisation's ability to create an environment that enables these two elements to interact, with organisational processes as a third element to be included to improve business results when implementing I4. Management can focus on operations, activities, or products. A participant mentioned that they had developed a matrix for transition metrics that assesses whether tasks

are assigned to employees with the right expertise and working experience to ensure the effective adoption of I4. The matrix is based on four criteria: digital technology proficiency, leadership experience, communication experience, and experience in roles critical for I4 implementation, with further categorisation based on industry segments. This highlights the importance of aligning technology, people, and organisational processes to adopt I4 successfully: *“For the transition metrics, I have developed a matrix that lets me check if each task is assigned to an employee with the right level of expertise and working experience. The questions are based on four criteria: digital technology (proficiency in Software Development), leadership (experience in using Lean and Agile methods), communication (experience in leadership roles) and experience in roles that are critical for the implementation of I4. Industry segments further categorise the transition metrics.”* (Tr.3)

5.9.8 Diverse Management

Five respondents foster a culture of respect and shared values in the organisation that embraces diversity and demonstrates respect towards each person in the team. According to the respondents, an important aspect to consider when recruiting team members is inclusivity, as it will help bring out the best in each member and contribute towards a better overall organisational culture. A participant emphasised that diversity played a crucial role in effective leadership and productivity during the adoption of I4 and mentioned actively recruiting individuals from different backgrounds to create a more inclusive and creative work environment:

“Diversity is key to being an effective leader within our organisation. I believe my staff are more productive when they have a diverse view of the world. And I try to achieve this diversity by actively recruiting and creating an inclusive environment where people can be themselves, learn new things and feel at home. This is why I like to recruit team members from different backgrounds.” (Tr.1)

5.9.9 Establishing and Maintaining Collaborative Work

Various factors contributed to creating and maintaining a thriving work environment, such as trust, leadership, empowerment, employee socialisation and supportive environment. These factors contain several sub-components contributing to them all working seamlessly together.

A participant emphasised the importance of having a collaborative work environment characterised by mutual respect and a focus on teamwork that produces better results and requires trust, leadership, empowerment, employee socialization, and a supportive work environment, all contributing factors to creating and maintaining a thriving work environment:

“A collaborative work environment is a type of office culture where people feel comfortable and work together in an atmosphere of mutual respect. It focuses on the importance of understanding that working as a team produces better results. The key elements are trust, leadership, empowerment, employee socialisation and a supportive work environment.” (Tr.6)

Most respondents mentioned that leadership plays a very important role in creating a collaborative workspace environment. According to a participant, leadership was critical in creating a collaborative workspace environment. Training employees to collaborate effectively in a digital environment is essential. This included educating employees on the importance of teamwork and how it directly contributes to achieving shared goals. Additionally, employees should trust their managers, peers, business partners, and suppliers for I4 technologies to help achieve their goals:

“I would say that the most crucial element is leadership. Investing time in training employees to collaborate effectively in a digital environment is crucial. We must educate them on the importance of teamwork and how it directly contributes to achieving our shared goals. Employees must trust their manager, manager's manager, peers, business partners, and suppliers for I4 technologies to achieve our goals.”(Tr.11)

It can be seen that the adoption of I4 is intricately tied to developing an organisational culture that promotes collaboration, diversity and inclusion, feedback and mentoring, team motivation and customer orientation, which is significantly impacted by the dynamics of effective leadership in automotive SMEs.

5.10 Learning and Knowledge Sharing Culture

The eighth key theme that emerged from the interview data was learning and knowledge sharing culture during the adoption of I4, involving a range of themes such as sharing best practice, improvement of technological adoption rate, establishing open-source mentality, value creation driven, encouragement of different approaches to share knowledge, knowledge for everyone accessible, learning by doing mentality and the alignment between digital transformation and business strategy. These themes are underlined with the associated codes, as shown in Figure 5.8, which ultimately led to the emergence of the eight key theme, the learning and knowledge sharing culture during the adoption of I4. These themes illustrate the significance of promoting an organisational culture of learning and knowledge sharing in adopting I4 technologies in manufacturing SMEs in the automotive industry. By encouraging different knowledge-sharing approaches and making knowledge accessible to employees, organisations can improve their technological adoption rate, establish an open-source mentality, and create value. Sharing best practices and aligning digital transformation with business strategy are other key aspects of developing a successful learning and knowledge-sharing culture.

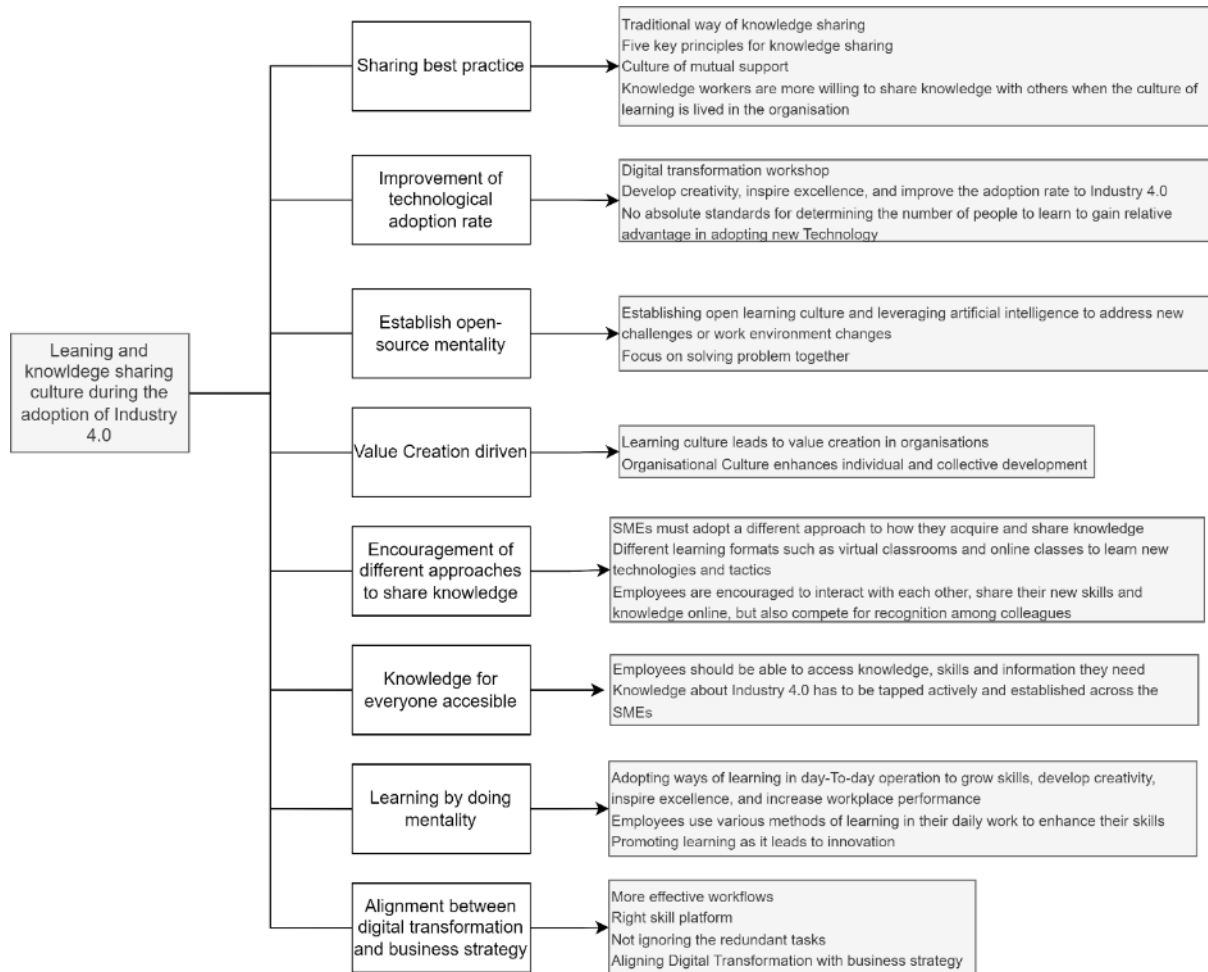


Figure 5.8: Learning and Knowledge Sharing Culture during the adoption of Industry 4.0

– Grouped Codes, Note: By the researcher

5.10.1 Encouragement of different approach to share knowledge and share best practice.

According to the respondents, I4 is a multidisciplinary field that combines various technologies and human resources. However, as digitalisation and automation can be complex and challenging for employees who lack familiarity with these technologies, it is crucial to establish a culture of knowledge sharing by encouraging experienced stakeholders to guide and support others in adopting I4 practices, ultimately enabling employees to perform their roles more effectively. As one participant noted, it is crucial to establish a culture of knowledge sharing by encouraging experienced stakeholders to guide and support others in adopting I4 practices, ultimately enabling employees to perform their roles more effectively. The participant further suggested encouraging stakeholders to develop a technology-oriented mindset and share knowledge and experience could be a good practice:

“It is important to foster a culture of knowledge sharing by encouraging stakeholders with more knowledge and experience to guide others on how to do their job more effectively when adopting I4.

Encouraging stakeholders to develop a technology-oriented mindset and share knowledge and experience could be a good practice.”(Tr.14)

As a participant noted, it is crucial to have future-proof programs that assist employees in becoming more comfortable with technology and sharing knowledge to cultivate an adaptive culture where employees can readily apply innovations. As the participant further stated, the future of task assignments during adopting I4 will be a continuous learning and innovation cycle. Moreover, in the coming years, new tools and technologies will emerge, enabling the automation of tasks to free up human resources for other duties:

“In my opinion, the future in the assignment of tasks when adopting I4 is a continuous learning and innovation cycle. During the next few years, we will experience various new tools and technologies that will help us automate our tasks to free up human resources for other duties.”(Tr.10).

As a participant noted, it is important to build a strong foundation for employees to feel safe in sharing knowledge in I4. This can be challenging, as what constitutes knowledge may vary from organisation to organisation based on the quality of implementation and available resources in manufacturing SMEs. Consequently, employees may be hesitant to share knowledge. To overcome this, managers and senior leadership must lead by example and actively share their knowledge, creating a culture of openness and trust that encourages employees to step out of their comfort zones and share their knowledge:

“For knowledge sharing to occur, you must build a strong foundation for your employees to feel safe in stepping outside their comfort zones and feel confident enough to do so. This means that managers and senior leadership must lead by example and proactively share their own knowledge.”(Tr.9)

5.10.2 Knowledge for Everyone Accessible and Improvement of Technological Adoption Rate

As a participant noted, access to knowledge is a significant obstacle in adopting I4. This requires a fundamental overhaul of the industry's knowledge management systems to promote and accelerate its adoption. They shared that ERP data is not easily accessible to operations, creating difficulties in making informed decisions regarding business process improvement and production planning. This most often resulted in production bottlenecks and poor customer service. Here, Digital Transformation Managers have the challenge of addressing these issues while simultaneously building organisational capabilities and aligning them with strategic goals:

“For example, our ERP data is not easily accessible to the operations, so it becomes difficult to make better decisions regarding business process improvement and production planning. As a result of this problem, there are bottlenecks in production which lead to poor customer service. My job as a Digital Transformation Manager is challenging since I need to address these issues one by one and at the same time build up Organisations capabilities as well as align them with the strategic goals of my organisation”.(Tr.2)

As one participant noted, access to knowledge, mainly technical information, is a significant challenge in adopting I4 due to data silos and restricted access to professionals skilled in working with various solutions. In addressing this issue, the participant shared that their organisation shifted its core values from a "transaction-oriented" to a "collaboration-oriented" mindset to break down silos and promote knowledge sharing. The organisation implemented joint workshops, meetings, training programs, and learning sessions to foster mutual trust and collaboration between departments:

"The first thing we did was to stop the "silo" working structure. We had silos in every group and sub-groups. The typical mindset was that we all worked in our groups as individuals and didn't communicate outside of our groups. So we had to break this mindset by changing our core values from "transaction-oriented" to "collaboration oriented". To create collaboration, we had to develop mutual trust between all departments through joint workshops, meetings, training programs and learning sessions." (Tr.6)

5.10.3 Learning by Doing and Establish Open-Source Mentality

Developing an open-source application that everyone can use requires a lot of work. This collaborative approach According to the respondents, the diffusion of management and technology innovations and the implementation of specific management methods is a complex and lengthy process. As noted by one participant, the adoption of I4 not only entails changes in the internal and external environment but also requires the involvement of various stakeholders to create organisational resonance. In this regard, the organisation prioritises efficiency and continuous improvement while maintaining an openness to innovation and recognising the risks involved. This gradual change process allows successful innovation to be incorporated into the organisation's processes:

"The organisation is oriented toward thinking and doing things differently. While we maintain an openness to innovation, we also recognise the risks of trying new things. As part of our culture, we prioritise doing things correctly the first time rather than repeating the same processes, reflecting our commitment to efficiency and continuous improvement. The organisation's gradual change process allows for innovation to be inserted into our processes always to be successful." (Tr.5)

As a participant noted, adopting new practices, particularly in manufacturing, inevitably involves modifying current processes. This is especially challenging when breaking the old culture, especially concerning management. Adopting lean manufacturing and continuous improvement has resulted in a shift in the traditional roles of machine operators and supervisors, with shop-floor supervision increasingly falling under management responsibility. Workers are encouraged to take on more initiative and accountability, which can lead to resistance from those focused on technical expertise or apprehensive about relinquishing control and maintaining the status quo:

"Adopting new practices, particularly in a manufacturing setting, inevitably involves modifying current processes. In most cases, it is tough to break the old culture, especially regarding management." (Tr.4)

Developing an open-source application that everyone can use requires much work and involves various stakeholders who will leverage the application. As a participant reported, the traditional 'open-door' management policy only provided a channel for communication between employees and management, needing a more structured flow of information for effective knowledge-sharing. Alternatively, an open-source project-based collaboration platform could foster a comprehensive knowledge-sharing system at the organisational level, enabling collaborative learning and expertise-sharing. While this approach is more challenging to accomplish, it establishes a culture of knowledge sharing and collaboration with the support and guidance of management:

“The second approach is management can establish a culture of knowledge sharing by designing an open-source platform for project-based collaboration. Developing an open-source application that everyone can use requires a lot of work. This collaborative approach allows employees to identify, create and share information. This approach is a little harder to accomplish because it requires employees to work with management's support and guidance. It can be complex and involve various stakeholders who will leverage the application.”(Tr. 5)

5.10.4 Value Creation and Alignment between Digital Transformation and Business Strategy

As a participant noted, their organisation is very open to new technologies and innovations, evaluating them based on their merits and shortcomings while ensuring that their evaluation of proposed solutions aligns with the organisation's business strategy regarding value creation, cost, and risk management. Respondents' opinions were divided on how digital transformation and business strategy can be aligned to accelerate innovation and fulfil organisational missions. Organisations face the challenge of rapidly creating innovations to meet consumers' demands while adopting I4. Despite the dynamic business environment discouraging long-term resource allocation planning, organisations must identify shifts in the market to remain competitive and need strategies that enable prompt reaction and proactive positioning for long-term success when adopting I4 in the manufacturing industry:

“We are very open when it comes to new technologies and innovations. We do not close our minds to any new technology or solution. We evaluate these based on their advantages and disadvantages. The evaluation of proposed solutions must be consistent with the business strategy in terms of value creation, cost, and risk management. We evaluate proposed solutions for each project or programme with a thorough evaluation of the three dimensions, then decide on the future course.” (Tr.14)

The transformation of an organisation is critical in developing a plan, and communicating and operationalising strategies are crucial for success. As a participant noted, the company's current organisational culture is hierarchical, controlled, and siloed, with numerous policies and procedures. However, the participant expressed the need to shift towards a result-based culture and focus on achieving business results. Aligning business with organisational culture, processes, and technology is

essential for building organisational value, and an aligned approach to digital management across functions can optimise resources and reduce business costs:

“The company's current organisational culture is based on hierarchy, control and silos. The company has created many policies and procedures to guide employees, but we are trying to change the policy-based culture to a result based one. While working in the company, we will need to focus on the business results that we want to achieve. We will then develop the necessary policies and procedures to achieve these goals.”(Tr.3)

As one participant noted, digital transformation is a strategic initiative for organisations that requires alignment with business strategy, embracing digital technologies, and implementing a new mindset for the future of manufacturing based on data analytics and IoT. The challenge lies in driving alignment within the organisation and creating awareness for the new value propositions and benefits of I4 for stakeholders. The participant suggested starting with pilot projects or roadmap activities following an agile approach to demonstrate the short-term impact of I4 on different areas of responsibilities:

“The key challenge is that it's hard to align your organisation with the I4 ambition because it requires a complete change of mindset, technologies, processes etc. Therefore, you need to drive alignment within the organisation by creating awareness for the new value propositions and giving transparency on how this will benefit stakeholders. And this is where I see an opportunity for IT / digital managers to start with pilot projects or roadmap activities following an agile approach, so everyone can see how I4 will impact their area of responsibilities in the short-term horizon (1-3 years).”(Tr.8)

It can be seen that the organisational culture is deeply affected by the adoption of I4, as this technological shift requires a fundamental change in the way organisations operate, communicate, and manage their resources. An adaptive and proactive organisational culture that values learning and knowledge-sharing seems critical for successfully adopting I4 practices, ensuring continuous improvement, and driving innovation in manufacturing SMEs in the automotive industry.

5.11 Maintaining Energetic and Motivated Work Environment

The ninth key theme that emerged from the interview data was maintaining an energetic and motivated work environment during adoption of I4, involving a range of themes such as intrinsic and extrinsic motivational factors, appreciation and reward for higher outcome, sense of recognition, building trust and open-door policy. These themes are further grouped into sub-themes such as friendly holidays, appropriate remuneration, data sharing, assigning responsibilities, listening to new ideas and listening and solving problems. The themes and sub-themes underlined with the associated codes, as shown in Figure 5.9, which ultimately led to the emergence of the ninth key theme, maintaining energetic and motivated work environment during adoption of I4.

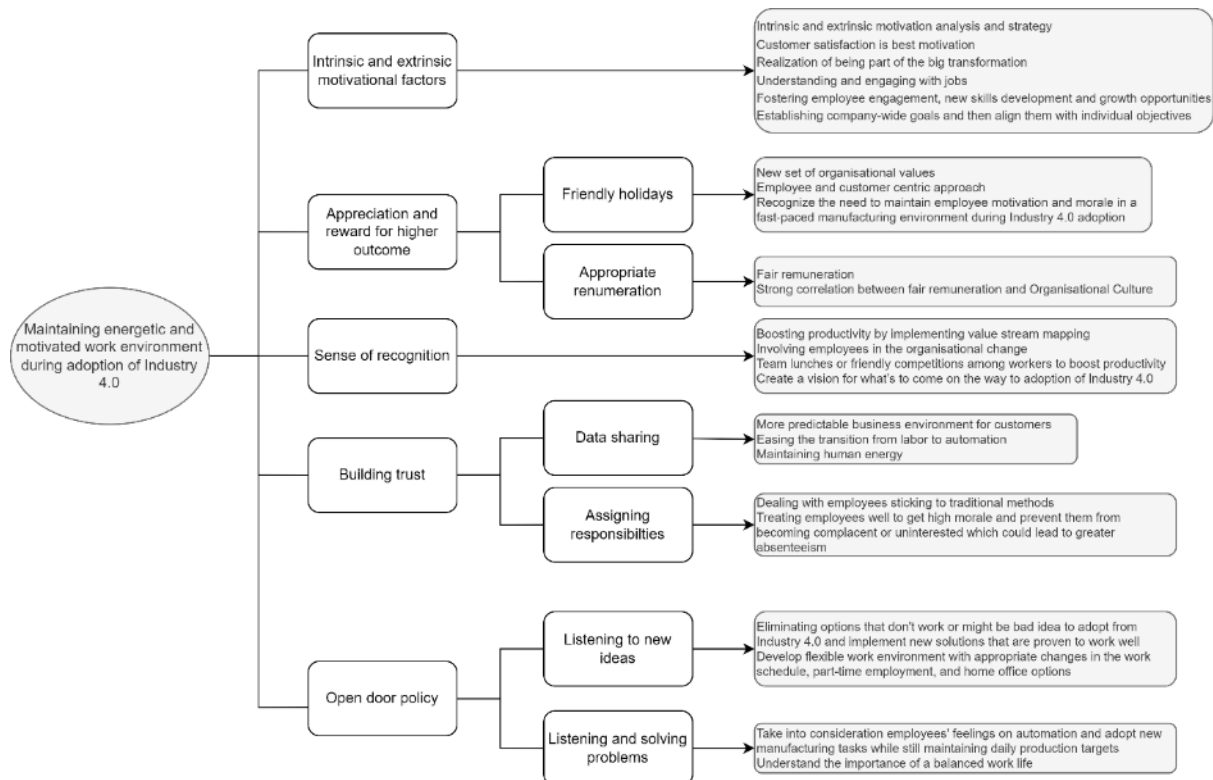


Figure 5.9: Maintaining an Energetic and Motivated Work Environment during the Adoption of Industry 4.0 – Grouped Codes, Note: By the researcher

The ninth key theme, “Maintaining an Energetic and Motivated Work Environment during the Adoption of Industry 4.0”, highlights the importance of employee motivation and engagement during the technological transformation process. The underlining codes to this theme, such as intrinsic and extrinsic motivational factors, appropriate remuneration, sense of recognition, building trust, open door policy, and friendly holidays, demonstrate the diverse range of strategies organisations can adopt to create a positive and energetic work environment for their employees. These themes and sub-themes underscore the significance of organisational culture in shaping employee attitudes and behaviours towards adopting I4 technologies. Ultimately, the mastery of i4 technologies requires organisations to foster an environment that encourages employee growth, development, and engagement, and this section aims to provide the necessary insights to achieve this goal.

5.11.1 Compilation of the Themes that Contribute to Maintaining Energetic and Motivated Work Environment

Seven respondents stated that finding, hiring, training, and retaining good human resources is challenging for small and medium-sized companies in the automotive industry. The involved SMEs applied various strategies, including analysing intrinsic and extrinsic motivational needs, the culture of values, the sense of recognition, time off and fair compensation, etc. To effectively address the challenges that may arise during the adoption of I4, it is crucial for manufacturing SMEs in the

automotive industry to consider both intrinsic and extrinsic motivational factors for their employees. To maintain an energetic and motivated work environment during the adoption of I4, it is crucial to understand organisational culture's impact on intrinsic and extrinsic motivational factors. As one interviewee noted, employees can need help to stay motivated in facing challenges such as job security concerns. Thus, it is necessary to thoroughly analyse the existing organisational culture and develop new values, vision statements, and goals that inspire and motivate employees to reach their full potential:

"It is essential to consider both their intrinsic and extrinsic motives to effectively motivate our employees, as the organisational culture impacts both. This starts with thoroughly analysing the company's existing organisational culture. Based on this, we can develop a new set of values, vision and mission statements, and goals that inspire and motivate our employees to exceed their expectations and achieve more than they previously thought possible." (Tr 1)

A participant expressed that many companies tend to prioritise their product and service offerings but to achieve sustainable success, their organisation must prioritise building a culture of pride and professionalism while cultivating a sense of purpose among employees. The participant highlighted that the recognition experience had been linked to intrinsic motivation, where employees who feel part of a significant and distinctive movement within their organisation are motivated by the excitement of creating something new and leading the charge for change. The participant further stated that employees who feel connected to a larger mission are more engaged, productive, and fulfilled, increasing job satisfaction and positively impacting their lives inside and outside the workplace:

"Companies usually focus on their product and service offerings. To achieve sustainable success, it's vital for my organisation to prioritise building a culture of pride and professionalism and cultivating a sense of purpose among employees, as employees who feel connected to a larger mission are more engaged, productive, and fulfilled, ultimately leading to increased job satisfaction and a positive impact on their lives inside and outside of the workplace."(Tr.13)

A participant expressed that the Organisational Culture should be designed to promote efficiency while also being conducive for leaders to make decisions with minimal resistance from the front-line workers. The Organisational Culture should cater to the needs of the employees, providing them with freedom and flexibility not typically seen in traditional manufacturing organisations. To achieve these objectives, a well-defined Organisational Culture is necessary, as it creates an environment that promotes productivity and ultimately leads to the organisation's success:

"The Organisational Culture should be designed in such a way to provide an environment that promotes efficiency and also the right culture for the leaders to take their decisions with minimal resistance from the front-line workers. The Organisational Culture should cater to the needs of the employees and provide them with freedom and flexibility not known in traditional manufacturing organisations. To achieve these objectives, they need a well-defined Organisational Culture."(Tr.9)

A participant expressed that their organisation's culture is less flexible and open to adopting new technologies due to their adherence to legacy technologies. The participant also noted that their organisation's culture is derived from traditional manufacturing approaches and associated constraints, which hinder the adoption of new technologies. Furthermore, the participant's current organisational structure must be adapted to accommodate I4 practices, as the two cultures have a clear difference:

"We currently have a culture derived from the traditional manufacturing approach and its associated constraints. The difference is that we must adapt our current organisational structure to accommodate I4 practices. In short, I would say that there is a clear difference between the two cultures." (Tr.9)

A participant expressed that dealing with two cultures requires a balance, with the current organisational culture providing security and trust in the work environment but also leading to employee indifference in the face of the cyclical economy during I4. They highlighted that the disruptive practices of I4 require manufacturing SMEs to adapt their approach and that organisational culture can be crucial in mitigating indifference. They suggested that creating a culture that encourages change and promotes learning while being easy to assimilate is a prerequisite for successful adoption and alignment with I4 practices:

"I think that organisational culture can mitigate a mutual indifference amongst the individuals in the adoption of I4 and could be highly effective under the following circumstances: Firstly, a cultural alignment is a prerequisite for successful adoption. It can be done by creating a culture that encourages change and promotes learning; cultural change must be easy to assimilate." (Tr.9)

One respondent adopted an open-door policy where the employees can candidly communicate with the management and executives of the company. As a result, the communication gap between them is reduced. Moreover, this motivates the employees since whenever they have a concern or something to discuss, they can easily access the managers and other executives in the organisation:

"It is all about the transparency of the business intelligence tools. We also do a lot of work to communicate all the benefits of these tools (ROI, quality) to our employees and ensure they know how to use them. In addition, we have an open-door policy and available every week to explain and guide employees." (Tr.1)

A participant expressed that fair remuneration is significant in maintaining a positive and respectful culture in the company. They stated that there is a strong correlation between the company culture and fair remuneration. It is crucial to offer employees reasonable financial rewards and benefits, as it is one of the most important factors they consider when recruiting new employees and is part of their overall value proposition. The participant emphasised that fair remuneration keeps employees motivated, energetic, and committed and promotes a positive and inclusive work environment:

"There is a strong correlation between the culture we have at our company and fair remuneration. It is imperative to have a positive, inclusive, and respectful culture. Fair remuneration is one of the most important factors we consider when looking for employees. It is a crucial element in our recruitment process and is part of our overall value proposition". (Tr. 1)

Another encouraging and motivating factor in the organisation is building the trust of the employees which is exemplified as stated by a participant:

“Trust is built by making small but impactful and committed changes such as giving employees access to the data they need to do their job, not keeping things for themselves”. (Tr.1)

It can be seen that the organisational culture is deeply affected by the intrinsic and extrinsic motivational factors of employees, making it crucial to maintain an energetic and motivated work environment during the adoption of I4.

5.12 Managing Organisational Differences

The tenth key theme that emerged from the interview data was managing organisational differences during adoption of I4, involving a range of themes such as ways of resolving conflicts, unified culture, visibility of common objectives across organisations, differences arising from old and new manufacturing technology, involvement of the stakeholders in the technology adoption. The themes are underlined with the associated codes, as shown in Figure 5.10, which ultimately led to the emergence of the tenth key theme, managing organisational differences during adoption of I4.

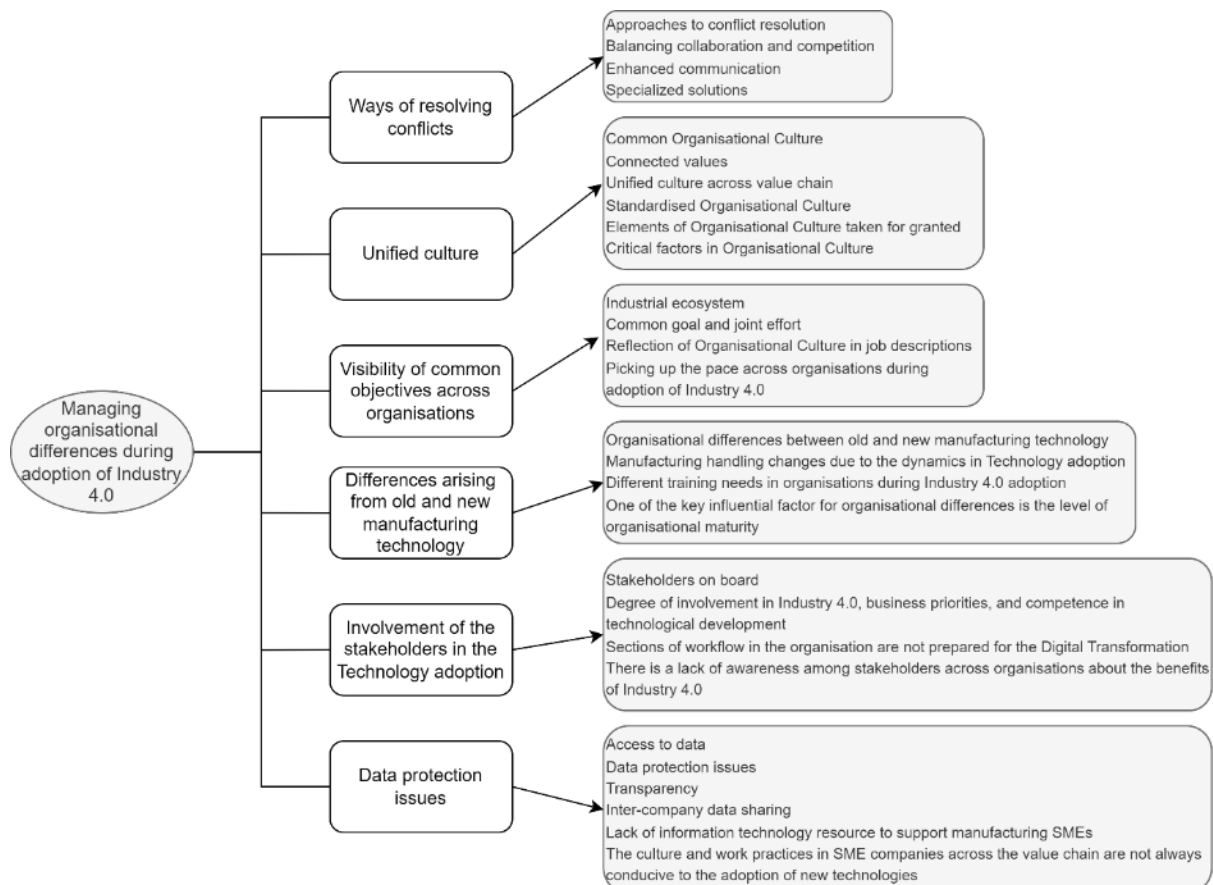


Figure 5.10: Managing Organisational Differences during adoption of Industry 4.0 – Grouped Codes.

Note: By the researcher

This section on “Managing Organisational Differences during Adoption of Industry 4.0” is crucial as adopting I4 requires manufacturing SMEs in the automotive industry to various challenges, such as differences arising from old and new manufacturing technology, data protection issues and conflicts. Addressing these challenges is essential to ensure a successful diffusion of management and technology innovations while adopting I4. This section provides insights into how organisations can manage these differences effectively.

5.12.1 Differences Arising from Old and New Manufacturing Technology

A respondent commented that it is rather challenging to handle the extensive legacy IT infrastructure and product portfolio, which are very different and have been developed by other departments at different times without a clear governance framework. Getting the various stakeholders to agree on a typical architecture for all products and creating a framework for what individuals must do in product development presents a challenge. A participant stated that their company faced significant challenges due to a legacy IT infrastructure and a diverse portfolio of products designed by different departments that needed a clear governance framework. They also shared that the company had many guidelines and procedures, which contained information that may not be relevant to I4. They were still determining the impact of these guidelines being altered. Additionally, the participant expressed that the company needed more human resources, meaning they had to approach things differently:

“Our company is struggling with a huge legacy IT infrastructure. We face many challenges since our portfolio of products is very diverse and has been designed by different departments at different points in time without any clear governance framework. In addition, we have hundreds if not thousands of pages of guidelines and procedures that contain information that may or may not be relevant to I4.”
(Tr.1)

A participant shared that there needs to be more comprehensive knowledge between manufacturers with old and new technologies, leading to conflicts among the members of an SME organisation. More guidance is needed on the meaning of I4, which creates confusion about how this digital transformation should be carried out. This sentiment is echoed in the words of a participant who stated:

“We have five different teams working on different aspects of our digital transformation strategy, but communication is a common issue in all of them. Our departments and teams face some challenges in communicating with each other, especially when sharing information or when there is conflict over ideas or visions for the future. This has been an issue because we are changing many things at once, and people haven’t always understood what we are doing or why we need to do certain things this way.” (Tr. 4)

The respondents have identified the differences between old and new manufacturing technologies as a key driver in increasing SMEs’ business management and leadership challenges. Specifically, people with different levels of understanding about I4 are in continual conflict about its implications for them,

their business sector and the industry. Without any guidelines or protocols around digitisation, it creates disputes among members of SME organisations on how to proceed with their digital transformation. A participant shared that the enhanced production capacity for manufacturing SMEs and technological advancements, such as Artificial Intelligence, are paving the way for a new era of I4 and could lead to disruptions in existing business models. They stated that their company is moving into a new era and, therefore, need to create a positive culture supporting the organisation's changes. During the adoption of I4, they had some opinions about their new digital vision and what this would mean for the company. As the participant explained, these conflicts are common. However, they must be managed by someone who understands both sides of the argument and can explain how this will benefit everyone in the organisation, especially when developing new business models during adoption of I4:

"Our company is moving into a new era. This is why we need to create a positive culture that supports the changes within the organisation. We need to focus on our strengths as an organisation and build on these to support our new ICT solutions. During the adoption of I4, we have had some opinions about our new digital vision and what this will mean for the company as a whole. These conflicts are common, but they must be managed by someone who understands both sides of the argument and can explain how this will benefit everyone in the organisation, especially when developing new business models like I4." (Tr.3)

5.12.2 Unified Culture and Ways of Resolving Conflicts

A unified culture across the entire value chain is a strategy used in practice and was also put forward by the participants for adopting I4. Furthermore, the stakeholders in the value chain must work together to make the adoption of I4 successful. A clear and unified organisational culture ensures trust, transparency, collaboration and sharing across the ecosystem. Most participants made suggestions and presented ideal scenarios for resolving conflicts, while some also presented the practical approaches and methods used in their respective organisations. Understanding employees' backgrounds were crucial in this context, as the level of I4 implementation within an organisation will likely vary depending on factors such as market position, product and service offerings, and the company's willingness to adopt new technologies, as noted by three respondents. A participant shared that an ideal organisational culture would be open, collaborative, and inclusive, which would help accept technology and mitigate organisational differences. Furthermore, they expressed that if the degree of adoption was high and there were organisational differences, the new system would be complex and challenging. The participants believed that a culture of collaboration would be necessary to smooth out these differences while supporting the adoption of technologies:

"Each organisation has a unique culture and the degree of adoption would vary from company to company. In general, I would say that the ideal organisational culture is one that is open, collaborative

and inclusive. Within these principles, we must define how these keywords are applied to the workforce within our organisation.”(Tr.2)

According to the views of interviewed participants, adopting I4 necessitates companies to develop a clear purpose and vision statement reflecting their unique sectoral position in a changing market. To achieve collaboration across the value chain, creating or revising mission and vision statements to align organisational culture with I4 standards is crucial. Additionally, a company’s external stakeholders require a unified culture to make them feel like part of the ecosystem rather than just an outsider working around it. Therefore, as expressed by a participant, companies should strive for a common culture with a clear and consistent message through their business relationships:

“A company’s external stakeholders require a unified culture to make them feel like part of the ecosystem, rather than just an outsider working around it. With this in mind, companies ought to strive for a common culture with a clear and consistent message through their business relationships.” (Tr.1).

A participant expressed that a shared organisational culture between stakeholders of the connected value chain can contribute to creating a competitive environment. A connected value chain can be successful only if the differences in the organisational culture are balanced. This is in line with the sentiment expressed in a quote from another participant, who stated that having a common organisational culture is essential for successful collaboration with suppliers in the industry and for mitigating mutual indifference in companies while adopting I4. Therefore, every stakeholder in the connected value chain must have a common organisational culture to pull in a single direction:

“Having a common corporate organisational culture will help businesses collaborate with their suppliers in the industry. It will help mitigate mutual indifference in companies when adopting I4...I think every stakeholder of the connected value chain should have a common organisational culture to pull in a single direction”. (Tr.1)

5.12.3 Involve Stakeholders in the Technological Adoption Process

According to the respondents, a better industrial ecosystem is also a positive factor in avoiding friction. An industrial ecosystem is where all participants interact in the same collaborative space to create value for consumers and all other participants in the industry, e.g., suppliers, distributors, and service providers. A common goal of accelerating digital solutions across the value chain would strengthen the I4 ecosystem. Many manufacturing SMEs recognise the benefits of collaboration and partnership in managing organisational differences while adopting I4. According to participants, involving employees in the process and introducing a shared organisational culture, vision, and implementation plan were key strategies for managing differences. Creating a shared vision for all employees also promotes

mutual understanding and cooperation, reducing the risk of disagreement among team members. One participant emphasised the importance of engaging with internal and external stakeholders, listening to their feedback and proactively seeking opportunities for innovation:

“I am always looking for ways to develop relationships with internal partners and external experts, providing them with opportunities to share their experience concerning organisational culture, strategy, business model innovation etc....I am proactive in engaging stakeholders who are key players in the process and listen carefully where there is a need for improvement but keep my eyes open for opportunities because it helps me find innovative solutions that will benefit everyone.”(Tr.12)

A participant shared that for I4 success, commitment from both employees and industrial partners to newer technologies is crucial, alongside creating a shared vision, employees’ commitment and passion for potential benefits, development of flexible work structures, and suitable organisational change management. Regular meetings with employees and external stakeholders can be valuable for adopting innovative ideas. As another participant stated, their organisation fosters a culture of listening to new ideas from employees and external partners through regular sessions. In such sessions, management must accept innovative proposals without bias and act upon their recommendations if they are viable:

“We have a culture of listening to new ideas from employees and external partners. We organise regular sessions where all employees can propose ideas that could be implemented in the future. These sessions are also scheduled with external partners. What is important for this kind of session is that management accepts the innovative proposals made by employees without any bias and acts upon their recommendations if they are viable.” (Tr.7.

One participant shared that aligning all partners simultaneously was their organisation’s most significant challenge during the adoption of I4, and two other participants echoed this sentiment. The need for a revaluation of alignment and change management strategies was emphasised. As the participant put it, achieving excellence in productivity, quality, and innovation is only possible with the active commitment of all partners in the value chain. This highlights the critical role that collaboration and effective communication play in the success of I4 adoption.:

“The biggest challenge in implementing I4 along the value chain is to align all partners at the same time. There is no way an organisation can achieve excellence in productivity, quality and innovation without the active commitment of its partners.” (Tr. 9)

5.12.4 Data Protection Issues

Access to data can be a cause of conflict in the involved manufacturing SMEs in the automotive industry. According to the respondents, providing employees with easy access to data and knowledge allows them to do their jobs efficiently. On the other hand, organisations face trust and security issues when granting access to data. A participant shared that transparency is crucial when sharing data, as service providers and consumers must be in sync. However, there were cases where leading service providers needed to be more open to sharing data with suppliers. Therefore, the participant proposed an integrated approach that involves all stakeholders. This approach should include all relevant IT, HR, Logistics & Purchasing or Production departments. They must be on board with the digital transformation and willing to contribute to its success. In the participant's view, a holistic approach that involves all stakeholders is necessary for achieving the goals of digital transformation:

“We are talking about a holistic approach. In my opinion, all relevant stakeholders have to be on board and willing to accomplish their contribution to the digital transformation. All the departments like IT, HR, Logistics & Purchasing or Production should be on board this change process”. (Tr 1)

A participant stated that transparency is essential during the adoption of I4, as it requires a comprehensive and transparent approach by all stakeholders to improve products and services. Organisational differences arising from adopting new technology further underline the importance of open communication and transparency. As the participant highlighted:

“I think there is no other way but to be transparent in sharing data because when service providers and consumers exchange a product or service, they have to be in a mutual agreement. Otherwise, it will not work.” (Tr. 15)

It can be seen that managing organisational differences during the adoption of I4 is crucial due to the profound impact that the new manufacturing technology has on organisational culture, the need for involving stakeholders in the technology adoption process, the data protection issues that arise, and the importance of creating a unified culture and resolving conflicts to achieve successful adoption and implementation.

5.13 Survival and Sustainable Strategies

The eleventh key theme that emerged from the interview data survival and sustainable strategies during adoption of I4, involving a range of themes such as knowing the industry standards, filling the knowledge gap, testing new business models, gathering the right data, competitiveness, focus on metrics for organisational performance, scrutinising the existing business models and staying customer focused. The themes are underlined with the associated codes, as shown in Figure 5.11,

which ultimately led to the emergence of the eleventh key theme, survival and sustainable strategies during the adoption of I4.

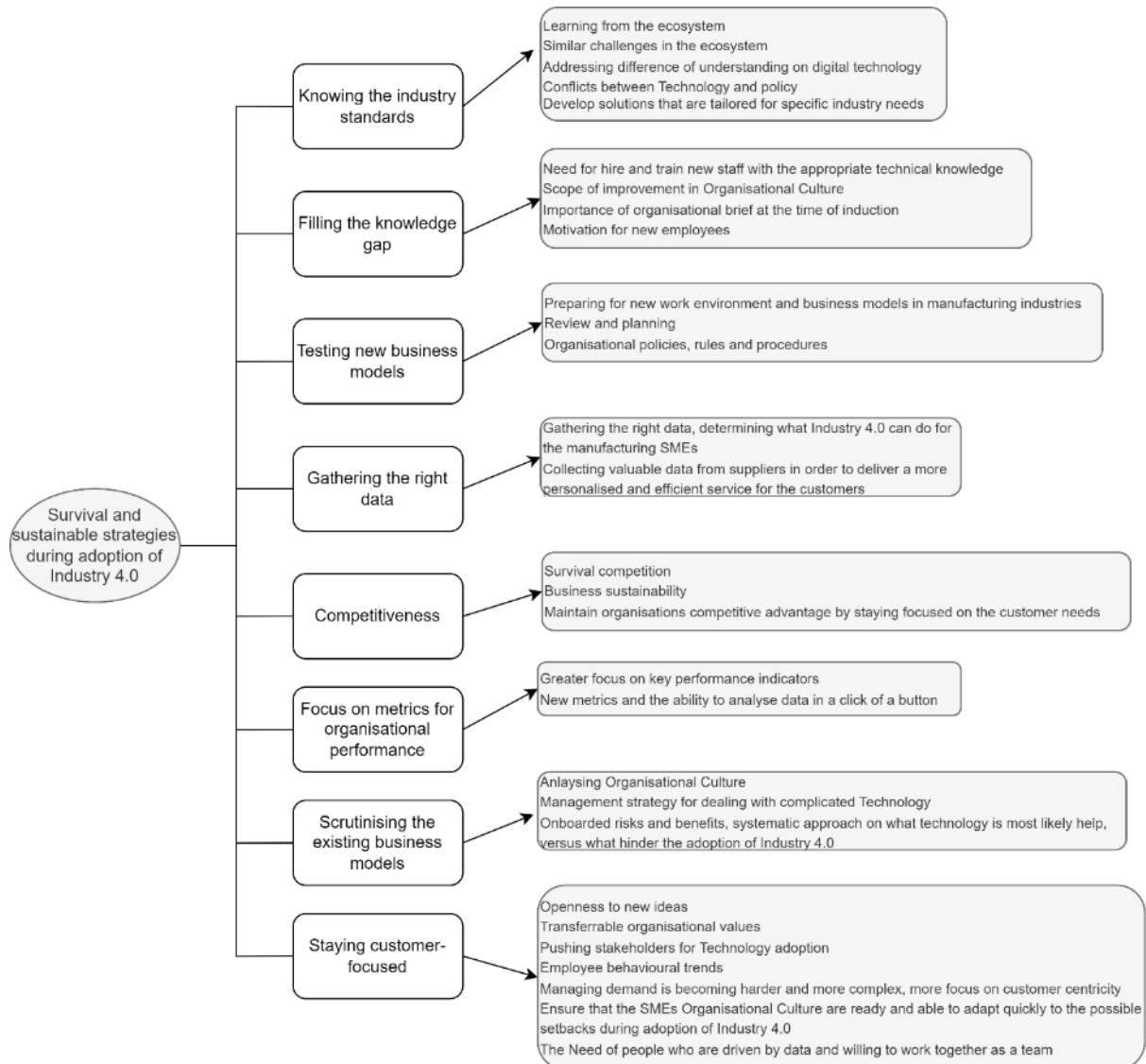


Figure 5.11: Survival and Sustainable Strategies during the Adoption of Industry 4.0 – Grouped codes, Note: By the researcher.

This section focuses on the survival and sustainable strategies SMEs must adopt to remain competitive in the rapidly evolving digital landscape. The section draws on themes identified in the analysis of the interviews conducted with manufacturing SMEs in the automotive industry, including competitiveness, focus on metrics for organisational performance, scrutinising existing business models, staying customer-focused, knowing industry standards, filling the knowledge gap, testing new business models, and gathering the right data. Through a detailed analysis of these themes, this section aims to provide insights into the strategies SMEs must adopt to successfully diffuse

management and technology innovations during the adoption of I4 to survive and thrive in the rapidly changing manufacturing industry.

5.13.1 Knowing the Industry Standards and Competitiveness

Knowing the industry standards is critical for manufacturing SMEs to develop a strategic plan that embeds digital technologies and expands the internal innovation ecosystem to remain competitive. As a participant highlighted:

“We are building an internal digital innovation ecosystem, embedding digital capabilities into our competitive advantage to drive meaningful value for our customers by reducing costs, increasing speed, increasing quality and producing better products. We are also building an external digital innovation ecosystem by collaborating with partners inside and outside our organisation - suppliers, recruitment agencies, training providers...- to find solutions within a complex environment.” (Tr.10)

This requires collaboration with partners inside and outside the organisation, such as suppliers, recruitment agencies, and training providers, to build an external digital innovation ecosystem and find solutions within a complex environment. By leveraging these collaborations and embracing digital transformation, manufacturing SMEs can stay competitive and continue to meet the evolving needs of their customers. As one of the interviewees highlighted, the organisational culture is critical in establishing alignment with external partners, suppliers, and customers for successful I4 adoption. By investing in open innovation and developing an integrated culture, the organisation can foster collaboration and alleviate internal competition while sourcing and selecting the most appropriate ideas to increase the value of business partners. In turn, this approach opens up areas for innovation in IoT, AI, robotics, and analytics that may have yet to be noticed by employees, ultimately maximising the organisation's growth potential. The respondents emphasised the importance of addressing the gap between the current status and how far the organisation has progressed towards I4 adoption, including discussing industry standards, emerging technologies, and new skills required:

“Organisational Culture is a key factor for creating an excellent alignment with external partners, suppliers, and customers for I4 adoption. By investing in open innovation and developing an open and integrated culture, we can: 1) Alleviate internal competition and foster a collaborative atmosphere within the organisation. 2)Source and select the right ideas from outside the organisation to increase our business partners' value. 3) Increase potential partnerships and open areas for innovation, including IoT, AI, robotics, analytics – ideas that our own employees could have missed. This way, we can maximize our growth potential.” (Tr.13)

As a participant pointed out, one of the critical tasks in the adoption of I4 is to make data and information understandable. This is because the decision-making process relies heavily on the availability of meaningful information. Introducing new technologies can aid this task by facilitating faster data analysis and presenting it in simpler terms. In this context, building and managing a solid internal and external digital innovation ecosystem is vital to empower employees with the necessary technological and digital principles to succeed in their day-to-day work.:

“key element is building, managing, and continuing to grow an internal and external digital innovation ecosystem for I4; you need to develop a strong sense of technology and digital principles to empower employees in their day-to-day work effectively. Within and outside the organisation.” (Tr. 1)

5.13.2 Filling the Knowledge Gap and Focus on Metrics for Organisational Performance

Filling the knowledge gap emerged as a crucial theme in the context of survival and sustainable strategies during the adoption of I4 in manufacturing SMEs in the automotive industry. As a participant stated, the greatest hindrance to implementing modern technologies such as artificial intelligence and blockchain is not technological but cultural, despite the increasing demand for them. It is essential to address the knowledge gap by hiring and training new staff with the appropriate technical knowledge and improving the organisational culture to motivate employees and ensure a smooth induction process. Teams and individual employees may need help to respond to the demand for I4 due to skillsets and knowledge gaps. It is necessary to fill these gaps to adopt modern technologies successfully:

“In my opinion, the greatest hindrance to implementing modern technologies such as artificial intelligence and blockchain is not technological, but cultural in nature, despite the increasing demand for them. However, teams and/or individual employees cannot respond to this demand for various reasons (skillsets, knowledge gaps, ...).” (Tr. 7)

As a participant highlighted, a strong team spirit and a cooperative attitude among employees were crucial factors in facilitating digital transformation initiatives in the manufacturing SMEs in the automotive industry. In this context, the role of a digital transformation manager was to develop an agile and flexible organisation that could effectively embrace new challenges and leverage learnings from previous experiences to identify and address gaps between business processes and current transformation practices. This approach focuses on achieving greater agility and competitiveness by continually transforming strategies and business models through data collection, analysis, and the introduction of new technologies, as well as revising business functions and developing a market-oriented mindset:

“According to my experience, the most important factors have been a strong team spirit and teamwork attitude. The most important role of a digital transformation manager is to develop a flexible organisation that can embrace new challenges and use the learnings from these experiences to identify the gaps between business processes and current transformation practices.” (Tr. 4)

As reported by one participant, a crucial factor in the successful adoption of I4 technologies is identifying and addressing knowledge gaps. To tackle this challenge, the participant developed a matrix that assesses the suitability of employees for specific tasks based on four criteria: digital technology proficiency, leadership experience, communication skills, and experience in critical roles for I4 implementation. The matrix aims to ensure that the right people with the appropriate expertise and experience are assigned to each task, ultimately contributing to the organisation's survival and sustainability in the rapidly changing landscape of manufacturing SMEs in the automotive industry:

“I have developed a matrix that lets me check if each task is assigned to an employee with the right level of expertise and working experience. The questions are based on four criteria: digital technology (proficiency in Software Development), leadership (experience in using Lean and Agile methods), communication (experience in leadership roles) and experience in roles that are critical for the implementation of I4. Industry segments further categorise the transition metrics.” (Tr.3)

The respondents noted that their organisations are currently undergoing digital transformation initiatives, which prioritise achieving greater agility by continuously transforming strategies and business models through data collection, analysis, the introduction of new technologies, revising business functions, and cultivating a market-oriented mindset. In addition, the respondents cited a strong team spirit and teamwork attitude as crucial factors in facilitating the digital transformation, with the role of a digital transformation manager being to develop a flexible organisation that can effectively address new challenges and leverage lessons learned to identify gaps between current transformation practices and business processes:

“The adoption of I4 is measured continuously in our company. We have developed tools for project management and digital architecture design, which are very important for each project. Regarding I4, there are two types of indicators used to measure performance: 1) indicators that affect the quality of our products, 2) indicators that reflect the success of our program daily.” (Tr. 15)

5.13.3 Scrutinising the Existing and Testing New Business Models

Scrutinising existing business models is crucial in adopting I4, as it requires a fundamental shift in manufacturing SMEs' strategies towards survival and sustainability. A respondent highlighted the challenges in embracing I4, with financial resources being a significant obstacle. Organisations must

utilise existing capabilities such as in-house technology and business models to overcome this hurdle. However, they noted that their partner organisations still need to change their strategies to adopt I4, emphasising the need for flexibility and open-mindedness to succeed in this dynamic environment:

“The organisation needs to be flexible and open-minded because I4 is a digital transformation that demands a fast change in the dynamic environment. For example, if a company adopts I4 but its partners do not, it will have to change its strategy again.” (Tr.15)

I4 encompasses new technologies and requires a shift towards new business and operating models that can effectively deploy these technologies. It goes beyond implementing new technologies and capabilities, as it involves a new world of technology and human interaction, where collaboration, trust, and new relationships are created. As one participant stated, adopting I4 necessitates a significant shift in organisational culture and structure:

“The new world is calling for a major shift in organisational culture and structure. This new world is about technology and human interaction, collaboration and trust, and all the new relationships they created. I4 is more than just technology; it's about business models, operating models, even new business models that new technologies will deploy.” (Tr.14)

As highlighted by a participant, manufacturing SMEs in the automotive industry are undergoing a significant transition towards I4 adoption. They have acknowledged the importance of this digital transformation and are proactively engaging in a learning process to understand its implications better. In order to remain competitive and sustainable, these organisations are shifting their focus from solely manufacturing products to developing capabilities that allow them to change their offerings. To reduce risks and improve productivity, respondents emphasised the need for a supportive organisational culture that fosters speed, innovation, and the implementation of new business models. A fast-moving environment requires flexible and autonomous decision-making, empowering employees to catch up with competitors and drive innovation.

“The company needs to have a culture that supports speed, innovation, and new business models. Having a fast-moving environment like this requires flexible and willing people to make decisions quickly without the guidance of management. This way, you can catch up with competitors, but more importantly, you can have a chance to innovate and create new business models that will work.” (Tr. 10)

As a participant reflected on the challenges of adopting I4 technologies, they highlighted the importance of evaluating existing business models to ensure sustainability in the rapidly changing manufacturing business. The participant stated that implementing new manufacturing processes

requires a different approach than developing or changing products or services. They identified gaps and missing pieces in their approach by collaborating with colleagues who worked on previous transformations. This underscores the need for a systematic approach to scrutinise existing business models to determine their compatibility with I4 and develop sustainable strategies for survival in the automotive industry:

“We believe that implementing new business processes requires a different approach than what is usually used for developing/changing new products or services.... I had several interviews with colleagues who worked closely with me on previous transformations to develop our approach. That's how I identified some gaps and missing pieces in my approach that needed improvements.” (Tr. 9)

5.13.4 Gathering the Right Data and Staying Customer Focused

Gathering the right data is crucial for successfully adopting I4 in manufacturing SMEs in the automotive industry. As a participant noted, I4 adoption requires significant organisational structure, culture, and process changes. To ensure a sustainable and credible strategy, collecting and analysing the right data from all relevant areas of the organisation is crucial, providing an accurate real-time view of the industry's needs, opportunities, and risks for each industrial process. It is also essential to foster the right organisational culture, where all employees participate in implementing the company's digital transformation. In this regard, the participant stated:

“In my personal opinion, for full exploitation of the potential of I4, various factors should be considered, including the following: Firstly, it is necessary to create a strategy for I4 and codify it into a clear digital strategy by collecting and analysing data from all relevant areas in the organisation. Secondly, it is very significant to establish an appropriate organisational culture to effectively diffuse industrial innovations induced by technology. Thirdly, the organisation needs to have a critical mass of digital resources and experts.” (Tr.6)

Manufacturing SMEs in the automotive industry are exploring ways to increase competitiveness and sustainability by adopting I4 technologies. As a participant noted, modern production lines should incorporate intelligent sensors to capture and transmit data to an ERP system for real-time monitoring and analysis. This feedback mechanism between the physical and virtual worlds enables resources to be used more efficiently and effectively while providing market feedback to help organisations stay responsive. By integrating data collection and analysis, manufacturing SMEs can gain valuable insights and make informed decisions about their production processes, ultimately driving success and growth in the automotive industry:

“I4 enables our organisation to be more competitive by providing a streamlined system of advanced manufacturing and product development processes. This means that we can create a feedback

mechanism between the virtual and physical worlds to make resources more efficient, effective, and responsive to market feedback. Also, it will allow us to take an integrated approach to data collection from real-time sensors connected with the production line directly into ERP systems for us to have information about the processes at any given moment.” (Tr.3)

Organisational Culture plays a vital role in gathering the right data and staying customer focused during the adoption of I4 in the manufacturing SMEs of the automotive industry. As a respondent stated, the traditional focus on manufacturing products has shifted towards gaining in-depth knowledge of customer experience to develop better tools and processes for them. However, this new focus on the customer has posed increased challenges for SMEs. Data collection has become more complex and requires a different type of analysis than companies are used to. The participant further explained that data in manufacturing is typically captured in manufacturing automation systems or ERP systems, which need more flexibility, making it difficult for SMEs to update them and make them more customer-focused. In this context, the respondent stressed the importance of describing to employees the behaviours required to work towards a shared vision statement, such as punctuality, quality, customer focus, teamwork, and openness, to ensure a customer-centric organisational culture.:

“I describe to them what behaviours are required of them as an employee at our company. These include aspects such as punctuality, quality, customer focus, teamwork, openness and so on. These values are often integrated into the company's vision statement. The employee must understand what he needs to do for their role (e.g., working with other employees).” (Tr.14)

It can be seen that organisational culture plays a critical role in manufacturing SMEs' survival and sustainable strategies during the adoption of I4. The cultural shift required to adopt new technologies and business models can be a significant challenge, and a supportive organisational culture that fosters speed, innovation, and the implementation of new business models is crucial. Furthermore, it appears that organisations need a culture that supports a customer-centric focus, collects and analyses the right data, and develops a flexible and open-minded approach to change in a dynamic environment. Addressing knowledge gaps by hiring and training staff, developing a matrix to assess employees' suitability for specific tasks, and focusing on organisational performance metrics also seems important factors in adopting I4. Therefore, it can be seen that developing an integrated and open organisational culture that values collaboration and innovation is critical for manufacturing SMEs to remain competitive, meet evolving customer needs and maximise their growth potential.

5.14 Chapter Summary

The presentation of the collected data in this Chapter 5 has demonstrated that the composition of expert opinions on the existing and preferred organisational culture, combined with the professional

experience of the experts in the adoption of I4, allows for an appropriate mix of qualitative and quantitative data. In the Chapter 6, the collected data sets presented in Chapter 5 will serve as the basis for conducting a mixed method data analysis, aimed at formulating the key factors of organisational culture in manufacturing SMEs in the automotive industry.

Chapter 6 Mixed Method Analysis

6.1 Chapter Introduction

This chapter discusses qualitative and quantitative findings and the combined conclusion on grounded theory. This chapter provides critical knowledge for managers of manufacturing SMEs in adopting I4 in terms of underlying organisational culture derived from the survey results and key factors of organisational culture for the successful diffusion of management and technology innovations during the adoption of I4 drawn from the industry expert interviews. The interview questions were derived from the 15 statements of day-to-day business activities in the survey and addressed during the semi-structured interview with 15 managers and experts working in manufacturing SMEs in the automotive industry. It was aimed to relate the interview questions to the activities addressed in the survey by formulating the questions to fit the environment of manufacturing SMEs that are adopting I4 in the automotive industry. The key factors of organisational culture that emerged after data processing using grounded theory are discussed by supporting survey results. This chapter is to conduct a mixed-method analysis that involves qualitative and quantitative data analysis and results. Further, the findings are embedded to draw conclusions and to contribute to the new knowledge generation for key factors of organisational culture in successful diffusing management and technology innovations during the adoption of I4 in manufacturing SMEs in the automotive industry. Furthermore, the survey aims to determine the scope of existing and preferred organisational culture with consideration of the impact of the global Covid-19 pandemic outbreak on 84 small and medium-sized manufacturing companies in the automotive industry based on the four dimensions of organisational culture - power, role, performance and support orientation. To this end, eleven key factors of organisational culture have been developed due to the application of grounded theory and in conjunction with the survey results.

6.2 Key factors of Organisational Culture Emerged as a Result of Grounded Theory

Using the grounded theory approach to analyse the qualitative data, eleven key factors were identified and discussed in the previous chapter based on insights gathered from the research participants. To ensure a comprehensive analysis, a mixed method analysis was employed, incorporating both qualitative and quantitative data. In the following sections 6.3 to 6.13, the relevance of these qualitative findings to the quantitative survey results will be discussed.

6.3 Proposing first Key Factor of Organisational Culture: Openness to Employees Input

6.3.1 Importance of the Discussion

This discussion provides the foundation for understanding the organisation in manufacturing SMEs in the automotive industry from the point of view of the organisational priorities and the key factors of organisational culture during the adoption of I4. The survey results show that the prevailing

organisational culture in SMEs is support oriented. The discussion offers a significant need for improving the organisation's openness with the employees' perspective to successfully adopt I4 in the automotive industry. The discussion also provides insight into the role of organisational culture in the successful integration of I4 with its key aspects in production and business processes on the one hand and in providing perspective and leadership for I4 on the other hand. The discussion also shows that when looking at it from a more holistic view by combining the semi-structured interview and the survey results as a business process change, organisational culture plays a role in changing it.

6.3.2 Discussion Organisational Priorities during Adoption of I4

The qualitative interview consists of 15 questions and is complemented by three optional questions each. The first question of the semi-structured interview is: "How open is management to listening to new ideas from team members about how they would like I4 strategies adopted?". In section 5.3, the openness to employees' input has been explored as part of the organisational culture seen from the managers' perspectives that took part in the qualitative research. Openness as a cultural trait of the organisation refers to the behavioural aspects of the leadership and management of the organisation to encourage or engage all employees in discussions to receive inputs from employees concerning the adoption of I4-related issues. The general perception of the participants was that most manufacturing SMEs in the automotive industry that has successfully adopted technological prioritise to establish a culture of listening. However, the culture of being open to employees' input does not necessarily mean that everything that comes in the form of input and feedback from employees will contribute to the organisation's success. Moreover, processes that integrate the corresponding four aspects of „Transparent System", "Creating a Culture of Listening", "New Ideas and Energy", and "Developing a Digital Strategy", as presented in section 5.3, ought to be installed in manufacturing companies to successfully gauge the input that comes from employees during the adoption of I4 in the automotive industry. Openness is not only encouraging for the employees, but it also adds innovative ideas to the planning and business development (Burcharth, Knudsen, & Søndergaard, 2017). Frequent feedback from the employees results in a collection of ideas. The collection of ideas is based on the employee's understanding and experience, which helps management to improve the business processes and effective implementation of the adoption of I4. At one level, the innovative ideas contribute to organisational growth and increased improvement in manufacturing planning, and at another level, employees are encouraged and motivated by the acknowledgement of their contribution (Bartol & Srivastava, 2002). Acknowledgement of input brings new energy to employees. This creates a perception of being able to contribute and be part of a larger system that leverages their potential and rewards them financially. These organisational behaviours help employees maintain a positive attitude and increase productivity. According to the Survey results as shown in Table 6.1, most of the participants – 89% for existing and 85% for preferred the organisational culture - ranked a “4” for a

support-oriented organisational culture as to members of the organisation are expected to give priority cooperating with the people with whom they work, to solve work and personal problems, and on the other hand 71% for existing and 88% for the preferred organisational culture ranked with a “1” for a role oriented organisational culture as to for carrying out the duties of their jobs; staying within the policies and procedures related to their jobs.

Table 6.1: Survey Question 1 – Ranking of Activities A-D

Members of the organisation are expected to give priority to								
	A		B		C		D	
	Meeting the needs and demand of their supervisors and other high-level people in the organisation.		Carrying out the duties of their own jobs; staying within the policies and procedures related to their jobs.		Meeting the challenges of the task, finding a better way to do things.		Cooperating with the people with whom they work, to solve work and personal problems.	
	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	8	3	60	74	2	2	5	1
<i>2</i>	61	70	7	2	13	8	1	2
<i>3</i>	4	10	10	0	66	65	3	10
<i>4</i>	11	1	7	8	3	9	75	71
<i>Total Obs.</i>	84	84	84	84	84	84	84	84

Note: Based on Harrison and Stokes (1992)

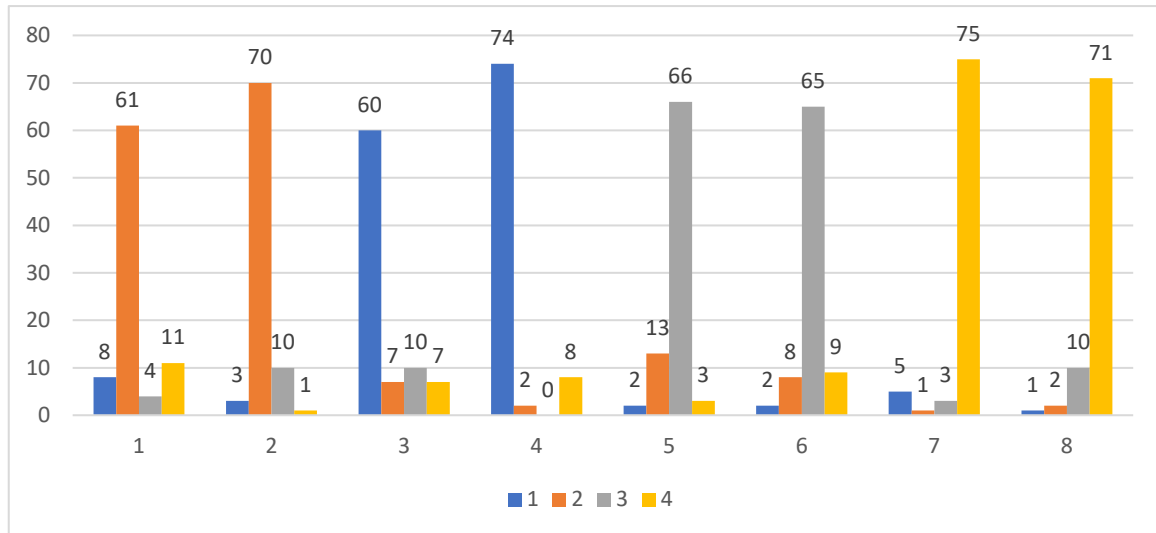


Figure 6.2: Graphical Illustration of Table 6.1

The survey results show that the willingness of the organisation to cooperate in the work environment to solve work and personal problems is high. Still, that lack of knowledge and understanding for doing the job effectively during adopting I4 could present an obstacle. Two types of culture are mentioned in the scorecard, i.e., existing and preferred cultures. Where the score is closely similar in existing and preferred cultures, the organisations are successfully adopting I4, and their existing culture is suitable and preferred by the employees. Openness to employees' input is not limited to contributing to diffusing management and technologically innovative ideas. It also includes a culture that allows employees to question management if they have differing opinions and exhibit less understanding of any new system the organisation adopts. As stated by Veile et al. (2019), I4 is a new system which is not already understood and learnt by all employees during their training and education (Veile, Kiel, Müller, & Voigt, 2019). Therefore, it is obvious to have questions from the employees because they are directly involved in implementing I4. The management's acceptance of feedback on I4 can improve interdepartmental collaboration and encourage employees to propose new ideas for existing work problems. A transparent system is another trait of openness that is one of the positive aspects of a technology-friendly culture. There are various methods and patterns for sharing information, including data sharing by management and maintaining a good trust relationship among employees. In some companies, there is uncertainty about sharing data with employees, but the majority of companies believe that employees cannot perform better until they have access to the data they are working on (Serenko & Bontis, 2016). For this reason, organisations are building trust and sharing data with employees who protect it responsibly. The organisational culture gradually builds on the shared value system. Cabrera et al. (2001) argue that the concept of culture can provide a valuable medium to assess and manage technological change (Cabrera, Cabrera, & Barajas, 2001). Further, the employee's belief in the organisational culture makes it easy to develop the digital transformation strategy (Cabrera et al.,

2001). The communication gap is reduced in such a cultural setting, increasing the possibility of quick learning and adaptation to modern technologies (Jackson, 2011).

6.3.3 Theoretical Meaning and Practical Implication

Proposition 1 proposes a rethinking of the openness to employees' input and its influence on the diffusion of management and technology innovations during the adoption of I4: The level of transparency is not equal in all organisations, which might lead to inconsistencies in digital strategies across the organisations over time. Technological change challenges employees and becomes a compulsory prerequisite for organisations to be consistent across their business landscape. Most questions are raised by employees to managers, inquiring about the nature of the technology system and the reasons for its adoption. Addressing these questions is key to the success of the digital strategy, which is sustained by the increasing involvement of employees in planning, implementing and taking ownership of the I4 adoption process. It can be seen that proposition one has been well-proven through a clear and logical line of thought. However, at the time of completion of this thesis, there are still insufficient case studies to demonstrate the impact of the global COVID-19 pandemic on organisational culture and the adoption of I4 in the automotive industry. The change in the work and business practice world remains to be seen and is subject to further case studies.

6.4 Proposing second Key Factor of Organisational Culture: Practical Strengths of the Organisational Environment

6.4.1 Importance of the Discussion

The survey results show that the prevailing organisational culture in SMEs is support-oriented. The discussion provides critical knowledge on essential elements of practical strengths of organisations in a manufacturing environment, which has been discussed in section 5.4 and is crucial for the successful diffusion of management and technology innovations during the adoption of I4. These elements include flexible organisational culture, new technological knowledge, IT infrastructure at different levels, proper employee training and motivation, and effective customer collaboration. Moreover, it highlights how employees should be motivated to adopt these new practices and technologies within their work environment and organisation. Without this, organisations will likely not succeed in diffusion management or technological innovations during adoption.

6.4.2 Discussion Practical Strength of the Organisations

The second question of the semi-structured interview is: “Can you give an example of which organisational culture factors have proven most effective in managing the tasks in manufacturing SMEs connected with adopting I4?”. In the previous section, 5.4, the practical strength of the organisational

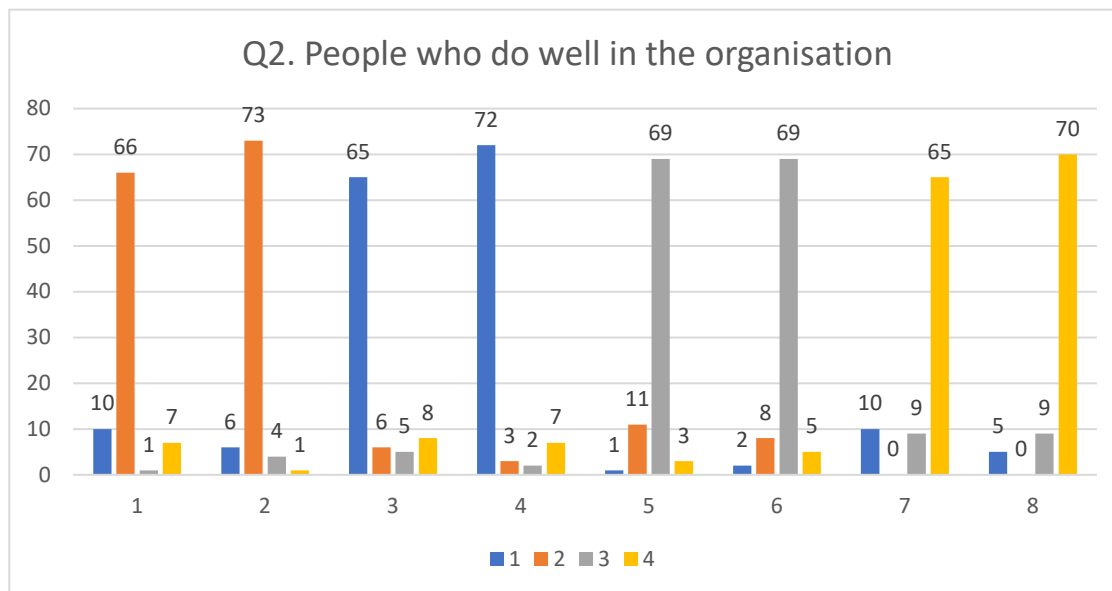
environment in implementing I4 has been examined about the organisational culture as perceived by the managers who participated in the interview. Proceeding from the application of grounded theory to the qualitative data, another key theme emerged as a practical strength of the organisation. This practical strength encompasses the interplay of organisational culture and the management of interconnected human and technological resources to maximise their contribution to the organisations during the adoption of I4. The culture of organisations adopting I4 has distinct patterns and shared values that are helpful for technological transformation and business growth (Oztemel & Gursev, 2020). In the previous section, 5.5, Figure 5.2 illustrated the practical organisational strength, which is composed of elements of a flexible organisational culture that focuses on results and employee motivation, employee monitoring that focuses on performance and attitude, automation and efficiency linkage that focuses on improved productivity and competence development, a customer-centric approach that focuses on customer survey and satisfaction, business analysis that focuses on corporate strength and market-driven organisational growth that focuses on role models and healthy collaboration. Customer and supplier requirements are key imperatives for SMEs (Mulligan & Cormican, 2006). Customers often react strongly to service failures, so an organisation's recovery efforts must be equally strong and effective (A. K. Smith, Bolton, & Wagner, 1999). Developments including rapidly changing and unpredictable market needs and customer preferences, customer expectations for responsiveness, and the connectivity capabilities available to embedded systems are prompting many companies to move from products to services and to continuously introduce new features/benefits that extend the capabilities of existing products and create new business opportunities (Breivold & Sandström, 2015). The approaches and methodologies to keep the customers engaged may vary among the companies, but the purpose is similar in all companies (Berman, 2012). Customer surveys were often conducted to assess certain products and services' perceptions, trends and needs. Frequent customer surveys help to identify the interest and preferences of the customers (R. R. Burke, 2002) and they are included in business planning and product design. Once the customer needs are identified, the companies put their energy into delivering the utmost customer satisfaction (Bolden, Waterson, Warr, Clegg, & Wall, 1997). Hence customer satisfaction was one of the desired outcomes of the firm organisational culture (Yarbrough, Morgan, & Vorhies, 2011). The customer needs are not only understood by the management but also the team members are connected to the management through a culture of flexibility, a friendly working environment and effective communication so that everyone understands them. The trickle-down effect of the customer-centric approach positively affects the employees, who work to respond to customers' interests and expected satisfaction. Market-driven organisational growth is the priority of companies that compete with similar companies. Customer surveys and open market research are essential tools for identifying market trends and planning (Singh, Garg, & Deshmukh, 2008). Business analysis is carried out to understand the current business status and keep the business on track (Baker & Sinkula, 2007). Business analysis is multi-faceted and includes market trends, current

sales, deficits in customer behaviour and growth rates. When deficiencies are identified in sales and services, customer satisfaction and business strategy, companies tend to change their planning accordingly. The use of I4 technologies also contributes to business growth. (Dalenogare, Benitez, Ayala, & Frank, 2018). In a customer-centric organisation, the performance of leadership and employees is linked to customer satisfaction (Walker, Smither, & Waldman, 2008). In such an organisation, management and employees are motivated by increased revenue from customer satisfaction and the rewarding experience of building a supportive culture that fulfils customers' needs. Four categories are mentioned, and participants' responses have been taken to rank these categories in existing and preferred cultures. These categories include managers who can influence and use power and politics; those who work within the system and follow the rules, are technically competent, effective, and committed to finishing the given task appropriately; the fourth category includes those who build a strong collaborative work environment. The first category is not positively perceived because the use of power and politics in an organisational culture is harmful (Pettigrew, 1979). The other categories are related to the employees who feel a sense of ownership and responsibility for better performance and business growth. According to the Survey results as shown in Table 6.2, most of the participants – 77% for existing and 83% for preferred the organisational culture - ranked a “4” for a support-oriented organisational culture as to people who do well in the organisation tend to be those who build a close working relationship with others by being cooperative, responsive and caring, on the other hand, 77% for existing and 86% for the preferred organisational culture ranked with a “1” for a role oriented organisational culture as play by the rules, work within the system, and strive to do things correctly.

Table 6.2: Survey Question 2 -Ranking of Activities A-D

	People who do well in the organisation tend to be those who							
	A		B		C		D	
	Know how to please their supervisor and are able and willing to use power and politics to get ahead.		play be the rules, work within the system, and strive to do things correctly.		are technically competent and effective, with a strong commitment to getting the job done.		build close working relationship with others by being cooperative, responsive, and caring	
	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
1	10	6	65	72	1	2	10	5
2	66	73	6	3	11	8	0	0
3	1	4	5	2	69	69	9	9
4	7	1	8	7	3	5	65	70
<i>Total Obs.</i>	84	84	84	84	84	84	84	84

Note: Based on Harrison and Stokes (1992)



Figure

6.3: Graphical Illustration of Table 6.2

As reflected in Table 6.2 and Figure 6.3, most participants perceive the people who do well in the organisation as support oriented by building a close relationship with others and being cooperative and responsive as an organisational strength. On the other hand, people who do well follow the rules and

adhere to the organisation's existing policies are perceived as least dominant. The reason for this could be multi-dimensional. Firstly, being an innovative company requires that employees have room for creativity and ingenuity to cope with the demands of the tasks involved in adopting I4. This aligns with the importance of a flexible organisational culture, as outlined in the previous section, 6.3. It can be seen that both the perspectives of role and support oriented are not mutually exclusive. As summarised in Figure 5.2, the flexible organisational culture and being customer-centric contribute to the organisation's overall practical strength.

6.4.3 Theoretical Meaning and Practical Implication

Tasks of manufacturing SMEs in the effort to adopt new technology are complex and require precise organisational culture development for their successful implementation. Examining the adopted organisational culture in innovation diffusion, which ought to be an essential part of successful manufacturing organisations, is still insufficiently researched. It can be seen that that proposition two has been well-proven through a clear and logical line of thought. However, the practical strength of the manufacturing organisations and their role in the success or failure of diffusion management are in the current literature not completely comprehended. It can be suggested that the practical strength of manufacturing organisations can be enhanced, as shown in Figure 5.2, with the help of a flexible organisational culture, by combining organisational, technological and social innovations. The flexible organisational culture can be combined by integrating participative and business-oriented elements within the same organisational system. In this way, the advantages of the flexible organisational culture are derived both in technological innovation-diffusion and in market-driven growth during the adoption of I4 in the automotive industry.

6.5 Proposing third Key Factor of Organisational Culture: People Management Strategies and Approaches

6.5.1 Importance of the Discussion

People management strategies involve competing with priorities in daily business life. Choosing one priority over another can lead to the reluctance of aspects of the organisational culture, which is essential for adopting I4. The survey results show that the prevailing organisational culture in SMEs is achievement-oriented. Establishing an organisational culture, as recommended in the previous section, 5.6, can help relieve managers' lives by nurturing the essential aspects of people management strategies. An ongoing assessment of the employees' traits can support skill development tremendously as the adoption of I4 develops. Since the outbreak of the COVID-19 worldwide pandemic, managers have been forced to manage employees in remote and stationary offices. Despite the I4 development, they were never in the working world's history. A situation like this before with the scope of impact has

affected managers this much. Group dynamics in social science are mainly researched with people working in the same physical environment. Many creative Smalltalk's emerged from the random talk with managers and employees during the coffee break are no longer as frequent as they used to be. The effect of the change in paradigms remains to see in the future. Figure 5.3 proposes an approach that heightens managers' awareness of key considerations when establishing organisational culture and implementing people management strategies.

6.5.2 Discussion People Management Strategies and Approaches of the Organisations

The third question of the semi-structured interview is: "How likely is it for a leader in your organisation to empower employees to overcome their personal reservations about new technology and challenges? What factors play a key role in this?". In section 5.6, people management strategies and approaches of the organisation in implementing I4 has been examined concerning the organisational culture as perceived by the managers who participated in the interview. Proceeding from applying grounded theory to the qualitative data, another key theme emerged as people management strategies and approaches of the organisation.

In the previous section, people's management has been discussed as part of the organisational culture seen from the managers' perspectives that took part in the qualitative research. It is diverse and has several subcomponents, including recruitment and training, task assignment and performance evaluation of the employees. Different employees perform distinct functions of the companies therefore managing employees requires knowledge of their personal traits, qualifications, skills, and experience. Organisations included in this study have revealed several procedures adopted and accultured for managing human resources during the adoption of I4. These procedures are positively related to organisational readiness to adopt modern technologies (Lehman, Greener, & Simpson, 2002). The managers mentioned that the selection of human resources is carefully made by assessing personal traits and then providing skill development (Shamim, Cang, Yu, & Li, 2016) training and continuous professional development opportunities. Onsite and offsite worker management is a phenomenon that emerged after the Covid-19 outbreak when people were advised to work from home as a precautionary measure to protect their health (Wang, Liu, Qian, & Parker, 2021). This led to changes in the management structure and, thus, to changes in the organisational culture. Managers have been challenged to develop new strategies for managing on-site and home-based employees. This affected all companies, including manufacturing SMEs. Various management strategies have been developed and used to organise workers who work from home. Participants indicated that they made a concerted effort to get their employees to work from home while not compromising on results. Although this was a challenge, most of the managers could manage it. Organisational culture also includes the nature of on-the-job training, where existing and newly hired employees receive training while performing their jobs. The on-job training for recently employed workers is essential to learn the organisational values,

work ethics and relevant job skills (Hanaysha, 2016). It combinedly formulates the individual attitude best fit for organisational growth. A positive organisational culture helps new employees learn about the organisation and the work environment necessary for adopting I4 technologies. New recruitments are made by assessing the individual's personality traits and their technological skills, interest, and attitude (Hanaysha & Tahir, 2016). Once the employees are recruited, trained, and placed in various positions in the organisation, they are evaluated based on several performance indicators related to their job, organisational behaviour, and productivity. Mentoring is done based on the findings of the performance evaluation (Kamble, Gunasekaran, Ghadge, & Raut, 2020). Performance evaluation is carried out according to the KPIs and the mentoring of employees and professional development training are arranged. Organisations consider employees' personal traits, alignment with the organisational culture, and organisational contribution when assessing their performance. According to the Survey results as shown in Table 6.3, most of the participants – 92% for existing and preferred the organisational culture - ranked a “4” for an achievement-oriented organisational culture as the organisation treats individuals as “associates” or peers who are mutually committed to the achievement of a common purpose, and on the other hand, 95% for existing and the preferred organisational culture ranked with a “1” for a power-oriented organisational culture as to organisation treats individuals as “hands” whose time and energy are at the disposal of persons at higher levels in the hierarchy. The survey indicates that the organisation's power-oriented organisational culture is less preferred. As discussed in the previous section, the management of onsite and offsite workers in the people management strategies can be ineffective for managers to impose power over employees working remotely and in the stationery offices. Also, the organisational priorities and skill development demand more and more ownership from employees, which contributes to the notion that employees in the adoption of I4 are working increasingly independently from their managers and are achievement-oriented.

Table 6.3: Survey Question 3 – Ranking of Activities A-D

The organisation treats individuals								
	A		B		C		D	
	as "hands" whose time and energy are at the disposal of persons at higher levels in the hierarchy.		as "employees" whose time and energy are purchased through a contract, with rights and obligations for both sides.		as "associates" or peers who are mutually committed to the achievement of a common purpose.		as "family" or "friends" who like being together and who care about and support one another.	
Rank	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
	1	2	3	4	5	6	7	8
1	80	80	2	1	1	1	0	0
2	1	2	77	6	6	3	3	2
3	1	1	0	0	0	3	80	80
4	2	1	5	77	77	77	1	2
	84	84	84	84	84	84	84	84

Note: Based on Harrison and Stokes (1992)

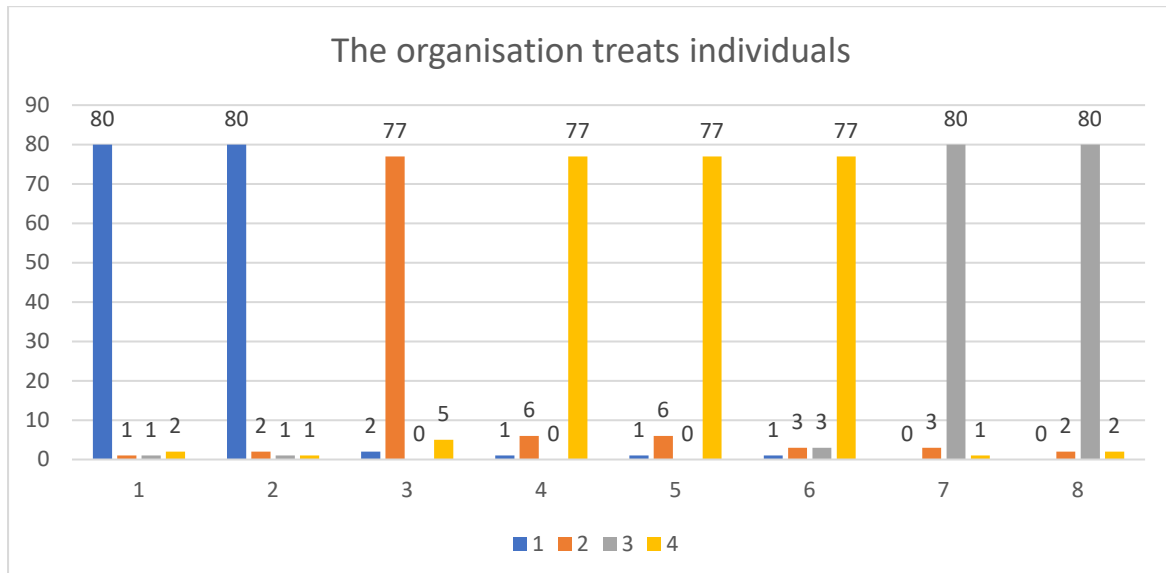


Figure 6.4: Graphical illustration of Table 6.3, Note: By the researcher.

6.5.3 Theoretical Meaning and Practical Implication

The world of work in manufacturing SMEs is continuously changing more than ever due to the impact of COVID-19, which required the SMEs worldwide to maintain their operations during the adoption of I4 with mixed work styles consisting of teams with remote and stationery office workers. Here managers need to maintain a sustainable organisational culture considering the modern aspects of people management strategies in the automotive industry. Figure 5.3 suggests this organisational culture for people management strategies during the adoption of I4 in the automotive sector. It can be seen that considering these aspects provides the practitioners with a guideline on which part of the organisational culture to consider making it key for successful people's management strategies.

6.6 Proposing fourth Key Factor of Organisational Culture: Perceived Methodologies of Decision-Making Process

6.6.1 Importance of this discussion

The discussion underpins the importance of the decision-making process in manufacturing SMEs when adopting I4. The survey results show that the prevailing organisational culture in SMEs is role-oriented. The diffusion of management and technology innovations requires making decisions in a timely and decision-efficient manner. These decisions directly influence the velocity of processes and the financial results the manufacturing SMEs can achieve. Inadequately made decisions are likely to result in errors that lead to suboptimal activities and, therefore, adverse outcomes concerning adopting I4. The influential factors for the decision-making process have been discussed in section 5.7. Hence, it is necessary for the seamless adoption of I4 to consider organisational culture and technology acceptance of the stakeholders, transparency of the digital strategy, onboarding of the stakeholders and fostering interdepartmental collaboration as important factors when conducting decision-making processes in organisations.

6.6.2 Discussion of Decision-Making Process during Adoption of I4

The fifth semi-structured interview question is: *"How would you assess the level of openness or visibility of your decision-making process in your organisation during the adoption of I4?"*. In section 5.7, the perceived methodologies of the decision-making process in organisations during the adoption of I4 in the automotive industry have been examined about the organisational culture as perceived by the managers who participated in the interview. Proceeding from applying grounded theory to the qualitative data, another key theme emerged as perceived methodologies of decision-making process in organisation. While the participatory decision-making process was a prevalent factor in the literature, it was not universally adopted by all organisations. Respondents describe the participatory decision-making of the manufacturing employees as most effective in the event of a technological change in

which input is received by all levels of the organisation, starting with ordinary employees and extending to all levels of the organisation's hierarchy (Bemmels & Reshef, 1991). Policies encourage employees to share their ideas with the management and leadership. The management evaluates the input and ideas received from the team members, and appropriate staff is included in the decision-making and policies of the organisation. It also refers to an organisational culture of inclusivity, a favourable factor for implementing I4 technology (Bai, Dallasega, Orzes, & Sarkis, 2020). Policies encourage employees to share their ideas with the management and leadership. The management evaluates the input and ideas received from the team members, and appropriate staff is included in the decision-making and policies of the organisation. It also refers to an organisational culture of inclusivity, a favourable factor for implementing I4 technology. Companies that have maintained a balanced culture are more suitable and successful in implementing modern technologies (Humphreys, McAdam, & Leckey, 2005). On the other hand, organisations with unorganised and imposed culture face resistance while making decisions about implementing recent technologies (Mittal et al., 2018). Conflict management varies in organisations but is also related to their organisational culture. In organisations with a better and balanced culture and work environment, there is less likely conflict among employees or between management and employees (Rees, Harvard Kennedy School, Kemp, & Davis, 2012). A more constructive organisational culture is characterised by an agreed-upon and coordinated flow of information when communication is two-way, management listens to employees, and employees agree with and follow management's decisions. Therefore, an inclusive culture is better than top-down management (Easterly, 2008). According to the Survey results, as shown in Table 6.4, most of the participants – 76% for the existing and 85% preferred organisational culture - ranked a “4” for an role-oriented organisational culture as to people are managed, directed, or influenced by their commitment to achieving the goals of the organisation, and on the other hand, 86% for the existing and the 77 % preferred organisational culture ranked with a “1” for a support oriented organisational culture as people are managed, directed, or influenced by the systems, rules, and procedures that prescribed what people should do and the right ways of doing it. The survey indicates that the role-oriented organisational culture is least preferred in the decision-making process. The overall decision-making processes of I4 adoption were discussed in section 5.7, outlining the key aspects, including the stakeholders and customers involved and the different methods perceived by the managers involved. The process itself is found to be multi-layered, encompassing cross-functional aspects of organisational behaviour and the integration of technology into organisations. The role-based organisational culture would limit the decision-making process since it would encourage employees to follow the rules, making them more reluctant to proceed with tasks for which there are no procedures. As shown in Figure 5.4, managers suggest a design thinking process to encourage employees who plan to adopt I4 to project the risk involved in taking or, more importantly, not taking the necessary steps in adopting I4. With this, it is clear that managers are increasingly adopting methods that consider the broader context to manage the

required changes needed on the path to I4. Another important aspect of this process is including customer feedback in the decision-making process. As customer requirements and preferences evolve, a successful organisation involves its members in the process and improves interdepartmental collaboration as required. Employee resistance is higher in organisations where management attempts to impose decisions on employees and does not listen to them (Butt, 2019).

Table 6.4: Survey Question 5 – Ranking of Activities A-D

	Decision-making processes are characterised by							
	A		B		C		D	
	directives, orders, and instructions that come down from higher levels.		the adherence to formal channels and reliance on policies and procedures for making decisions.		decisions being made closed to the point of action, by the people on the spot		the use of consensus decision-making methods to gain acceptance and support for decisions.	
	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	<i>4</i>	<i>3</i>	<i>2</i>	<i>8</i>	<i>5</i>	<i>6</i>	<i>72</i>	<i>65</i>
<i>2</i>	<i>2</i>	<i>8</i>	<i>9</i>	<i>4</i>	<i>68</i>	<i>67</i>	<i>6</i>	<i>7</i>
<i>3</i>	<i>63</i>	<i>72</i>	<i>9</i>	<i>1</i>	<i>6</i>	<i>2</i>	<i>6</i>	<i>11</i>
<i>4</i>	<i>15</i>	<i>1</i>	<i>64</i>	<i>71</i>	<i>5</i>	<i>9</i>	<i>0</i>	<i>1</i>
<i>Tot. Obs.</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>

Note: Based on Harrison and Stokes (1992)

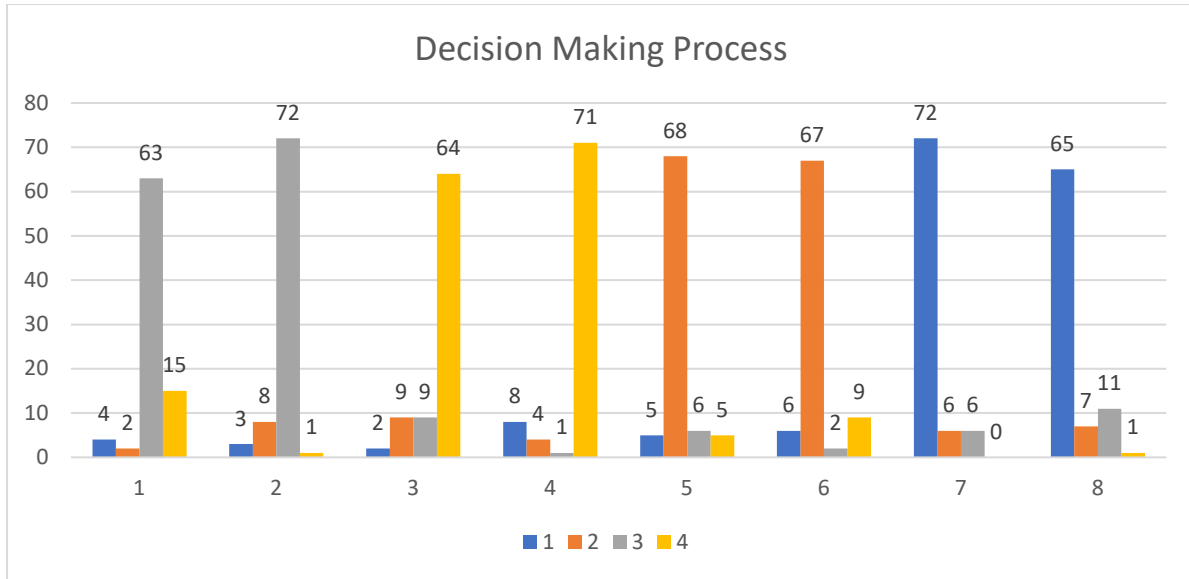


Figure 6.5: Graphical illustration of Table 6.4, Note: By the researcher.

6.6.3 Theoretical Meaning and Practical Implication

The adoption decision-making process is highly complex, with many layers and stakeholders. Each stakeholder has different goals and concerns in the context of I4. To succeed, the adoption decision-making process needs to consider all stakeholders and their needs, especially those sceptical about I4. Therefore, the Organisational Culture is essential for successfully adopting decision-making processes in manufacturing SMEs. The onboarding of the stakeholders in a transparent way will increase the information exchange and reduce mistrust within departments and across the organisation. The alignment of organisational culture with technology acceptance will enhance the success of selecting and implementing management techniques such as Design Thinking, which can be used to mitigate risks related to highly automated processes in a collaborative way between experts and non-experts. This discussion provides practitioners with essential guidance on identifying the factors that influence the decision-making process in I4 adoption and outlines various approaches, as demonstrated in Figure 5.4, to manage this complexity, particularly in onboarding, design thinking, customer involvement, establishing an organisational culture and creating transparency to support the decision-making process - all of which constitute critical success factors for the successful implementation of I4.

6.7 Proposing fifth Key Factor of Organisational Culture: Task Assigning and Performance Management

6.7.1 Importance of this Discussion

This discussion underscores the importance of the task assignment, which is not only limited to managing technological problems but also includes issues related to managing people. Adopting I4 is a

vital process that requires adequate preparation and training of employees to cope with the new tasks and ensure their success. In addition, the adoption of I4 in SMEs raises many practical problems in assigning functions to suitable candidates and managing the performance of employees. Hence, an appropriate management system must be developed to meet these needs. The survey results show that the prevailing organisational culture in SMEs is achievement-oriented. The biggest challenge is fully involving employees in task assignments when implementing I4, which was acknowledged by a few respondents but not fully grasped by organisations. Consequently, when assigning tasks to employees, insufficient attention is paid to the personal skills of employees as well as to the attitude of employees towards new technologies, resulting in an increasing complexity of organisational and managerial processes that is difficult to solve in practice without a strategic plan. Section 5.8 discussed the key factors for such a strategic plan for assigning tasks and monitoring employee performance that influence employee engagement and participation in the successful implementation of I4.

6.7.2 Discussion of the Influential Factors in Assigning Task Managing Performance

The sixth semi-structured interview question is: *“How do you define the characteristics of suitable employees when you assign them tasks that are in line with the adoption of I4?”*. In section 5.8, the influential factors in assigning task and managing performance during the I4 in the automotive industry has been examined about the organisational culture as perceived by the managers who participated in the interview. Proceeding from the application of grounded theory to the qualitative data, another key theme emerged as the organisation's task assigning and performance management. In the previous section, key factors in task assignment and performance management have been discussed as part of the organisational culture seen from the managers' perspectives that took part in the qualitative research. Growing organisations are faced with new tasks every day, which means that managers must continuously determine which people to involve in new assignments (Ghoshal & Bartlett, 1995). The assignment of tasks by managers depends on the relevance of employees' skills, previous experience, interest in innovative technologies, attitude and behaviour in a given organisational environment, and ability to think critically and evaluate rationally. A key factor in assigning new tasks to employees is the personal skills of the individuals in the organisation. Unique capabilities include the qualifications, skills and knowledge of the individual that is relevant and essential for the assignment of a new task. Managers understand the special skills of employees through their past work experience. As innovative technologies are adopted, employees are often not experts in their application and may need further training. A friendly work environment increases employees' understanding of the need for training and capacity building. Thus, personal skills refer to the interest and ability to learn skills quickly (Grzelczak, Kosacka, & Werner-Lewandowska, 2017). A holistic approach is needed to develop qualification strategies that close the gaps in competencies to meet the challenges of I4. Research findings show that leadership and language skills are the least developed competencies in implementing I4 (Hecklau,

Galeitzke, Flachs, & Kohl, 2016). Technological adoption is more accessible in an organisational culture when the employees have the ability and opportunities for critical thinking because they are willing to accept technological changes and be more able to solve problems (S. Law, 2009). It is also evident from the empirical results that consideration of personal capabilities is essential and ranked higher in existing and preferred cultures when assigning new tasks. According to the Survey results as shown in Table 6.5, most of the participants – 82% for the existing and 83 % preferred the organisational culture - ranked a “4” for an achievement-oriented organisational culture as to the assignment of tasks or jobs to individuals are based on matching the requirements of the jobs with the interests and abilities of the individuals. On the other hand, 83% of the existing and 86% of the preferred organisational culture ranked with a “1” for a role-oriented organisational culture, as assignments of tasks or jobs to individuals are based on the needs and plans of the organisation and the rules of the system (seniority, qualifications, etc.). In contrast to traditional manufacturing SMEs, knowledge workers are viewed by the participants as holding the skills needed for the new tasks, providing the personal skills to cope with the changes caused by the adoption of I4, as well as innovative thinkers who are willing to embrace new things and take the proactive approach to manage the changes. Moreover, the survey indicates that the role-oriented organisational culture is the least dominant in the organisation regarding task assignment and performance management.

Table 6.5: Survey Question 6 – Ranking of Activities A-D

	Assignments of task or jobs to individuals							
	A		B		C		D	
	the personal judgments, values, and wishes of those in positions of power.		the needs and plans of the organisation and the rules of the system (seniority, qualifications, etc.)		matching the requirements of the jobs with the interests and abilities of the individuals		the personal preferences of the individuals and their needs for growth and development.	
	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
Rank	1	2	3	4	5	6	7	8
1	5	10	70	72	0	1	9	2
2	70	70	8	6	5	5	1	3
3	0	2	3	2	10	8	73	73
4	9	2	3	4	69	70	1	6
<i>Total Obs.</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>

Note: Based on Harrison and Stokes (1992)

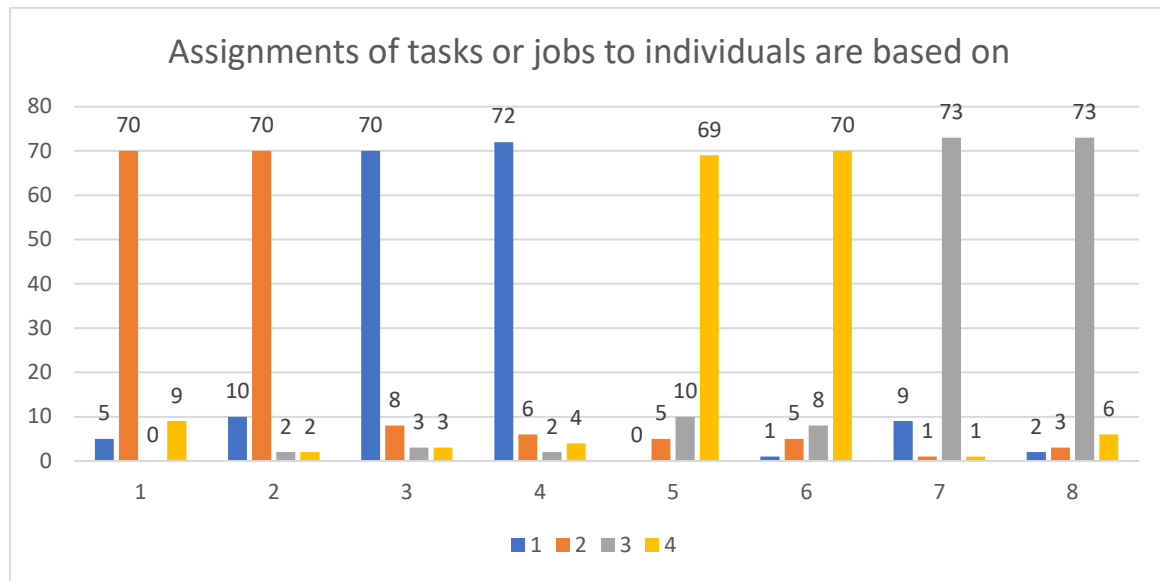


Figure 6.6: Graphical illustration of Table 6.5, Note: By the researcher.

6.7.3 Theoretical Meaning and Practical Implication

This discussion on the importance of task assignment in the successful implementation of I4 has practical implications for manufacturers in terms of (1) selecting suitable candidates for assignments, (2) training employees to cope with new tasks and ensure their success, and (3) managing employee performance. It is essential to consider the role of organisational culture and personal skills in employee engagement when selecting candidates for tasks. In addition, training programmes and development initiatives should be planned according to changes in the work environment created by I4 technologies. Finally, monitoring performance should evaluate formal duties and cover employees' attitudes toward technological change, which can lead to errors or jeopardise a successful implementation of I4. This thesis supports the rationale that organisations tend to use a top-down approach when assigning tasks for the realisation of I4, focusing on technological and formal issues rather than on the personal skills of employees or their attitudes towards new technologies. A successful I4 adoption demands a strategic plan for assigning tasks and monitoring employee performance that includes a holistic approach to organisational culture and the interactions between technology, employees, and management, as demonstrated in Figure 5.5.

6.8 Proposing sixth Key Factor of Organisational Culture: Dynamics of Good Team Players

6.8.1 Importance of this Discussion

This discussion stresses the importance of fostering good team players as an effective means for successfully adopting I4 in manufacturing SMEs. The process of adopting I4, the characteristics of a good team player, the impact of these characteristics on the SME that adopts I4, and their effectiveness

have been discussed in section 5.9. Thus, the velocity with which new management and technology innovations are adopted depends not only on their technical abilities but also on the willingness of the employees working as a team to adopt the technology. The survey results show that the prevailing organisational culture in SMEs is achievement-oriented. The main contribution of this discussion is to illustrate the criticality of the skills, attitudes, and behaviours of good team players in organisations during the adoption of I4 and provide managers and HR managers with a list of behaviours and skills essential to engage good team players.

6.8.2 Discussion of the Dynamics of Good Team Players

The seventh semi-structured interview question is: *“How would you describe your best leadership approach that fosters your employees' commitment and willingness to use digital tools to get things done more effectively in the wake of I4 adoption?”*. In section 5.9, the dynamics of a good team player during the adoption of I4 in the automotive industry have been examined about the organisational culture perceived by the managers who participated in the interview. Proceeding from the application of grounded theory to the qualitative data, another key theme emerged as the dynamics of good team players. In the previous section, key factors in organisational culture and its interconnection with employees' competence and attitudes towards adopting I4 technologies have been discussed as part of the semi-structured interviews with managers in manufacturing SMEs in the automotive industry. The research findings reveal the importance of comprehending the behaviour that can lead to the efficient adoption of I4. The research findings underscore the importance of understanding the type of organisational behaviour exhibited by employees that enables the successful implementation of I4. These characteristics are employee success, understanding of the system, adherence to the Code of Conduct, motivation and commitment, in-depth business knowledge, efficiency and time management, interest and passion for technology, and respect for other colleagues. Good employees enabling a smooth adoption of I4 have a deep understanding of the organisation, the business, working methods, existing market practices, and other similar knowledge. Moreover, they are good at learning new skills and updating their knowledge of new technologies. These employees' behaviour and attitudes reflect compliance with the Code of Conduct. The organisation's rules and policies are well observed and followed, which helps maintain an organisational culture of higher productivity and better results. Employee levels of motivation and commitment are more significant in these categories and produce better results. Employees also have a greater sense of ownership when companies encourage them to participate and recognize them as good employees. According to the research results of qualitative research, another characteristic of good employees is completing tasks on time, which leads to efficiency and effective use of company resources in the implementation of I4. Completing tasks on time increases efficiency and contributes to a better organisational reputation. Such practices positively influence stakeholder perceptions, as well as foster the overall growth of the organisation. Continuous

technological innovation demands employees to be ready for and passionate about technology, as the lack of readiness and passion leads to resistance to technological change. Another characteristic of employees in organisations with suitable work environments and organisational cultures is that they not only show willingness and passion for technology on an individual level but also act as role models for their colleagues so that entire teams can be inspired to embrace I4. Survey results as shown in Table 6.6, most of the participants – 93% for the existing and preferred organisational culture - ranked a “4” for an achievement-oriented organisational culture as employees are expected to be self-motivated and competent, willing to take the initiative to get things done, ready to challenge those whom they report if that is necessary to obtain good results. On the other hand, 94% of the existing and preferred organisational culture ranked with a “1” for a role-oriented organisational culture as employees are expected to be responsible and reliable, carrying out the duties and responsibilities of their jobs and avoiding actions that could surprise or embarrass their supervisors. Moreover, the survey indicates that the role-oriented organisational culture is least dominant in the organisation in the context of being a good employee.

Table 6.6: Survey Question 7 – Ranking of Activities A-D

Employees are expected to be								
	A		B		C		D	
	hard-working, compliant, obedient, and loyal to the interests of those to whom they report.		responsible and reliable, carrying out the duties and responsibilities of their jobs and avoiding actions that could surprise or embarrass their supervisors.		self-motivated and competent, willing to take the initiative to get things done; willing to challenge those to whom thy report if that is necessary to obtain good results.		good team workers, supportive and cooperative, who get along well with others.	
<i>Rank</i>	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	<i>1</i>	<i>2</i>	<i>79</i>	<i>79</i>	<i>1</i>	<i>0</i>	<i>2</i>	<i>2</i>
<i>2</i>	<i>80</i>	<i>79</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>3</i>	<i>1</i>	<i>1</i>
<i>3</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>3</i>	<i>80</i>	<i>78</i>
<i>4</i>	<i>2</i>	<i>2</i>	<i>2</i>	<i>1</i>	<i>78</i>	<i>78</i>	<i>1</i>	<i>3</i>
<i>Total</i>								
<i>Obs.</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>

Note: Based on Harrison and Stokes (1992)

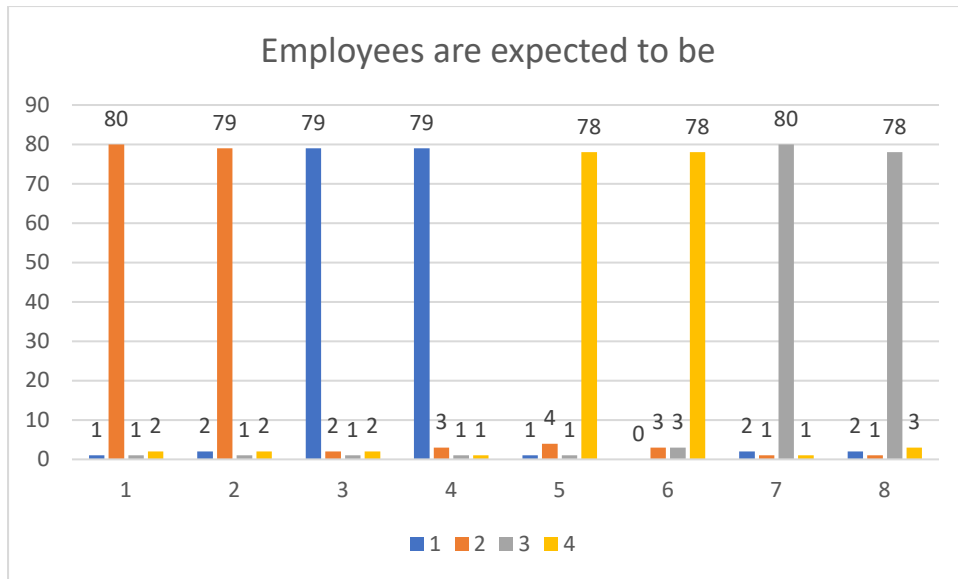


Figure 6.7: Graphical illustration of Table 6.5, Note: By the researcher.

6.8.3 Theoretical Meaning and Practical Implication

The discussion provides managers with comprehensive theoretical knowledge into identifying requirements for a good team player in I4. It also provides practitioners with a list of required skills, attitudes and behaviours for employees to become good team players. It also facilitates the adoption process from traditional business organisations to SMEs adopting I4. The practical implications of the discussion are that it provides managers with a set of procedures to determine the required skills, attitudes and behaviours of good team players that could help bridge the gap between highly innovative organisations and traditional manufacturing SMEs.

6.9 Proposing seventh Key Factor of Organisational Culture: Dynamics of Good Managers

6.9.1 The Importance of this Discussion

There are various theories on what makes a good leader, as it is impossible to specify these qualities for one person for the best leadership during the adoption of I4. However, the traits of a good employee emerged from the interviews and survey results discussed in section 5.10. The survey results show that the prevailing organisational culture in SMEs is role-oriented. The qualities of good managers for an effective adoption of I4 include effective communication with employees, team and customer orientation, people skills and the ability to influence, build and maintain collaboration, and have a positive attitude towards change and innovation. Adopting new technologies without good leadership could lead to failure, recognising that digital strategies may not be aligned with organisational capabilities, resulting in high costs and low productivity.

6.9.2 Discussion of the Dynamics of Good Managers

The eighth semi-structured interview question is: *“What factors indicate that management is actively fostering an organisational culture that builds employees' confidence in using new technologies and encourages them to contribute with their own ideas to become more effective in adopting I4?”*. In section 5.10, the dynamics of good managers during the adoption of I4 in the automotive industry have been examined regarding the organisational culture perceived by the managers who participated in the interview. Proceeding from the application of grounded theory to the qualitative data, another key theme emerged as the dynamics of good managers. In the previous section, key factors in organisational culture and its interconnection with managers' qualities towards adopting I4 technologies have been discussed as part of the semi-structured interviews with managers in manufacturing SMEs in the automotive industry. The comparative analysis of the overall strategies of managers included in this study concerning the adoption of I4 technologies leads to the conclusion that there are significant differences between managers in their process for adopting various technologies that are not limited to the implementation of I4. However, the results of the qualitative analysis suggest that the following key characteristics of managers are among the foremost: Leadership skills and guiding principles, fostering team performance and motivation, establishing, and maintaining a collaborative work environment and strong organisational culture, providing feedback and mentoring, and handling employee diversification. Leadership and vision are among the fundamental qualities of managers. Entrepreneurial vision is a multifaceted phenomenon, including knowledge and ideas about current and future business models (Ibarra, Ganzarain, & Igartua, 2018). Managers in manufacturing SMEs in the automotive industry also need to be able to lead the teams through the adoption process to I4. They form the link between the SME's strategic and operational objectives. That's why any innovative technology is adopted by the managers who prepare their teams to accept modern technologies and learn their practical use in the SME. Team members are not always equally skilled, but managers play an essential role in building teams with diverse skills and creating a learning environment (Oberer & Erkollar, 2018). Adopting new technologies related to I4 is challenging for organisations. However, team members with more expertise in a particular area help other members to learn and improve their skills under the supervision of those managers who understand the needs of the employees and allocate appropriate resources to build the capacity of their team. In this way, good managers motivate their teams, strengthening the organisation's performance. Survey results, as shown in Table 6.7, most of the participants – 90% for the existing and preferred organisational culture - ranked a “4” for a role-oriented organisational culture as managers and supervisors are expected to be impersonal and proper, avoiding the exercise of authority for their advantage. On the other hand, 92% of the existing and 90% of the preferred organisational culture ranked with a “1” for an achievement-oriented organisational culture, as managers and supervisors are expected to be democratic and willing to accept subordinates' ideas

about the task. Moreover, the survey indicates that the achievement-oriented organisational culture is least dominant in the organisation in the context of being a good manager.

Table 6.7: Survey Question 8 – Ranking of Activities A-D

Managers and supervisors are expected to be								
	A		B		C		D	
	strong and decisive; firm but fair.		impersonal and proper, avoiding the exercise of authority for their own advantage.		democratic and willing to accept subordinates' ideas about the task.		supportive, responsive, and concerned about the personal concerns and needs of those whose work they supervise.	
	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	<i>1</i>	<i>0</i>	<i>4</i>	<i>5</i>	<i>77</i>	<i>76</i>	<i>1</i>	<i>0</i>
<i>2</i>	<i>4</i>	<i>6</i>	<i>3</i>	<i>1</i>	<i>3</i>	<i>4</i>	<i>77</i>	<i>77</i>
<i>3</i>	<i>78</i>	<i>78</i>	<i>1</i>	<i>2</i>	<i>0</i>	<i>1</i>	<i>3</i>	<i>4</i>
<i>4</i>	<i>1</i>	<i>0</i>	<i>76</i>	<i>76</i>	<i>4</i>	<i>3</i>	<i>3</i>	<i>3</i>
	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>

Note: Based on Harrison and Stokes (1992)

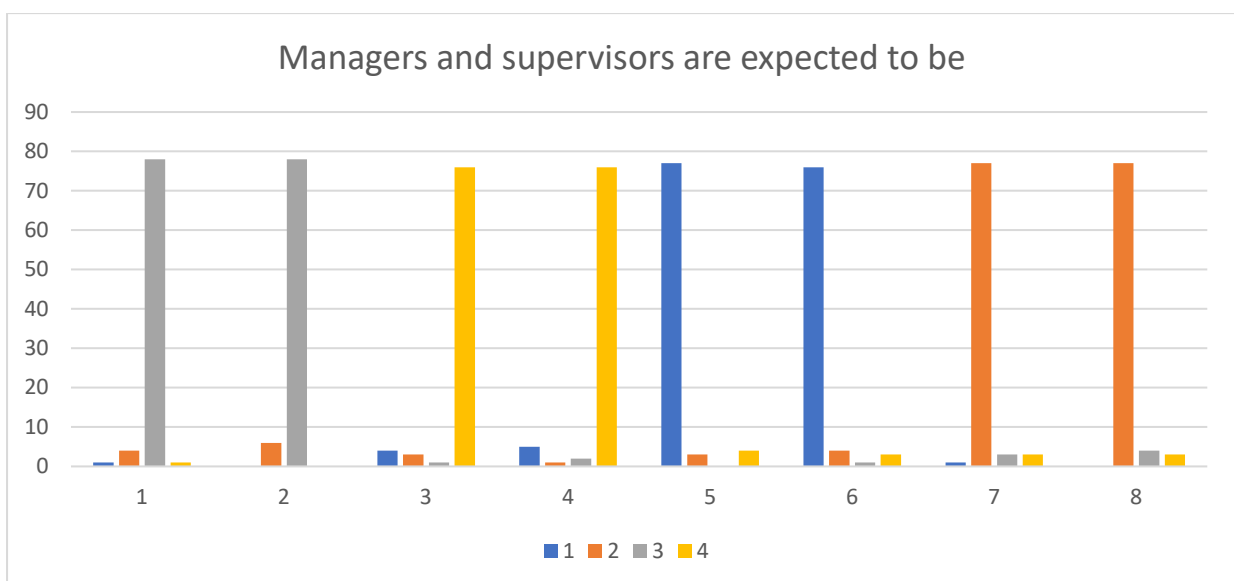


Figure 6.8: Graphical illustration of Table 6.7, Note: By the researcher.

6.9.3 Theoretical Meaning and Practical Implication

The theoretical meaning of this discussion is to define good leadership during the adoption of I4 for focus on specific business processes in manufacturing organisations, from which managers of SMEs will be able to identify and apply management practices, skills and methods that are to support their knowledge as well as their understanding about the adoption of I4. It can be seen that the value of the findings lies in recognising the limited focus on good leadership compared to extensive study of good management practices, particularly concerning the successful adoption of I4 in the automotive industry. Therefore, this research fills a gap by identifying good management and characteristics, as shown in Figure 5.7, which leads to the successful adoption of I4.

6.10 Proposing eighth Key Factor of Organisational Culture: Learning and Knowledge

Sharing Culture

6.10.1 Importance of this Discussion

The discussion provides the foundation for learning and sharing culture in manufacturing SMEs when adopting I4 in the automotive industry. The survey results show that the prevailing organisational culture in SMEs is achievement oriented. Employees' responsibilities could change significantly in the adoption of I4. The same job role could be performed differently in different organisations due to the increasing demands of flexible job roles and performance requirements. Organisations with a strong learning culture can leverage internal and external resources to develop employees' skills to achieve more efficiently. The essential findings are that the demand for skill development plays a role in the turbulent competitive environment of diffusion management and technology innovations, where fast-moving technologies are used for competitive advantage and where knowledge is shared and reused among competitors. Such an environment is shown in Figure 5.8, which encourages learning and sharing culture in manufacturing SMEs.

6.10.2 Discussion of the Learning and Knowledge Sharing Culture

The ninth semi-structured interview question is: *“How can management foster a culture of knowledge sharing by encouraging stakeholders with more knowledge and experience to guide others on how to do their job more effectively when adopting I4?”*. In section 5.11, the learning and knowledge-sharing culture during the adoption of I4 in the automotive industry has been examined about the organisational culture perceived by the managers who participated in the interview. Proceeding from the application of grounded theory to the qualitative data, another key theme emerged as learning and knowledge sharing culture. In the preceding section, the semi-structured interviews with managers in small and medium-sized enterprises in the automotive sector discussed the organisational culture of learning and knowledge sharing in the context of adopting I4. However, the findings of the qualitative analysis

indicate that a culture of shared learning and knowledge sharing in manufacturing SMEs is positively associated with the effectiveness of I4 adoption. The state of knowledge and technology is constantly changing. Therefore, the learning and knowledge-sharing culture are essential for organisational and business progress (C. C. Law & Ngai, 2008). Various methods for learning and sharing knowledge are used, including traditional learning methods, digital transformation workshops, and other training programs. Organisations have also defined the principles of knowledge sharing to distinguish between information knowledge and data (Ayala, Paslauskis, Ghezzi, & Frank, 2017). The concept behind this distinction is to improve employee skills without conflict. When knowledge, information, and data were distinctively defined, the employees understood their position and role. The inside is more concerned with learning, polishing, and implementing new skills for business growth. The information is more related to day-to-day updates and facts about the business and market, while the data relates to business, sales, finances, and market trends. There was no one best leadership style in all situations. Leaders must broaden their range of perspectives by listening, embracing open-mindedness, and applying different leadership styles needed in other cases appropriately. The organisation's management will be as successful as it can in creating a culture that can adapt its thinking and practices according to changing circumstances (Michna & Kmiecik, 2020). Traditional methods of knowledge sharing include the documents that managers provide to their team members. These documents are mostly instruction manuals or articles about innovative technologies and new capabilities (Ayala et al., 2017; Lepore, Dubbini, Micozzi, & Spigarelli, 2022). The research findings from the qualitative analysis indicate one of the most effective methods of gaining buy-in from stakeholders is to invite a digital transformation workshop across organisations of the connected value chain. These workshops aim to share best practices, experiences, knowledge, and insights with the people involved. These workshops also align the overall project team with its culture, knowledge, and experience with digital transformation. These workshops help the stakeholders and the project team understand each other's expectations and align their efforts to implement I4. The respondents consider the automotive industry a successful 'learning organisation' developed in a complex market environment with constant technological change. The manufacturing SMEs' continuous development and adoption of new technologies, such as I4, have created a shift towards knowledge-sharing within and outside their organisational structures. Based on the respondents' view, the implementation of Industrial 4.0 has impacted the culture of knowledge sharing within and outside the organisations, focusing on how this affects benefits such as increased innovation, increased product quality, reduced production costs, improved customer service experience and happier employees. Survey results as shown in Table 6.8, most of the participants – 82% for the existing and 88% preferred organisational culture - ranked a “4” for an achievement-oriented organisational culture as it is considered legitimate for one person to tell another what to do when they have more excellent knowledge and expertise and use it to guide the other person or to teach them to do the work. On the other hand, 83% of the existing and 82% preferred organisational culture ranked

with a “1” for a power-oriented organisational culture, as it is considered legitimate for one person to tell another person what to do when they have more power, authority, or “clout” in the organisation. Moreover, the survey indicates that the power-oriented organisational culture is least dominant in the organisation in the context of learning and knowledge-sharing culture.

Table 6.8: Survey Question 9 – Ranking Activities A-D

It is considered legitimate for one person to tell another what to do when								
	A		B		C		D	
	he or she has more power, authority, or "clout" in the organisation.		it is part of the responsibilities included in his or her job description.		he or she has greater knowledge and expertise and uses it to guide the other person or to teach him or her to do the work.		the other person asks for his or her help, guidance, or advice.	
	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture	Existing culture	Preferred Culture
Rank	1	2	3	4	5	6	7	8
1	70	69	8	13	2	3	7	2
2	6	11	67	67	9	3	1	2
3	2	4	6	1	4	4	72	75
4	6	0	3	3	69	74	4	5
	84	84	84	84	84	84	84	84

Note: Based on Harrison and Stokes (1992)

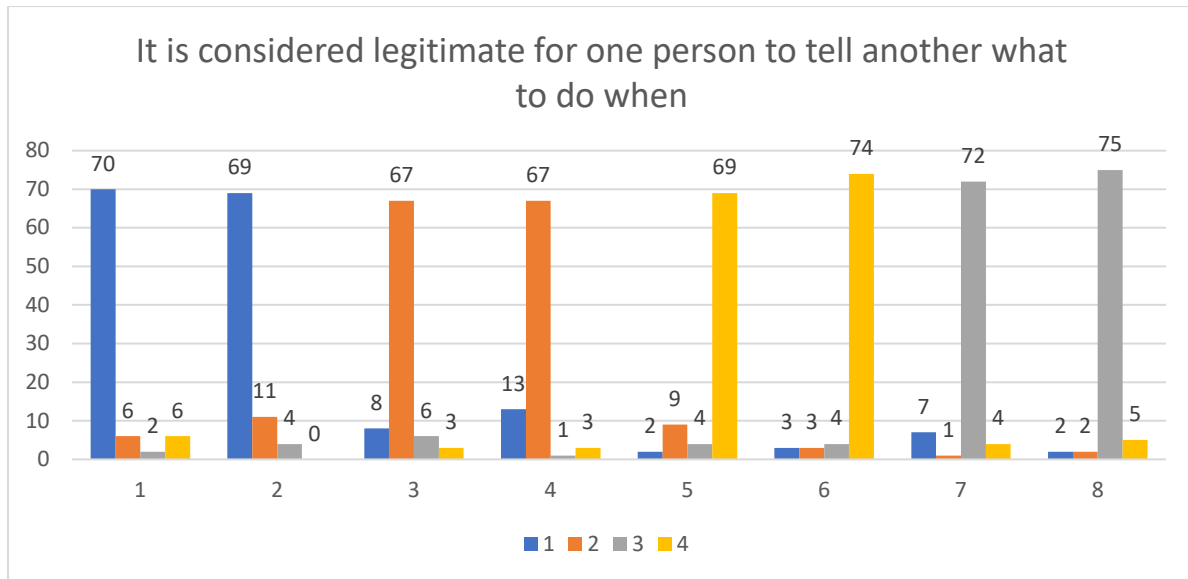


Figure 6.9: Graphical illustration of Table 6.8, Note: By the researcher.

6.10.3 Theoretical Meaning and Practical Implication

The culture of sharing between employees and stakeholders is vital to the adoption of I4 in the automotive industry, which requires a well-defined business and digital strategy for its successful adoption in SMEs. The culture of sharing, as shown in Figure 5.8, can encourage employees to engage in service-oriented activities and improve employee work performance, create a positive business environment and develop a culture of trust and mutual engagement between all stakeholders. The findings also provide practical guidance to managers and practitioners working in SMEs with limited resources in developing a shared knowledge management system for I4 manufacturing activities and guide how SMEs in the ecosystem can establish a culture of mutual engagement and build trust between different stakeholders.

6.11 Proposing ninth Key Factor of Organisational Culture: Maintaining an Energetic and Motivated Work Environment

6.11.1 Importance of this Discussion

This discussion underlines the importance of employee motivation and engagement for implementing I4 in the automotive industry in the context of the organisational cultures of manufacturing SMEs. The essential findings are that employees' motivation, commitment, and work environment perceptions are critical for manufacturing SMEs to fulfil their mission and objectives toward adopting I4. The survey results show that the prevailing organisational culture in SMEs is achievement-oriented. Factors such as intrinsic and extrinsic motivation, appreciation and reward for the higher outcome, sense of recognition, building trust and having an open-door policy have been discussed in section 5.12. The

value of the findings lies in their implication for the acceptance and implementation of I4 and their contribution to the ecosystem of manufacturing SMEs in the automotive industry.

6.11.2 Discussion of the Motivation and Commitment of the Employees

The tenth semi-structured question interview is: *“What do you think are the key motivational factors for the stakeholders in your organisation to be engaged to achieve measurable success in adopting I4?”*. In section 5.12, the motivation and commitment of the employees during the adoption of I4 in the automotive industry have been examined about the organisational culture as perceived by the managers who participated in the interview. Proceeding from the application of grounded theory to the qualitative data, another key theme emerged as the maintaining energetic and motivated work environment.

In the preceding section, the semi-structured interviews with managers in small and medium-sized enterprises in the automotive sector discussed the motivation and employee commitment in the context of adopting I4. The role of motivational climate and sense of belonging in manufacturing employees in the automotive business can significantly influence the willingness to change during the adoption of I4. In particular, the research findings of the qualitative analysis indicate that employee commitment to changes is influenced by organisational culture during the adoption of I4. The results show that a lack of appreciation and rewards for a job well done and not feeling like an essential part of an organisation are associated with low commitment to change at work. Qualitative behavioural analysis is one of the key tasks of the managers and leaders involved in the study to understand employee attitudes and intrinsic and extrinsic motivation factors, and thus to address the specific needs of employees to implement I4 successfully. Motivation strategies based on the results of such behavioural analysis are then developed and become part of the organisation's regular work environment and culture. The factors that discourage employees and cause frustration are also identified and prevented on the organisation's side. While most managers interviewed listed the positive and negative aspects and implemented them to maintain a healthy work environment and culture, managers sometimes reveal they are not fully satisfied. Discontent and frustration among employees indicate a conflict between employees and management. The organisations that have successfully implemented I4 technology have made more effective arrangements for employee motivation, organisational culture, and positive employee attitudes. On the other hand, the organisations planning to implement or have already started to implement have more problems with employee satisfaction and internal collaboration. This is also seen as an obstacle to the introduction of I4. Recognition and remuneration are two distinct forms of employee appreciation, with financial compensation being the most impactful. While most organisations have a remuneration system, a type of appreciation system, not all organisations have effective recognition and reward programs in place. It includes occasional checks, bonuses, and salary increases. Employees tend to be attracted to and positively influenced by monetary rewards. The non-monetary tips and appreciation are in the form of certificates of appreciation, sponsored trips, training,

family vacations, etc. Other motivational factors and activities include trust-building, recognition and listening to the employees without maintaining hierarchies. Trust-building is a key factor that intrinsically affects employees and increases their energy. The recognition of employees and a sense of being part of an extensive system also strengthen the bond between the organisation and employees, as evident from experiences shared by managers. If the employees have issues, they can discuss them with their managers or the leadership because most organisations have set an open-door policy that allows employees access to their managers, bosses, and higher leadership. Survey results as shown in Table 6.9, most of the participants – 94% for the existing and 92% preferred organisational culture - ranked a “4” for an achievement-oriented organisational culture as work motivation is primarily the result of strong desires to achieve, to create, and to innovate and peer pressure to contribute to the success of the organisations. On the other hand, 95% of the existing and 93% preferred organisational culture ranked with a “1” for a power-oriented organisational culture as work motivation primarily the result of hope for rewards, fear of punishment, or personal loyalty to the supervisor. Moreover, the survey indicates that the power-oriented organisational culture is the least dominant in the organisation in the context of the motivation and commitment of the employees.

Table 6.9: Survey Question to Work Motivation is Primarily the Result of.

	Work motivation is primarily the result of							
	A hope for rewards, fear of punishment, or personal loyalty to the supervisor.		B Acceptance of the norm of providing a "fair day's work for a fair day's pay".		C strong desires to achieve, to create, and to innovate and peer pressure to contribute to the success of the organisation.		D people waiting to help others and to develop and maintain satisfying working relationships.	
	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	<i>80</i>	<i>78</i>	<i>1</i>	<i>2</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>
<i>2</i>	<i>1</i>	<i>3</i>	<i>79</i>	<i>77</i>	<i>1</i>	<i>1</i>	<i>3</i>	<i>4</i>
<i>3</i>	<i>2</i>	<i>2</i>	<i>2</i>	<i>2</i>	<i>3</i>	<i>5</i>	<i>79</i>	<i>77</i>
<i>4</i>	<i>1</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>79</i>	<i>77</i>	<i>1</i>	<i>2</i>
<i>Total Obs</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>	<i>84</i>

Note: Based on Harrison and Stokes (1992)

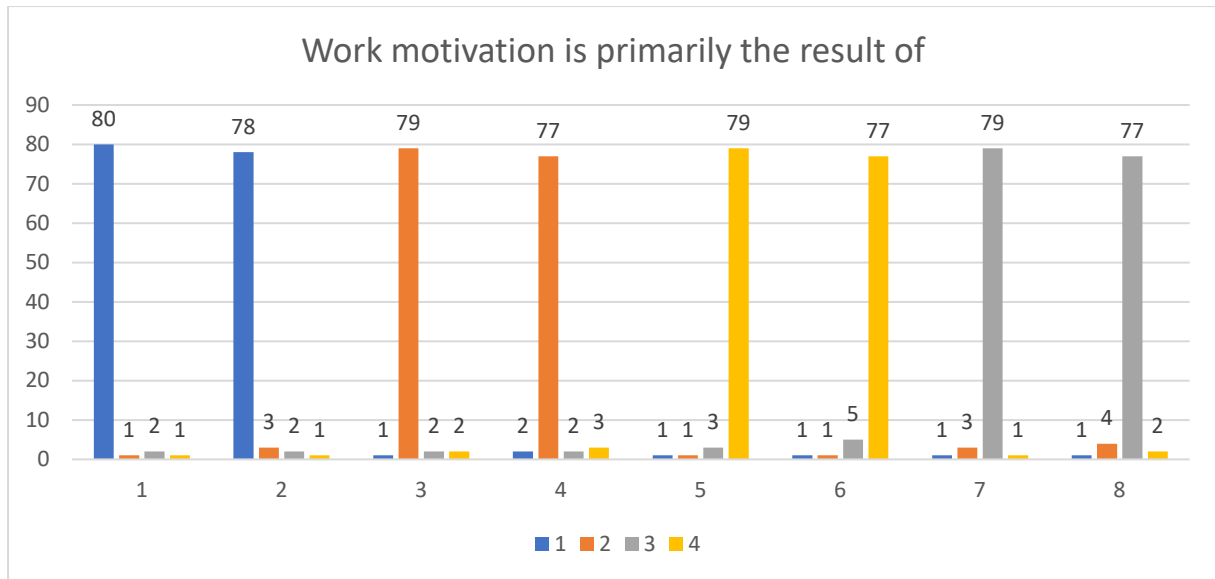


Figure 6.10: Graphical illustration of Table 6.9, Note: By the researcher.

6.11.3 Theoretical Meaning and Practical Implication

This discussion indicated that formulating the strategic plan, as shown in Figure 5.9, is a key factor that will motivate and engage employees in the organisation of manufacturing SMEs towards adopting I4. The practical implications are to target improving employees' motivation and commitment through various forms such as communication, training, employee engagement, recognition and building trust among employees and all stakeholders involved to implement concerted efforts to adopt I4 in manufacturing SMEs effectively.

6.12 Proposing tenth Key Factor of Organisational Culture: Managing Organisational Differences

6.12.1 Importance of this Discussion

The discussion provides critical knowledge for managers of manufacturing SMEs during the adoption of I4 regarding the underlining organisational culture reflected in the survey results and managing organisational differences derived from the expert interviews.

The discussion provides six key components for managing organisational differences for manufacturing SMEs in adopting I4 in the automotive industry. In section 5.13, these key components have been discussed. The Survey results revealed that the most dominant organisational cultures are achievement oriented. Furthermore, this discussion provides critical knowledge for carefully considering the current and future diversity challenges to achieve a common understanding of the business objectives among different organisations, including partners and customers of the manufacturing SMEs in the automotive industry. The key to success is to enable a unified culture across organisations along the value chain.

The organisational structure and practices deeply affect a unified culture, closely linked to an environment of trust and confident cooperation among business partners and employees. To avoid conflicts, it is essential to identify common business goals, as shown in Figure 5.10 and create a shared understanding within the organisation to enable a collaborative approach to adopt I4 across organisations.

6.12.2 Discussion of the Diversity and Conflict Management

The eleventh semi-structured question interview is: *“Do you think that organisational culture has the potential to mitigate a mutual indifference amongst the individuals in the adoption of I4?”*. In the preceding section, the semi-structured interviews with managers in small and medium-sized enterprises in the automotive sector discussed diversity and conflict management in the context of adopting I4. In section 5.13, the diversity and conflict management during the adoption of I4 in the automotive industry has been examined about the organisational culture perceived by the managers who participated in the interview. Proceeding from applying grounded theory to the qualitative data, another key theme emerged as managing organisational differences. Organisations that maintain a consistent organisational culture in which all employees are treated fairly according to their roles, contributions, and attitudes are viewed by participating managers as favourable towards adopting new technologies. Issues such as Discrimination, Prejudice and Unequal Treatment are rare in these organisations. A consistent culture binds the employees of an organisation from different backgrounds working together in various areas and departments. Organisational goals and culture are solid binding forces for implementing I4.

On the other hand, diversity and conflict management have opposite characteristics without a coherent organisational culture. Employees have many complaints about the managers and leadership and a higher level of dissatisfaction due to the communication gap between employees and the management. There is less internal collaboration, employee retention is weaker, and employee contribution is not based on motivation, but management gives orders and rules to maximize output. As a result, there is a lack of cross-departmental collaboration, which poses a barrier to adopting I4 technology. Managers from better companies shared their experiences and reasons behind successfully implementing digital technologies. To retain employees and motivate them to adopt I4, the organisations concerned have introduced guidelines for recognizing individual differences and a culture of acceptance of all differences in terms of origin and background, qualifications, skills and experience, personal characteristics, and all other differences. These guidelines ensure that employees are judged somewhat based on their performance, contribution to the company, attitude, and talent. In addition, intra-departmental collaboration is improved, which can be very beneficial for implementing I4 technology. Although interdepartmental relationships are sometimes competitive, it is a positive competition and even increases employee performance. A culture of better employee management, maintaining

motivation, a reward system, and recognizing and embracing diversity are high-level attributes in a successful organisation as I4 is adopted. As shown in Table 6.10, most participants – 89% for the existing and 96% preferred organisational culture - ranked a “4” for an achievement-oriented organisational culture as the relationship between work groups or departments is generally cooperative when they need to achieve common goals. People usually are willing to cut red tape and cross organisational boundaries to get the job done. On the other hand, 86% of the existing and 93% preferred organisational culture ranked with a “1” for a role-oriented organisational culture as the relationship between work groups or departments is generally characterised by indifference toward each other, helping each other only when it is convenient or when higher levels direct them to do so. Moreover, the survey indicates that the role-oriented organisational culture is least dominant in the organisation in the context of diversity and conflict management.

Table 6.10: Survey Question 11 – Ranking of Activities A-D

	Relationship between work groups or departments are generally							
	A		B		C		D	
	competitive, with both looking out for their own interests and helping each other only when they can see some advantage for themselves by doing so.		characterised by indifference toward each other, helping each other only when it is convenient or when they are directed by higher levels to do so.		cooperative when they need to achieve common goals. People are normally willing to cut red tape and cross organisational boundaries in order to get the job done.		friendly, with a high level of responsiveness to requests for help from other groups.	
	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	4	4	72	78	1	1	8	2
<i>2</i>	72	78	4	3	7	0	1	3
<i>3</i>	2	2	6	1	1	2	75	79
<i>4</i>	6	0	2	2	75	81	0	0
<i>Total</i>								
<i>Obs.</i>	84	84	84	84	84	84	84	84

Note: Based on Harrison and Stokes (1992)

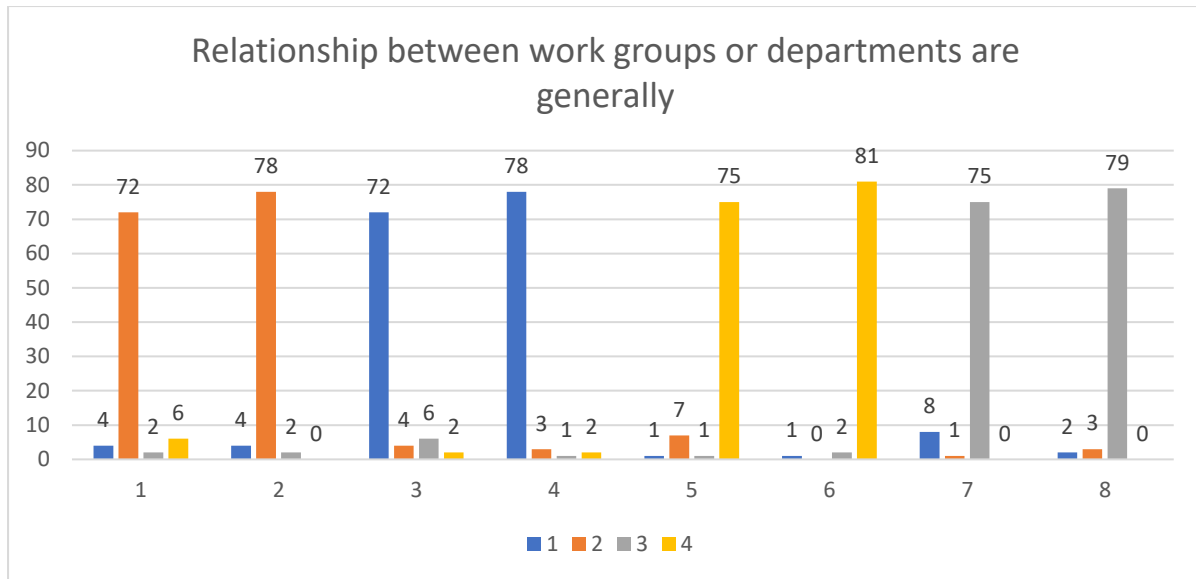


Figure 6.11: Graphical Illustration of Table 6.10, Note: By the researcher

6.12.3 Theoretical Meaning and Practical Implication

This discussion guides practitioners of manufacturing SMEs in deciding on a unified approach for managing organisational differences to achieve their expected business goals and create an integrated organisation. It was essential to develop a shared understanding of what business objectives can be achieved through adopting I4 and developing strategies for integrating different companies' systems to achieve a shared business vision. These approaches must be developed through a strategic partnership between the other parties in the value chain, including partners along the value chain and customers, as shown in Figure 5.10.

6.13 Proposing eleventh Key Factor of Organisational Culture: Survival and Sustainable

Strategies

6.13.1 Importance of this Discussion

The discussion provides critical knowledge for managers of manufacturing SMEs during the adoption of I4 regarding the underlining organisational culture reflected in the survey results and survival and sustainable strategies derived from the expert interviews.

The discussion suggests eight key components of survival and sustainable strategies for manufacturing SMEs in adopting I4 in the automotive industry. In section 5.14, these critical components have been discussed. The Survey result revealed that the most dominant organisational cultures are support oriented. Improved performance of SMEs lies in developing proactive, relevant and sustainable strategies during the adoption of I4 by an environment suitable for the manufacturing SMEs. The key stakeholders in adopting I4 are the organisational stakeholders, partners and customers, which may have

conflicting interests, especially when new business models are introduced to remain competitive in the manufacturing sector. The main contribution of this discussion is to provide a comprehensive theoretical conception for developing proper strategies relevant for SMEs, to survive the digital transformation in the manufacturing and automotive business. The key to success is filling the knowledge gap between what stakeholders (organisational stakeholders, partners and customers) know about I4 and how to transfer this knowledge into cost-efficient business models considering the influential factors as shown in Figure 5.11.

6.13.2 Discussion of the Business Sustainability during the Adoption of I4

The thirteenth semi-structured interview question is: *“What are the key organisational culture factors for the excellent alignment of your organisation with external partners, suppliers, and customers to achieve effective adoption of I4?”*. In section 5.14, the business sustainability of a manufacturing SME during the adoption of I4 in the automotive industry has been examined about the organisational culture perceived by the managers who participated in the interview. Proceeding from applying grounded theory to the qualitative data, another key theme emerged as the survival and sustainable strategies. Sustainability is not the sole factor; the results of the qualitative analysis indicate that various components of the business, systems, visions and operations influence it. Sustainability is understood as the survival of a company in a competitive market. According to participating managers, digital transformation is closely linked to sustainability, as rapidly changing market trends need to be addressed by manufacturing SMEs. In this regard, the specific efforts of firms to sustain their business and survive in the market include a detailed market analysis, a growth policy aligned with the market, an understanding of customer needs with changing interests, and organisational culture oriented toward maintaining healthy work relationships and communication with customers, respect for all stakeholders, employee satisfaction, and an analysis of business threats. The selected manufacturing SMEs have shown their position as strong in most of the mentioned factors though not every organisation implements every component. Most selected organisations consider crucial aspects such as market analysis and relevant policy formulation, employee satisfaction, learning and knowledge sharing in the same culture and maintaining customer satisfaction. Business strategies also include emerging technologies and market-responsive digitization of the system to preserve competition and compatibility during the adoption of I4. All these activities and factors are combined into a single organisational culture by ideal organisations.

The adoption of I4 is inevitable in the current scenario if SMEs want to be competitive and maintain their sustainability. Technological change is the most critical factor for the participating managers, as SMEs quickly adopt emerging technologies, and outdated technologies no longer offer an advantage in the competitive market. The organisational culture's overall picture reflects these factors for survival and business growth while adopting I4. The market environment of SMEs in the automotive

manufacturing sector is a complex system in which there is a brutal struggle for survival, requiring constant efforts to keep up with the technological changes needed to adopt I4. Survey results as shown in Table 6.11, most of the participants – 82% for the existing and 86% preferred organisational culture - ranked a “4” for a support-oriented organisational culture as to the larger environment outside the organisation respondent to thought it were a community of interdependent parts in which the common interests are the most important. On the other hand, 88% of the existing and 88% preferred organisational culture ranked with a “1” for a power-oriented organisational culture as to the larger environment outside the organisation is respondent to as though it were a jungle, where the organisation competes for survival with others. Moreover, the survey indicates that the power-oriented organisational culture is least dominant in the organisation in the context of business sustainability during the adoption of I4 in the automotive industry.

Table 6.11: Survey Question 13 – Ranking of Activities A-D

The larger environment outside the organisation is responded to as though it were								
	A		B		C		D	
	a jungle, where the organisation is in competition for survival with others.		an orderly system in which relationships are determined by structure and procedure and where everyone is expected to abide by the rules.		a competition for excellence in which productivity, quality, and innovation bring success		a community of interdependent parts in which the common interests are the most important.	
	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture	Existin g culture	Preferre d Culture
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
<i>1</i>	74	74	4	6	1	1	4	2
<i>2</i>	7	6	7	8	71	70	2	3
<i>3</i>	2	2	67	68	5	6	9	7
<i>4</i>	1	2	6	2	7	7	69	72
<i>Total</i>								
<i>Obs.</i>	84	84	84	84	84	84	84	84

Note: Based on Harrison and Stokes (1992)

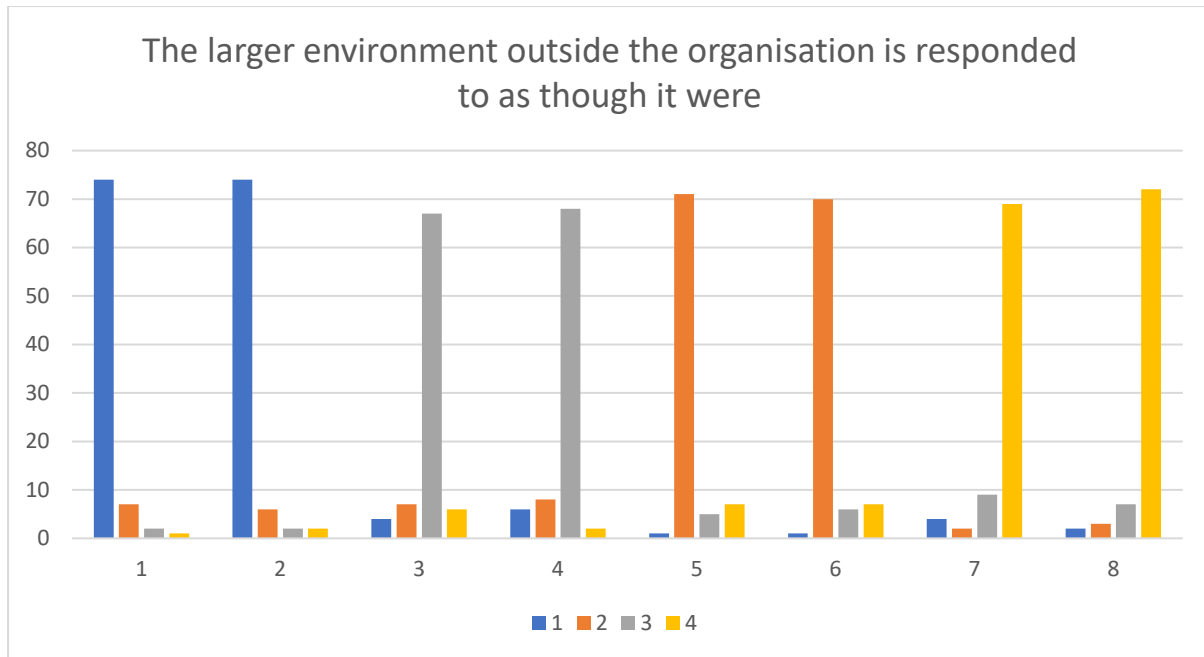


Figure 6.12: Graphical illustration of Table 6.11, Note: By the researcher

6.13.3 Theoretical Meaning and Practical Implication

The theoretical meaning of this discussion is to present objective academic guidance on developing sustainable strategies based on analysing what is known about I4 to stay competitive intellectually and financially during the adoption process. The key challenges for practitioners were to identify the most critical factors influencing the survival and sustainable strategies of manufacturing SMEs during the adoption of I4 in the manufacturing sector and to fill the knowledge gap between organisational stakeholders and customers in terms of understanding how to transfer this knowledge into cost-efficient business models. To implement a successful strategy, it was necessary to develop a complete understanding, including the key aspects, as shown in Figure 5.11, of what different stakeholders (organisational stakeholders, partners and customers) need to know to fill the knowledge gap between the current and future business challenges along the way to the adoption of I4.

6.14 Chapter Summary:

The rigorous examination of data outlined in Chapter 6 unveils an intricate interplay between two central elements: Primarily, the survey findings shed light on the existing and the preferred organisational cultural dimensions, focusing on the considerable impacts of the COVID-19 pandemic. Concurrently, the emergence of eleven distinct key organisational culture factors integral to successfully adopting I4, as delineated in Section 5, augments this multifaceted understanding. The convergence of these essential elements gives rise to a comprehensive framework, effectively depicted in Figure 6.13. This PRAS framework serves as a robust guide, paving the way for the

successful integration of management and technological innovations within the industry landscape of manufacturing SMEs navigating the successful diffusion of management and technology innovations during the adoption I4 in the automotive sector.

Four Organisational Dimensions:

P = Power Oriented

R = Role Oriented

A = Achievement Oriented

S = Support Oriented

#	Key Factors of Organisational Culture	most preferred (rated a "4")		least preferred (rated a "1")
		Existing Organisational Culture	Preferred Organisational Culture	Preferred Organisational Culture
1	Openness to Employees Input	S	S	R
2	Practical Strengths of Organisational Environment	S	S	R
3	People Management Strategies and Approaches	A	R, A	P
4	Perceived Methodologies of Decision-Making Process in Organisation	R	R	S
5	Task Assigning and Performance Management	A	A	R
6	Dynamics of Good Team Players	A	A	R
7	Dynamics of Good Managers	R	R	A
8	Learning and Knowledge Sharing Culture	A	A	P
9	Maintaining an Energetic and Motivated Work Environment	A	A	P
10	Managing Organisational Differences	A	A	R
11	Survival and Sustainable Strategies	S	S	P

Figure 6.13: PRAS Framework - Proposed Set of Key Factors of Organisational Culture Categorised by Four Cultural Dimensions.

Chapter 7 Conclusion and Further Work

7.1 Achievements

This section presents a summary of the key findings of the thesis in relation to the originally formulated research objectives:

Research Objective 1 serves to fully understand and analyse organisational culture developed by management during the implementation of I4 in SMEs.

The present literature review provides a concise review of the nature of organisational culture and its challenges for manufacturing SMEs in effectively disseminating management and technology innovations during the adoption of I4 in the automotive industry. Previous literature has offered limited research on the impact of organisational culture on the successful diffusion of management and technology innovations during the adoption of I4 by manufacturing SMEs in the automotive industry. Furthermore, it has been found that organisational culture is a vague concept with various meanings used by researchers. This variety has led to several potentially divergent definitions, delaying the development and progress of research on organisational culture in the context of the research topic. It can be seen that the adoption of I4 necessitates a change in mindset, organisational culture, and digital infrastructure in the manufacturing SMEs in the automotive industry. Hence, it has been deemed critical to identify key factors of organisational culture that enable the effective diffusion of management and technology innovations within organisations during the adoption of I4. However, the existing literature does not provide a clear delineation of such key factors, including the impact of external influences such as COVID-19 pandemic. These findings underscore the

significance of this work, which seeks to address the role of organisational culture on the effective diffusion of managerial and technological innovations for successful adopting I4 in the automotive industry.

Research Objective 2 serves to evaluate the extent of the organisational culture in manufacturing SMEs in the automotive industry defined by the management when adopting I4.

The second research objective is to understand the influence and depth of organizational culture, as defined by management, on the effective diffusion of management and technology innovations during I4 adoption. This objective was addressed through a sample survey of 124 managers in manufacturing SMEs in the automotive industry. The data obtained from the 84 SME managers were analysed, and key conclusions were drawn in the previous Chapter 6 based on a mixed method analysis. This objective revealed the crucial role of employee participation in creating a robust organisational culture. However, to build a sense of ownership, commitment, and buy-in from employees, managers need to listen to their ideas and provide them with opportunities for feedback. By addressing employees' input about I4 adoption, managers at automotive manufacturers can deepen existing relationships and create new ones. This dialogue helps foster the practical strength of the organisational environment. It has been found that the organisational environment significantly impacts an SME's ability to innovate and implement I4, providing a competitive advantage. Effective people management strategies were found critical in engaging employees when adopting new technologies, especially given the increasing use of automation, which necessitates fewer workers for tasks previously carried out by humans. The adoption of I4 has the potential to redefine roles and dynamics within organisations, impacting both managers and employees. This research suggests that the concept of good team players as delineated in Section 5.9 may transition to align more closely with the whole organisation rather than specific roles. This shift is likely to result in altered team behaviours and operationalised processes. Furthermore, "good managers" as delineated in Section 5.10 might need to adapt their leadership styles' to focus more on processes over people and emphasise the effectiveness of teams rather than individual workers. It was found that this research objective has contributed significantly to understanding the intersection of organisational culture, relationships between managers and employees, and I4 adoption within the manufacturing SMEs in the automotive industry.

Research Objective 3 serves to identify, analyse and evaluate key factors of organisational culture which enable a successful implementation of I4 in manufacturing SMEs in the automotive industry.

This research objective was focused on analysing elements of organisational culture that enable effective diffusing of management and technology innovations for successful adoption of I4 in

manufacturing SMEs in the automotive industry. The research analysis resulted in the identification of 11 key themes or concepts of the organisational culture that are crucial for the effective diffusion of management and technology innovations during the successful adoption of I4 by manufacturing SMEs in the automotive industry, including 1) Openness to Employee Input, 2) Practical Strengths of Organisational Environment, 3) People Management Strategies and Approaches, 4) Perceived Methodologies of Decision-Making Process, 5) Task Assigning and Performance Management, 6) Dynamics of Good Team Players, 7) Dynamics of Good Managers, 8) Learning and Knowledge Sharing Culture, 9) Maintaining an Energetic and Motivated Work Environment, 10) Managing Organisational Differences, and 11) Survival and Sustainable Strategies. The 11 key themes or concepts of organisational culture identified by the research play a critical role in concert to ensure the overall success of manufacturing SMEs during I4 adoption in the automotive industry.

Research Objective 4 serves to propose a set of key factors which effects the organisational culture for diffusing management and technology innovations for successful adoption of I4 for manufacturing SMEs in the automotive sector.

This research objective is to identify a set of organisational key factors that enable the manufacturing SMEs for effective diffusion of management and technology innovations for successful adoption of Industry 4.0 in the automotive industry. It was decided to apply the mixed-methods analysis to analyse the results of the grounded theory analysis and conducted a sample survey. The result of the research analysis culminated into the emergence of a comprehensive framework, which is illustrated in Figure 6.13. Specifically, this framework consists of the eleven key themes associated with organizational culture, as outlined in Chapter 5. Moreover, the framework combines four dimensions of organizational culture-power, role, performance, and support orientation-and highlights their significance for the effective diffusion of management and technology innovations for the successful adoption of I4. It was found that this comprehensive framework plays a critical role in concert to ensure the overall success of manufacturing SMEs during I4 adoption in the automotive industry. They provide a valuable framework that SMEs in the automotive industry and other sectors can use to bundle and guide their efforts towards the effective implementation of I4.

In conclusion, this research systematically addressed its four key objectives through a multi-pronged approach. A literature review revealed gaps in understanding the role of organizational culture in I4 adoption in manufacturing SMEs (Research Objective 1). A sample survey of automotive SME managers provided insights into the influence of management-defined existing and preferred organisational culture in manufacturing SME organisations during the I4 adoption (Research Objective 2). Thematic analysis identified eleven key organizational culture factors for successful I4 adoption (Objective 3). Finally, mixed-methods analysis generated a comprehensive framework linking these eleven factors across four cultural dimensions to guide SMEs in effectively adopting I4

(Research Objective 4). By employing a literature review, survey data, qualitative analysis, and a synthesizing framework, this research offers theoretical and practical contributions to navigate the complex role of organizational culture in the successful diffusion of management and technological innovations during Industry 4.0 adoption in automotive manufacturing SMEs.

7.2 Contribution to the New Knowledge Generation

The contribution of this research to the new knowledge generation is provide a comprehensive framework of key factors of organisational culture and dimensions relevant to the effectiveness of the diffusion of management and technology innovations for a successful adoption of I4 in manufacturing SMEs in the automotive industry. The primary outcome and contribution to knowledge are the identification of eleven key factors of organisational culture combined with four cultural dimensions: Power-, Role-, Achievement- and Support-oriented. This framework facilitates a methodological examination of organisational culture from a holistic overview across different stages of I4 adoption. It presents a pragmatic approach to address the prevailing challenges faced by manufacturing SMEs in the automotive sector during I4 adoption, thereby comprehensively contributing to the current body of knowledge. Furthermore, the research provides new insights into the nature of management and technology innovations to better understand their adoption in SMEs during the diffusion of I4, including the impact of the outbreak of COVID-19. Moreover, it highlights organisational culture as a distinctive and prevalent factor in a systematic and structured approach for effective diffusion of innovation in manufacturing SMEs. Aligning with Porter (1996), this research further underscores the necessity of strategic management and guidance in the implementation of I4. The role of strategic leadership is even more pivotal in managing the challenges of balancing legacy and novel I4 technologies in the automotive industry context (Morel et al., 2007; Piccarozzi et al., 2018).

- 1) The theoretical underpinning of this research is that adopting I4 and diffusing management and technology innovations will be facilitated by management's willingness and ability to engage in open dialogue with employees, leading to more excellent shaping and adaptation opportunities for organisational culture. Moreover, to effectively navigate the adoption of I4, management needs to prioritise utilising employee input and engage stakeholders who play vital roles within the connected value chain. By actively involving employees and stakeholders, managers can foster a collaborative environment that facilitates the successful adoption of I4 in the automotive industry.
- 2) This research contributes new theoretical knowledge by emphasizing the importance of a flexible organizational culture in facilitating knowledge exchange during the adoption of Industry 4.0. It also underscores the significance of aligning organizational culture with

strategic leadership and knowledge-sharing for effective performance evaluation.

Furthermore, the study highlights the challenges faced by the automotive industry, such as skill shortages and the impact of the COVID-19 pandemic, emphasizing the need for manufacturing SMEs to develop management skills and leverage information technology systems to enhance efficiency and communication.

- 3) Participatory decision-making in organisational culture fosters collaboration, communication, and coordination among departments. This approach, aligned with the concept of leaders as facilitators, empowered employees with decision-making autonomy and promoted shared responsibility for improved knowledge sharing. Thereby, implementing such a culture can enhance the diffusion of management and technology innovations to successfully adopt I4 in manufacturing SMEs within the automotive industry.
- 4) The successful adoption of I4 required a comprehensive understanding and acknowledgement of the challenges associated with the diffusion of management and technology innovations within manufacturing organisations. Employee willingness to engage with new tasks and management's recognition of individuals' abilities to navigate complexities, solve problems, and complete tasks efficiently were crucial factors. Additionally, personality traits and values, such as assertiveness, efficacy, task orientation, ambition, commitment, and dedication, influence these abilities, aligning with the significance of adaptability for effective organisational performance.
- 5) Identifying specific dynamics of good team players in I4 adoption provides practitioners and researchers with a catalogue of required employee skills, attitudes and behaviours, as depicted in Figure 5.6. These findings contribute to knowledge by fostering a more effective team dynamic in manufacturing SMEs during the adoption of I4. A central dynamic highlighted is the emergence of a collaborative work environment. The research underscores the significance of an organisational culture that fosters mutual trust and cooperation in facilitating effective teamwork and navigating the complexities of I4 adoption, providing valuable insights into the multifaceted nature of diffusing management and technology innovations.
- 6) Establishing a learning and knowledge-sharing culture is a pivotal element in adopting I4, with a strong emphasis on continuous learning as a driver of successful adoption. Effective knowledge management played a crucial role in enhancing the diffusion of management and technology innovations during the I4 adoption process. As a key success factor for the

effective diffusion of management and technology innovations, the workforce has become an essential resource for increasing value creation and organisational performance. To generate new knowledge in manufacturing SMEs and ensure the long-term success of the I4 adoption, employees must have flexible learning opportunities to create innovative ideas.

- 7) The Achievement-oriented cultural dimension is essential for maintaining an energetic and motivated work environment during the adoption of I4. Mapping these dynamics can facilitate effective diffusion of management and technology innovations, integrating employees into growth plans and developing organisational competencies. Furthermore, attention to employees' sentiments, cultural acceptance of innovations, and managing resistance are crucial for the successful adoption of I4 in manufacturing SMEs in the automotive industry, emphasising trust-building and compatibility in the diffusion process.
- 8) Managing organisational differences and fostering a unified culture are vital factors for the successful adoption of I4 and cutting-edge manufacturing technology in SMEs in the automotive industry. This involves involving stakeholders in the new product design and manufacturing process, identifying their needs, and promoting their active participation. Additionally, talent management plays a crucial role in fostering an innovative culture and driving digital transformation amidst the challenges of a volatile business environment.
- 9) The underlying cultural dimensions of survival and sustainable strategies, as exemplified in Figure 6.13, demonstrate a clear preference for support-oriented dimensions. It emphasises the importance of transitioning from hierarchical structures to collaborative approaches for the successful adoption of I4 adoption in manufacturing SMEs. Additionally, it underscores the significance of scrutinising and evaluating existing business models to enhance competitiveness in the automotive industry context.

7.3 Limitation and Further Work

The research has several limitations. For instance, a small sample size of 84 manufacturing SMEs and 15 respondents for the semi-structured interviews were used due to financial constraints, limiting the generalisation of the results. However, although these results cannot be generalised to the wider non-automotive population, these results provide a first step for future research by providing an understanding of key factors of organisational culture that can be used to achieve effective diffusion management and technology innovations during the adoption of I4 in automotive SMEs.

- Due to the complexity and nature of the research topic, the research has not considered all the factors that could be directly responsible for the organisational culture of the individual organisations.

Practitioners shared their years of experience, which is highly dependent on the maturity level of their particular SME. Therefore, some aspects and associated challenges may be fundamental in one organisation and not in another. However, the research has been done considering that all the proposed eleven key factors of the organisational culture are equally important and have to be taken care of for effective diffusing of management and technology innovations during the adoption of I4 in the automotive industry.

- The organisational culture analysis in the conducted sample survey is based on the four organisational culture dimensions: power, role, achievement and support-oriented. The research deals with many organisational culture issues, which might cause overload and saturation in a few researchers. Moreover, the results are sometimes inconsistent and difficult to interpret when analysing those factors that other studies have used. More research on these issues is required from different perspectives to provide more consistency and positive results to maintain the credibility and validity of the research findings.

- The impact of COVID-19 on the organisational culture in manufacturing SMEs in the automotive industry in the survey and semi-structured interviews has been addressed to a limited extent. The full extent of the impact of the COVID-19 pandemic on organisational culture, which led to a paradigm shift in the automotive industry, remains to be seen, so future research studies are needed to confirm the findings. Further research can focus on these key factors of the organisational culture in more detail if more SMEs in the study area are interviewed and surveyed about them. Further research can be conducted through case studies to obtain a large sample size of the manufacturing SMEs thus to obtain better statistical values.

- The survey results in Table 5.1 show that the support-oriented and the achievement-oriented are the most dominant cultural dimensions across various organizational activities, both in the existing and preferred cultures. Support-oriented cultures emphasise cooperation, teamwork, and a people-centric approach, while achievement-oriented cultures prioritise competence, results, and a strong commitment to achieving goals. At first glance, these two cultural dimensions may seem contradictory, but their complementary nature can contribute significantly to organisational performance and innovation. Future research could explore how these cultural dimensions complement each other and contribute to organisational performance in the context of effective diffusion of management and technology diffusion for the successful adoption of Industry 4.0 in manufacturing SMEs in the automotive industry.

- The survey results in Table 5.1 – A.8 show that managers are primarily expected to exhibit role-oriented behaviours, such as being impersonal and proper and avoiding the exercise of authority for personal advantage, rather than exhibiting achievement-oriented behaviours. However, the organisational culture leans toward an achievement-oriented approach, emphasizing competence, effectiveness, and a strong commitment to getting the job done. This could indicate a misalignment

between the expectations for managers and the broader organisational culture. Further research could explore the potential impact of this misalignment on the successful adoption of Industry 4.0 and the effectiveness of leadership in driving organisational cultural change.

- This research focused specifically on organisational culture factors, but national cultural dimensions can also influence SMEs' receptivity to innovation diffusion. Future research could explore the interplay between national and organisational culture by conducting cross-cultural comparative case studies of SMEs in different countries adopting Industry 4.0. Earlier studies in this field such as Frameworks such as Hofstede's cultural dimensions theory or the GLOBE study (Hofstede, 1990), effective meshing of management practices with national cultures in the adoption of new technologies in a manufacturing organisation (Chow, Kato, & Shields, 1994) could provide helpful starting points for examining how national cultural characteristics interact with and shape organisational culture and innovation adoption behaviours in manufacturing SMEs in the automotive industry during the adoption of Industry 4.0. It can be said that such research can shed light on how manufacturing SMEs can effectively adapt their organisational culture and managerial strategies to align with national cultural expectations and industry best practices, ultimately facilitating successful innovation diffusion in the context of Industry 4.0.

- While the PRAS framework developed in this study offers valuable insights for manufacturing SMEs in the automotive sector, future research could explore the generalisability of this framework to SMEs in other industry sectors. Replicating this study in the context of SMEs in service industries, technology sectors, or creative fields undergoing digital transformation could test the framework's broad applicability while potentially uncovering new sector-specific organisational cultural factors. Such research would enhance the practical utility of the PRAS framework for SME managers across a broader spectrum of industries.

- The PRAS framework could serve as a useful conceptual foundation for more targeted investigations into the role of specific emerging technologies, such as artificial intelligence (AI), in manufacturing SMEs' Industry 4.0 adoption processes in the automotive sector. Future studies could explore in-depth how the organisational culture factors identified in this study impact the integration of AI technologies into SMEs' business models and manufacturing processes. Longitudinal case studies or action research methodologies could be employed to examine how the adoption of AI technologies in turn reshapes organisational culture, structures, skills, and leadership approaches over time within SMEs.

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Appendix A: Norms that Promote Innovation

Norms that Promote Innovation

A. Norms to Promote Creativity

1) Risk Taking

- freedom to try things and fail
- acceptance of mistakes
- allow discussion of "dump" ideas
- no punishment for failure
- challenge the status quo
- forget the past
- willingness not to focus on the short term
- expectation that innovation is part of your job
- positive attitudes about change
- drive to improve

2) Rewards for Change

- ideas are valued
- respect for beginning ideas
- build into structure: budgets, opportunities, resources, tools, time and promotions.
- top management attention and support
- celebration of accomplishments
- suggestions are implemented
- encouragement

3) Openess

- open communication and share information
- listen better
- open access
- bright people, strong egos
- scanning broad thinking
- force exposure outside the company
- move people around
- encourage lateral think
- adopt the customer's perspective
- don't be too sensitive
- continuous training
- intellectual honesty
- expect and accept conflict
- willingness to consult others

B. Norms to Promote Implementation

1) Common Goals

- sense of pride in the organization
- teamwork
- willingness to share the credit
- flexiblity in jobs, budgets, functional areas
- sense of ownership
- eliminate mixed messages
- manage interdependencies
- shared visions and common direction
- build consensus
- mutual respect and trust
- concern for the whole organization

2) Autonomy

- decision making responsibility at lower levels
- decentralized procedures
- freedom to act
- expectation of action
- belief that you can have an impact
- delegation
- quick, flexible decision making
- minimize the bureaucracy

3) Belief in Action

- don't be obsessed with precision
- emphsais on results
- meet your commitments
- anxiety about timelines
- value getting things done
- hard work is expected and appreciated
- empower people
- emphasis on quality
- eagerness to get things done
- cut through the bureaucracy

Source: O'Reilly (1989)

Table 3.5: The Seven Stages of an Interview Enquiry

Phase	Description
1. Thematising	Formulate the purpose and the conception of the interview theme
2. Designing	Plan the design of the study, taking into consideration all seven stages, before interviewing
3. Interviewing	Conduct the interview based on interview guide.
4. Transcribing	Prepare the interview material for analysis, includes transcript.
5. Analyzing	Decide which which modes of analysis are appropriate for the interviews
6. Verifying	Ascertain the validity, reliabilty and generalizability of the interview findings
7. Reporting	Communicate the findings and the methods in a scientific manner, considering the ethical aspects and that results in a readable product

Appendix B: Sample Survey Questions

You are invited to participate in our survey which is based on organisational culture. It will take approximately 15 minutes to complete the questionnaire.

Ranking Key:

4 = The dominant view, or your most preferred alternative.

3= The next most dominant view, or your most preferred alternative.

2= The next most dominant view, or your most preferred alternative.

1= The least dominant view or least preferred alternative.

Please refer your ratings "Preferred Culture" post COVID-19.

Please rate in the order of 4,3,2 and 1, and avoid duplicate ratings within each column.

Thank you very much for your time and support.

Existing Preferred

Culture Culture

1. Members of the organisation are expected to give first priority to

_____ *a. meeting the needs and demands of their supervisors and other high-level people in the organisations.*

_____ *b. carrying out the duties of their own jobs; staying within the policies and procedures related to their jobs.*

_____ *c. meeting the challenges of the task, finding a better way to do things.*

_____ *d. cooperating with the people with whom they work, to solve work and personal problems.*

2. People who do well in the organisation tend to be those who

_____ *a. know how to please their supervisors and are able to willing to use power and politics to get ahead.*

_____ *b. play by the rules, work within the system, and strive to do things correctly.*

_____ *c. are technically competent and effective, with a strong commitment to getting the job done.*

_____ *d. build close working relationships with others by being cooperative, responsive, and caring.*

3. The organisations treats individuals

_____ *a. as "hands" whose time and energy are at the disposal of persons at higher levels in the hierarchy.*

_____ *b. as "employees" whose time and energy are purchased through a contract,*

with rights and obligations for both sides.

_____ *c. as “associates” or peers who are mutually committed to the achievement of a common purpose.*

_____ *d. as “family” or “friends” who like being together and who care about and support one another.*

4. People are managed, directed, or influenced by

_____ *a. people in positions of authority, who exercise their power through the use of rewards and punishments.*

_____ *b. the systems, rules, and procedures that prescribe what people should do and the right ways of doing it.*

_____ *c. their own commitment to achieve the goals of the organisation.*

_____ *d. their own desire to be accepted by others and to be good members of their work group.*

5. Decision-making processes are characterised by

_____ *a. directives, orders, and instructions that come down from higher levels.*

_____ *b. the adherence to formal channels and reliance on policies and procedures for making decisions.*

_____ *c. decisions being made close to the point of action, by the people on the spot.*

_____ *d. the use of consensus decision-making methods to gain acceptance and support for decisions.*

6. Assignments of tasks or jobs to individuals are based on

_____ *a. the personal judgements, values, and wishes of those in positions of power.*

_____ *b. the needs and plans of the organisation and the rules of the system (seniority, qualifications, etc.).*

_____ *c. matching the requirements of the job with the interests and abilities of the individuals.*

_____ *d. the personal preferences of the individuals and their needs for growth and development.*

7. Employees are expected to be

_____ *a. hard-working, compliant, obedient, and loyal to the interests of those to*

whom they report.

_____ *b. responsible and reliable, carrying out the duties and responsibilities of their jobs and avoiding actions that could surprise or embarrass their supervisors.*

_____ *c. self-motivated and competent, willing to take the initiative to get things done; willing to challenge those to whom they report if that is necessary to*

obtain good results.

_____ *d. good team workers, supportive and cooperative, who get along well with others.*

8. Managers and supervisors are expected to be

_____ *a. strong and decisive; firm but fair.*

_____ *b. impersonal and proper, avoiding the exercise of authority for their own advantage.*

_____ *c. democratic and willing to accept subordinates' ideas about the task.*

_____ *d. supportive, responsive, and concerned about the personal concerns and needs of those whose work they supervise.*

9. It is considered legitimate for one person to tell another what to do when

_____ *a. he or she has more power, authority, or "clout" in the organisation.*

_____ *b. it is part of the responsibilities included in his or her job description.*

_____ *c. he or she has greater knowledge and expertise and uses it to guide the other person or to teach him or her to do the work.*

_____ *d. the other person asks for his or her help, guidance, or advice.*

10. Work motivation is primarily the result of

_____ *a. hope for rewards, fear of punishment, or personal loyalty to the supervisor.*

_____ *b. acceptance of the norm of providing a "fair day's work for a fair day's pay."*

_____ *c. strong desires to achieve, to create, and to innovate and peer pressure to contribute to the success of the organisations.*

_____ *d. people wanting to help others and to develop and maintain satisfying working relationships.*

11. Relationships between work groups or departments are generally

_____ *a. competitive, with both looking out for their own interests and helping each other only when they can see some advantage for themselves by doing so.*

_____ *b. characterised by indifference toward each other, helping each other only when it is convenient or when they are directed by higher levels to do so.*

_____ *c. cooperative when they need to achieve common goals. People are normally willing to cut red tape and cross organisational boundaries in order to get the job done.*

_____ *d. friendly, with a high level of responsiveness to requests for help from other groups.*

12. Intergroup and interpersonal conflicts are usually

_____ *a. dealt with by the personal intervention of people at higher levels of authority.*

_____ *b. avoided by reference to rules, procedures, and formal definitions of authority and responsibility.*

_____ *c. resolved through discussions aimed at getting the best outcomes possible for the work issues involved.*

_____ *d. dealt with in a manner that maintains good working relationships and minimizes the chances of people getting hurt.*

13. The larger environment outside the organisation is responded to as though it were

_____ *a. a jungle, where the organisation is in competition for survival with others.*

_____ *b. an orderly system in which relationships are determined by structures and procedures and where everyone is expected to abide by the rules.*

_____ *c. competition for excellence in which productivity, quality, and innovation bring success.*

_____ *d. a community of interdependent parts in which the common interests are the most important.*

14. If rules, systems, or procedures get in the way, people

_____ *a. break them if they have enough clout to get by with it or if they think they can get away with it without being caught.*

_____ *b. generally abide by them or go through proper channels to get permission to deviate from them or have them changed.*

_____ c. tend to ignore or by-pass them to accomplish their tasks or perform their jobs better.

_____ d. support one another in ignoring or bending them if they are felt to be unfair or to create hardships for others.

15. New people in the organisation need to learn

_____ a. who really runs things; who can help or hurt them; whom to avoid offending; the norms (unwritten rules) that have to be observed if they are to stay out of trouble.

_____ b. the formal rules and procedures and to abide by them; to stay within the formal boundaries of their jobs.

_____ c. what resources are available to help them do their jobs; to take the initiative to apply their skills and knowledge to their jobs.

_____ d. how to cooperate; how to be good team members; how to develop good working relationships with others.

Note: Based on the Harrison and Stokes (1992)

Appendix C: List of Codes

1) List of Codes for Openness to Employees Input during Industry 4.0 Adoption.

Codes
Comments on the Working Environment
Openness for Collaboration
Priorities in the Organisation
Acceptance of Feedback on Industry 4.0
Business Analysis
Good Communication within Teams
Scenario Building in Advance
New Ideas from Everywhere
Learning from the Experience
Openness for Innovation
New Ideas also Bring Challenges
Customers Discuss the Product
Many Questions about Adoption of Industry 4.0

Creating a Culture of Contribution
Open and Helping Environment Contributes to Success
No Moderation Required
People Talk About the New Programs and Contribute
Desire to Change People and Methodologies
People Need to Act Differently
Shared Values are Established
Organisation Must Have a Clear Roadmap For Industry 4.0
Internal Core Competence is Greatest Asset
Development of Digital Strategy
Sense of Common Purpose
Value of Trust is Higher in Digital Society
Internal Forum for Employees to Share Their Thoughts
Meetings and Forums Held Frequently
Meetings and Forums are Insightful and Productive
Use of Visual Tools for Communicating and Explaining New Ideas
Use of Notebook Plays and Essential Role
Several Tools Used to Capture and Record Information in the Meeting
Meetings and Information Sharing is Helpful a lot for Decision Making
Face to Face Meeting Help Creating a Healthy Digital Transformation
Creating A Listening Culture in the Organisation
Change in Task and Influence on Work Environment
Employees can Propose the Solutions
Set Processes and Procedures that Exists in the Organisation
Define Processes and Procedures Make Working Easy
The Long and Complex Transformation Process
New Technologies and Evolution of Production Processes
Change Management to Build the Right Organisational Culture
Digitization is Changing Relationship between Man and Machine
Setting Digital Transformation Goals
Key Steps to Take during Implementation of the Digital Transformation
Leadership Needs to Understand the Change
Failure as Way of Generating New Ideas
Important to Understand the Benefits of Change
Critical Elements of Organisational Culture

Benefits of Open Communication
Organisational culture consists of Practices
Organisational Culture Plays Important Role in Employee Retention
Trust is an Essential Part of Organisational Culture
Equal Treatment and Recognition of all Employees
Diversity is a Key Element to Organisational Culture
Inclusive Environment nurtures Diversity in the Organisation

Source: By the researcher

2) List of Codes for Practical Strengths of Organisational Environment during Industry 4.0.

Codes
Flexible Organisational Culture
Automation in Factories Help Efficiency
Keeping an Eye on the Employees
Machine Takes Over and Analyse Human Work
Performance Measurement in Organisation
Media Analytics, Product Surveys to Measure Performance
Robust Digital Transformation Culture
Digital Transformation Roadmap
Customer Centric Approach
Market Responsive Organisational Growth
Effective Implementation of the Strategy Makes One Proud
Role Model Employee
Commitment, Ethics, Goals, Values Make Role Model
Employee Talents Results from Cultural Mix
Personnel Need Assessment
Finding Suitable Candidates
Personality Traits and Abilities Required
Acknowledgement of the Personality Traits and Skills of the Employees
Most Exciting Experience Achieving Milestones
The Employees who Played Effective Role
Proactive in Technology Adoption
Skill Enhancement Through Ongoing Trainings
Healthy Collaboration
Collaborative and Cross Functional Approach
Goal of Digital Transformation

Combination of Technical and Non-Technical Staff
Cognitive Skills are Require for Adoption of Industry 4.0
Best Organisational Structure for Adoption
Agile Organisation Helps Employee to Find Solutions
Brainstorming for Finding Solutions
Desirable Work Characteristics for Adoption
Undesirable Work Characteristics
Incorporating of Desirable Work Characteristics

Note: By the researcher

3) List of Codes for People Management Strategies and Approaches of the Organisations during Adoption of Industry 4.0.

Codes
Getting Involved to Learn About Other Feelings
Employee Empowerment is Difficult to Measure
Link Between Empowerment and Organisational Culture
Being Aware of Personal Characteristics of Employees is Helpful
Organisational Culture is not Static
Organisational Challenges While Dealing with Work from Home Employees
Difference Between Employees Working from Home and in Office
Adoption Challenges While Dealing with Virtual Teams
A Unified Approach to Manage Adoption
Organisational Culture is an Expression of Shared Values
Organisational Structure Changed Due to Offsite Working
Virtual Meetings are More Relaxed
Productivity is Affected by Offsite Working Employees
Offsite Meetings Save Resources and Maximize Profitability
On Campus Work is More Advantageous and Preferred
Cultural Expectations of Management from Employees
Well Developed Digital Culture Become Organisational Priority
Clearly Defined Organisational Priorities, Goals, Values and Vision for Future
Digitalisation must Create Transparency
Digital Culture is a Mindset to Think and Act Together
Some Companies have Lousy Transformation Experience
Various Skill Sets are Important for the Effective Implementation of Industry 4.0
People are More Effective when utilising Technology

A High Level of Innovation is Required in the Use of ICT in Industry 4.0
Training and Mentoring for new Employees
Leading by Example
Encouraging Innovation
Sharing Critical Learning
Prioritisation of Goals
Creating a Positive Organisational Culture
Building and Growing Digital Ecosystems
Strong Sense of Technology
To Know How to Take the Process Forward
Employees need to Have an Implicit Understanding of the System
Conductive Internal Environment
Use of AI in Industry 4.0 Implementation process
AI is not a Tool but an Approach
AI-based Software is Deployed
The Process is Evolving and is not Completed yet.

Note: By the researcher

4) List of Codes for Perceived Methodologies of Decision-Making Process in Organisation during the Adoption of Industry 4.0.

Codes
Process are Highly Transparent
Design Thinking
Organisational Structure has Teams for Implementation of the Process
The Teams are Involved in the Decision-Making Process
Faster Decision Making
Old and New Way of Doing Things
Linking Digital Transformation with Organisational Culture-Decision Making
Business Transformation Design Model
Decision Making at Departmental Level
Collaboration Across Department Needed for Faster Decision Making
Organisational Structure Cannot be Changed Rather Transformed
Defining New Organisational Culture
Restructuring of the Organisation and Removal of Hierarchies
Industry 4.0 is not just a System for Communicating Online, but it is an Ecosystem
The Industry 4.0 Environment Needs Time for its Establishment

Conflicts in Decision Making
Conflicts are Resolved with Mutual Understanding and Higher Communication
Functional Culture for Conflict Resolution
Drastic Changes Required for Faster Implementation
Decisions are Not Always Anchored by Clear Criteria
Decision Making Process Takes Place over a Period of Time with Multiple Stakeholders
Person-to-Person Decision Making is Preferred
Digital Transformation Managers Use Informal Methods for Decision Making Process
Command and Control Decision Making Leads to Resentment Among Staff Members
Decision Making Process is Collaborative
Nurturing the Spirit of Innovation and Creativity Among Employees
Transparency in Decision-Making Process
Lack of Managerial Expertise become a Barrier for Successful adoption of Industry 4.0
Monitor and Adjust Impact Technology on Organisations' Mission and Goals
Bottom-Up Approach may not Work as Well in some Cases due to Ownership Issues
Decision Making Processes should be Dynamic, Flexible and Robust to Manage Risks
Innovation Decisions must also Consider Changes in External Environment
Success of Technology depends on the Culture of Making Decision Collectively
Flexible Data Gathering and Reporting Methods
The Decision-Making Process is Highly Focused on Feedback from the Customer.
The Decision-Making Process is Evolving Continuously
Decision-Making at Industry 4.0 Manufacturing Firms is Succinct and Decentralised
Smooth Manufacturing Necessitates a Clean Decision-Making Process
Transparency and Open Dialogue with Customers are Key for Decision-Making Process.
Cultural Differences Can Affect Decision-Making in Large Ways.
Processes are not Completely Automated.
Human Input is Required for High Quality Work.
Industry 4.0 Enables the Analysis of Data in Real Time to Make Decisions.
Provides Guidance on Actions Required.

Note: By the researcher

5) List of Influential Factors in Task Assigning and Performance Management during Adoption of Industry 4.0 in the Automotive Industry.

Codes
Employees Willingness to Learn New Task and Skills
Cognitive, Behavioural, Emotional and Social Capabilities

Matching Employees Traits with Task Requirements
Management Leadership Skills
Looking at Previous Experience of Employees While Hiring
Creativity, Critical Thinking, Technological Knowledge, Flexibility and Teamwork
Culture of Continuous Improvement Starting in the Hiring Process
Attitude of Individual to Adoption of Industry is Critical for True Success
Employees Understand each Other's Competencies.
Meetings to Share Thoughts on Tasks during Technological Adoption
Addressing Disparity between Interest, Abilities and Job Requirements
A Place for Employees to Go and Talk
Matching Potential Resources and Requirement to Tasks in the Organisation
Job Alignment with Employees through Interactive Management Process.
Fostering Collaboration via Interactive and Accurate Schemes
Employee Opinions on their Role in Task Completion
Task Exposure and Readiness to Take Up New Challenges
Establish a Culture of Goal Setting and Rewarding Employees in Task Achievement
Gamification Practices in Task Assigning and Performance Management
Maintain Database of Tasks and Match Candidates for Each Tasks
Establish a Community of Industry 4.0 Experts Accessible for Employees
Building an Appropriate Management Structure to Fit Organisational Needs
Roles and Responsibilities Aligned with the Job Description
Considering the Human Factor in Successful Tasks
Assign the Right Person to a Task
Identifying Business Opportunities by Employing Advanced Analytics Methods
Managerial Knowledge of the Desired Outcome of the Specific Task
Managing Corporate Identity, Trust and Power Relationships in Teams to Ensure Optimal Performance.
Task Assignment is a Critical Phase of the Digitalisation-Project.
Industry 4.0 Delivers New Opportunities in Manufacturing Performance, Productivity, Efficiency and Profitability.

Note: Adopted by the researcher

6) List of Codes for Dynamics of Good Team Players during the Adoption of Industry 4.0.

Codes
If Employees Take More Time on Projects Manager Discussions
Hands Off Managers

Management Perspective on Successful Employee
Personal Qualities, Motivation, Commitment and Dedication
Understanding the Big Picture by Employees
Common Objective and Acceptance of Cultural Diversity
Adherence to Work Instructions to Successful Implementation of Industry 4.0
Accountability of Stakeholders For Task Fulfilment
Agile Working Practices
Multitasking by Employees
Clear Code of Conduct and Organisational Culture
Code of Conduct to be 100% reflected in Organisational Culture
Being Comfortable with Ambiguity, Willing to Try New and Different Things
Positive Attitude Towards Anything that is New, even if They Do Not Want It.
Not Constrained by the Belief that they can't Do it during adoption of Industry 4.0
Open To New Ideas and not insisting a solution doesn't work
Communicate Effectively with Team Members and Management
Share Knowledge Openly with Team Members, even if it Means Giving Up Some of the Credit.
Focus on Strengthening Internal Processes and External Relations with Suppliers, Customers, and Other External Partners of the SMEs Value Chain.
Develop Collaborative Relationships across the Value Chain to Ensure Product Opportunities Match Customer Needs.
Good Interpersonal Skills are Very Important in Today's Workforce.
Facilitating External Knowledge Acquisition through Conferences, Exhibitions, Workshops, Seminars, Trade Fairs and Business Events.
Takes Personal Ownership and Ensures that each Person Feels Valued and Respected
Encouraging a Culture where Input from Others is Welcomed
Lives the Culture that Teamwork Generally Depends on Everyone's Contributions and Supports Pitching Ideas for Improvement or Development.
Ability to Lead the Manufacturing SME with their Actions and their Words during Adoption of Industry 4.0.

Note: By the researcher

7) List of Codes for Dynamics of Good Managers during the adoption of Industry 4.0.

Codes
Zen-Like Leadership Method
Leading in the Background
Innovation and Change Management Strategy

Understanding the Need for Transformation
Ability to Align the Existing Business Models to the Changing Requirements
Encouraging Employees to be More Customer Focussed
Changing Role of Managers Due to Covid-19 World-Wide Pandemic
Management Acts to Foster Employees Confidence
Management must Exercise Respect, Trust and Support
Giving Feedback on Employees Performance to Sustaining Employees Confidence.
Managing without Team Members Incurring Excessive Costs.
High Information Levels to Interact with Employees and Industry Partners in an Effective Manner.
Able to Engage Employees and Maximize their Skillsets.
Changing Mindset and Preparing to Face Challenges
Understanding of Technologies in such as Autonomous Vehicles, Artificial Intelligence, Robotics etc.
Able to Create a Dynamic Team with True Social Integration
Have Collaborative Leadership Ability
Managing Multiple Functional Groups with Strong Multi-Disciplinary Skills and Expertise
Interpersonal skills and the Ability to Understand and Work with People from Different Cultural Backgrounds.
Emphasising Cross-Cultural Competence and Changes in Globalized Environment.
Demonstrating Interest in Employees Personal Development.
Investment of Time, Attention and Effort into Developing Individual Strengths
Management Must Allow Their Employees to Take Ownership of their Doings.
Mobile Working Arrangements to Improve Productivity and Service
Seeking Acceptance and Feedback at all Levels of the Organisation by Providing Right Information at Right Time.
Encourage Creativity by Providing Employees with Autonomy over Specific Work Processes and Tasks
Good Leaders are also Good Listeners
Managers in SMEs across the Value Chain have Good Standings with Industry 4.0
Clear View of Potential Opportunities or Threats that AI Poses to the Manufacturing SMEs
Not Overly Attached to Traditional Business Models
Coping with Changes in a Fast-Moving Digital World when Adopting New Technologies.
Lives a Culture of Cost avoidance by Identifying what Works and Addresses what does not Work

Note: adopted by the researcher

8) List of Codes for Learning and Knowledge Sharing Culture during the Adoption of Industry 4.0.

Codes
Traditional Way of Knowledge Sharing
Digital Transformation Workshop
Right Skill Platform
Establishment of Key Principles for Knowledge Sharing
More Effective Workflows
Not Ignoring the Redundant Tasks
Focus on Solving Problem Together
Culture of Mutual Support
Aligning Digital Transformation with Business Strategy
Incorporate Knowledge Sharing in the DNA of the Organisation
Adopting a Learning-by-Doing Culture in Day-To-Day Operation to Grow Skills, Develop Creativity, Inspire Excellence, and Increase Workplace Performance.
Employees Usage of Various Methods of Learning in their Daily Activities
Develop Creativity, Inspire Excellence, and Improve the Adoption Rate to Industry 4.0.
Right Organisational Culture in Place Enhances Individual and Collective Development.
Promoting Learning as it Leads to Innovation
Employees should be Able to Access Knowledge, Skills and Information they Need.
SMEs must Adopt a Different Approach to Acquire and Share Knowledge
Knowledge about Industry 4.0 must be Tapped Actively and Established across the SMEs.
Employing Different Learning Formats such as Virtual Classrooms and Online Classes to Learn new Technologies and Tactics.
Establishing Open Learning Culture and Leveraging Artificial Intelligence to Address new Challenges or Work Environment Changes.
No Absolute Standards for Determining Number of People needed to Adopt Successfully Industry 4.0 standards across manufacturing SMEs.
Learning Culture Leads to Value Creation in Organisations throughout the Automotive Industry.
Employees are Encouraged to Interact with Each Other, Share their New Skills and Knowledge Online, but also Compete for Recognition Among Colleagues.

Note: By the researcher

9) List of Codes for Maintaining an Energetic and Motivated Work Environment during the Adoption of Industry 4.0.

<i>Codes</i>

Intrinsic and Extrinsic Motivation Analysis and Strategy
New Set of Organisational Values
Customer Satisfaction is Best Motivation
More Predictable Business Environment for Customers
Customer Centric Approach
Realization of Being Part of the Big Transformation
Understanding and Engaging with Jobs
Dealing with Employees Sticking to Traditional Methods
Open Door Policy
Fair Renumeration
Friendly Holidays
Strong Correlation Between Fair Renumeration and Organisational Culture
Fostering Employee Engagement, New Skills Development and Growth Opportunities
Involving Employees in the Organisational Change
Boosting Productivity by Implementing Value Stream Mapping
Easing the Transition from Labour to Automation
Maintaining Human Energy
Prevent Employees from Becoming Complacent or Uninterested in Industry 4.0 which could Lead to Greater Absenteeism.
Team Lunches or Friendly Competitions Among Workers to Boost Productivity
Create a Vision for What's to Come on the Way to Adoption of Industry 4.0.
Establishing Company-Wide Goals and then Align them with Individual Objectives.
Recognize the Need to Maintain Employee Motivation and Morale in a Fast-Paced Manufacturing Environment during Industry 4.0 Adoption.
Eliminating Options that don't Work or Might be Bad Idea to Adopt from Industry 4.0 and Implement New Solutions that are Proven to Work Well.
Take into Consideration Employees' Feelings on Automation and Adopt New Manufacturing Tasks while still Maintaining Daily Production Targets.
Develop Flexible Work Environment with Appropriate Changes in the Work Schedule, Part-Time Employment, and Home Office Options.
Understand the Importance of a Balanced Work Life.

Note: By the researcher

10) List of Codes for Managing Organisational Differences during the adoption of Industry 4.0.

Codes
Common Organisational Culture

Connected Organisational Values
Access to Data Available to All Members of the Organisation
Transparency in Data Protection Issues
Transparency in Organisational Performance
Stakeholders on Board
Framing Industry 4.0 in Industrial Ecosystem
Visibility of the Common Goals and Joint efforts
Embrace Unified Culture Across Value Chain
Struggle in Changing Organisational Culture
Definition of Standards in Organisational Culture Across Organisations
Approaches to Conflict Resolution
Taken for Granted-Elements of Organisational Culture
Reflection of Organisational Culture in Job Description
Balancing Collaboration and Competition
Enhanced Communication throughout Value Chain during Adoption of Industry 4.0
Specialized Solutions
Critical Factors in Organisational Culture
Organisational Differences between Old and New Manufacturing Technology
Inter-company Data Sharing
Increased Complexity in Manufacturing Handling during Technology Adoption
Different Training Needs in Organisations During Industry 4.0 Adoption
Picking Up the Industry-Pace Across Organisations when adopting Industry 4.0
Level of Organisational Maturity as the Key Influential Factor
Involvement in Industry 4.0, Business Priorities, and Competence in Technological Development
Lack of IT Resource to Support SMEs
Typical Workflow in Traditional Organisation are not Suitable for the Digital Transformation
Lack of Consent Among Stakeholders Across Organisations of the Benefits of Industry 4.0
The Culture and Work Practices in SME Companies across the Value Chain are not Always Conducive to the Adoption of new Technologies.

Note: By the researcher

11) List of Codes for Survival and Sustainable Strategies during the adoption of Industry 4.0.

Codes
Learning from The Ecosystem
Survival Competition
Business Sustainability

Openness to New Ideas
Transferrable Organisational Values
Similar Challenges in The Ecosystem
Pushing Stakeholders for Adoption
Employee Behavioural Trends
Addressing Difference of Understanding on Digital Technology
Conflicts between Technology and Policy
Management Strategy-Dealing Complicated Transformation
Organisational Policies, Rules and Procedures
Review and Planning
Analysing Organisational Culture
Importance of Organisational Brief at the Time of Introducing Industry 4.0
Motivation for New Employees
Scope of Improvement in Organisational Culture
Need for Hire and Train New Staff with the Appropriate Technical Knowledge.
Greater Focus on Key Performance Indicators.
New Metrics and the Ability to Analyse Data in a Click of a Button.
Develop Solutions that are Tailored for Specific Needs in the Automotive Industry.
Preparing for New Work Environment and Business Models in Manufacturing Industries.
Managing Demand is Becoming Harder and More Complex - More Focus on Customer Centricity.
Onboarded Risks and Benefits - Systematic Approach on what Technology is most Likely Help, versus what Hinder Adoption of Industry 4.0.
Maintain Organisations Competitive Advantage by Staying Focused on the Customer Needs.
Gathering the Right Data, determining what Industry 4.0 can do for the Manufacturing SMEs.
Collecting Valuable Data from your Suppliers to Deliver a More Personalized and Efficient Service for your Customers.
Organisations must be Flexible enough to Mitigate the Drawbacks and Handle Changes when Adopting New Technology
Ensure that the SMEs Organisational Culture are Ready and Able to Adapt quickly to the Possible Setbacks during Adoption of Industry 4.0
The Need of People who are Driven by Data and Willing to Work Together as a Team.

Note: By the researcher

Appendix D: Semi-structured interview questions

Date / Time / Location: 23.06.2021 / _09__:45_ / Telko

Interviewee No.<_15_>

I. Introduction

Icebreaking through informal questions like

- How long have you been working for the company?

3 Years and 10 months

- Have you been enjoying it?

AW:

Warm up by explaining how the interview will be conducted:

- explain the purpose of the research

I am explaining the aim of the research and define the relevant terms before we start with the interview questions.

- Clarity on terms used in this research (Organisational Culture, Organisational Dimensions: Power Oriented, Role Oriented, Achievement Oriented, Support Oriented, Industry 4.0, Key factors, Automotive Industry).

II. Interview Questions

2.1 Priorities in the organisation:

a) How open is management to listening to new ideas from team members about how they would like industry 4.0 strategies adopted?

b) Does the organisation have established shared values that link its strategies and guide employees to achieve common goals?

c) How do you consider the importance of employee participation in adopting to Industry 4.0? Do your employees have the capability to propose new ideas or are there set processes and procedures for this?

d) What are the critical elements of organisational culture that contribute to retain a collaborative work environment?

Olgun: What are the critical elements of organisational culture that contribute to retaining a collaborative work environment?

2.2 Best practices in the organisation:

a) Can you give an example of which organisational culture factors have proven most effective in managing the tasks in manufacturing SMEs connected with adopting Industry 4.0?

b) Is there a clearly defined mechanism for measuring performance throughout the organisation, specifically focused on the adoption of Industry 4.0?

- c) Can you please describe what personal qualities make an employee a role model in your organisation? To what extent has the exercise of roles and responsibilities contributed to the success of adopting of Industry 4.0?
- d) If an employee had a work problem, would it be easy for him or her to ask for help from another employee in the organisation, or do you feel that the organisation is too rigid in this regard?

2.3 Approach to individuals by the organisation:

- a) **How likely is it for a leader in your organisation to empower employees to overcome their personal reservations to new technology and challenges? What factors play a key role in this?**
- b) What are the organisational challenges for managers in leading employees who work from home and employees who work in corporate offices during the implementation of Industry 4.0? How can the organisation meet these challenges?
- c) How do managers typically communicate tasks to employees to ensure a coordinated approach, including employees who work from home offices and companies' offices, to achieve organisational objectives in adopting Industry 4.0?
- d) Do you think the distance between remote and stationary employees plays a role in achieving organisational goals in the transition to Industry 4.0?

2.4 Ways in which people are managed, directed, or influenced in the organisation:

- a) **Are there any specific cultural expectations that must be met by the management in your organisation for successful adopting Industry 4.0? Can you please define your understanding of cultural expectations?**
- b) How do you think the following skillsets are necessary to adopt Industry 4.0 : Project management, interdisciplinary collaboration, cross-organisational collaboration, and the ability in thinking outside the box? Which do you think will be most important for the organisation?
- c) How does management ascertain that the goals of Industry 4.0 are broken down into actionable tasks for the employees in your organisation to successfully adopt Industry 4.0?
- d) Does your organisational structure enable employees to take on more responsibility in the adoption of Industry 4.0 without the necessity of management intervention?

2.5 Typical for decision-making processes in the organisation:

- a) **How would you assess the level of openness or visibility of your decision-making process in your organisation during the adoption of Industry 4.0?**
- b) Based on your experience and knowledge of Industry 4.0, describe how a standardized decision-making process should look to enable a successful implementation of Industry 4.0?

- c) Do you think that greater flexibility in decision-making processes is needed in your organisation to adopt Industry 4.0 more quickly, or do the existing decision-making approaches work well and do not require any profound change?
- d) From your management point of view, how should employees behave when policy or procedure gets in their way when adopting Industry 4.0?

2.6 Factors influencing the assignment of tasks to individuals:

- a) **Can you describe the procedures for assigning a task to an employee to enable the successful adoption of Industry 4.0? How do you define the characteristics of suitable employees when you assign them tasks that are in line with the adoption of Industry 4.0?**
- b) When assigning tasks, does your organisation use a formal procedure or does it assign tasks based on individual preferences and knowledge?
- c) In your tasks assignment, how do you match employees interests and capabilities with the prerequisites for fulfilling the task for successful adoption of Industry 4.0?
- d) What do you think that the management should consider for mitigating the disparity between the interests and abilities of the employees versus the task requirements when adopting Industry 4.0?

2.7 How to be a successful team member in the organisation:

- a) **How would you describe your best leadership approach that fosters your employees' commitment and willingness to use digital tools to get things done more effectively in the wake of Industry 4.0 adoption? Would you please define your understanding more effectively?**
- b) From the point of view of the management, what makes a successful employee in your organisation during adoption of Industry 4.0?
- c) How do you think adherence to work instructions and job descriptions affects the success of the adoption of Industry 4.0 in your organisation?
- d) Does your organisation have a code of conduct that defines how to be a good team member, support each other, and get along well? If yes, to what extent is the code of conduct reflected in your organisational culture during the implementation of Industry 4.0?

2.8 How to be a successful manager and supervisor in the organisation:

- a) **What factors indicate that management is actively fostering an organisational culture that builds employees' confidence in using new technologies and encourages them to contribute with their own ideas to become more effective in adopting Industry 4.0? Would you please define your understanding of being more effective?**
- b) What factors do you think are perceived as key in providing excellent management leadership in your organisation to enable a successful adaption to Industry 4.0?
- c) Do you feel that the Covid-19 pandemic has impacted the roles of the Manager and supervisor in your organisation, in terms of how authority is exercised in the adoption of Industry 4.0?

- d) From your perspective, what factors indicate that management is actively promoting an organisational culture that supports employee confidence in the use of new technologies in the adoption of Industry 4.0?

2.9 Entitlement for a person to tell another what to do:

- a) **How can management foster a culture of knowledge sharing by encouraging stakeholders with more knowledge and experience to guide others on how to do their job more effectively when adopting Industry 4.0?**
- b) What factors make organisational workflows more effective, so that a stakeholder can more easily communicate to other stakeholders what should be done in the adoption of Industry 4.0? Can you please define what you mean by "more effective"?
- c) Hypothetically speaking, you have identified deficits/overlaps of tasks in workflows when implementing Industry 4.0. How would you address the task owner(s) situation, which is most consistent with your organisational culture?
- d) How does management foster a culture of mutual support when adopting Industry 4.0?

2.10 Sources of work motivation:

- a) **What do you think are the key motivational factors for the stakeholders in your organisation to be engaged to achieve measurable success in adopting Industry 4.0?**
- b) What role does fair remuneration play for the employees' work motivation in your company in the adoption of Industry 4.0?
- d) How do you think a work atmosphere based on a culture of trust can be established during the adoption of Industry 4.0?

2.11 Relationships between work groups or departments in the organisation:

- a) **Do you think that organisational culture has the potential to mitigate a mutual indifference amongst the individuals in the adoption of Industry 4.0? If YES, please explain more.**
- b) To fully exploit the potential of Industry 4.0, the organisations require a holistic approach throughout the value chain. Do you agree with this statement? What factors do you think would enhance the holistic approach in the organisation during the adoption of Industry 4.0? Would you please explain your understanding of a holistic approach?
- c) Let's assume there is an existing unified perception of organisational culture which follow the stakeholders along the connected value chain during the adoption of Industry 4.0, how would you characterise the unified organisational culture works for everyone in the value chain?
- d) How do you ensure that employees understand how their work contributes to the adoption of Industry 4.0?

2.12 Types of conflicts between groups and people:

- a) **Which management key approaches to organisational culture work best in your organisation to avert any cross-team and interpersonal conflicts when adopting Industry 4.0?**

- b) Do you think that the responsibilities and tasks for the successful adoption of Industry 4.0 are clearly defined and communicated to your employees and stakeholders? Which key factors of organisational culture should not be missing in the job descriptions to facilitate the successful adoption of Industry 4.0?
- c) To sustain a competitive advantage, the adoption of Industry 4.0 requires a fine balance between cooperation and competition for excellence between the individuals across the value chain. Do you think there are specific cultural factors in your organisation that help to achieve this fine balance?
- d) What factors in the organisational culture would you say foster good working relationships and minimize the likelihood of misunderstandings among employees in your organisation when adopting Industry 4.0?

2.13 Ways in which members of the Organisation respond to outside world:

- a) **What are the key organisational culture factors for the excellent alignment of your organisation with external partners, suppliers, and customers to achieve effective adoption of Industry 4.0?**
- b) Based on your opinion, what type of organisational culture should be adopted by the Organisation to enhance sustainability relationships with customers, suppliers, and partners along the value chain?
- c) What are the most important values of your organisational culture that should be adopted by your customers, suppliers, and partners to achieve excellence in productivity, quality and innovation during adoption Industry 4.0?
- d) What do you think are the biggest challenges when it comes to implementing Industry 4.0 along the value chain?

2.14 Work attitude of people in the organisation if rules, systems, or procedures get in the way:

- a) **To what extent does your organisational culture encourage employees to try new things when adopting Industry 4.0, rather than sticking to the “it’s always been done this way” mentality?**
- b) What countermeasures does management take when rules, systems, or procedures get in the way of employees when adopting to Industry 4.0?
- c) Effective Industry 4.0 requires a holistic approach that engages stakeholders along the value chain in the adoption process. Do you actively engage internal and external stakeholders in adopting Industry 4.0, by aligning the organisational culture with them accordingly?
- d) *Do you actively encourage internal and external stakeholders to enhance their processes during the adoption of Industry 4.0, by aligning the organisational culture with them accordingly?*

2.15 What new employees need to learn to be successful in the organisation:

- a) **How does the company familiarize the new employee with the organisational culture along with the formal rules and procedures which are helpful for the adoption of Industry 4.0?**
- b) Do you think it is beneficial for newly hired employees in your organisation to be briefed in advance on which norms (unwritten rules) they must adhere to avoid running into conflict with other stakeholders during the introduction of Industry 4.0?
- c) What are the shared company values? And which key aspects of the shared company values do you think will enable new employees in your organisation to do their jobs more effectively as they adopt Industry 4.0?
- d) What factors are critical or need to be improved in the organisational culture to help new employees learn how to cooperate and be a good team member when adopting Industry 4.0?

IV. Next steps

All answers will be transcribed within the coming week. I will send a copy of the transcript to you for final checking and approval.

Would you like a copy of the final study (approximately 2021)

☐	☐
Y	N

Many thanks for your participation.

Olgun Özyurt

Appendix E: Information Package

University of Gloucestershire



Information package

You are invited to participate in a study conducted by Olgun Özyurt as part of his PhD thesis at the University of Gloucestershire, Cheltenham, United Kingdom. Please take your time and read the following information carefully before you decide whether or not to participate. Please ask me if anything is unclear to you or if you would like more information.

Purpose of the study

The purpose of the study is to produce a practical guide for management based on the organisational culture for effective diffusion of management and technology innovation for the successful adoption of Industry 4.0 in manufacturing SMEs in the automotive industry.

Why have I been asked to take part?

I am inviting Manager of manufacturing SMEs in the automotive sector to take part in an interview regarding their experience which is relevant for the study.

What will taking part in the study involve?

If you agree to take part in an interview, I will talk with you about the process of adopting to Industry 4.0 and what factors of organisational culture influence the outcome of the process in your company. The interview would be either face-to-face, in a location to suit to you, or over the telephone / videoconference. The interview would take about 30-60 minutes.

What will happen next?

If you would like to take part, please complete and return the attached “Participant Consent Form” with the reply-paid envelope provided. I will contact you will tell you more about the project and answer any question you might have. You can then decide whether you wish to be interviewed or not.

Do I have to take part in the study?

You do not have to take part in this study. If you provide your contact details for an interview, this will not commit you to taking part in an interview. It is entirely up to you to decide whether or not to take part in the research.

What are the possible benefits and risks of taking part?

I hope this study will allow me to develop a practical guide for manufacturing SMEs they can use during the adoption of Industry 4.0.

Will my taking part in this study be kept confidential?

Your name will not be associated with the research materials, and you will not be identified or identifiable in the report resulting from the research. The interview transcript data will be destroyed at the completion of this study.

Who do I contact for more information?

If you would like more information or have any concerns about this study, please contact me.

Thank you for reading this information package

APPENDIX F: Participant Informed Consent Form

University of Gloucestershire



Participant Informed Consent Form for Engagement in Doctoral Research Interview

Title of Research Project: Key factors of the Organisational Culture for effectively diffusing management and technology innovations induced by Industry 4.0 in manufacturing SMEs in the Automotive Industry.

Researcher: Olgun Özyurt (PhD student of the University of Gloucestershire)

Please initial the box if you agree with the statement to the left

- 1 I confirm that I have read and understand the introduction package dated 7th April, 2021 explaining the above research project and I have had the opportunity to ask questions about the project. ☐
- 2 I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐
- 3 I understand that my responses will be kept strictly confidential. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report that result from the research. ☐
- 4 I understood that the data collected from me will be destroyed after completion of this study. However, I will get the transcript of my interview for final alignment. ☐
- 5 I give permission for audio-recording and for taking notes. ☐
6. I agree to take part in the above research project and will inform the investigator () should my contact details change. ☐

Name of participant Date Signature

Name of participant Date Signature

APPENDIX F: Interview Transcript

Appendix G: Interview transcript (sample)

The respective interviewee permitted publication of this interview, which was conducted in summer 2021

Moderator = Interviewer, question according to the interview guide

FUQ = Follow-up questions from the interviewer

I. Introduction

Icebreaking through informal questions like

Moderator: How long have you been working for the company?

Four Years and 10 months

Moderator: Have you been enjoying your current role as Digital Transformation Manager?

Absolutely, it has been quite a fascinating journey. This role presents an endless array of opportunities and achievements. My journey with the company started around five years ago when I was the Digital Transformation Manager. Shortly after my arrival, a pivotal meeting occurred with the company's CEO, involving my immediate superior. The CEO had a vision, a concept that necessitated a digital overhaul, and he graciously offered me the chance to spearhead this venture. Hence, we embarked on this transformative project. Its success was evident in the new brand image we managed to cultivate by introducing innovative products and services.

Moderator: What are your responsibilities as a Digital Transformation Manager implementing Industry 4.0 in the automotive manufacturing industry?

As the person steering our manufacturing company towards Industry 4.0, I am wholeheartedly committed to introducing novel systems and processes. My primary duties revolve around risk and supplier management and deploying business intelligence tools such as interactive dashboards and key performance indicators (KPIs). As the Digital Transformation Manager, I strive to empower our team to handle and decipher data more proficiently, including orchestrating relevant training sessions. My relentless pursuit of innovative solutions to streamline our manufacturing processes has remained my top-most priority since my first day. Once we find the ideal solution, I will ensure its seamless integration with our existing operations by harmonizing IT systems with our other processes.

Warm up by explaining how the interview will be conducted:

Moderator: I am explaining the aim of the research and define the relevant terms before we start with the interview questions.

- Clarity on terms used in this research (Organisational Culture, Organisational Dimensions: Power Oriented, Role Oriented, Achievement Oriented, Support Oriented, Industry 4.0, Key factors, Automotive Industry).

II. Interview Questions

2.1 Priorities in the organization:

Question 1: How open is management to listening to new ideas from team members about how they would like industry 4.0 strategies adopted?

The organizational culture of our company is very open to new ideas. Our management likes to hear new ideas from team members regarding adopting Industry 4.0 strategies in our manufacturing SMEs. Any suggestion given by a team member is considered a bit of advice, and if it can be implemented, it will be considered.

FUQ: How would you sum up the management's attitude towards innovation in your organization?

As a leader, I perceive our administration as being particularly receptive to innovative concepts, consistently seeking out chances to incorporate them. We are always engaged in acquiring new knowledge and embracing novel ideas. Our approach is not simply about embracing new products; we endeavour to enhance them, introducing fresh components whenever possible.

FUQ: Is the company's management inspired by its own employees?

Our management is indeed inspired by its own employees. Although we are in the manufacturing & Service industry, we maintain a continuous exchange with the clients. Our managers show enthusiasm in listening to us as we give them feedback about our observations, suggestions and concerns. They listen to us and then analyse our feedbacks before taking action. In fact, it is very encouraging to be listened to by managers and advised at any time on how we can improve our work.

FUQ: How do you think the company handles situations that arise when new ideas lead to failure?

In our organization, we view setbacks as not defeats but learning experiences. The distinction between triumph and defeat here hinges on this unique perspective. We embrace every proposal with an open heart, understanding that initial efforts may not always yield the desired outcome. Yet, we never shy away from revisiting these ideas, refining them, and setting them into motion again, aiming for improved results. Our leadership fosters an innovative environment, propelling us to experiment with fresh concepts. They believe there are no real failures, merely lessons to be learned and built upon.

FUQ: Great! Let's move to the next question, then. Does the organization have established shared values that link its strategies and guide employees to achieve common goals during the adoption of Industry 4.0?

Yes, I can say that our company has established shared values. We always agree when implementing the organization's strategies and guiding employees to achieve the common goals during the adoption of Industry 4.0. We have a

vision and mission that guide us when we face any challenge or obstacle. We understand the importance of co-operation and sharing ideas among employees to achieve our mission and vision. I am also planning how to integrate Industry 4.0 into our company's operations and digital manufacturing environment. Since we are an automotive manufacturing organization with both production and service areas, it is crucial to integrate Industry 4.0 as much as possible in all of our departments to gain better efficiency, productivity and quality on each level.

FUQ: Can you specify your set of shared values that are guiding your employees to achieve the Industry 4.0 goals?

Sure, I can say on top of my head that:

- 1) Fostering partnership for organisational success. Our organisation maintains a steadfast belief that our people are the linchpin to our success. This ideology means each individual should perceive their role as a collaborative partner, moving towards shared objectives. They must be adept at teamwork, willing to exchange ideas, and open to sharing knowledge with their peers.
- 2) Delivering customer value through innovation. Our continuous quest is to refine our products and services to provide superior value to our customers. We nurture a culture that encourages the generation of novel ideas, all aimed at enhancing the value of our offerings through innovative solutions and optimised efficiency. Our leadership exemplifies a commendable approach towards this objective, always probing for ways to upgrade our existing product line or service offerings.
- 3) Embracing constant improvement and innovation. This tenet is a fundamental value within our company. Our leadership team is perpetually looking for strategies to streamline our operations and processes through innovative measures and ongoing enhancement. Incorporating Industry 4.0 practices into our various departmental activities is a testament to our commitment to this cause.
- 4) Pursuing quality, reliability, and customer satisfaction. The primary goal of our company is to satisfy our customers with top-tier products and services consistently and without interruption. This implies an unwavering focus on quality, reliability, and customer satisfaction, manifesting in our production activities, like workflow optimisation, and service activities, like prompt delivery, open communication, and customer issue resolution. Our attention is continuously on product development, upgrades, and service quality enhancements to ensure our customers get the best value.
- 5) People as the cornerstone of our organisation's success. We recognise our people's critical role in propelling our company's success. As such, we are committed to fostering an environment where they can grow, excel, and reach their full potential.

- 6) Cultivating a results-oriented culture. Our organisational ethos emphasises being driven to deliver results through dedication and effort. Our goals and the rationale behind them must be clear to everyone. In pursuit of these objectives, all members of our organisation must exhibit a positive, can-do attitude and show unwavering enthusiasm.
- 7) Advocating for teamwork. We persistently strive for excellence in all our endeavours and emphasise the power of collaboration to our employees. We believe that a team can achieve far more than individuals working in silos. Hence, we consider teamwork an invaluable asset in both our production and service activities

FUQ: Let's move to the next question then. How do you consider the importance of employee participation in adopting Industry 4.0?

The importance of employee participation cannot be underestimated since this is the key factor for achieving Industry 4.0. Our company's managers emphasize the idea of having a well-functioning team where everyone feels involved and motivated to achieve success on their own level while working together with other members of their department and/or company. To encourage employees on different levels to share ideas, our managers use brainstorming techniques to find new ways to work, achieve better results, and increase productivity. Therefore, we always discuss how we can improve our processes through innovation to streamline them cost-effectively. This cultural shift towards collaboration is starting to show results in our organization.

FUQ: Can you explain your understanding of cultural shift during the adoption of Industry 4.0?

Sure. I believe that every organization goes through a transition from traditional management styles towards a more collaborative environment where everyone is involved in achieving common goals. For example, the focus was at what level and function would be responsible for completing a task in the past. Nowadays, this has changed almost everywhere in our company as we understand that people on different levels and functions should be involved in completing tasks together. This cultural shift began to be visible over the last year or two. Our organization's managers focused on how departments can work alongside each other while performing their daily tasks. In addition, departments are still responsible for achieving tasks; however, they are encouraged to share ideas during their meetings.

FUQ: How has this affected your employee's capability to propose new ideas, or are there set processes and procedures for this?

Given the aforementioned shift in culture, the concept of employee involvement has evolved to such an extent that employees themselves are beginning to envision novel ways to enhance our current processes and services. Today, every individual in our company is urged to voice their ideas,

seeking innovative approaches to accomplishing tasks. This is an uplifting trend that has been embraced wholeheartedly by everyone within our organization.

FUQ: Do you have any examples or stories?

Absolutely. Just the previous week, we gathered our digital team for an essential conference. During this meeting, all team members brainstormed ways to enhance our present applications and service models. We ended up with the decision that it was high time we developed a fresh application that could supersede our existing service structure. We are set to delve into this concept in greater depth in our forthcoming meeting, where everyone will have the platform to contribute their unique ideas and recommendations. Furthermore, we understand that there's a solid group of employees who are already clued into this prospect and are keen to see it materialise.

FUQ: Sounds great! So within your organization, do you have an active culture where the employee is motivated to achieve results through hard work and being team-oriented?

Yes, we do!

FUQ: How do you deal with the challenges of maintaining a high-performance work environment without managers who demand compliance or weakens incentives?

I believe that our company has established a high-performing work environment that encourages employees to cooperate and co-create new ideas to achieve better results. This is possible thanks to our managers who always seek ways to develop this environment by asking employees questions on improving the company's overall performance. At this point, I would like to mention that our managers are trained to establish a strong performance-based work environment at the management and employee levels. Through short training, they become aware of the most important factors in building such an environment for people and performance. For example, employee motivation strategies to increase productivity and quality based on work analysis during the adoption of Industry 4.0 will be identified.

2.2 Best practices in the organization:

Question 2: Can you give an example of which organizational culture factors have proven most effective in managing the tasks connected with adopting Industry 4.0? Can you please define what you mean by "most effective"?

I would like to discuss regarding the structure and management process of the Industry 4.0 program implemented within our organization. It is crucial for our company to establish a clear and precise vision in order to implement Industry 4.0 into our manufacturing operations effectively. Our mission statement, crafted back in 2014, holds a significant purpose that highlights the responsibilities of our leaders. This particular aspect has played a major role in the prosperous advancement of this program. Every resource within our organization is

responsible for achieving our mission and must be able to articulate clearly the purpose behind embarking on this digital transformation journey. The Industry 4.0 program structure and management process hold significant value for businesses seeking to enhance their existing situation within an IT/IS culture. However, I firmly believe that its relevance extends beyond the confines of the automotive industry. Fundamental self-transformation becomes necessary if substantial and tangible change is desired in the automotive sector.

FUQ: You have given an example of the development of a strong mission statement that has contributed positively to the success of your Industry 4.0 program. Could you give another example of organisational culture factors that have helped with successful adoption?

As I've mentioned, one crucial factor that greatly impacts an individual's ability to initiate change is their motivation. People who are genuinely driven will invariably find the necessary time and means to succeed. Within my team, we have experienced a profound sense of motivation when actively participating in our company's digital transformation program. We firmly believe that the future of our organization hinges upon this endeavour. The culture prevailing within our organization is characterized by several fundamental principles. Firstly, we prioritize long-term commitment, recognizing that sustainable progress is achieved through steadfast dedication. Secondly, we adopt tools and methodologies best suited to the tasks at hand, ensuring optimal outcomes. Thirdly, we maintain flexibility in our approach to change management, acknowledging the need to adapt and evolve. Lastly, we embody a positive attitude when confronting challenges, leveraging them as opportunities for growth. Undoubtedly, exceptional leadership is the most influential force shaping our organizational culture. Since the program's implementation in 2014 within our IT/IS environment, these leaders have consistently exemplified effective ways to motivate individuals by setting clear goals. They have also fostered a culture of trust, where delivering on commitments is encouraged without instilling fear or doubt.

FUQ: Is there a clearly defined mechanism for measuring performance throughout the organisation, specifically focused on adopting Industry 4.0?

We've developed valuable tools for project management and digital architecture design, which play a crucial role in every project. At our company, we constantly evaluate the implementation of Industry 4.0. When measuring performance in the context of Industry 4.0, we utilize two types of indicators. The first type focuses on the impact on product quality, while the second type gauges the daily success of our program. We also assess performance based on the outcomes of each project. For Industry 4.0, reviewing the results once the program is completed regularly is essential. However, continuous evaluation during the program's execution is equally important. This aspect holds particular significance for businesses heavily reliant on quality, such as the automotive industry.

FUQ: What does success look like for your Industry 4.0 strategy?

Before I respond to your question, I would like to mention our company's vision of success, which revolves around the concept of Industry 4.0. Our objective is to wholeheartedly adopt Industry 4.0 and undergo a thorough digital makeover to safeguard our competitive edge in the foreseeable future. Central to our aspirations is developing innovative digital solutions for our valued customers. Equally important, we aim to foster a culture of continuous learning and professional growth among our team members. We strive to cultivate an engaged workforce that remains deeply involved in our company's activities and maintains constant connectivity with their respective projects. Such a harmonious integration of Industry 4.0 principles is what defines success for us as an organization.

FUQ: What are the most important skills needed by your team today?

In today's rapidly evolving landscape, the demand for individuals with exceptional multitasking abilities and strong teamwork skills has intensified, mainly due to the extensive opportunities of Industry 4.0. When organizations introduce new platforms, they rely on their teams to develop software tailored to these cutting-edge environments. Furthermore, it is crucial to have adaptable individuals who can embrace change seamlessly. This is particularly important within organizations where new programs are implemented annually or every few years, necessitating employees who can continuously grow and excel professionally. Additionally, when considering our company and others transitioning to Industry 4.0, I firmly believe that adopting the right mindset becomes paramount. We should avoid making changes for the sake of change itself but scrutinize whether sound reasons exist to deviate from established practices. This principle speaks for itself, serving as the foundation for successful implementation.

FUQ: Can you please describe what personal qualities make an employee a role model in your organization?

I'd like to stress the importance of discovering individuals who can maintain motivation and adapt their mindsets and behaviours. The business realm is constantly in flux, making it exceedingly difficult to predict how circumstances will unfold accurately. To make crucial choices, it is essential to possess a willingness to embrace change. Our company has faced significant turbulence regarding ownership, management methods, and digital transformation, and these factors have deeply affected both our organization and our employees. We have witnessed numerous instances of innovation within our company, accompanied by personnel transitions. However, since 2014, our team has consistently strived for improvement. For two years, we could not introduce any new products or services to our customers, forcing us to ponder how we could discover fresh sources of revenue to weather these challenging times. We earnestly contemplated what actions were necessary to ensure our future success. During this period, we initiated the program,

and since then, we have effectively identified new collaborative approaches among ourselves and our colleagues.

FUQ: If an employee had a work problem, would it be easy for them to ask for help from another employee in the organization, or do you feel that the organization is too rigid in this regard?

I wouldn't say it's overly rigid, but numerous new hurdles hinder employee communication. As employees have become more connected in the workplace environment, how we communicate has undergone significant changes. Face-to-face discussions and phone calls have become less common, and employees seem reluctant to utilise these traditional channels. The concern stems from a fear of intruding on someone's valuable time or invading their personal space by sending a simple text message. Simultaneously, everyone is engrossed in their projects, making it challenging to schedule meetings or even grab coffee together. There's a concern about disrupting colleagues' workflow.

2.3 Approach to individuals by the organization:

Question 3: How likely is it for a leader in your organization to empower employees to overcome their personal reservations to new technology and challenges? What factors play a key role in this?

To achieve success, I firmly believe it is crucial, to begin with small, manageable steps. They become more engaged and invested by gradually introducing individuals to the processes. When it comes to getting employees on board, they need to comprehend the reasons behind the necessity of embracing these changes. To facilitate this understanding, I often make associations with emerging technologies like driverless cars, digital health, and 3D printing. These examples serve as tangible evidence of our direction and highlight the application of innovative technology. In the context of Manufacturing 4.0, it is vital to remain aware of the advantages and disadvantages associated with Industry 4.0. This awareness ensures that employees develop a positive perspective towards these advancements.

FUQ: How can a leader in your organization promote a transformation at a personal level?

By the way, I believe this is an excellent topic that warrants further exploration. We should delve deeper into how to address this subject. I've been contemplating this matter for quite some time and would be delighted to share my insights, techniques for generating ideas, challenges in project management, and other related aspects. However, due to time constraints in this interview format, I propose we continue this discussion later if that is feasible.

FUQ: Does a leader in your organization understand how a group is affected by its transformation?

The transformation has a great impact on the team, which is often more than is expected. Several factors must be considered when implementing new technologies and changes, which must be addressed in the project plan.

FUQ: What are the organizational challenges for managers in leading employees who work from home and employees who work in corporate offices during the implementation of Industry 4.0? How can the organization meet these challenges?

Let's see, it can be challenging if companies do not have their own facilities or if the company lacks communication with the employees. The main challenge is to provide communication and feedback to employees through project tracking, communication channels, Personal Document Management (PDM), etc., so they understand what is currently happening in the organisation.

FUQ: Can you elaborate on this?

Yes. The program team needs regular feedback from the business units. This means project management support to communicate the progress of the transformation at regular intervals, e.g., monthly or quarterly meetings among colleagues in addition to ad hoc meetings. There are many ways to collaborate across distances. To make the transformation process more efficient and effective, creating a PDM (Personal Document Management) system using electronic documents is recommended.

FUQ: How do managers typically communicate tasks to employees to ensure a coordinated approach, including employees who work from home offices and companies' offices, to achieve organizational objectives in adopting Industry 4.0?

I don't have good experience with this, but managers often use emails to communicate tasks. They often forget that employees are not working at their desks 24/7 and are communicating with each other through email:

1) Employees must be notified of company changes through project tracking. 2) Employees must be aware of the important strategic initiatives in the organisation, especially when there are major or dramatic changes. 3) Managers should be aware of the out-of-hours working hours and agency workers in different countries to avoid a breakdown in communication. 4) Use exact wording in emails to maximise chances for a well-defined response from employees. 5) Using project tracking to communicate a list of tasks is a key way to ensure that everyone is fully informed when delivering tasks successfully or not. 6) Try to divide change tasks into small steps and ensure everyone completes them according to plan. This can be achieved by using a checklist for tasks and daily updates. 7) Ensure employees understand their new roles and responsibilities through a training course.

FUQ: I see your point on the informal communication process used by many companies to disseminate information about changes within the company regarding Industry 4.0. Yes, indeed. A good way of communication is a formula to describe the transformation process and the benefits of going through this process. This can be used in all communication channels and still be effective.

FUQ: What do you think of the approach some companies or organisations have adopted to support employees who work from home?

In my personal opinion, I firmly believe that companies have a responsibility to uphold consistent and meaningful communication with all their employees, irrespective of their physical work setting, be it the office or their homes. It is crucial for organizations to acknowledge and value the contributions of both types of workers equally.

FUQ: Do you think the distance between remote and stationary employees plays a role in achieving organizational goals in the transition to Industry 4.0?

Yes, I believe that the distance between remote employees and stationary employees significantly impacts the transformation process. To communicate effectively to these groups, it is important to use OneNote OneDrive, an electronic notebook that can be used in any device with Microsoft Office or any other Office-compatible software installed.

FUQ: How do you ensure that colleagues' knowledge of Industry 4.0 changes is communicated?

This will be easier when measurable targets are set for specific items, e.g. the number of documents in PDM, the number of documents ready for translation, the number of invoices sent to suppliers, etc.

FUQ: Do you have any specific examples of projects which have involved applying Industry 4.0 technologies in your manufacturing methods?

Yes, many projects have been implemented for this purpose. For example, I have worked with a client to establish a global manufacturing platform connected to other manufacturing plants worldwide. This can be achieved by implementing sharing knowledge and forming an electronic network. Another example is the implementation of IoT technologies to communicate with other plants in different countries.

2.4 Ways in which people are managed, directed, or influenced in the organisation:

Question 4: Are there any specific cultural expectations that must be met by the management in your organisation for successful adopting Industry 4.0? Can you please define your understanding of cultural expectations?

In order to cope with the demand of Industry 4.0 , it is crucial to shift the existing mindset of our organisation towards a digital way of thinking and functioning. For

instance, traditional companies typically possess a hierarchical structure where individuals are accountable for their own tasks. In such a scenario, it becomes essential for managers to empower employees to think outside the box and generate ideas collectively. Employees should be granted the freedom to take reasonable risks and independently resolve problems. Striking the right balance between freedom of action and responsibility is the key to success, as it allows individuals to innovate, identify issues at an early stage, efficiently solve them, and swiftly yield positive outcome.

FUQ: Can you define the three main pillars of management strategies used in your organisation when adopting Industry 4.0?

I really think that most companies have their own definition of Industry 4.0 and its key performance indicators. The three main pillars of management strategies may be technology, people, and process. Industry 4.0 is about making a change from a production-based to a customer-centric way of thinking and working to achieve better customer satisfaction, reduce costs, increase revenue from new services, and become more efficient from all stakeholders' perspectives. To achieve this goal, companies need to determine what factors are critical for strategic success in Industry 4.0 and apply the best practices to achieve the desired target outcomes. These factors are driven by the strategy that the company has developed. There is no magic recipe for success, and the strategic goals must be aligned to the overall organisation's culture and goals of its departments. Management needs to identify industry-specific needs of customers and competitors, develop the innovation strategy, align their goals with business units, integrate new technology with existing business processes and systems to target new consumer requirements, set the measurable objectives of the organisation/departments/projects/programs, align them with KPIs (key performance indicators), measure performance regularly to know what's going on in each project/programs, identify opportunities for improvement, share information across divisions as much as possible without losing control over it.

FUQ: Which skillsets are essential for your organisations to adopt Industry 4.0 successfully?

The ability to effectively manage people and demonstrate leadership skills is essential for achieving success in implementing Industry 4.0 strategies. In order to thrive in this new era, organisations must undergo a cultural shift and adapt their work processes to align with technological advancements. Leading by example and taking ownership of one's ideas and actions are vital to this transformation. When implementing Industry 4.0 in the automotive industry, the key lies in shifting the current mindset to embrace a digital way of thinking and working. This requires organisations to be flexible and open-minded, as Industry 4.0 represents a digital revolution that necessitates swift adaptation to the ever-changing business landscape. For instance, if a company embraces Industry 4.0 while its competitors lag behind, it may need to reevaluate its strategy again. Innovation is also critical to this process, requiring employees to take the initiative and unleash their creativity. It is important to avoid getting stuck at the brainstorming stage and

instead foster an environment where new ideas for improvement can flourish. Collaboration among cross-functional teams is immensely valuable, as it brings together diverse perspectives from different departments. This ensures that all angles are thoroughly considered during the decision-making process before implementation commences.

FUQ: How does management ascertain that the goals of Industry 4.0 are broken down into actionable tasks for the employees in your organization to adopt Industry 4.0 successfully?

When adopting Industry 4.0, the most important thing is for employees to identify what they can bring to improve a project and their department sustainably. It relates to having a positive mindset and not risking failure when trying something new or taking a new responsibility. It's also good that each employee knows their responsibilities and the goals set by the company so that everyone is clear about where they are going in general terms. In my opinion, managers need to explain the strategies/goals of the company in plain language so that employees understand what it means personally for them when these strategies have been implemented. Each department and person in the company should be involved in this process to know how each task contributes to the company's success.

FUQ: What do you think is the most critical aspect that management should prioritise for improvement?

In my opinion, the crucial aspect that management should focus on for improvement is keeping abreast of technological advancements. Technology serves as the pivotal catalyst for Industry 4.0, and its full implementation is still an ongoing process. Hence, it becomes imperative for us to acquire fresh skills and seamlessly blend them with our existing mindset and operational approaches. Additionally, it is of utmost importance for managers to exhibit a keen interest in understanding both the capabilities that humans possess and their requirements from technology, as well as the reciprocal interaction between the two.

FUQ: Does your organisational structure enable employees to take on more responsibility in adopting Industry 4.0 without needing management intervention? If not, what would you do to ensure that this happens?

Yes, I think that my organisation is structured to ensure that employees can take on more responsibility with minimum management intervention. Our organisation has a flat organisational structure, and we collaborate closely among the departments. It gives us the flexibility to make changes and implement new ideas and technology fast in all processes and projects/programs.

FUQ: What are the most important lessons your organisation has learned throughout adopting Industry 4.0??

Throughout our journey, my organisation has gained a profound understanding of a valuable lesson: the implementation of new processes and strategies requires time. Consequently, it is imperative to exercise patience, both individually and as a team, in order to witness tangible enhancements in productivity and quality. This took time because we didn't do it by ourselves immediately, but after working

on new processes for months or at least half of a year. We also had to change some people's mindsets within the organisation, so they appreciated these changes enough to apply them in their daily work.

2.5 Typical for decision-making processes in the organization:

Question 5: How would you assess the level of openness or visibility of your decision-making process in your organisation during the adoption of Industry 4.0?

My colleagues and I have regular meetings with our cross-functional colleagues. We discuss all projects and the decisions we need to make along the way.

FUQ: Who is typically involved in a discussion of a certain decision?

Our business unit leaders, IT/IS team, sales and delivery teams, external partners etc.

FUQ: What is the role of the digital transformation manager in this process?

My responsibility is to manage all relevant projects that are relevant for our business unit. If it's a big project, I involve even more individuals from different divisions in my decision-making process. Being a manager means taking care of all issues related to a certain area or project. In my case, it's the digital transformation projects.

FUQ: What is your priority when making a decision?

What is your priority when making a decision? The strategic and operational goals must align with Industry 4.0 in the automotive industry. Many areas of improvement can lead to improved performance and efficiency. I think having a good strategic alignment to transform towards a digital future is important. We can quickly lose track if we do not have a clear strategy for achieving Industry 4.0. Thus, I always try to align strategic and operational goals with my business unit leaders. You must determine if your strategy is aligned with the company vision, the divisional strategies, and the business unit strategies.

FUQ: And if not?

If not, then I need to find out why the alignment was not done in the first place. Is it a communication issue? Or did someone forget about it? It could be challenging to resolve this problem without support from my manager or peers. But as a manager, I am accountable for it.

FUQ: If the alignment is not the priority of your decision-making processes, how would you make decisions?

If it's more important to stick to the current business process and culture than get closer to Industry 4.0, we should do more analysis first. I can imagine that many of my colleagues and people in our industry prefer sticking to old ways instead of changing them. To make a well-informed decision, we must establish a definitive roadmap regarding whether we should adhere to our existing processes or embrace a novel and more effective approach. Regardless of our path, I am committed to

tirelessly seeking the best solution for our organization. I do so by actively engaging with team members, valuing their perspectives on our present circumstances, and encouraging their input on how they envision transforming it.

FUQ: Based on your experience and knowledge of Industry 4.0, describe how a standardized decision-making process should look to enable a successful implementation of Industry 4.0?

It seems simple to me. The culture in Industry 4.0 should be more open and agile, and there must be a great sense of ownership for our decisions. Decisions should be made collaboratively, and individual employees' opinions should be considered. And we need to define clearly what outcomes we want to achieve to learn and improve our processes further.

FUQ: Do you believe greater flexibility in decision-making processes is necessary for your organisation to embrace Industry 4.0 faster and more effectively? Or do you think the current decision-making approaches function well and don't require significant changes?

Considering your question, I would presume that having more flexible decision-making processes is preferable to adhering strictly to our current methods. Industry 4.0 is a relatively novel concept that demands swift adoption. However, we should not overlook the importance of our company's culture and practices. Introducing multiple changes simultaneously could overwhelm individuals regarding their work and mindset. The ideal approach is to gradually introduce new concepts while aligning them with the existing ones. By communicating the benefits of Industry 4.0 to everyone involved, we can foster their willingness to embrace the change and accept the organization's transition. There are occasions when we need to push past the limits of our comfort zone and set out on a quest for exploration in unfamiliar territories. This venture not only enhances our ability to make wise choices but also grants us the strength to foster profound viewpoints as we confront the challenges that lie ahead. Personally, I had the opportunity to delve into the realm of programming not long ago, marking my initial foray into this captivating realm. The experience proved to be truly invigorating, offering me a whole new outlook on the intricate software development process.

FUQ: From your management point of view, how should employees behave when policy or procedure gets in their way when adopting Industry 4.0?

During my professional journey, I've had the privilege of overseeing multiple transformations and closely observing the behaviours exhibited by employees in my team. It is common to encounter individuals who perceive themselves as possessing superior knowledge compared to their peers. Nevertheless, I firmly believe that cultivating an open mind is paramount because it allows us to absorb new information swiftly and effectively address any challenges that may emerge. To achieve a prosperous integration of Industry 4.0, it becomes imperative for every member of the organization to adhere to the established protocols and exhibit respectful behaviour towards one another, regardless of any personal differences or conflicts that may exist.

FUQ: How do you manage change-resistant employees?

Rather than attempting to forcefully alter it, we should take the time to understand why certain individuals or teams are resistant to the changes we propose. By engaging in open and empathetic dialogue, we can address their concerns and potentially revise our approach to garner unanimous acceptance from the entire team. Ultimately, however, the decision to embrace a new practice or policy remains personal. If a particular individual is unwilling to adopt the changes, there isn't much I can do unless the entire team supports my decision, given my role as team leader.

2.6 Factors influencing the assignment of tasks to individuals:

Question 6: Can you describe the procedures for assigning a task to an employee to enable the successful adoption of Industry 4.0? How do you define the characteristics of suitable employees when you assign them tasks that are in line with the adoption of Industry 4.0?

The assignment of tasks to employees involves the establishment of effective communication channels and formats. Communication channels refer to the various methods employed, such as phone calls, meetings, and other forms of direct interaction. As communication channels become more streamlined and efficient, communication's overall effectiveness and productivity improve. However, it is essential to maintain flexibility in communication processes to accommodate updates and changes. Within a conceptual framework, three significant methods can be employed to drive organisational behavioural changes. On the other hand, communication formats determine the specific modes of communication, including formal letters, emails, or chat and instant messaging platforms. It is crucial that all employees actively participate in and possess adequate knowledge about new initiatives to ensure their successful implementation. Behavioural theory, design thinking, and user-centred design are all vital components in facilitating the adoption of Industry 4.0, making it a smoother transition. Behavioural theory is instrumental in modifying an organization's behaviour by altering processes, procedures, or policies based on defined objectives. Since each situation has unique characteristics, there is no universally applicable approach to achieving desired outcomes. Whether one opts for the traditional method of seeking input from department heads or devising a comprehensive plan for implementing changes, it is crucial to motivate employees and help them understand the personal benefits associated with the proposed alterations.

FUQ: We can then move on to the question. What are the incentives and motivations of employees towards the new technology?

Two necessary incentives must be addressed when implementing Industry 4.0 into an organisation's internal IT system: 1. The first is technological innovation, such as new technology, better tools and processes, new ways of working and career paths. 2. The second is worker satisfaction, such as job satisfaction, personal recognition and more flexible working hours. The best way to motivate individuals

to adopt new technology is by embedding the benefits of the latest IT system into their jobs. Rather than giving them a choice between whether or not they should work with the new technology, start by offering them career opportunities and benefits. As you can see, employees have different motives for using computer software. When workers already use computers daily, incentive programs should focus on personal development and autonomy. Or, if workers might be installing this application just because they want to keep up with trends, give them training and knowledge before they can fully appreciate the benefits of it.

FUQ: How do you define the characteristics of suitable employees when you assign them tasks that are in line with the adoption of Industry 4.0?

The characteristics of suitable employees can be described in two key aspects: adaptability and willingness. When hiring new staff, it is crucial to find adaptable individuals open to embracing new technologies and work styles. They should be willing to take on new responsibilities and tasks, contributing to the organization's overall efficiency and productivity. Additionally, existing employees should be able to learn and adapt to new technologies, recognizing how their personal contributions can enhance their application and understanding their impact on future productivity. In essence, if a manager possesses excellent ideas but lacks the necessary skills to implement them, delegating job responsibilities to individuals with the required skills becomes vital. This can be achieved through various means, such as Training programs: Providing structured training programs to equip employees with the knowledge and skills required to excel in their assigned tasks related to Industry 4.0. Coaching programs: Implementing coaching programs that offer personalized guidance and support to employees, enabling them to navigate the challenges of Industry 4.0 effectively. On-the-job experience: Allowing employees to gain hands-on experience with new technologies and work processes through practical application in their day-to-day work. When employees resist change, it becomes crucial for change leaders to effectively communicate with them. This involves setting clear business objectives and openly communicating with each team member. By highlighting the benefits of utilizing new technologies in their work or daily lives, employees can be motivated to embrace the changes and adapt accordingly.

FUQ: When assigning tasks, does your organization follow a structured protocol, or do you rely on individual preferences and expertise?

At our organization, we employ a blend of formal and informal approaches. The formal procedures encompass the systematic steps we undertake to manage our daily operations, including staff recruitment, task allocation, product sales, etc. On the other hand, informal procedures revolve around our interactions with colleagues regarding social activities. For example, when organizing an annual retreat or when someone comes up with valuable ideas that could impact the organization somehow.

FUQ: How do you ensure employees' interests and capabilities align with the prerequisites for successfully adopting Industry 4.0 in their assigned tasks?

When assigning tasks, we consider several factors to ensure a match between employees' interests and capabilities and the task requirements. These factors include the Importance of the task: We assess the significance of each task to determine its priority and strategic value within the context of Industry 4.0 implementation. Key requirements of the task: We identify the specific skills, knowledge, and expertise necessary to perform the task effectively in the Industry 4.0 environment. Skill level required: We evaluate the proficiency level required for the task, considering the complexity and technical demands associated with Industry 4.0 adoption. Training and development opportunities: We consider the availability of training programs and development initiatives to enhance employees' skills and competencies relevant to Industry 4.0. Employee's career development: We recognize employees' long-term growth and advancement prospects within the Industry 4.0 framework, aligning their assigned tasks with their career aspirations. As Industry 4.0 advances, it becomes crucial to acknowledge that tasks are becoming more intricate. Employees might face challenges in accomplishing these tasks with the same ease as they did in the past. To effectively integrate Industry 4.0 into their respective job responsibilities, employees must possess a thorough comprehension of their abilities, as well as the proficiencies of their co-workers. By considering these five aspects in task assignments, we strive to facilitate successful adoption of Industry 4.0 while leveraging the capabilities and interests of our employees.

FUQ: You mentioned the importance of ensuring employees are well-informed about the advantages of embracing the new technology. Could you please elaborate on the specific attributes or features employees should be mindful of when acquiring the skills to implement them?

There are three distinctive characteristics that employees should consider when learning to utilize this new technology effectively. Firstly, their level of motivation plays a crucial role. They must be driven and enthusiastic about embracing this innovation, which will ultimately contribute to the organization's success. Without a clear understanding of how the technology can help achieve organizational goals, they may encounter difficulties implementing the necessary procedures, leading to errors or inefficiencies. Secondly, employees' attention span is another key aspect. They should have a positive attitude towards acquiring new knowledge and adapting to change. Embracing the latest technology requires them to develop new competencies and abilities that may differ from their existing skill set. Without a genuine eagerness to expand their skill set, employees may face challenges in fully utilizing the technology to its potential. To ensure a successful implementation, clear and comprehensive communication is crucial.

FUQ: What role do you expect the employees to play when they are adopting Industry 4.0?

This is about teamwork and cooperation between staff based on their skills, knowledge, background and technical abilities. They must work together to ensure successful implementation. So the employees need to accept their roles within the

organisation and understand how to serve their best interests when dealing with new technologies in their jobs.

FUQ: Industry 4.0 requires a lot of social and technical knowledge. How do you train your employees and match their skills and knowledge with the task assigned to them?

To ensure our employees have the right skills, we use formal methods such as working on projects together and through training sessions. We also use indirect methods such as indirect coaching sessions, supervision on the job, suggesting resources like books or journals that can be used for further learning and then finding their own answer to the issues they face.

FUQ: What do you think the management should consider for mitigating the disparity between the interests and abilities of the employees versus the task requirements when adopting Industry 4.0?

To mitigate this disparity, managers should use various methods to improve the match between employees' interests and abilities and the task requirements. One method may be asking employees to learn new things, while another may be giving them more training or collaborating with other individuals who have the skills they lack. Managers are responsible for mitigating this disparity because it affects an organisation's productivity. This can happen if employers do not stimulate employees' interests and abilities. This is the approach we follow in my organization: 1) I recommend to my employees that they actively participate in conferences and other events that provide opportunities for acquiring new skills. 2) I consistently motivate them to enrol in relevant courses that enable them to incorporate emerging technologies into their job responsibilities. 3) I ask them to visit our partner companies and observe how they work with new technologies. 4) If we have a project, I assign it to someone with solid experience in working on similar projects because the objective of any project is achieved by successfully implementing this technology and not by having great ideas about it.

2.7 How to be a successful team member in the organisation:

Question 7: How would you describe your best leadership approach that fosters your employees' commitment and willingness to use digital tools to get things done more effectively in the wake of Industry 4.0 adoption? Would you please define your understanding more effectively?

I would say it's not easy to be good at leadership. The best leadership should include the following key characteristics based on my experience:

1) Communication skills- Communication is essential for leadership. People are naturally social animals, always seeking dialogue, empathy, understanding, and assistance. A truly effective leader possesses the remarkable skill of communicating with individuals across all organisational levels. Their leadership style must prioritize the organisation's collective mission, rather than being driven by personal motives or self-interest.

2) Confidence - Clearly define the objectives and the tasks required to accomplish them. Ensure everyone knows your vision, what is expected of them, and how it contributes to the overall goal/mission. Be confident that you can deliver results that matter or even be known as a role model that employees can look up to.

3) Integrity - Integrity is essential to lead an organization. It is the ability to make sound decisions based on information and facts while considering all potential consequences of any decision. The role of an effective leader should be ethical, honest and takes responsibility for their actions.

4) Motivation - Not everyone can achieve greatness in life. It takes determination and focuses on being successful in life. A good leader must be able to motivate others towards meaningful goals; these are not the same as incentives that exploit weakness or trick people into doing something against their will.

5) Reliability/Dependability - Good leaders take the initiative and follow through. They ensure they do their duty as assigned and don't leave anything out (e.g., board meetings, conference calls, presentations). They also make sure that all information is communicated well and on time.

FUQ: From the management's point of view, what makes a successful employee in your organization during the adoption of Industry 4.0?

Successful employees within our organization demonstrate exceptional commitment to promptly fulfilling their duties and responsibilities with utmost effectiveness and efficiency. Their work consistently showcases accuracy and a clear focus on achieving desired outcomes. Moreover, they exhibit remarkable teamwork skills, adeptly functioning as team members and inspiring team leaders. Notably, their positive attitude permeates the workplace, often lightening the atmosphere with a well-placed dose of humour for their colleagues. Above all, these exemplary employees embody honesty and reliability, making them truly dependable. Their unwavering dedication to excellence is evident through their persistent positive mindset, which enables them to tackle pertinent challenges and deliver effective solutions.

FUQ: Anything more?

I want to highlight that employees exhibit different levels of performance, which the company's culture and standards can influence. People possess diverse capacities for adapting to changes. Some individuals excel in such circumstances, while others face difficulties. It's crucial to bear in mind that when an employee's performance doesn't meet expectations, there's no reason to become frustrated or engage in self-criticism. It is crucial to acknowledge and value the efforts of all employees and offer them deserved recognition. With time, these individuals will progress and acquire the necessary skills to embrace digital transformation with creativity.

FUQ: How do you think adherence to work instructions and job descriptions affects the success of adopting Industry 4.0 in your organization? How successful are they in your experience?

I think that compliance is key to success in my organization. Ensuring strict adherence to work instructions and job descriptions is paramount to the triumph of any organization. Throughout my extensive tenure as a digital transformation manager, I have had the privilege of collaborating closely with numerous teams for an extended period. As long as the management has clarified the customer's requirement, all tasks should be done according to what has been specified. This includes a detailed plan and a project/task schedule which can be easily accomplished if everyone knows their tasks and responsibilities clearly: 1) Look for the relevant information on the company intranet or from a document library. 2) Generate a project schedule by referring to the document library. 3) Understand what team members have been assigned and what is expected of them. 4) Ensure they meet their deadlines and deliver their tasks as required. Accordingly, 5) Ensure that they communicate with each other and share information using digital tools to ensure that all people know what is required of each other and needed for various tasks.

FUQ: Does your organisation have a code of conduct that defines how to be a good team member, support each other, and get along well? Would you please define it?

Yes, we have a code of conduct in my organisation. It defines how to be a good team member, support each other and get along well. The key point here is that the digital transformation manager must ensure that all know their roles and responsibilities well and achieve the overall transformation effort's overall goals.

a) A good team member should be willing to communicate with others and share opinions to ensure high efficiency.

b) A good team member must also be open-minded and maintain an inquisitive attitude towards solving problems. They should never lose hope when facing challenges because they bring new ideas into the organization that contribute towards positive change.

c) A good team member should have a sense of humour and arrive at a shared understanding of any problem with other people. They can give feedback on any initiatives that fellow employees are developing.

The role of the digital transformation manager is to provide oversight, direction and guidance within the team. d) A good team member needs to communicate with their manager and work as a team member. They must know how each person plays a role in the overall transformation effort and what each person contributes.

e) A good team member should also be proactive and ensure work is done appropriately. They should check if projects are completed on time so management can act according to specific deadlines.

f) Nothing should distract anyone from their work and tasks, including time for personal well-being or soft skills training.

FUQ: To what extent does your organizational culture reflect the code of conduct during implementing Industry 4.0?

Positive collaboration and teamwork that fosters personal growth at the workplace significantly enhance the likelihood of success, elevating one's capacity to accomplish goals and objectives. I believe the code of conduct holds paramount importance in shaping the organizational culture. It should be applied across all facets of the company, encompassing the recruitment of new employees, team management, delegation of tasks to team members, constructive feedback, and effective information sharing. Moreover, the code of conduct should be incorporated into training new employees, acquainting them with the expected standards of behaviour when working with the company.

2.8 How to be a successful manager and supervisor in the organisation:

Question 8: What factors indicate that management is actively fostering an organizational culture that builds employees' confidence in using new technologies and encourages them to contribute with their own ideas to become more effective in adopting Industry 4.0? Would you please define your understanding of being more effective?

It is important to make a distinction between technology and knowledge and skills. One cannot be used without the other. Suppose the company's management fails to motivate employees to enhance their skills and acquire new knowledge. In that case, they will not emerge as leaders in digital transformation, responsible for spearheading IT transformation initiatives. The industry will undoubtedly witness the emergence of novel technologies. However, not all of them will be applicable to your business processes, particularly considering employees' inclination to engage with the latest technologies. It is crucial to discern who is interested in comprehending the functioning and alignment of technologies within their organization. This ability, known as business acumen, enables us to determine which new technologies should be adopted initially and how to leverage them to our advantage. Despite their potential challenges, we must consistently remain prepared to embrace technological changes.

FUQ: What factors do you believe in your organisation are crucial for successful management leadership to effectively adapt to Industry 4.0?

I think possessing business acumen is of utmost importance, although it serves as just the initial stage. The subsequent step entails identifying specific challenges or opportunities within the company that can be addressed by implementing Industry 4.0 technologies. It is crucial to clearly understand the types of problems we aim to solve with Industry 4.0. When given a task concerning IT transformation, my initial step is to gather a comprehensive list of the challenges that can be addressed by embracing innovative technologies and strategies. I find that the most impactful method entails establishing an atmosphere of collaboration, wherein people can freely share their perspectives regarding the organisation's future, encompassing its strengths, weaknesses, and opportunities for enhancement. This initial phase is pivotal. The subsequent step involves organizing

and categorizing the ideas shared in order to prevent unproductive discussions in subsequent meetings.

FUQ: How do you ensure that relevant information flows seamlessly among your team members in different locations?

We prefer FaceTime or Skype because it's faster, easier and cheaper than other tools like Google Hangouts or similar applications. This way, we can deliver presentations or brainstorming sessions via video chat since it is much easier to show visualisations on video than during an audio call.

FUQ: The lockdown necessitated by the coronavirus pandemic has come at an immense economic cost to the automotive manufacturing industry. But at the same time, the lessons learned to encourage the adoption of emerging routines and collaborative task technologies when team members work from home. As a result, working from home is seen by many as a positive for improving performance. However, others suggest that working from home is overrated. Collaborative teamwork practices might be somewhat different when each team member works from home. How do you ensure that remote workers become engaged in collaborative teamwork practices?

I strongly advocate for remote work due to its numerous advantages. Firstly, it significantly reduces the time and expenses associated with commuting and fuel consumption. As for productivity, I firmly believe that it remains unaffected, if not improved. Based on my observations, individuals who work remotely tend to be more efficient than their counterparts who adhere to a traditional office setup. This is primarily because remote workers have the freedom to manage their time effectively, avoiding late-night work when there are minimal distractions. Moreover, working from home allows for greater flexibility in establishing a personalized schedule that maximizes productivity while fostering more robust connections with family members during meal times.

FUQ: Have you noticed any changes in the roles of managers and supervisors in your organization due to the COVID-19 pandemic, particularly in terms of how authority is exerted in embracing Industry 4.0?

Personally, I haven't observed significant impacts. Although a few individuals I know have transitioned to remote work to avoid the virus, they have been able to accomplish their tasks effectively. As an example, my boss has been successfully managing everything from home, even in the comfort of pyjamas and slippers. Thus, I believe the pandemic hasn't had a substantial influence on this aspect.

FUQ: How can you effectively support and enhance the performance of remote workers within your organization?

While working remotely allows us to manage our time better, certain aspects require pre-planning and guidance. While some tasks can be handled independently, others may necessitate closer supervision and support from the management team. For instance, ensuring the regular maintenance of computer systems and other day-to-day activities can be easily overlooked when working from home. It is crucial to provide employees with clear instructions to prevent

any oversight. I believe fostering teamwork is critical, provided that individuals are sufficiently motivated. However, it takes time for everyone to collaborate seamlessly. Initially, most remote workers may require some form of guidance and support to adapt to the remote work environment effectively..

FUQ: Can you elaborate on this?

I think the work of the manager and supervisor is to provide feedback and advice to employees. This includes informing them about their progress towards goals and giving feedback when they miss a deadline. It is also essential to guide employees when they have trouble with something because the manager's responsibility is to motivate people.

FUQ: How do you ensure that remote workers in your organisation are motivated?

I think motivation comes from identifying a problem or an opportunity that can be addressed using one or more IoT technologies. Embracing novel technologies has become increasingly pivotal to streamline operations, enhance productivity, and optimize outcomes. A notable instance of this is our recent undertaking, wherein my team and I have commenced collaborating on an artificial intelligence (AI) bot aimed at expediting and improving problem-solving capabilities. Motivation is related to recognition for individual performance, so managers must know what's happening around them. Another important aspect is the environment and conditions for work, so we need to control and monitor productivity and quality of work. Finally, we need to motivate people by providing recognition and rewards.

FUQ: How do you ensure that remote workers understand that they contribute valuable work to the organisation's performance?

Sure thing! I think providing recognition and rewards for individual contributions is the key. Individual performance is more important than how well the organisation does, so we need to focus more than on overall results.

FUQ: From your perspective, what factors indicate that management is actively promoting an organisational culture that supports employee confidence in using new technologies in the adoption of Industry 4.0?

The recent COVID-19 pandemic presented an excellent chance to advocate for a cultural shift within my company. I'm uncertain if it aligns with our past practices, as we haven't faced significant pressures to adapt. Nevertheless, I intend to seize this opportunity to promote novel and distinctive approaches compared to our previous endeavours. Creating an innovative culture is crucial for our success. It involves encouraging the adoption of new technologies, refining work methodologies, and promoting collaboration. This approach boosts productivity and performance, ensures we stay ahead in the competitive market, and fulfils our customers' demands for ground-breaking solutions.

2.9 Entitlement for a person to tell another what to do:

Question 9: How can management foster a culture of knowledge sharing by encouraging stakeholders with more knowledge and experience to guide others on how to do their job more effectively when adopting Industry 4.0?

There are two primary approaches to consider. Firstly, to acknowledge the significance of team members sharing knowledge. When people don't recognize or value the importance of exchanging information, they tend to be less engaged. However, acknowledging the significance of sharing knowledge within a team creates an atmosphere that motivates individuals to contribute their expertise and perspectives to others willingly. Hence, it is absolutely vital to emphasize and highlight the importance of knowledge sharing within the team. Doing so can create an environment where more individuals feel motivated and inspired to willingly share their valuable experiences and expertise with others. 2) It is essential for management to actively support and facilitate this endeavour by implementing a variety of practical strategies, such as conducting one-on-one sessions and the job-training.

FUQ: I'd like to delve deeper into this matter for a while. When it comes to embracing Industry 4.0, it appears crucial to effectively organize individuals into teams to attain the desired outcomes. However, do you believe it is appropriate for management to be actively involved in the process of organizing people? Could this potentially serve as a pretext for micromanaging employees?

No, I don't think so. Management can create a working group and project team structure based on organisational needs and competence development. For example, suppose there is a strong need for knowledge sharing within a particular area or industry domain. In that case, management can create a team dedicated to this competence sharing and ensure that the project team has experts from different regions. This can be done to support the adoption of Industry 4.0, not to micromanage employees. A good understanding of the business requirements is essential for success in an organization. The more knowledge people possess about their domain, the better they can help others find solutions to relevant problems.

FUQ: What factors make organisational workflows more effective so a stakeholder can communicate more easily with other stakeholders? What should be done in adopting Industry 4.0?

The most important factor is knowledge sharing and understanding business requirements.

To establish proper priorities, effective processes, and efficient ways of working, individuals must clearly comprehend the situation at hand. Individuals with extensive knowledge in their specific fields are better equipped to help others recognise and address relevant problems. Acquiring such a deep understanding demands a substantial commitment of time and effort. Another critical factor is the organisation's orientation before and after adopting Industry 4.0: who is it for, and what results will come from it? It is crucial to determine these before you start the transformation process. This way, everyone knows their part and can contribute

appropriately. The information sharing between project team members needs to be handled effectively. They must communicate quickly and efficiently so that they do not become rivals at work or develop unnecessary accounts about each other's performance - both negative emotions that usually lead to poor teamwork and performance.

FUQ: Hypothetically speaking, you identified deficits/overlaps of workflow tasks when implementing Industry 4.0. How would you address the task owner(s) situation, which is most consistent with your organisational culture?

In this situation, management should work with the individuals in charge of the tasks and determine how they prefer to do them. Management could help them write or describe what they want to achieve if there are any gaps. This will help everyone to achieve their objectives more effectively.

FUQ: How do you think organisations define knowledge?

I think the most critical factor is the organisation's orientation before and after adopting Industry 4.0: who is it for, and what results will come from it? It is crucial to determine these before you start the transformation process. In addition to the organisational orientation, organisations must clearly define what knowledge is and how to share it effectively. This way, everyone knows their part and can contribute appropriately. The information sharing between project team members needs to be handled effectively. They must communicate quickly and efficiently so that they do not become rivals at work or develop unnecessary accounts about each other's performance - both negative emotions that usually lead to poor teamwork and performance. I believe it could vary based on the organisation's size. In a smaller organisation, there would usually be a limited number of individuals who know the system's inner workings. Still, there could be teams in larger organisations who share their knowledge within their area of expertise, such as the quality function inside an organisation..

FUQ: How does management foster a culture of mutual support when adopting Industry 4.0?

I think that you need to create the space for the organisation. For example, working in an agile organisation, you can create sprint teams that share knowledge within their area of expertise. You can also foster knowledge sharing within the organisation by informing everyone, ensuring they know what is new. You also need to create shared accountability for projects, workflows or activities. For example, if this is about creating an innovation process of new products or services, the project leader should take charge of this and give it to another team if things are out of hand. This way, other teams will know what is expected and contribute to the project leader's accountability. If your organisation still operates under a conventional business framework, wherein individuals are assessed and rewarded based on their accomplishments and performance, transitioning to Industry 4.0 will be challenging. Such a shift can engender a sense of distrust in the leadership, potentially impeding any implementation project's success.

2.10 Sources of work motivation:

Question 10: What do you think are the key motivational factors for the stakeholders in your organization to be engaged to achieve measurable success in adopting Industry 4.0?

In my opinion, there are instances where individuals may not exhibit sufficient motivation in their work due to a lack of clear understanding regarding its purpose. Nevertheless, employing effective strategies to elucidate the significance of their tasks can significantly enhance their motivation and drive them to excel in their performance. So, I define the critical business goals for each business unit I work with. I create a strategy to help the business unit achieve its goals, determine what is required, and work with them to define action plans. Specifically, I would define key motivational factors 1) Clear key business goals, which are measurable by key performance indicators. 2) the importance of goal achievement for the organisation's success, 3) how much it determines their success, 4) people want to achieve something when they know the importance of achieving the goal for themselves and others.

FUQ: How vital is fair compensation in driving your company's employees to embrace Industry 4.0?

Determining what constitutes modest payment can be complex as it involves diverse perspectives on appropriate remuneration levels. I believe in the principle that individuals receive compensation in line with their contributions. If employees excel in their roles, they should be adequately rewarded. Moreover, when employees clearly understand their job expectations, they feel valued and inspired to deliver their best performance. Additionally, our company offers a comprehensive benefits package that reflects the effort employees put in hourly, contributing to their motivation to excel. I consider this aspect another influential factor in driving exceptional performance among our workforce.

FUQ: What role does the possibility of promotion play in your company's employees' motivation to adopt Industry 4.0?

I don't think this is relevant for motivating people to adopt Industry 4.0. Still, I believe that if people want to be promoted, they must demonstrate their ability to implement or support significant changes within the organisation. For example, the implementation of Industry 4.0 requires new skills and talents, so they need to demonstrate their willingness in using these new skills and using them effectively.

FUQ: How do you think a work atmosphere based on a culture of trust can be established during the adoption of Industry 4.0?

Creating a work environment that fosters trust and cultivates a strong sense of culture hinges on the proactive commitment of senior executives to assume accountability for the advancement of each individual. These leaders must demonstrate a genuine eagerness to embrace responsibility for the success and growth of every team member, effectively guiding them towards fulfilling their professional aspirations. This aspect becomes particularly critical within an

organization actively undertaking extensive transformations like those associated with Industry 4.0.

2.11 Relationships between work groups or departments in the organisation:

Question 11: Do you think that organizational culture has the potential to mitigate a mutual indifference amongst the individuals in the adoption of Industry 4.0? If YES, please explain more.

I think that the organisational culture is significant for sustainable digital transformation. The culture must be aligned with the new business objectives and create a positive environment for innovation and critical thinking. In my opinion, culture is primarily concentrated within an organization, and it invariably hinges upon individuals' unique qualities and roles within the organization. It is crucial to acknowledge the existence of diverse personalities within an organization. It would be unreasonable to anticipate every individual, particularly those from different backgrounds, to fully embrace the exact same culture we uphold. The fundamental objective of digital transformation is optimizing the utilization of existing resources to establish a robust organization capable of enduring uncertain circumstances. Consequently, I firmly believe that a shift in culture is unavoidable. Amid an ambiguous future, the utmost valuable attributes for an organization are freedom and flexibility. Adapting to new working conditions will be critical for organisations to survive in the future.

FUQ: To fully exploit the potential of Industry 4.0, the organisations require a holistic approach throughout the value chain. Do you agree with this statement?

I think the statement is correct. The main objective of Industry 4.0 is to improve efficiency. Considering that the automotive industry is vertically integrated, all parts of the value chain will be strongly interconnected. For example, suppliers must communicate with each other and respond to new opportunities on behalf of their clients along the entire value chain. The same is true across the value chain, from design to manufacturing and transportation. The level of integration will also be high, from plant automation to supplier management and service. These are just some of the benefits achieved through Industry 4.0, which will make the supply chain more efficient and thus enable lower customer costs and prices.

FUQ: What do you mean with a holistic approach in the automotive industry?

Industry 4.0 will offer many benefits regarding efficiency and cost reduction in manufacturing. A holistic approach means that all parts of the value chain are aligned strategically and operationally. This alignment ensures optimal integration, which is difficult for companies from different industries. We fully recognize the significance of being well-prepared to tackle any task in the business workflow. With the advent of Industry 4.0, we are fortunate to enjoy various advantages that greatly enhance efficiency and help reduce costs. These benefits are not only limited to manufacturing; they extend well beyond, impacting other areas of operation too.

FUQ: What factors do you think would enhance the holistic approach in the organisation during the adoption of Industry 4.0? Would you please explain your understanding of a holistic approach?

According to the definition, I mean aligning operations and strategies of the organisation in all stages of the value chain. This means that two companies with very different specialisations must have at least one area to work together. For example, in manufacturing, the companies should be able to work together in areas such as design automation, production engineering, assembly automation and plant construction:

- a) They are interconnected
- b) They are similar
- c) Can be easily understood by the members of each team
- d) Use common terminology/tools/principles

FUQ: Let's assume there is an existing unified perception of organisational culture which follow the stakeholders along the connected value chain during the adoption of Industry 4.0. How would you characterize the unified organisational culture works for everyone in the value chain?

This unified perception would enable an organisation to react to any change in the automotive industry. This organisational culture must be aligned with the organisation's strategy, which means its goal is to improve efficiency and increase profitability. This is because this approach will help the organisation survive in uncertain times. According to this approach, each company's culture must be aligned with its strategy.

FUQ: Do you think that the unified organisational culture helps mitigate the mutual indifference amongst the individuals in adopting Industry 4.0? If YES, please explain more.

Yes, I think it has a positive effect on organisational digital transformation. The adoption of Industry 4.0 will require employees to change their working conditions. Their job profile will differ according to each company's strategy and operating model; thus, our employees need to adapt their practice to fit the company's new vision. This means they must facilitate organisational change by sharing best practices, ensuring synergy between workgroups and departments. The unified organisational culture works very well in this regard.

FUQ: How do you describe your organisation's different types of organisational cultures when adopting Industry 4.0?

There are different types of digital transformation cultures within organisations depending on the various characteristics of each organisation. According to my experience, there are three main types:

- (1) - The current organisation's culture is conservative and internally focused, not open to change and innovation. This kind of culture leads to sluggish and irrelevant decision-making. It often leads to a lack of awareness regarding business changes

and trends, and there is no proper communication between all organisation members. This is one of the most common types of culture within organisations.

(2) - The existing organisation's culture is innovative and externally focused, open to change and new ideas. This kind of culture enables open communication. New ideas and innovation are encouraged throughout the organisation, which creates a fast decision-making process and adaptable behaviours in times of change or crisis within the industry. It promotes an environment that facilitates digital transformation and helps decrease the time needed to adapt to Industry 4.0.

(3) - The culture of the future organisation is innovative and externally focused; it is open to change and new ideas. This kind of culture also enables open communication between employees, customers, shareholders etc. According to my observation, this kind of culture is the most important in adopting Industry 4.0. Therefore, it is recommended that companies with a culture similar to this one use digital transformation technologies to move forward.

FUQ: What are the similarities between the three different cultures?

The similarity between these three types is that they have no significant differences regarding adaptivity towards Industry 4.0. It means that organisations with a conservative culture can quickly adapt to new technology by adopting an innovative or creative corporate culture. Most basic characteristics are already present within these organisations' current organisational structures.

FUQ: How do you ensure that employees understand how their work contributes to the adoption of Industry 4.0?

To understand how their work contributes to adopting Industry 4.0, there must be good communication between the employee and the line manager. A strong connection between employees and their line managers is crucial for people to embrace and adopt new technologies. Employees ought to understand how their work will change in the future clearly. They need to be aware of what is expected from them and how their efforts contribute to the overall objectives of the transformation. Building a solid connection between managers and their teams is crucial to grasp this knowledge truly. Effective communication and a close relationship play critical roles in achieving this understanding. Moreover, it is vital to ensure that every employee is well-informed about their specific roles, responsibilities, and obligations regarding the digital transformation within the organisation. Creating a human connection and fostering open communication channels between managers and employees will help alleviate concerns and promote a positive mindset towards embracing technological advancements. Ultimately, this will facilitate a smoother transition and enable employees to adapt to new forms of technology with confidence and ease.

FUQ: How do you manage the different actors working in the value chain while implementing Industry 4.0 tools?

It is essential to ensure that all actors know their duties and roles while implementing these new technologies to increase the probability of success for the entire value chain. All members must be involved in active communication for

them to be effective. According to my observation, there are many ways to manage different actors within the value chain during digital transformation processes. Still, one of them is to create a clear distinction between each actor's responsibilities and functions along the value chain.

2.12 Types of conflicts between groups and people:

Question 12: Which management key approaches to organizational culture work best in your organisation to avert any cross-team and interpersonal conflicts when adopting Industry 4.0?

We avoid any problems and conflicts in the first place. One fundamental principle at our organisation is prioritising the larger goals and overall vision rather than getting caught up in micromanagement. I believe that team members can excel in their roles when they comprehend their tasks. It's equally essential for them to be aware of what jobs they should avoid and the reasons behind those restrictions, and it's our responsibility to provide the necessary guidance. Regarding our organisational culture, we value a collaborative approach to handling matters within the company. In simpler terms, we encourage open discussions and aim to address as many topics as possible. Some people may bring up as many as possible if it respects its regulations, policies and practices. Therefore, we have a democratic way of decision-making at all levels of the organisation with a clear understanding of the strategy and mission. We also encourage employees to seek responsibility at all levels, whether a management decision or a personal decision related to work efficiency that improves teamwork, profits and innovation within the organisation.

FUQ: Do you think the responsibilities and tasks for the successful adoption of Industry 4.0 are clearly defined and communicated to your employees and stakeholders?

- 1) We have a strategy that everyone understands. We define the responsibilities and tasks clearly and communicate them to all employees and stakeholders. We ensure that the stakeholders know exactly what they are supposed to do and how to function effectively. We anticipate a sort of commitment and participation. That's why our strategy has been effective: It is simple because all stakeholders are part of setting the direction for the organisation. We also hold meetings with employees at all levels to maintain or change the strategy whenever necessary.
- 2) We pay attention to creating an engaging workplace. This has led to increased productivity, satisfied employees and improved customer service. Everyone should be involved in this process; all should share information and search for new ideas, solutions and techniques within the boundaries of our legal framework.
- 3) We provide continuous training opportunities for people across different levels to develop their skills and competencies and increase their knowledge about Industry 4.0 if necessary.

FUQ: To sustain a competitive advantage, the adoption of Industry 4.0 requires a fine balance between cooperation and competition for excellence between the individuals across the value chain. Do you think there are specific cultural factors in your organization that help to achieve this fine balance?

Collaboration and teamwork among employees and teams foster a culture that thrives on genuine cooperation. I understand that the power of working together and achieving organisational goals drives progress within the organisation. This approach benefits everyone involved as long as it's built on trust, motivation, and commitment. It takes hard work, dedication and contribution from all the employees to get better results for customers, clients and partners. We never forget that every employee is an asset to the organisation. This is true whether we are talking about cooperation or competition: "Racehorses compete with each other, but they also cooperate". That's how we see our people: we cooperate among the teams of our organisation while competing against all players who will try to take our customers away from us.

FUQ: Can you talk a little more about how your organisation addresses this fine balance between cooperation and competition regarding excellence between the individuals across the value chain?

To foster cooperation and collaboration, we have created a culture supporting collaboration within our organisation. There is a personal commitment from individuals as well as commitment from teams. I strongly believe in working together at all levels to achieve goals and progress within the organisation. Everybody has a role in this process regardless of their position or competency. That's why we have set up objectives for all employees. Everyone understands the organisational objectives and knows how they contribute to achieving these goals, so everyone works to achieve them. Every team should adopt this culture, every process and every business unit within the organisation.

FUQ: What factors in the organizational culture would you say foster good working relationships and minimize the likelihood of misunderstandings among employees in your organisation when adopting Industry 4.0?

In our collaborative work environment, mutual trust is the key factor that drives our culture. To foster this trust, we have devised a strategic plan as a guiding principle for all our operations. We strongly emphasize the importance of personal commitment from each team member. Furthermore, we have designed a workspace that actively promotes collaboration and the free flow of information and ideas among all employees. We encourage open communication channels, allowing individuals to readily seek assistance and support from their colleagues. We arrange team lunches and celebrations, allowing people from different levels of the organization to mingle and build camaraderie. These events foster a sense of unity and promote teamwork, which is crucial for our success. To demonstrate our dedication to our employees, we prioritize their needs and well-being. One way we do this is through monthly meetings at their workplaces. During these gatherings, I engage with them to discuss the organization's progress, our strategic direction, and their roles within it. These meetings serve as an invaluable platform

to address any concerns, clarify misunderstandings, and identify opportunities for growth and development—our approach centres around cultivating an environment where trust, collaboration, and open communication are deeply ingrained. Doing so creates a solid foundation for teamwork, productivity, and continuous improvement.

2.13 Ways in which members of the Organisation respond to outside world:

Question 13: What are the key organizational culture factors for the excellent alignment of your organisation with external partners, suppliers, and customers to achieve effective adoption of Industry 4.0?

The organisational culture is the most important factor in achieving alignment. I want to share a real example that we faced recently. My team and I were developing requirements for an Industry 4.0 project, and we had to use a cloud-based solution to manage distributed resources in the cloud. In this case, our organisation doesn't have much experience with Cloud technologies, as you know, so it is a new method for our developers and partners and those who are using those applications from outside of the organisation. We thought it would be best to use this system because it is the most popular one in our field. I was afraid of distributing this task among the different team members. We all know that sometimes people do not like each other and working together can be difficult or even tense. However, I was glad we overcame the obstacles and worked together to create this system with valuable features.

FUQ: Based on your opinion, what type of organisational culture should be adopted by the Organisation to enhance sustainable relationships with customers, suppliers, and partners along the value chain?

I believe it is important to gain trust with partners or customers. It should be done by accepting the feedback from the different stakeholders. They are important for our success, so it is important to keep them happy. Feedback is valuable since it will help your organisation grow stronger and better.

FUQ: How can your organisation ensure that organisational culture is aligned effectively with the value chain in the resource-constrained environment?

From my understanding, we must ensure that our resources are readily accessible and promptly provided. We must remain flexible and open-minded to navigate the ever-changing landscape. We must be willing to make necessary adjustments without hesitation. We mustn't shy away from change but rather embrace it wholeheartedly. Let's welcome new opportunities with open arms and maintain a high level of adaptability in our approach. Moreover, our resources must be transparent, allowing everyone to utilize them most effectively.

FUQ: Please share your experience and best practices in ensuring that organisational culture is aligned effectively with the value chain in the resource-constrained environment.

I believe that is crucial to make your resources available to your customer in the most convenient way possible. To do this, we must be careful about project

management and communication because they are vital for successful projects. I also believe that communication from the organisation should be open and transparent. All critical information will be shared with everyone interested in a better future for your organisation. It will be a substantial competitive advantage if your organisation is open to feedback from the outside world. This will help to improve your organisation and ensure sustainability.

FUQ: Based on your experience as a digital transformation manager, what are the key factors that effectively facilitated the adoption of Industry 4.0?

I have a suggestion for leading successful projects that's pretty straightforward. The key is, to begin with a small project and implement it. Once you've completed that task, it's time to start considering the next course of action and inform your team about the necessary requirements for that phase. Don't feel pressured to undertake something huge or intricate. The magnitude and intricacy should match the scale of the organization you're employed in, as well as your personal expertise, abilities, and mindset. You can even kick things off with a small step and build upon it gradually. For instance, making small changes can yield better results in a shorter timeframe, benefiting your customers or users at each stage throughout the project's lifecycle.

FUQ: What are the most important values of your organizational culture that your customers should adopt, suppliers, and partners to achieve excellence in productivity, quality and innovation during the adoption of Industry 4.0?

I think that transparency is most important for our customers, suppliers, and partners. If they know about our organisation's problems and issues they can help us to improve. As you know, transparency is about sharing information and about sharing resources with everyone outside of your organisation. That's why I suggested making your resources available quickly and easily so that customers can use them in the best possible way because it depends on the customer too.

FUQ: What are the key steps to effectively implement Industry 4.0 in your organisation?

We should not only focus on new technology but also on digital transformation, which is the way you use digital tools to make your products, services, and business more efficient. We should start with small projects to gradually improve the existing processes and systems. Doing so saves both time and money and helps prevent unnecessary delays. Moreover, I strongly believe that we must be open to feedback from our customers and strive for ongoing improvement.

FUQ: What do you think are the biggest challenges to implementing Industry 4.0 along the value chain?

To successfully implement Industry 4.0, it is crucial to define your strategic goals and identify any potential problems that may arise during the process. Utilizing digital tools can help overcome these identified issues and align your efforts with the strategic objectives. Additionally, introducing new products or services becomes essential in engaging clients who may not immediately perceive the benefits of new technology. By doing so, you can ensure organizational success by

bringing innovations to the market, boosting productivity, and fostering business growth. Considering solutions that save time and enhance client productivity is important, as this can significantly impact customer satisfaction. Overcoming the "cabin factor" or "not invented here" syndrome is key in this journey, and one way to achieve this is by educating your team about the organizational goals. Clear communication of strategic plans to the team is vital, and starting small with technology or product introductions can ease the transition. Before implementing new technology or services, it is essential to assess their suitability for your organization, considering factors such as compatibility and feasibility. It is a continuous process to improve all aspects of your organizational operations, aiming to maintain a competitive advantage over rivals. This includes enhancing your services and products to surpass competitors, which can involve introducing new technology, improving quality, and implementing new features or digital tools.

2.14 Work attitude of people in the organization if rules, systems, or procedures get in the way:

Question 14: To what extent does your organizational culture encourage employees to try new things when adopting Industry 4.0, rather than sticking to the "it's always been done this way" mentality?

In my experience, I've observed that many organizations face challenges due to the absence of effective sales and marketing strategies, resulting in increased costs and a deviation from their core competencies. Surprisingly, despite the evident value digital technologies bring, most companies still lack digital strategies. I believe engaging digital transformation managers who can guide the organization's shift from an analogue to a digital world is crucial to address this issue. As a professional, I strive to define clear goals for my customers and senior management, emphasizing the importance of digital transformation. Through this process, I've witnessed a positive cultural shift within companies, leading to the development of fresh ideas and innovative approaches. A newfound openness to change is essential to stay competitive in today's fast-paced business landscape. One of the key transformations I've implemented to ensure the successful adoption of Industry 4.0 is the introduction of agile methods. This approach allows us to prioritize project goals based on their significance, enabling the organization to focus on what truly matters at any moment. Effective communication, constant monitoring, and thorough review of development processes are crucial for success. I advocate for controlling all IT projects through key performance indicators (KPIs) to ensure transparency and accountability. These metrics provide valuable insights into project progress and performance, helping us make data-driven decisions. Furthermore, fostering collaboration between teams is vital as it allows for efficient task prioritization and facilitates the seamless exchange of information. By addressing these key aspects and embracing digital transformation, organizations can overcome challenges, streamline their operations, and ultimately become more competitive.

FUQ: What countermeasures does management take when rules, systems, or procedures get in the way of employees when adopting Industry 4.0?

The management sets the countermeasures in a company, following general rules such as project management and Agile methods. Making organisational changes, especially regarding its culture, can be difficult. The Agile Methodology effectively achieves goals, learns from failures, and applies lean principles. Changing people's mindsets and fostering a positive culture necessitate adopting new methods and implementing a development process aligned with strategic goals. It is essential to introduce new ways of thinking to the team. While encountering failures is likely during this process, it serves as an opportunity for learning and growth, allowing for better performance in the future.

FUQ: Effective Industry 4.0 requires a holistic approach that engages stakeholders along the value chain in the adoption process. Do you actively engage internal and external stakeholders in adopting Industry 4.0 by aligning the organizational culture with them accordingly?

Our organisation has recently embarked on the digital transformation journey, implementing new projects and exploring potential business opportunities. At this stage, objectively assessing the results is still too early. We will continue testing and evaluating our progress as we progress with our digital transformation roadmap. There is a gap in understanding how to tackle this particular issue effectively. To ensure success, I recommend that managers formulate a strategy that promotes adopting new work practices among employees.

FUQ: Do you actively encourage internal and external stakeholders to enhance their processes while adopting Industry 4.0 by aligning the organisational culture with them accordingly?

I strongly believe that digital methods are essential for business processes, not just limited to Industry 4.0. I remember a customer who questioned my methods a decade ago, which sparked my investigation into the slow pace of change. I delved into organisational culture and discovered Agile Methodology as the solution. It revolves around three pillars: being Agile in doing well and adapting, being flexible in responding to changes, and being able to rapidly adapt by adopting agile methods. Applying these pillars helps create better plans, reduce costs, and measure progress. In the future, I aim to use Agility in all my interactions with customers, employees, and business partners to build a better world for everyone.

2.15 What new employees need to learn to be successful in the organization:

[Question 15: How does the company familiarise the new employee with the organizational culture along with the formal rules and procedures which are helpful for the adoption of Industry 4.0?](#)

In my role, it's essential to promote the company's values and key drivers for Digital Transformation, ensuring employees understand what is expected of them. To aid in this, we have a document called "Digital Health" that provides further

explanations. A significant part of my job is aligning the company's strategy with the skills of our employees. This involves assessing their current state and envisioning their future success. I also focus on adapting their knowledge, skills, and behaviours to meet the company's evolving learning needs. To achieve this, I dedicate considerable time to training them effectively. Understanding our workforce is crucial. It allows me to identify where employees may face challenges and the level of importance in helping them progress. By investing in their development, I can ensure they have the necessary tools to thrive. Our talented development team recently created a modular serverless IoT platform for monitoring vehicles. This innovative platform represents our commitment to embracing technological advancements and delivering cutting-edge solutions.

FUQ: Do you think it is beneficial for newly hired employees in your organization to be briefed in advance on which norms (unwritten rules) they must adhere to to avoid running into conflict with other stakeholders during the introduction of Industry 4.0?

I think that employees should understand the expectations and norms. No one should be afraid to speak the truth and should be able to speak up when things do not happen as expected.

FUQ: What would you like to say about the skills and abilities required for your position?

To overcome various challenges, I need to possess strong problem-solving skills. This involves identifying problems and finding suitable solutions tailored to address them. By carefully analysing current affairs, I can determine what is lacking or missing in different situations, allowing me to customize and adapt solutions effectively. I need to understand how technology can support my goals. This includes exploring the interactions between various technologies and being aware of their potential misuse for undesirable purposes. Additionally, I must manage my stakeholders' needs while ensuring that the technology I utilize aligns with the company's objectives. To stay ahead, I need to closely monitor the business environment and how it can impact our readership.

FUQ: What are the shared company values? And which key aspects of the shared company values do you think will enable new employees in your organisation to do their jobs more effectively as they adopt Industry 4.0?

The shared company values are innovation, openness to people, and quality. We strive to uphold these values in our daily operations, both within our organization and in our customer interactions. In adopting Industry 4.0, these key aspects of our shared company values will enable new employees to perform their jobs more effectively. Openness to People: In the era of Industry 4.0, collaboration and communication play crucial roles. Our value of openness to people fosters a culture of inclusivity and teamwork, encouraging new employees to actively engage with colleagues, share knowledge, and collaborate across departments. This enables them to leverage the organisation's collective expertise and adapt to

the collaborative nature of Industry 4.0 initiatives. They will have the foundation to embrace technological advancements, collaborate effectively, and deliver quality outcomes that drive customer satisfaction and contribute to their own job satisfaction.

FUQ: What factors are critical or need to be improved in the organisational culture to help new employees learn how to cooperate and be good team members when adopting Industry 4.0?

To help new employees learn how to cooperate and be effective team members when adopting Industry 4.0, there are several critical factors that I would consider:

- a) Foster a culture emphasising collaboration and teamwork's importance. Encourage open communication, knowledge sharing, and cross-functional collaboration. Promote a sense of collective responsibility towards achieving common goals related to Industry 4.0 initiatives.
- b) I encourage employees to acquire new skills and knowledge related to Industry 4.0 technologies and processes. We provide training, workshops, and professional development opportunities to support employees in staying updated and adaptable to the evolving landscape.
- c) I encourage my colleagues to adopt a supportive leadership style that empowers employees, provides guidance, and encourages open dialogue.

IV. Next steps

All answers will be transcribed within the coming week. I will send a copy of the transcript to you for final checking and approval.

Would you like a copy of the final study (approximately 2021)

Y	N
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Many thanks for your participation.