

# Strategic design of culture for digital transformation

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## ABSTRACT

Industrial organizations need to take a cultural leap in order to integrate social systems with rapidly evolving digital technologies. Subsequently, aspiration for digital transformation enabled by organizational culture is ubiquitous; however, guidance in the literature on how to refresh the culture in pursuit of digital transformation strategy is underdeveloped. We conducted a diagnostic multi-case study on the organization culture in three globally renowned industrial organizations undergoing digital transformation strategy implementation. Through thematic analysis of qualitative data, we identified cultural artefacts, values in action, and assumptions that industrial organizations should refresh to enable digital transformation. It was found that forerunner industrial organizations' approach to culture is strategically proactive and thoughtful. Furthermore, their leaders employed culture as a social control system for digital technology adoption. The research findings are summarized as an exploratory framework for the strategic design of culture for the purpose, governance, ecosystem, and organization of sociotechnical systems.

## 1. Introduction

The culture of an organization connects the people, work, work groups, and their purpose (Coyle, 2018). Culture has social colors and diversities that are networked to pursue the business purpose of an organization (Jelinek et al., 1983). In fact, culture is the 'organization's mind' (Mintzberg et al., 1998, p. 265); culture provides a system of accepted meanings (Chatman and Cha, 2003) for the employees to interpret a strategy, the situation, and the associated actions needed for strategy implementation (Pettigrew, 1979). Hence, future-ready firms thrive even in the face of changing business realities (Barney, 1986; Mintzberg et al., 1998; O'Reilly and Chatman, 1996; Parida et al., 2019) by strategically renewing the culture (Schein, 1990; Warner and Wäger, 2019) in support of their purpose, governance, organization, and ecosystem (Pasmore et al., 2019; Volberda et al., 2021).

Organizational culture-enabled strategic renewal is vital in the current disruptive digital age (Vial, 2019; Volberda et al., 2021; Warner and Wäger, 2019). Because digital technology advances have altered the relationship between our cyber and physical realities (Sony and Naik, 2020; Vial, 2019), the 'what', 'who', 'why' and 'how' of organizational work have changed. Despite two decades of upsurge, digital-technology investments are still increasing (McKinsey, 2019; Statista, 2020) as most businesses are still falling short of attaining their digital strategy targets (Kane et al., 2016; Tabrizi et al., 2019; Wade and Shan, 2020). Though the articulated strategies of most organizations are comparable (Barney, 1986; Gartner, 2020; Kane et al., 2016; Porter and Heppelmann, 2015), however the strong culture existing in traditional industrial organizations often challenges the implementation of technology-driven strategy (Mumford, 2006).

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Traditionally, industrial organizations have focused on superior manufacturing technologies to compete for higher market share and profitability, and now digital technologies offer a new competitive spectrum for them (Porter and Heppelmann, 2015). Instead of a solo run market-based approach, with digital technologies industrial organizations can transform business value complementarities within the whole ecosystem (Jacobides et al., 2018). Such transformation through digital technologies (i.e., digital transformation) encompasses not just technological change, however, all that organizations carry out – from the individual knowledge of workers' daily work routines to the entire business model. Therefore, digital transformation necessitates a sociotechnical system perspective that incorporates the organization's goals, people, work tasks, physical infrastructure, processes, external value networks, governance, culture, strategy and technology (Coyle, 2018; Davis et al., 2014; Imran et al., 2021; Kane et al., 2016; Kreutzer and Land, 2015; Mitki et al., 2019; Sony and Naik, 2020; Vial, 2019).

The adoption of digital technologies to bring meaningful work to the employees is at the crux of sociotechnical systems, where emphasis is on social and technical systems codesign (Pasmore et al., 2019; Trist and Bamforth, 1951). A hesitant approach to synchronizing social and technical systems reaps limited benefit for industrial organizations (Mumford, 2006), while in altering technical, social, and environmental conditions, an unattended culture becomes a liability and a source of resistance to strategy (Barney, 1986; Gagliardi, 1986). Whereas the deliberate preparedness of the organizational culture for digital technology adoption can make traditional organizations future-ready (Parida et al., 2019).

It is natural that organizations will renew their cultures (Pettigrew, 1979). However, it would be naive to believe that new values, explicit and tacit beliefs, and artefacts can just be installed (like a widget) to make the culture supportive of the strategy implementation. Instead, cultures should be strategically designed, carefully crafted, lived, and nurtured, so that people can successfully execute the business strategy (Chatman and Cha, 2003). A strategically designed organizational culture enables innovativeness, flexibility and agility, ecosystem-wide engagement, transparency, openness, and superior financial performance with customer success as the outcomes of digital transformation (Kolagar et al., 2022; Vial, 2019; Warner and Wäger, 2019).

The significance of organizational culture for digital transformation is widely acknowledged in the literature. However, guidance on how business organizations might build a culture that supports digital transformation as strategy implementation is remarkably limited. Mainstream research is either conceptual or inferred from a wide (and old) range of changes that business organizations have experienced (see the literature review on digital transformation mainstream research by Kiefer et al., 2021; Kolagar et al., 2022; Nadkarni and Prügl 2021; Verhoef et al., 2021; Vial, 2019). Furthermore, there is insufficient empirical research on culture in relation to digital transformation in the literature on strategy and sociotechnical systems (Table 1). Though, there have been worthy attempts to explain the leaders' tasks in digital transformation (Singh et al., 2020) and furthermore to include culture in the strategy curriculum (Cepa and Schildt, 2022 *in press*). There are calls to identify organizational idiosyncrasies of organizational culture which the manager and leaders must learn in order 'to find their way' for strategizing in a digital age (Volberda et al., 2021, p. 15; Kolagar et al., 2022, p.

**Table 1**  
Recent empirical research on digital transformation culture.

Reference	Methods	Research focus and relevant findings	Opportunities for current research
Abhari et al. (2021)	Survey-based exploratory study; PLS (quantitative) analysis of 260 survey responses.	Theorizing the digital culture relationship with employee experience. Proposing the components of digital culture: collectivism, power distance, uncertainty tolerance, long-term orientation, and indulgence. The results indicate that expecting a long-term orientation and digital culture have a positive effect on employee experience.	Digital transformation and digital culture are used as synonyms. What values and assumptions could drive long-term strategic orientation toward digital transformation.
Berghaus and Back (2017)	Activity theory and activity system study. Qualitative analysis of <u>secondary</u> data about the digital transformation programs in 11 organizations.	Organizational activities that enact digital innovation transformation strategy as a disruptive change. In the early phase of digital transformation, top management has the responsibility for organizational culture change. Collaboration platforms promote work coordination between different parts of the organization, hence influencing the company culture.	Although their research did not adopt cultural centric adoption, understanding of 'how to navigate the fuzzy front end of digital transformations more successfully' was not addressed. Thus, the activities of cultural upbringing appear in isolation from the transformation itself. Rather than a rapid change event of short duration, the digital transformation supported by cultural development is a long-haul effort for aligning the organization's purpose and executing strategies.
Dasgupta and Gupta (2010)	Single case study based in a developing country; quantitative regression analysis of 102 survey responses.	Technology acceptance model study. Factors influencing the acceptance and adoption of information technologies and systems. Organizational cultural factors of social influence, performance expectancy, facilitating conditions, and expected effort impact individuals' behavior toward adoption.	Single case study in a government sector. Male dominance in responses. Influence of national culture and of government institutions with high power distance.

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Table 1 (continued)

Reference	Methods	Research focus and relevant findings	Opportunities for current research
Dubey et al. (2019)	Institutional theory; resource-based view; and organizational culture. Survey-based 127 responses; quantitative data analyzed with structural equation modeling.	Data for improved organizational performance and how external pressures affect the data culture. Big data culture significantly moderates big data and predictive analysis capabilities in manufacturing organizations.	Dubey et al.'s research 'results provide an initial step for researchers to investigate how organizational culture can further explain the adoption' (p. 355) of digital technologies. There is a call to understand how such culture develops.
Duerr et al. (2018)	Exploratory study: eleven case studies and data collected via with 27 interviews.	Schein's mode to identify artefacts, values, beliefs, and the underlying assumptions of digital culture. The first study with explicit identification of the facets of digital culture.	Their research opted for generalizability, which might have led to obscure understanding of the applicable facets. For example, the espoused values were investigated, but not the values in action as a facet of digital culture. Contextual understanding of 'digital organizational culture' is necessary. These researchers 'see promising avenues for future research in looking deeper into these constituents' (p. 5134)
Ghosh et al. (2022)	Exploratory study; five case companies; 25 interviews.	Dynamic capability perspective of digital transformation. Development of digital transformation capability (DTC) by specifically reconfiguring the existing capabilities is organizational culture dependent. Shifting from an old to a new mindset is the responsibility of transformative culture.	'Cultural transformation capability is a key to DTC', while there is a gap about how culture drives mindset reconfiguration, which makes digital transformation capability dynamic.
Hartl and Hess (2017)	Exploratory research; Delphi method; 25 respondents (15 practitioners; 10 researchers).	Twelve cultural values that have a role in digital transformation success. Positioned these identified values using the competing value framework (CVF). Research identified that the adhocracy and clan culture types contribute to digital transformation.	These researchers emphasize the call for future research on 'how, and with what measures organizational values can be changed to reach the ideal target culture supportive of a successful digital transformation' (p. 8).
Martínez-Caro et al. (2020)	Quantitative study of a multinational company; survey data from 93 respondents.	Digital culture positively impacts the adoption of digital technologies for business value development. The research offered a potential definition of digital culture from the perspective of strategic planning: a means through which an organization can begin to plan for digital strategies in a rapidly changing environment.	The findings of their research are quantitative, and 'may not be relevant when addressing strategic aspects' (p. 9). The apparent outcomes are attributed equally to the digital culture. A look at the specifics of digital culture, how digital culture design, cultivation, shaping, and nurturing happens in practice.
Rubino et al. (2020)	Quantitative study of 27 European countries' secondary data on digitalization, cultural dimensions, and innovation from 2014 to 2018. Selected data was collected from four different databases.	Deployed Hofstede's national culture framework to show the national culture's influence on firms' digitalization. The findings show significant (inverse) relationship in masculinity, uncertainty avoidance, and individualism, while indulgence positively improves digitalization.	These findings are based on secondary data. Rubio and the co-authors highlighted that the "second limitation is connected to the increasing level of globalization, which alters the cultural context in which firms operate in complex and obscure ways" (p. 1575).
Warner and Wäger (2019)	Qualitative study of the dynamic capabilities for digital transformation. Data collected from 7 global firms located in Germany. Thematic analysis of data from published reports and eighteen in-depth interviews.	Firms strategically build dynamic capabilities for digital transformation: digital sensing, digital seizing, and digital transforming capabilities. Digital transformation is an ongoing process for the strategic renewal of business models, collaborative approach, and organizational culture.	Provides high level statements for the refreshed culture as strategically renewed by digital transformation process. These findings offer a foundation to examine culture as a resource to build strategic capabilities "... and how corporate cultures can be refreshed ..." (p. 345).

195). This paper aims to address the repeated calls to explore the cultural enablement of digital transformation strategy.

Our research question is as follows: **How can industrial organizations strategically design a culture in their pursuit of digital transformation (DT)?**

We performed a diagnostic multi-case study (Janićjević, 2011) on digital transformation in three globally operating industrial organizations (Canato et al., 2013; Giorgi et al., 2017). These case organizations, forerunners in their industries in adopting digital technologies, are representative of traditional industrial organizations which are pursuing digital transformation as a strategy implementation and are in need of learning how their organizational culture could be refreshed in support of digital transformation. Our findings unravel the deliberately learned **values, assumptions, and artefacts** (Schein, 1990, 2004) that form cultural behaviors enabling digital transformation. These research findings contribute to the literature by highlighting culture as a strategic resource for digital transformation (Barney, 1986). We also demonstrate how leaders strategically prepare culture as a social control system for

digital technology adoption. Furthermore, the research findings in this paper are modeled as an exploratory framework for the strategic design of culture (Fig. 14) for the *purpose, governance, ecosystem, and organization* of sociotechnical systems (Pasmore et al., 2019). The strategic design of culture, especially in the pursuit of digital transformation, represents novel scholarship pioneered by this research. The research also has considerable managerial implications for executives and leaders involved in the strategic renewal of traditional industrial organizations. Our findings from the forerunner industrial organizations in this study are a focal reference for leaders in similar industrial contexts to replicate culture as a strategic resource and social control system for the implementation of digital transformation strategy.

## 2. Literature

Culture is the unwritten code of conduct for diverse individuals (Coyle, 2018; Jelinek et al., 1983) and concerns all aspects of purposeful organizations (Gregory, 1983). Culture as collective cognition furnishes a shared meaning (Mintzberg et al., 1998, p. 264–5) as to why and how the work tasks could be in pursuit of the organization's purpose (Coyle, 2018). It is the culture that supplements or restricts the business strategy implementation (Mintzberg et al., 1998). Business strategies and culture must attain a tighter fit for successful implementation (Chatman and Cha, 2003). For example, digital technologies bring must-do changes to the strategy, especially when businesses are eager to take advantage of being the first-movers or may target value chain disruptions (Kane et al., 2016). Culture as a shared platform for learning and experimenting enables transformation during such strategic renewals (Vial, 2019; Warner and Wäger, 2019).

Individuals sharing a common culture formulate, learn, and transmit their 'symbols, languages, beliefs, visions, ideologies, rituals, and myths' in terms of organizational actions (Pettigrew, 1979, p. 572) and strategies (Chatman and Cha, 2003). Hence, culture brings about a collectively learned response to business challenges and business value integration as the people perform their day-to-day work tasks (Schein, 1990, p. 112). These learned responses encoded in individuals' minds (Hofstede et al., 2010) tune individual interpretations of the business environment, as well internal and external events around them. For example, individuals learn what works and does not work in an organization; the collectively accepted courses of action and the no-go approaches; the ways to correlate to and celebrate achievements; and appropriate ways to share knowledge from the experience of success and failure in implementing strategies.

### 2.1. Three layers of organizational culture: artefacts, values, and assumptions

An organization's culture is always unique (Barney, 1986), and its manifestation occurs at multiple levels; therefore, culture cannot be nurtured just by a change manager or culture transformation program (Grugulis and Wilkinson, 2002). For example, the culture of an organization manifests itself at three levels (Fig. 1): artefacts, values, and assumptions (Schein, 1990, 2004; Schein and Schein, 2017). Strategy driven transformation needs a dynamic fit between these three levels of cultural manifestation (Osmundsen et al., 2018; Schein, 2004). Otherwise, a misfit between values, artefacts and tacit assumptions will lead to cultural ineffectiveness, that is, a social failure to embrace the strategies to achieve business longevity (Schein, 2009).

Schein's (1990, 2004, 2009) model of values, assumptions, and artefacts has been among the most widely deployed models across various strands of scholarship on organizational culture (Giorgia et al., 2015). This model has been lately deployed in the context of digital transformation (Duerr et al., 2018; Hartl and Hess, 2017).

**Artefacts** are the visible components in the tangible layer of an organization's culture. For example, structural configurations, business process models, technology and products, the common language and work style, and the environment and industry. Artefacts also include, e.g., working solutions that are valid for the group of people who work together for a (business) purpose (Schein, 2004). Artefacts as routines and rituals satisfy the curiosity of the employees about digital transformation: 'Why we do it that way' (Schein and Schein, 2017, p. 19). It has been established that changing organizational practices, i.e., artefacts is an essential part of the coercive

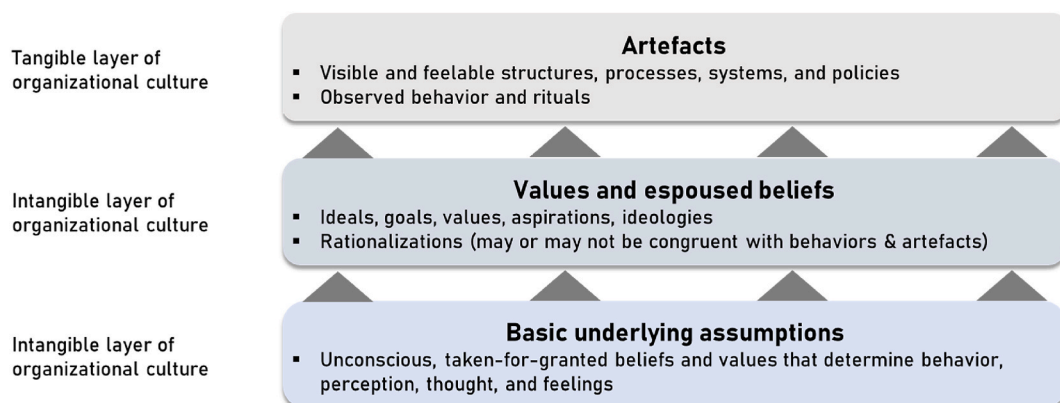


Fig. 1. Three layers of organizational culture, adopted from Schein (1990, 2004) and Schein and Schein (2017).

upbringing of culture (Canato et al., 2013; Pettigrew, 1979). Renewing artefacts can help withstand approval or disapproval of the organizational values.

**Values** are the preferable modes of conduct guided by the principles for survival in a social circle (Rokeach, 1973). Organizations espouse certain cultural values as their preferred behaviors, including those that are officially announced as vehicles to achieve vision and implement strategy (Maurer et al., 2011; Schein, 2004). The espoused (i.e., officially announced) values are continual targets for individuals to strive for. However, change-like transformations rely on actionable values (Hatch, 1993; Hofstede et al., 2010) to close the gap between the business outcomes, practices, and artefacts aspired to (Snull et al., 2020). These **values in action** are continuously tested, validated, and learned by/from its people (Hatch, 1993). The people (knowledge workers) live these values in action while striving for the survival and success of the organization, e.g., during digital transformation. Meanwhile, sustaining business success entails continual efforts to bridge the espoused values and values in action (Maurer et al., 2011). Leaders can make or break these bridging efforts (Schein, 2004).

Shared **assumptions** at large remain tacit, metaphorically speaking, these are the '*DNA of organization*' (Schein, 2004, p. 21). Taken-for-granted assumptions facilitate mental maps in interpreting various situations, deciding on appropriate and acceptable actions and creating awareness of nonconforming shared values and artefacts (Schein and Schein, 2017, p. 23). Cultural assumptions include, e.g., meetings are waste of time (Schein, 2017 p. 25); machines will overtake humans so we must resist such technology implementations; by focusing on high performance my manager wants me to focus on the business's bottom line; secrecy is important for a competitive position; our company does not guarantee employment security, so protect yourself, you are on your own; and sharing knowledge with colleagues from other departments will reduce our value-adding work and lead to lay-offs in our department. All such assumptions are made new, or existing ones are reinforced within a working community, in a team, in a function, or in a department. This making and breaking of the underlying assumptions increases, especially during cross-functional work coordination and when executing a must-do strategy implementation (Schein, 1990).

## 2.2. Sociotechnical system's strategic design of culture for strategy implementation

Human needs must be prioritized for technology-driven strategy implementation; therefore, sociotechnical system designs pursue a '*joint optimization of social and technical systems*' (Mumford, 2006, p. 321; Pasmore et al., 2019; Trist and Bamforth, 1951). The target of sociotechnical design is to guide people toward collective thinking about the reason for a strategy and how to take the required actions (Arz, 2017; Pettigrew, 1979). Culture holds this collective-thinking style of perpetual and dominant logic to enact the strategy (Mintzberg et al., 1998, p. 269) for technology-driven digital transformations (Jones et al., 2005). Schein's (1990) three layers of culture (values, assumptions, and artefacts) constitute an organization's mind (Mintzberg et al., 1998) to interpret strategy and let the leaders and employees develop (digital) capabilities for the implementation of strategy (Abhari et al., 2021; Ghosh et al., 2022).

When implementing strategies, culture acts as a social control system for the building of shared values, assumptions, and artefacts (Chatman and O'Reilly, 2016). It is not spoken and is intangible, yet through an invisible influence, culture determines how well an individual's (or group's) actions fit or do not fit in the organizational context. In this way, culture shapes collective attitudes and behaviors toward strategy (Chatman and O'Reilly, 2016; O'Reilly et al., 1991). Hence, culture looms the constellation of organizational activities equally for both the proponents and opponents of a strategy.

Disconnected from strategy, the culture's artefacts, values, and assumptions instill unwanted stability, that is, stagnation, a form of resistance to the strategy implementation. Consequently, the organization's collective response mechanisms fail to maintain fit with the business environment (Mintzberg et al., 1998). Stagnated culture is just an unseen impulse toward loss-making business operations (Barney, 1986). Once a valuable, rare, inimitable, and non-substitutable resource, an organization culture without the ability to learn new behaviors becomes an invisible reason for lost competitive advantage (Mintzberg et al., 1998). For example, Kodak's (the film company) sluggish cultural response to digital filming technologies led to lost market share, an 80% decline in workforce, and stalled the futureproofing of the company (Lucas and Goh, 2009). Despite such recorded cases, the literature on cultural preparedness for digital transformation is limited (Hartl, 2019; Vial, 2019).

According to Pasmore et al. (2019), the purpose, governance, ecosystem, and organization must evolve along with its external environment. Strategy-supportive culture has artefacts, values, and assumptions in alignment with these four components: purpose, governance, ecosystem, and organization of sociotechnical system design (Pasmore et al., 2019; Schein, 2004). Although the purpose needs occasional changes, the strategies driven by the system's purpose are subjected to more frequent adjustments coordinated by the governing rules (e.g., resource prioritization, data, information, and stakeholder decision-making). These governing rules are rigorous in support of the purpose. Whereas ecosystems thrive with a loosely controlled structure for business value complementarities, and attain a competitive advantage, such value cannot otherwise be produced (operationally, economically, and strategically) just with internal governing rules, for example, hierarchical control of one single industrial organization (Jacobides et al., 2018). Ecosystem partners (suppliers, partners, investors, research and educational institutions, and regulators, etc.) with their shared control and inclusive decision-making are likely to maintain alignment with the external environment (Pasmore et al., 2019). Here, digital technologies provide more opportunities for the contributing organizations (ecosystem partners) to coordinate, build mechanisms with their shared purpose, and prioritize resource investments (e.g., through purpose-built digital platforms).

An organization's structure, work procedures and policies, rewards, processes, and systems network the employees (Grugulis and Wilkinson, 2002) with its purpose, governance, and ecosystem. The embraced strategic design of culture leads to digital congruence (Kane et al., 2016) between people, policies, processes, structures, and the work required for strategy execution. In leading digital transformation, '*culture is all about execution*' (Chatman and Cha, 2003, p. 21). Strategically designing culture as a key resource mitigates the risk of '*embarrassing secrets*' (Rumelt, 2011, p. 209) and what can come into being during strategy execution (Mintzberg

et al., 1998, p. 283) while leveraging digital technologies (Nadkarni and Prügl, 2021; Verhoef et al., 2021).

### 2.3. Empirical research on organization culture as an enabler for digital transformation

Digital transformation success and organizational culture have been highlighted in the literature (Gurbaxani and Dunkle, 2019). In fact, such directives on latest information technologies (IT) driven transformation and organizational culture have been studied for decades (Leidner and Kayworth, 2006; Olson, 1982). It has been recognized that culture moderates the development of information technology, the developers, the process of development, and the users (Kappos and Rivard, 2008). However, in the digital age when ‘the very nature of strategy is changing’ leaders must consider both ‘within the firm and in the ecosystem’ cultures (Volberda et al., 2021, p. 5). Failure to address organizational culture impedes the digital transformation of traditional organizations and their business ecosystems (Kolagar et al., 2022), because unattended culture restrains trust building within one’s own organization as well as among ecosystem partners who primarily cooperate over digital technology-based media and platforms.

Despite repeated emphasis on the need for culture-enabled digital transformation (Warner and Wäger, 2019), research on how organizations design such a culture is conceptual and advisory in mainstream journals (Kiefer et al., 2021; Kolagar et al., 2022; Nadkarni and Prügl, 2021; Verhoef et al., 2021; Vial, 2019; Volberda et al., 2021). Furthermore, guidance in business strategy literature for business practitioners is based on literature reviews and secondary data. Only a handful of empirical research on organizational culture in the context of digital transformation has been published (see Table 1).

Early research on IT-supportive culture has identified social influence, performance expectancy, facilitating conditions, and expected effort impacts individuals’ behavior in adopting IT technologies (Dasgupta and Gupta, 2010). A qualitative analysis of secondary data by Berghaus and Back (2017) shows the importance of the role of top management in enabling such adoption through digital culture. By deploying a conceptual framework (Ostroff et al., 2020) for Hofstede’s framework for digital culture, Abhari et al. (2021) studied how employees’ positive experience and digital governance support digital transformation: they proposed that collectivism, power distance, uncertainty tolerance, long-term orientation, and indulgence influence digital culture.

Similarly, Rubino et al. (2020) deployed Hofstede’s framework to find the impact of national culture on the digitalization of European firms. Their findings show a significant (inverse) relationship in masculinity, uncertainty avoidance, and individualism, while indulgence positively improves digitalization. However, power distance did not show any significant impact on digitalization. According to their study, a long-term orientation in national culture does not influence digital technology driven transformations (Rubino et al., 2020). This finding is misaligned the literature on leadership as well as strategic management that establish long-term orientation is necessary for digital success (Kane et al., 2016; Parida et al., 2019; Porter and Heppelmann, 2014, 2015).

With the Delphi method application, Hartl and Hess (2017) identified twelve (12) cultural values that play a role in the digital transformation of organizations: openness toward change, agility, tolerance of failure, willingness to learn, participation, cooperation, customer centricity, entrepreneurship, risk affinity, and innovation. Compared with the CVF (competing value framework), clan and adhocracy cultural types foster digital transformation (Hartl and Hess, 2017). Digital culture positively impacts the adoption of digital technologies and business value development (Martínez-Caro et al., 2020). Schein’s (1990) three layered cultural model (Fig. 1) for digital transformation has been proposed by Duerr et al. (2018) as one conceptualization of digital organizational culture artefacts, values and beliefs, and underlying assumptions.

In their seminal case study of dynamic capabilities for digital transformation, Warner and Wäger (2019) identified culture as an enabler for digital transformation. These authors highlighted high level statements from the incumbent case organizations which refreshed their cultures during the digital transformation process. Meanwhile, their study acknowledges the pressing demand from academia and practitioners to explore “how corporate cultures can be refreshed” (Warner and Wäger, 2019, p. 345) to enable digital transformation in traditional organizations. In another similar study, Ghosh and co-authors (2021) conclude how such culture can drive the change in mindset for digital transformation dynamic capabilities.

### 3. Methodology

This research is a diagnostic multi-case study of idiosyncratic cultural changes in the context of digital transformation (Canato et al., 2013; Janičević, 2011; Giorgia et al., 2015). Our aim is to understand how culture as a key enabler (Rumelt, 2011; Warner and Wäger, 2019) for strategy implementation can be designed for refreshing artefacts, values, and assumptions that propel the digital transformation of industrial organizations. Since digital transformation is a contemporary, sociotechnical, and in-progress phenomenon, a qualitative case study best suits investigation of the idiosyncratic characteristics (Yin, 2014) of three layers of organizational culture (Schein, 1990, 2004). Meanwhile, a multiple case design enables data analysis across different situations (Yin, 2014) and the findings are grounded in varied empirical evidence (Eisenhardt and Graebner, 2007).

Our data collection started with grounded theory-based logic (Gioia et al., 2013) helping to discover that digital transformation is an ongoing phenomenon, rather than an end goal (as observed by Warner and Wäger, 2019) in our case organizations. We further discovered the distinguishable paths of each of the case organizations embarking on their digital transformation journey. We also noted similarities in their approach, i.e., proactiveness and deliberation in refreshing their organizational culture. This essentially required in our approach the seeking for applicable theories as the research progressed – the development of research case data informed us of the applicable theories, not vice versa. Such an abductive (inductive-deductive) approach allowed for the systematic combining (Dubois and Gadde, 2002) of the exploratory findings from our three industrial case organizations with the theoretical model of culture (Schein 1990, 2004) and strategic design of sociotechnical systems (Pasmore et al., 2019). As a result, we could unravel the deliberately learned values in action, reconstructing assumptions, and prioritized artefacts that form novel sociotechnical

behaviors enabling digital transformation in globally operated industrial organizations.

### 3.1. Research cases and the case selection process

The case selection was based on methodological expediency (Schofield, 2012), which combines elements of criterion sampling and convenience sampling (Fletcher and Plakoyiannaki, 2011). The foremost criterion for case selection was globally operating industrial organizations with rich histories and culture pursuing the adoption of digital technologies as strategy implementation initiatives or programs for digital transformation. The second criterion was common characteristics in the leadership, national/regional cultures, and organizational culture e.g., senior leaders with diverse cultural backgrounds headquartered in several countries of Northern Europe. The third implied criterion was to focus on industries related to energy and the environment as these industries have a sense of urgency to act quickly to save our planet, and digital technologies represent an opportunity for future business proofing. With inductive grounded theory method, we initiated our approach in a few industrial organizations which had officially announced digital transformation as strategy.

Our discovery for the research case concluded with the identification of four globally operating multinational industrial organizations headquartered in the Nordic countries. However, one of the selected cases no longer shared data after the first round of data collection. Hence, the data analyzed for this research is from three (3) globally operating industrial organizations. These organizations are world-renowned brands in their business segments. The footprint of their infrastructure (manufacturing plants, logistics centers, customer service units, and supplier and partner network) are spread over multiple locations in Asia, Africa, Australia, Europe, and North America, and their organization cultures are complex enough to be studied from national culture dimensions.

For the year 2020, the combined business revenue of these three cases amounted to over twenty billion euros (20B€). In the annual reports for 2022, these industrial organizations mention several successes in their digital transformation journey, e.g., expanded end-to-end digital ecosystem, extended portfolio of digital service solutions, and end customer digital interfaces for operations and lifecycle support. All three case organizations experienced a business revenue growth increase of up to approximately twenty-four billion euros (24B€) in 2022. An introduction to the cases is presented in Table 2, and further contextual details are documented in Appendix A. Permission to conduct research in the case organizations was subjected to nondisclosure agreements (NDAs).

### 3.2. Data collection and analysis

The data collection was performed within the wider scope of a research project in which the researchers' aim was to explain the digital transformation phenomenon from a sociotechnical system perspective (Davis et al., 2014; Mitki et al., 2019). A two-phase data collection approach (Gioia et al., 2013) was deployed for the whole project, and the data collection was carried out during 2019 and 2020 (prior to the COVID-19 pandemic). The research data (interviews and secondary data) was recorded in NVivo 12 project database, and the data analysis was performed in NVivo 12.

The first phase of data collection began by collecting publicly available documents (e.g., social media blogs, marketing materials, business reports, recorded interviews of executives, and companies' websites). Simultaneously, we initiated a search for the key informants in these case companies based on their publicly revealed profiles at the globally reached social network for professionals, LinkedIn. The research team then deployed their own professional network to approach these short-listed experts, and emails were sent to which we attached the research project objective and assurance of anonymity during the process. Those who positively replied with confirmation of their substantial role in the digital transformation were selected as key informants for the first round of interviews. During this first phase of data collection, twelve (12) key informants participated in open-ended interviews face-to-face or via video calls (via Skype, Teams or Zoom). These key informants made prominent contributions to their digital transformation programs and held influential leadership positions in the case organizations. The first-phase findings led to the identification of common enablers and targeted performance outcomes of digital transformation in our case organizations. Organizational culture was identified as one of the digital transformation enablers.

The second phase of data collection primarily consisted of semi-structured interviews. In the first round of data collection, the key informants also recommended experts and leaders for the second phase of data collection. In the second phase, we contacted the recommended experts via emails with the research guide attached. Participation was on a voluntary basis and was not mandatory. Those experts who agreed to share their insights as anonymous respondents were interviewed face-to-face or via video calls (via Skype, Teams or Zoom).

During the interviews, the research team explicitly asked questions about how culture enabled or restrained digital transformation. Naturally, the initial discussion about culture for digital transformation was limited to narration of the espoused cultural values written in the annual reports and on social channels. However, upon investigating how in practice these espoused values enable the whole culture, the interviewees acknowledged that communication around those (espoused) values alone was not enough. Instead, they urged that culture must be refreshed and reconstructed by leadership in action. Earlier referenced literature has similar guidance, whereby strategy implementation needs to go beyond espoused values and focus should be on values in action. Furthermore, our follow-up inquiries into the operationalization of culture as an enabler for digital transformation as strategic initiative let the experts elaborate with examples of values in action and the underlying assumptions that leaders should strategically reconstruct in the culture. It is relevant to mention explicitly that as the researchers were learning about digital transformation as a phenomenon and its associated changes, learning about the prioritized cultural artefacts did not require separate questions.

Most of the interviews (first phase, as well as second phase) were conducted by two members of the research team to ensure dependability and consistency. The recordings from the interviews were transcribed with the help of a commercial service company.

**Table 2**  
Contextual information about the industrial case organizations as of 2020.

Research data origin	Case A	Case B	Case C
<b>Business focus</b>	Offshore & Onshore Energy	HVAC and Electric Power	Wood Processing and Energy & Power
<b>Business footprints</b>	World-renowned brand in energy industry; multinational with six manufacturing sites across the globe; four business units; multibillion € annual sales; approx. 20,000 employees; main location of leadership and headquarters in Nordic countries.	World-renowned brand in its industry; multinational with seventy-one manufacturing sites across the globe; four business units; multibillion € annual sales; over 20,000 employees; main location of leadership and headquarters in the Nordic countries.	World-renowned brand in industry; multinational with fifty-one manufacturing sites across the globe; four business units; multibillion € annual sales; approx. 20,000 employees; main location of leadership and headquarters in the Nordic countries.
<b>History</b>	150+ years history of product and project engineering and manufacturing; Nordic industrial organization; multiple businesses units and segments; competitive product and service portfolio.	80+ years old product and project engineering and manufacturing; Nordic industrial organization; multiple business units and sub-units; competitive product portfolio.	120+ years history as process and manufacturing; Nordic industrial organization; multiple business units and segments, most diverse product and assets portfolio.
<b>Digital transformation strategy</b>	A separate dedicated digital organization was developed by hiring chief digital officer to lead the digital transformation as a strategic priority.	Digital transformation strategy implementation responsibilities dedicated to the heads of main business segments.	Digital transformation strategy implementation responsibilities dedicated to heads of business units.
<b>Business results 2020</b>	>4.5 B€	>7.5 B€	>9.5 B€
<b>Conducted interviews</b>	Nineteen (19)	Eleven (11)	Eleven (11)

These interview transcripts comprised more than five hundred pages. The list of interviewed experts is available in APPENDIX A.

The case study records in the NVivo database helped the research team maintain a clear chain of evidence from data collection to the formation of findings (Beverland and Lindgreen, 2010). In the first stage of analysis, one of the authors proofread the transcriptions, and then the research team performed initial coding of the complete data by segmenting the statements related to cultural values, assumptions, and artefacts. In the next stage, following Gioia et al. (2013), excerpts from these coded statements were sorted as first-order **concepts**. Then these concepts were further categorized in the second-order **themes** of culture (Schein, 1990, 2004), and these themes associated with the **aggregate dimensions** of strategic design (Pasmore et al., 2019). These concepts, themes, and aggregate dimensions representing the collective values in action, assumptions for reconstruction (of the culture) and artefacts, are prioritized by our case organizations as strategic design of culture that enables digital transformation. Our approach is aligned with Sætre & Ven De Ven’s (2021) abductive (inductive-deductive) theory building. During data analysis we also confirmed the replication of findings across all three the cases (Eisenhardt and Graebner, 2007; Yin, 2014). The data structure as the outcome of our thematic analysis (Gioia et al. (2013) is presented in APPENDIX B.

#### 4. Findings

Interestingly, all three case organizations aim at **customer centricity**, **agility**, and extended **collaboration** as their main yet gradually attainable outcomes from digital transformation strategy implementation. Meanwhile, most of the interviewees mentioned customer centricity as the prime target because they ‘... really want to be customer centric and serve the customer throughout the life cycle, as one company’ [VP], and ‘it’s basically everything and anything we’re looking into digitalizing or making the customer experience more digital’ [SMDT]. It is the people who enabled digital transformation, starting from the strategy formation process: ‘the mixing of digital experts with business experts, so the combination of digital expert knowledge and business expert knowledge draws the path of digital transformation strategy’ [GH]. This involves a new approach to strategy, as highlighted by one interviewee: ‘there is no more strategic planning or yearly plans, there is no more project linear execution. It’s always about being able to adapt to change, based on new information, changing markets, and changing situations’ [SMDT].

Digital technology-based business models are demanding for traditional industrial organizations, whose success is primarily built up of product and/or transactional services. One of the interviewed vice-presidents explained that: ‘we are trying to promote such a sort of mindset that whatever you do, you must involve customer co-creation. Only then can we move from being a product-oriented company to being a service-oriented company’ [VP]. Meanwhile, there is the acknowledgement that digital opportunities can be better capitalized to ‘work with external partners to actually sort of accelerate some of the stuff in the beginning’ [VP]. Strategizing for ‘digital transformation is giving us a different playground that goes more like agile-based trial’ [VPIT]. For a traditional industrial organization: ‘it’s a change of culture. We need to be faster, and we need to have more services than products’ [MDIT]. Leadership needs to engage people with this ‘mindset change and cultural change that is happening right now’ [GH]. The following subsections summarize the strategic design of cultural values in action, reconstructing assumptions, and prioritized artefacts in the case organizations.

##### 4.1. Strategic design of cultural values in action

Our case organizations are focusing on **approach holistically**, **co-creating with customers**, and **renew business value** as their prioritized values in action for their business purpose (Fig. 2). Digital transformation in a product-centric industrial organization needs

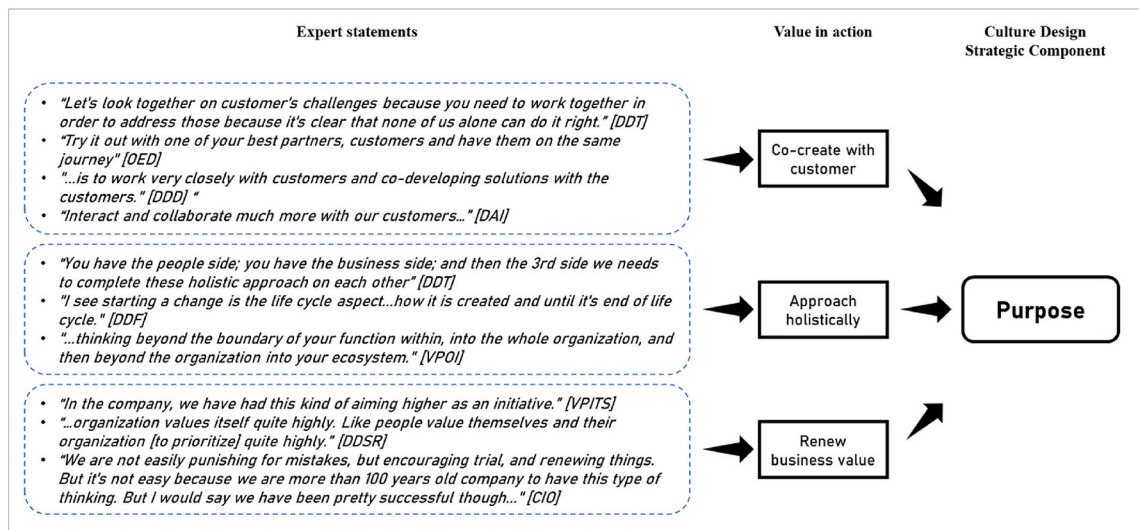


Fig. 2. Cultural values in action to enable the ‘purpose’ of digital transformation.

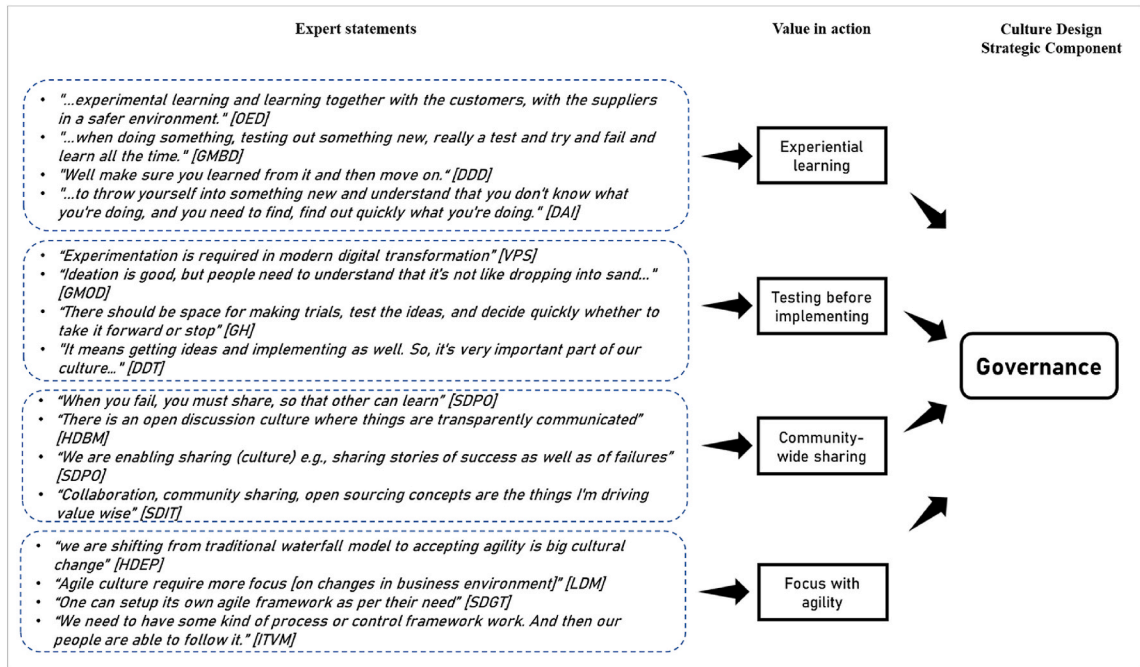


Fig. 3. Cultural values in action to enable the 'governance' of digital transformation.

constant upgrading to enable co-development of solutions and business value co-creation. Such continual renewals of business values involve cooperative engagement with customers and ecosystem partners. One contextual factor for the renewal of business purpose is that the energy and environment industries are going through transformation. Such an all-time service and solution value proposition needs a holistic approach to the different aspects of organizing people and the business stakeholders. Digital technology advances are enabling this holistic (lifecycle service) approach, at viable cost.

Digital transformation governance needed **experiential learning, testing before implementing, community-wide sharing, and focus with agility** as the cultural values in action (Fig. 3). A culture for learning from experiments includes trying and failing. An experiment-focused inclusive culture also builds a testing mindset prior to implementation, that is, encouraging people to ideate in a way that ideas for doing new things can be tested in a real-life setting, for example, by prototyping. Testing innovative ideas increases the likelihood of success, and gives deeper learning, although ideas fail, too. The pace of change that industrial organizations are experiencing is unprecedented: sharing successes, learning, and failures openly and across the community is essential for digital transformation governance. An extended community-wide sharing beyond the boundaries of one's own organization reduces the cost of experimentation and increases the likelihood of idea-to-value conversion. A mix of traditional governance mechanisms and agile approaches, frameworks, processes, and performance follow-up safeguard experiential learning. Agile must not create a distraction from governance, but instead focus efforts to capitalize and produce the best opportunities for the whole community.

The case organizations are positioning themselves to 'serve the customer throughout the life cycle' [VP], by bundling-up the value offerings from multiple actors in their industries. Their culture for ecosystem-wide collaboration with customers, suppliers, partners, research and educational institutions, and regulators is evolving by being **open to adaptation, sensemaking together, and tolerating with respect** as values in action (Fig. 4). One of the interviewed executives highlighted this point:

'... thinking beyond the boundary of your function within, into the whole organization, and then beyond the organization, into your ecosystem. Because the answer to filling that gap may or may not lie right there in front of me. It might lie with my customer and my supplier somewhere else in the ecosystem that I need to bring in.' [VPOI].

The ecosystem partners (suppliers, partners, investors, customers, research and educational institutions, and regulators) prepare their collaborative and dynamic response to environmental changes without compromising the value generated by one industrial organization or value complementarities offered by partners. In the case organizations, the leaders see the ecosystem as a platform to give and make sense of environmental changes through collaboration and conflicts during ideation, experimentation, implementation, and learning. Although openness to environmental adaptations is a prioritized cultural value, the practical worth of this value (being open to adapting to digital solutions) is also complemented with a shared sense of the partners' adaptations too. Collaboratively exploiting the opportunities with the best value complementarities is in the best interest of ecosystem partners. Toleration during collaboration in the ecosystem flourishes with respect, listening, and careful communication. This includes (both) agreeable and non-agreeable choices in the interest of the whole ecosystem.

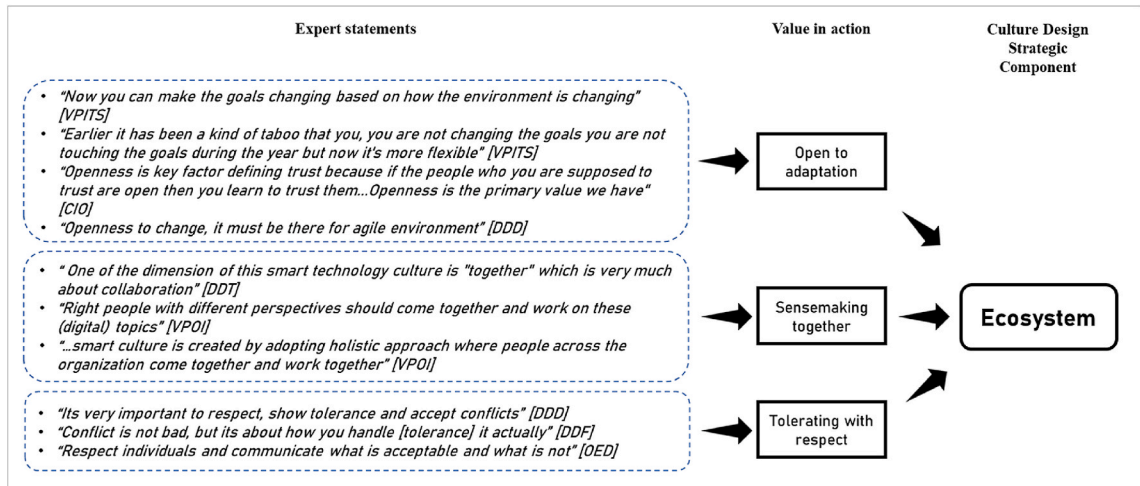


Fig. 4. Cultural values in action to enable the ‘ecosystem’ for digital transformation.

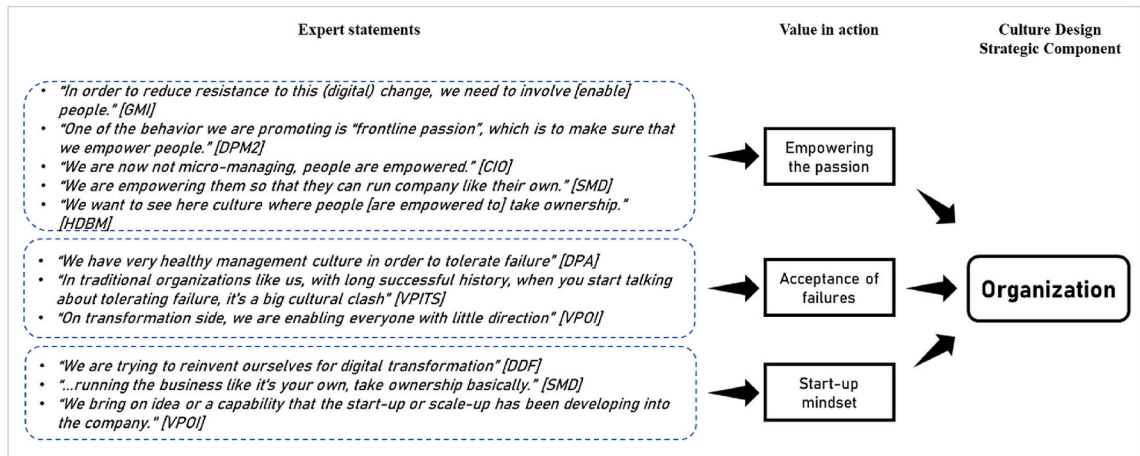


Fig. 5. Cultural values in action to enable the ‘organization’ for digital transformation.

The new values of a **start-up mindset**, **acceptance of failures** and **empowering the passion** (Fig. 5) bring in ownership, empowerment, and collaboration. The aim with a start-up mindset is that culture will support the rise of shared sense in people if they detect misalignments between their actions and the desired future (purpose) toward which the case organizations must renew and reinvent. The interviewed experts mentioned that such reinventing involves crossing the chasm of the organization’s history. With empowerment for passionate people, crossing the chasm, and adapting to environmental changes being the way forward, it is accepted that a few attempts to cross the history chasm may not be fruitful. This is the culture of accepting such fails, giving shared space and just enough direction so that the empowered people are willing to try, and try again, with the same passion.

This newly injected culture promises the reconstruction of ‘*shared tacit*’ beliefs and perceptions in our case organizations. These findings are outlined in the next sub-section.

#### 4.2. Strategic design of targeted assumptions for cultural reconstruction

As per the findings, people assumed a growing role in setting the organization purpose. The themed assumptions related to the purpose are as follows: **strategy is fixed and long-term, do it alone, upskilling [sunk] cost, experimentation is burden** and **failing is failure** (Fig. 6). As the purpose of industrial organizations shifts from product-centric to service-oriented life cycle support to the customers. Leadership in our case organizations has recognized that strategy is not company policy; instead, it is a dynamic set of choices amid multiple substitutes made possible with digital technologies. Strategic choice-making is continuous, thoughtful, and built over small though rapid experimentation with digital opportunities. On the other hand, employees’ own upskilling is an opportunity investment rather than a sunk cost.

We learned that ‘**experimentation is burden**’ is one fundamental assumption that the leaders are reconstructing. Three cases in this

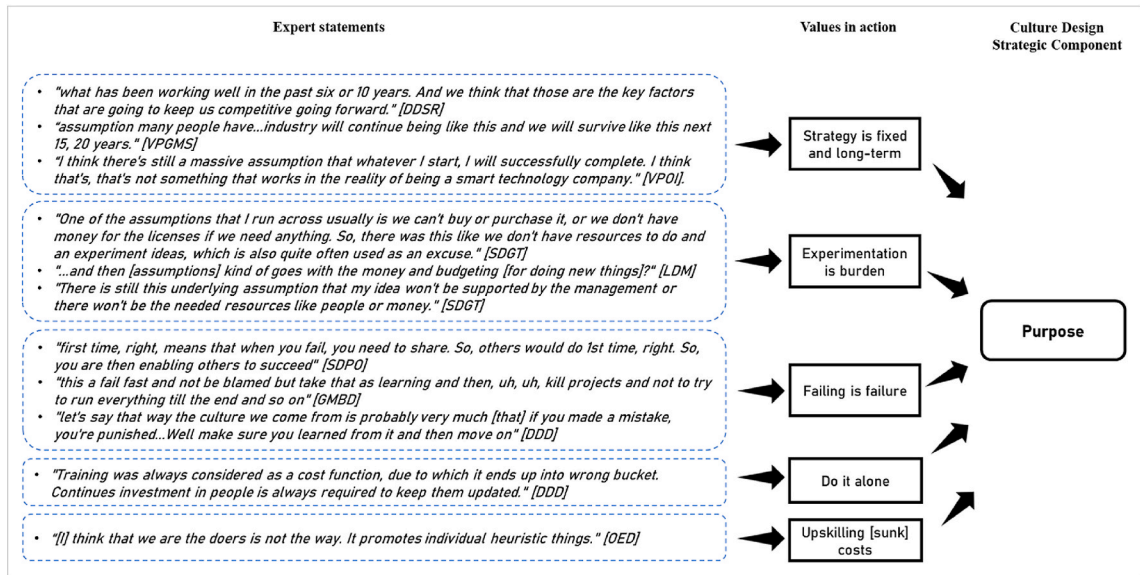


Fig. 6. Cultural assumptions under construction to enable the ‘purpose’ of digital transformation.

research approached experimentation (exploration) differently. One of our case organizations established a separate resource unit dedicated to digital transformation, while the other two cases built the resource capacities within the individual business units and support functions. These resources were empowered to experiment and allowed to fail. Failing as a risk reduction strategy is considered a significant response to altering people’s mindset from resource wastage and toward opportunity validation. An interviewee stated that ‘fail often, fail fast. It is a risk reduction strategy. It is not a risk. You do not need to take more risks, quite the opposite’ [SDIT].

Digital technologies bring (positive) uncertainty regarding the efficient running of operations (today) and strategies (tomorrow), as acknowledged by the interviewees; however, transformation cannot be implemented without functioning governance. The uncertainty-laden governance process is less known in (primarily) product-driven industrial organizations. The leaders saw a need for the deliberate inclusion of controlled uncertainty. Reconstructing the assumptions for **decisions and decision-makers**, **idea-to-value conversion**, **technology equals a ready solution**, and **technology is valued higher than people** were found to support the governance of digital transformation (Fig. 7). Not surprisingly, the assumption of knowing all (history long) customer needs made suboptimal value generation from innovative ideas. Such assumptions do not leave room for detailing the unknown (or newly developing) expectations of customers and ideating with partners in the ecosystem:

‘A lot of people, you know, are used to doing work at the same time as for the last 15 years, so it’s kind of innovation and agility that will take them out of their comfort zone, and maybe they don’t understand the chains of the new ideas.’ [LDM]

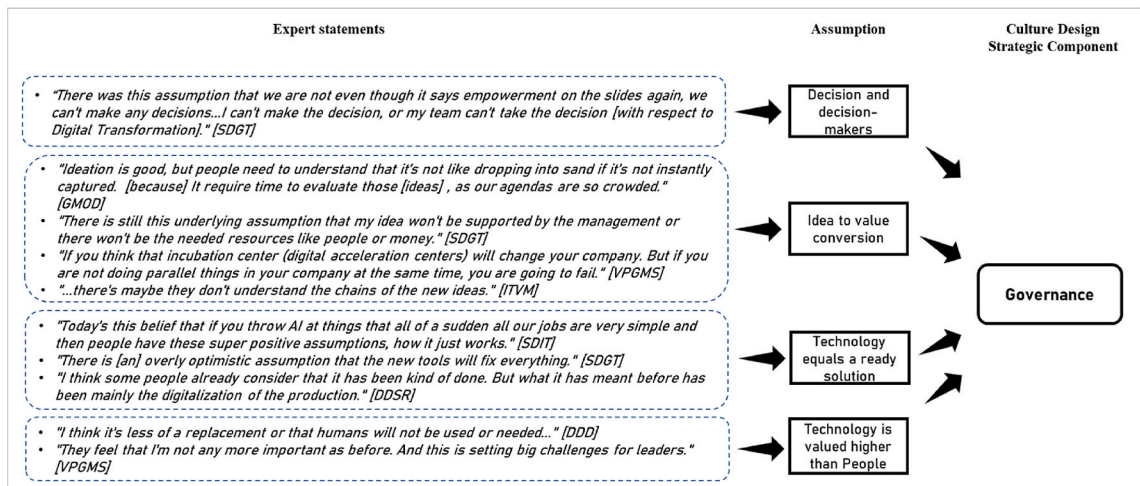


Fig. 7. Cultural assumptions under-construction to enable the ‘governance’ of digital transformation.

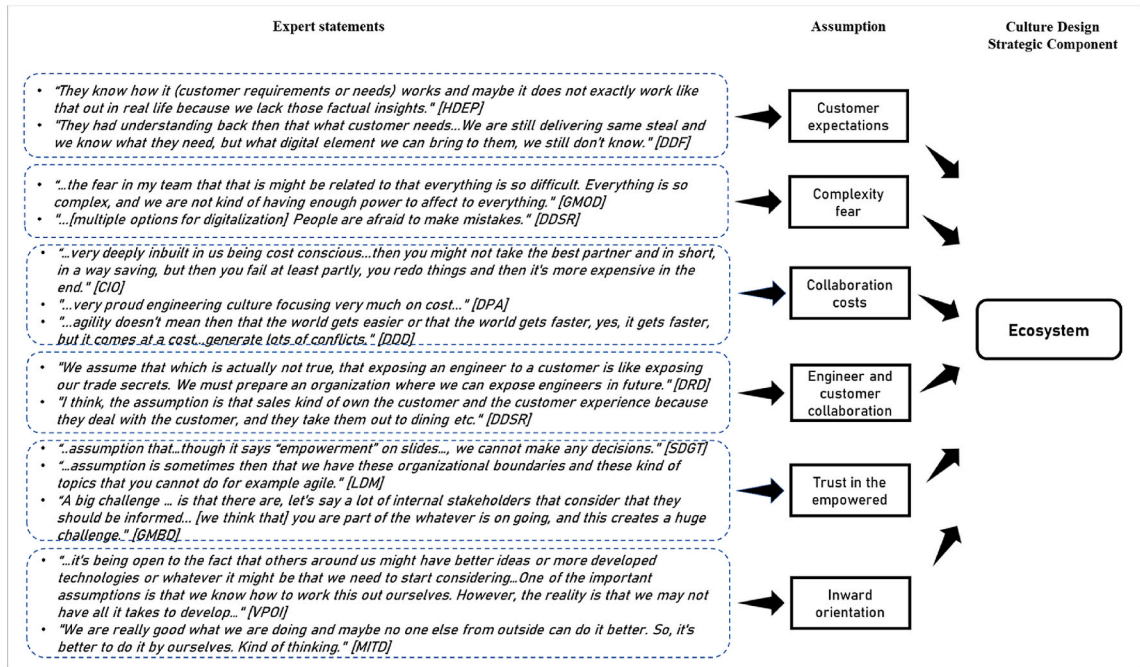


Fig. 8. Cultural assumptions under-construction to enable the 'ecosystem' for digital transformation.

Empowerment is critical to the outcome of collaboration; however, resting on existing assumptions potentially slows down the idea-to-value generation process (i.e., decision-making is slow). Another category of assumptions holding back collaboration is to doubt human decision-making. Because the assumption is that technology offers more robust decision-making with its unmatched speed of processing data. Such tacit beliefs make people afraid of being redundant. Such fears are further fueled by the tacit belief that **technology is valued higher than people**, especially when leaders overwhelmingly advocate data-backed decisions. Overemphasis on technology as a superpower is holding back people's creativity. It is recognized that leadership and people's (assumed) expectations from digital technologies demand achievement in a shorter timescale. There is also the realization that digital technologies offer opportunities and that going digital can make serviceability faster and at lower cost; however, technology readiness does not mean the readiness to adopt it as a ready-made solution.

The strategic design of culture in our case organizations contains assumptions about working in an ecosystem. A fundamental reflection has been historical pride in the ability to first define customer problems but also then solve those problems alone. Such cultural assumptions are ecosystem destroyers: for example, 'we know how to work this out ourselves'. Leaders in all three cases acknowledged that such assumptions need fundamental reconstruction: the '... reality is that we may not have all it takes ...' to satisfy the lifecycle needs of customers. An ecosystem approach is enabled by reconstructing assumptions around **customer expectations, complexity fear, collaboration costs, engineer and customer collaboration, inward orientation, and trust in the empowered** (Fig. 8).

Digital technology enables responding to customer triggered arguments of 'who owns' the customer. The assumption is that customers have 'diverse and demanding requirements', and that fulfilling their needs leads to costly products and services. Although the leaders acknowledged that custom-built solutions are complex, they can, however, produce sustainable competitive advantage. Such competitive advantage builds up with nongeneralizable complementarities between the ecosystem partners (suppliers, partners, investors, research and educational institutions, and regulators). In practice, empowered experts should be able to lead collaboration with partners in the ecosystem to design and implement such complementarities together with customers. In an ecosystem, assumptions holding back knowledge sharing can affect social acceptance and trust in the decisions made by these empowered experts.

In our case organizations, the assumptions about **digital powers being higher in the hierarchy, work requirements and job security, scale of reskilling needs, and control and manage** were under reconstruction (Fig. 9). In power-laden, top-down hierarchies, digital further cements the power, with those managers at the top. In certain situations, 'to be digitally transformed' was taken to mean that the management wants more data. Poor data quality as an important issue in management meetings further ramparts such assumptions that digital technologies are powering to the top in the hierarchies. As a result, people feel insecure at work.

Because digital technology brings new ways of working, it is assumed that people will bear the burden of adapting to new work methodologies and maintaining high-quality data, all of which must be learned at an unprecedented pace. The assumptions of 'scale of upskilling needs' reinforce the tacit beliefs that individuals are solely carrying the heavy burden of their upskilling. The hiring and firing of people outweighing digital competence and digital jargon is another barrier to the cultural design requirements. While only a limited number of employees get involved in experimentation with digital technologies, for rest of the organization upskilling is felt

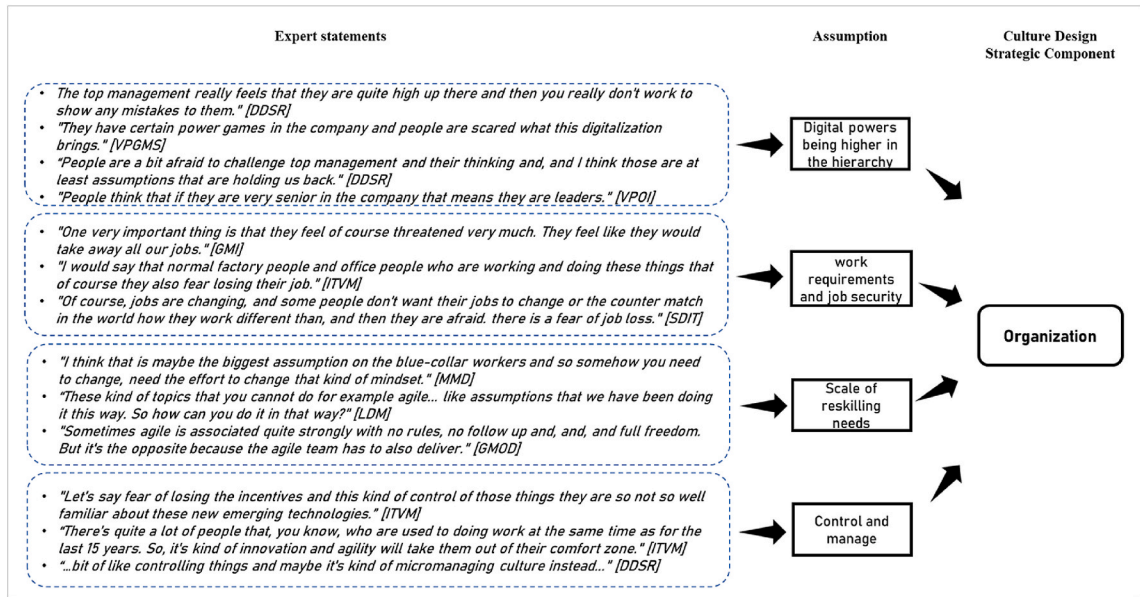


Fig. 9. Cultural assumptions under-construction to enable the ‘organization’ for digital transformation.

like an ask to learn everything or leaving the work to someone else. This was highlighted by leaders in the following:

*“We tried to propose and to suggest to people to let us help you in improving your processes and ways of working by implementing robotic process automation. And you know, we have people commenting, why should I do this when I will lose my job?” [DDT]*

*“There is fear that if we now implement, for example, robotic automation, so some of those things happening with the manpower utilized by own teams and functions will be totally let’s say in the black box. So, they are not controlling anymore.” [ITVM]*

Who is in control, people or digital? Fundamentally, this is a collective assumption around the human need to feel secure in a sociotechnical system. Digital brings speed and leaves limited (not enough) time for the usual follow-up of details. Here, people assume that digitalization relinquishes their control and further concentrates power in the top hierarchies, whereas their job incentives and security were already at risk.

4.3. Strategic design of prioritized cultural artefacts

The digital transformation driven artefacts are visible (identifiable) in all three case organizations. It was acknowledged by the interviewees that renewing artefacts withstands the approval or disapproval of the employees. The congruence of artefacts with cultural values plays a considerable role. Hence, certain artefacts were prioritized while the new cultural values embodied by the leaders reset the organizational tacit beliefs (assumptions). According to our findings, a prioritized focus is on making **celebration rituals** to bring about a sense of belonging regardless of whether a team fails or succeeds. Such wholehearted celebrations, in conjunction with the **rewards for desired behaviors**, guide people toward pursuing an organization’s strategic purpose (Fig. 10).

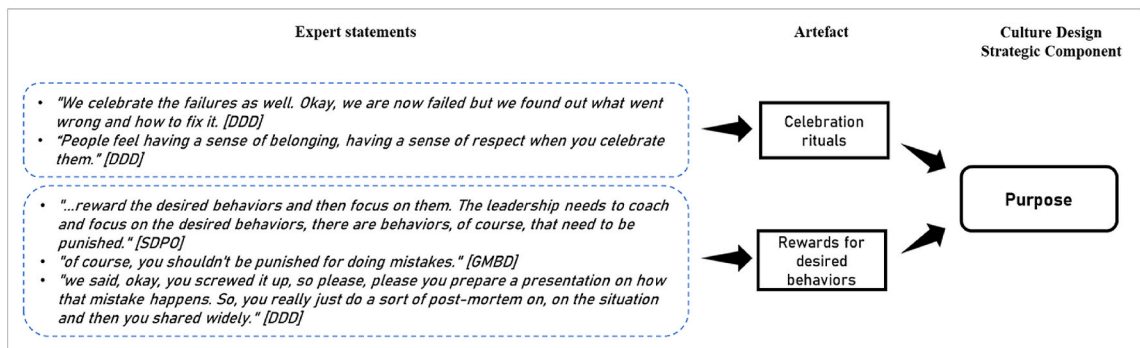


Fig. 10. Cultural artefacts that enable the ‘purpose’ of digital transformation.

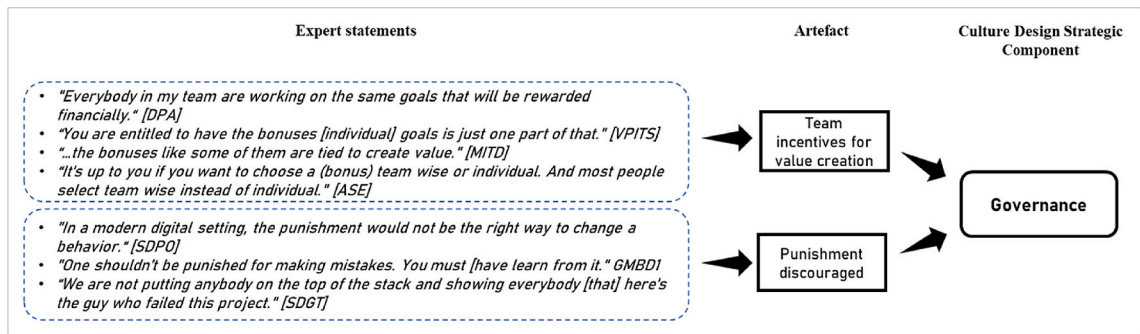


Fig. 11. Cultural artefacts that enable the ‘governance’ of digital transformation.

We found that **team incentives for value creation** and **punishment discouraged** are two prioritized governance artefacts (Fig. 11). We learned that engineering-driven industrial organizations build a proud culture with assumptions like ‘we are the doers ...’. Helping individuals to overcome the feelings of failing is crucial, as one expert stated the following about the approach:

‘People very often do not like to be exposed to the public and admit that they did something wrong ... in modern IT companies where they say well, we made a mistake. Well, make sure you learned from it and then move on’. [DDD]

An organization’s ability to measure the value created/added by use of digital in the work culture is important to address the assumptions around who gets or does not get work done and hence qualifies for incentives. Remarkably, while individuals understand their own contributions, team-wide incentives are ranked higher in our case organizations. From the collected data we could not conclude that team-wise incentives as artefacts are prioritized due to digital transformation. However, value creation as a whole team was more substantial with digital technology deployment. The leaders saw that promoting team-wise value creation and incentivizing could enable a healthy culture with a balance between collectivism and individualism.

In global industrial organizations, the tendency is to ‘work in their silos because of their profit-and-loss responsibilities’ [VP]. Therefore, the strategic design of artefacts in the support of the ecosystem includes **physical spaces for accelerated collaboration** combined with **digital space for collaborative learning** (Fig. 12). Digital purpose-built platforms accelerate collaboration and support the ‘learning-culture angle’ [SMDT]. Bringing people (physically) into a common room with all the needed facilitations is crucial for collective decision-making, from ideas to the development of non-generalizable value complementarities.

The cultural artefacts of a digital transformation must (i) ‘bring transparency to the whole value chain’ [GH] and (ii) ‘involve customer [in value] co-creation’ [VP]. Our research cases introduced new **formal functional hierarchies** and **purpose-driven informal structures** (Fig. 13). Informal and purpose-driven hierarchies are agile because of fewer tie-ups with profit-and-loss responsibilities, and they can experiment with ideas, prioritize the upskilling of resources, and empower the passionate. However, these formal and informal functions need a **digital supported way-of-working**, too. Above all, it is considered invaluable to bring in a **customer-inclusive way of working**. The target is a state where resource investments receive guidance from customer co-creation and co-invest exercises built within the corporate policies and work procedures.

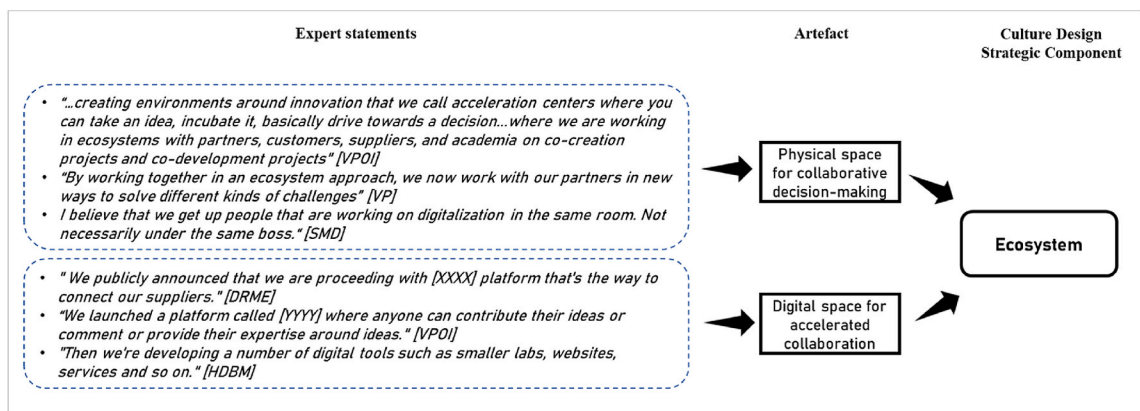


Fig. 12. Cultural artefacts that enable the ‘ecosystem’ for digital transformation.

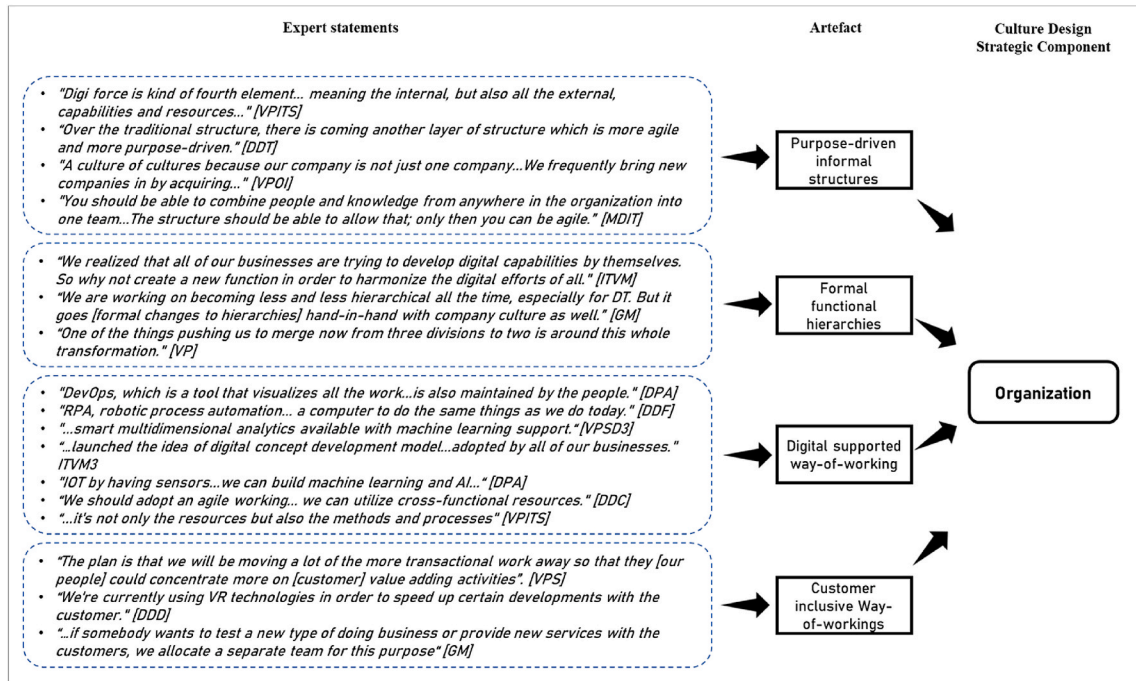


Fig. 13. Cultural artefacts that enable the ‘organization’ for digital transformation.

4.4. Framework for the strategic design of culture

Digital transformation needs ‘a different playground’ [VPIT]. Modern digital technologies will change ‘basically everything and anything’ [SMDT] within industrial organizations. In our research cases, the strategic design of culture for digital transformation has been driven by leaders living the values and prioritizing the required artefacts. In a digital transformation supportive culture, the apparent changes [artefacts] are celebrations, team-rewarding, and the physical and digital spaces for agile and collaborative decision-making in customer-centric development initiatives. Customer-centric developments need customer-inclusive ways of working. In doing so, these cultures are neutral (not punishing), and people are curious about experiential learning within formal and informal hierarchies. In the following, the research findings on the values in action, assumptions for the reconstruction and prioritized artefacts in our case organizations have been collected as an exploratory framework for the strategic design of culture (Fig. 14).

The cultural values of a holistic (customer lifecycle value) approach and co-creation with customers need continuous renewals at the strategic, tactical, and operational levels. Such renewals are promoted with a start-up mindset. The passionate (people as

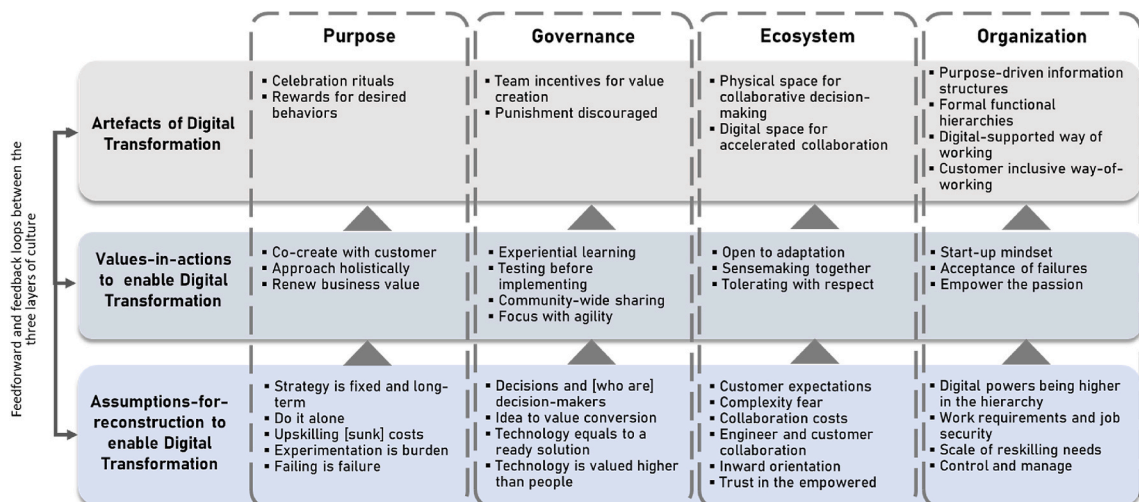


Fig. 14. Exploratory framework for the strategic design of culture to enable digital transformation in traditional industrial organizations.

knowledge workers and experts) are empowered to experiment with digital technologies. As all start-ups are not successful in scaling up the business value of innovations, the digital transformation culture values the important role of failing attempts. The culture of testing (prototyping) and community-wide sharing of the experiential learning helps our case organizations prioritize resourcing and helps to resolve disputes, here with a focus on agility within own organization and across the business ecosystem (customer, suppliers, partners, investors, research and educational institutions, and regulators, etc.). These new values are the preferred mode of conduct in shaping shared mental models and comprehending the possibilities with digital technologies.

Old, taken-for-granted, and silently consented to assumptions tacitly resist new cultural values. Such silently consented to tacit beliefs about strategy, upskilling, failing, customer expectation, being doer only, technical complexity, trust and empowerment, ideation, value creation, technology versus solution, hierarchies, work requirements, job security, and control and management of the work tasks need reconstruction.

## 5. Discussion and conclusions

### 5.1. Refreshed culture complements strategy implementation in sociotechnical business organizations

Our three case studies of forerunner world renowned industrial organizations present a complementary role of culture in business strategy implementation. These findings add to the organizational strategy literature by examining the cultural design for digital transformation as a sociotechnical phenomenon (Davis et al., 2014; Imran et al., 2021; Karimi and Walter, 2017; Kiefer et al., 2021; Pasmore et al., 2019; Sony and Naik, 2020). Our research establishes that traditional industrial organizations which sustain competitive advantage were able to continuously refresh (Warner and Wäger, 2019) the three layers of organizational culture. In these organizations, the leaders' approach to refreshing the culture is inherently proactive rather than hasty. Their selection of renewed behaviors to be cultivated in the culture is strategic (Kane et al., 2016; Warner and Wäger, 2019) rather than solely operational. In these case organizations leaders and people '*think, feel and act*' (Schein, 1996, p. 12) upon the strategy through refreshed cultural assumptions, values, and artefacts. Thereby the refreshed culture complements business strategy and hence propels success in digital strategy execution (Volberda et al., 2021).

While this research addresses recurring calls for an investigation into how industrial organizations prepare contextual idiosyncrasies including culture in their pursuit of digital transformation (Berghaus and Back, 2017; Dubey et al., 2019; Duerr et al., 2018; Ghosh et al., 2022; Hartl and Hess, 2017; Martínez-Caro et al., 2020; Volberda et al., 2021; Warner and Wäger, 2019), its findings are broader. These findings extend the social system design as a requirement for culture-inclusive business strategy (extending from Abhari et al., 2021; Ostroff et al., 2020). The leaders in our case organizations expound that digital transformation strategy, technology, and social aspect are inseparable within the three layers (artefacts, values, and assumptions) of organizational culture. Hence, the design of these three layers demands coherent upbrings alongside the technology-laden strategy formulation as well as strategy execution (Chatman and Cha, 2003).

Based on the case findings, we argue that the grown-up cross-sectional view of culture [for example, digital culture (Martínez-Caro et al., 2020), digital innovation culture (Kiefer et al., 2021), and big data culture (Dubey et al., 2019)] has led to a detached, limited, and reactive approach to digital transformation. As a result, organizations are attending to culture preparedness in haste, and then dump the responsibility to the strategy execution program teams. It is not surprising that detaching culture design and strategy formation allows forces in culture to overthrow well-articulated digital strategies (Gartner, 2020; Kane et al., 2016; Rumelt, 2011; Volberda et al., 2021). Our research data in fact shows evidence of the proactive reconstruction of long-lived cultural layers that could remain unattended and resist the digital transformation in our case organizations. This is in line with Kane et al. (2016, p.10), who found that leading organizations have supporting culture already at the early stages of digital transformation.

### 5.2. Socio-cultural control system for digital strategy execution

Over the successful history, the case organizations had learned to scale up of business operations consistently and efficiently. However, the multitude of disrupting changes required harmonic patterns of socially controlled response to the selected changes: for example, digital technology adoption for futureproofing of their business (Parida et al., 2019). The extant literature discusses that less formal social controls, for example organizational culture, are vital to successful strategy execution (O'Reilly and Chatman, 1996; Chatman and O'Reilly, 2016). Our findings have shed light on how such social control systems work (Chatman and Cha, 2003) in an organization's cultural layers of values, assumptions, and artefacts to enable digital transformation (Vial, 2019). These socio-cultural mechanisms are strategically designed for the purpose of governance, ecosystem, and organization (Pasmore et al., 2019). Our exploratory framework (Fig. 14) lists the values, assumptions and artefacts that constitute the sociocultural control system for digital transformation in our case organizations.

The research findings also shed light on cultural understanding of embedded work practices in their organizations (Vial, 2019). In our case organizations, business leaders could better approach technology and social controls, instead of solely leaving it to strategy consultants hired in the short term. The leaders and managers in these case organizations proactively seek '*what can come into being*' (Mintzberg et al., 1998, p. 283) and how to prepare the culture as a social mechanism for a likely future scenario with digital technologies. In the meantime, the feedback and feedforward loops between the three layers of culture cannot be left unattended. For example, cross-functional work coordination driven from the digital transformation supportive artefacts can also trigger the development of unsupportive assumptions. During transformation, these feedback loops continuously test (Hatch, 1993) newly developing values in action, and are diligently addressed by the leaders (Maurer et al., 2011; Schein, 2004) through coaching (Hatch et al., 2015)

as well as with “hard measures” (Hofstede et al., 2010, p. 375).

Like the guidance from Sony and Naik (2020, p. 8), they strategically build the culture for collaborative integration of end-to-end customer value processes. Hence, their technology-laden strategy execution is rooted within the day-to-day work performed by people socially connected with shared values, assumptions, and artefacts. With deeper understanding of how their organization works (Chatman and O’Reilly, 2016), the leaders were able to go beyond the ascribed values and artefacts of digital culture (Martinez-Caro et al., 2020). Meanwhile, the reconstruction of cultural assumptions further reinforced social controls by promoting the desired values in action (Schein, 2004).

### 5.3. Culture as a strategic resource for digital transformation

Recognition of the role of culture in the adoption of (digital) information technologies is well established (Kiefer et al., 2021; Nadkarni and Prügl, 2021; Vial, 2019). Meanwhile, the findings of this research highlight the role of culture as a strategic resource (Barney, 1986). Throughout their successful histories, our case organizations mastered the economics of operational scale-up with resource minimization. However, exploiting opportunities for non-generalizable complementarities with ecosystem partners (Jacobides et al., 2018), and including customers (Volberda et al., 2021), required new types of resources to maintain the economy of scale-based superior competitive advantage (Barney, 1986).

In acknowledging that efforts to attain the cultural enablement of strategy could be a slower process (Sony and Naik, 2020), the interviewees devised a strategic approach to developing their culture (Barney, 1986). The experts/leaders in the case organizations saw that the extent of the business transformation through digital technologies is much wider and continuous in nature. They wanted cultural resources for wider, frequent, formal and informal collaboration. For example, digital transformation requirements included a culture-supported ecosystem in which the sales experts collaborate with potential partners and suppliers, while the engineering experts co-create with customers and end-users to resolve industry-, society- and global-level problems.

In line with Volberda et al. (2021), our case organizations deployed culture as a resource to foster customer-driven assumptions, values, and artefacts. As discussed earlier, with understanding of how their organization works, the routinizing of newly developed artefacts (e.g., processes, procedures, structures, and digital platforms) promoted customer-centricity. With the routinization of these newly developed artefacts, the people could self-regulate their behavior toward ecosystem partners (customer, suppliers, partners, research and educational institutions, and regulators) with mutual respect, openness, and trust (Kolagar et al., 2022).

Traditional industrial organizations could seek a novel approach to build up culture as a strategic resource that is a valuable, rare, imperfectly imitable, and non-replaceable (VRIN) source of competitive advantage (Barney, 1986). Although culture is rooted deeper in the social systems, it is important to prioritize those values, assumptions and artefacts that can rampart a collective cognition (Mintzberg et al., 1998, p. 283) of the opportunities, and thus facilitate digital transformation as a coherent action for strategy execution (Rumelt, 2011, p. 268). In this way culture as a VRIN resource can sustain superior business performance (Barney, 1986). For example, a VRIN culture with strategically designed artefacts, values, and assumptions (Fig. 14) could contribute to the digital transforming dynamic capabilities (Ghosh et al., 2022; Warner and Wäger, 2019). Our approach to organizational culture as a strategic resource brings a fresh spectrum of possibilities for strategic management scholars, students, and practitioners (Cepa and Schildt, 2022; Singh et al., 2020).

### 5.4. Managerial implications, limitations, and future research

The findings of our case studies are relevant and transferable to globally operating industrial organizations with rich histories, especially in the energy and environment industries in urgent need of transformation with the help of advanced digital technologies. A first-hand insight into how leaders approach cultural design will be an asset to other practitioners. As managers and leaders in traditional industrial organizations juggle with a cross-sectional approach to culture, our research provides contextual depth to how cultural changes could be designed in the pursuit of digital transformation. The findings of this study can help managers understand the far reach of cultural assumptions as hidden and untold decisions which can restrict or permit strategic changes. The exploratory framework (Fig. 14) gives a source to design supportive culture within the three layers of assumptions, values, and artefacts. They can approach culture as a means of social control to guide day-to-day work collaboratively by putting theory into practice i.e., embodying the values through their actions.

This diagnostic case study on digital transformation as a sociotechnical phenomenon brings rich insights for scholars and practitioners; however, it has limitations (built in the research design). Culture as an enabler has its idiosyncrasies in each organization, and the organizational context of digital transformation as strategy can also be different. Thus, the findings of this research with reference to the values, assumptions, and artefacts in the case organization, especially the case-specific approaches as mentioned in the interviews, may not be mirrored in all other global industrial organizations. Thus, we do not claim universal generalization of our case study research findings (Yin, 2014). Further, our cases were globally operated industrial organizations with rich histories and are forerunners in terms of digital transformation strategy implementation. Younger industrial organizations, especially those with operations limited to one or a few geographical regions, may bring different insights regarding the strategic design of culture. Also, small- and medium-sized industrial organizations’ cultures would need dedicated research.

Furthermore, we acknowledge that our pointed focus on digital transformation does not cover all that is included in the strategies of organizations. For example, we noted that along with the digital transformation, *carbon neutral operations*, *environmental sustainability*, *gender equality*, and *circular supply management* are amongst the strategic priorities in all the three case organizations. Meanwhile, we observed a similar gap in the literature in explicating the culture in terms of other relevant points for industrial organizations. Future

research could address such gaps. The strategic design of culture will help scholars and practitioners to fill such gaps. It will be fascinating to explore cultural design for multiple and competing targets of wider strategy implementation initiatives.

Our case organizations are headquartered in Nordic countries. Hence, the interviewed experts were from diverse cultural backgrounds and geographically located in multiple countries across Europe. During the data collection on digital transformation as a sociotechnical phenomenon, as well in the data analysis, we have discounted the effect of national and regional cultures. This represents a limitation to this research but is an opportunity for future research to combine the strategic design of culture from both the organizational and national cultural point of views. For example, how the in-built national behaviors in globally operated organizations affect those organizational cultural values, assumptions, and artefacts which enable or constrain digital transformation. Such clinical research on culture (Janićijević, N. 2011) with a longitudinal setting can explain the process of cultural change across the digital transformation journey (see Hatch et al., 2015).

Knowledge about the strategic design of culture in globally operated services-only sector organizations is another research opportunity to evaluate and extend our exploratory proposed framework. The sociotechnical phenomenon investigated in the present research is digital transformation, which is one of the multiple realities transforming industrial organizations, for example, the technological advances related to energy and the environment. There is an opportunity for future research to investigate the strategic design of culture from multiple simultaneous transformations in an industrial sector. Our exploratory framework (Fig. 14) provides a starting point for such future research.

### CRediT authorship contribution statement

**Aurangzeb Butt:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **Faisal Imran:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – review & editing. **Petri Helo:** Conceptualization, Resources, Supervision, Writing – review & editing. **Jussi Kantola:** Conceptualization, Resources, Supervision, Writing – review & editing.

### Data availability

The authors do not have permission to share data.

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## APPENDIX A

### 1. Contextual information collected from secondary data sources

**Case A** strategizes data and digitalization as mega-market trends. Digital transformation is taken as an opportunity to enhance customer value and increase options to enrich customer experience. Digital transformation is part of their business strategy; digital technologies are reshaping the business models. The digital transformation program and related initiatives cover a sizable portion of R&D investments. The aim is to digitally connect multiple value chains and to be closer to their customers by developing digital intelligence, digital platforms and applications, and cloud-based virtual services. There is a specific focus on building 'innovation culture' where digitalization provides the foundation for securing a strong market position. The published materials on the website suggest that continuous learning and development of people to explore and exploit digital technologies is presented along the innovation culture. The industrial case organization is also investing in building the infrastructures (physical and digital) with the aim of having an innovation ecosystem which will foster collaborative innovation culture for external partners.

Digital transformation-built business strategy is actively promoted by **Case B**. Their digital transformation journey involves speeding up decision-making and getting closer to the customer. There is a focus on strengthening the digital customer experience by adding digital dimensions to all operations: building-in their product-specific digital technologies, digital-service platforms and tools, digitalization of operations (digital factories), and digital customer experience interfaces. Transforming business with digital technologies takes a considerable portion of R&D investment. The secondary data (annual reports and recorded interviews) suggests that the adoption of digital technologies is even pacing-up R&D activities for product and service development. This industrial organization reports that digital technologies are aimed at catering for operational complexity by providing lean and agile methodologies.

For **Case C**, the application of digital technologies is also for sustaining business success in the future. Bringing digital interfaces to all aspects of business is strategic to **Case C**. Transforming business with digital technologies takes up a considerable portion of R&D investment and the focus is on building a rich portfolio of digital projects. The industrial organization created a data management office, digital and data strategy, building digital platforms for intelligent operation, digital learning and people's engagement, digital supply chain management, digital sales, and digital customer experience. Heavily promoted is a work culture of data utilization that speeds up quality decisions. Understandably, the speed and approach of digital transformation varies between the different business units of **Case C**.

## 2. List of interviewed experts and their key responsibilities in digital transformation

#	NVivo code	Expert position	Digital transformation key responsibilities	Recording (Minutes rounded to the dividend of 5)
1	DDC	Head of Digital Culture	Supporting business strategy and growth through changes in digital knowledge, skills, and ways of working	50
2	MDT	Manager Digital Transformation	Planning competence development actions. Digital knowledge sharing	55
3	SPM	Senior Project Manager Digitalization	Leading digital projects	95
4	MDIT	Manger ITSM	IT Service management	86
5	GM	General Manager	Mobilization and operation of digital products and related cloud infrastructure	85
6	PM	Project Manager	Customer collaboration digital platform development	65
7	SMDT	Senior Manager Digital Transformation	Driving a people-first, customer-centric, smart-tech enabled, collaborative and innovative culture	60
8	VP	Vice President Digital Product Development	Key member of Digital Transformation team	65
9	OED	Operational Excellence Director	Lean and agile operational capability development, strategy implementation,	50
10	DDD	Director Digital Development	Co-creating digital products and services with customers	75
11	GMOD	General Manager, Operational Development	Operational Development portfolio management implementing business strategy and digitalization opportunities, site IT connectivity concept creation and implementation	70
12	DDT	Director Digital Transformation	Driving the digital transformation and culture journey (Domenico Dargenio)	85
13	GMBD	General Manager, Business Development	Strategy roadmaps and strategy execution	60
14	DAI	Director, Areas and Integrations	Transformation programs; IT operations; business mergers & acquisitions	75
15	DRD	Director, Head of Digital R&D	leading digital research and development	40
16	SDPO	Senior Digital Product Owner	Supporting the digital and culture transformation	80
17	DDF	Director Digital Foundation	PLM (Product Lifecycle Management) and RPA (Robotic Process Automation).	80
18	VPOI	Vice President Open Innovation	Digital culture and digital revenues	55
19	GMI	General Manager, Innovation	Leading the innovation activities	65
20	GH	Global Head	Global product management	60
21	SMD	Senior Manager Digitalization	Digital strategy work	80
22	ASE	Application Software Engineer	Model based design	80
23	VPGMS	Vice President, Global After Market Service	Leading the Global Aftermarket Service organization	70
24	HDBM	Head of Digital Business & Marketing	Innovative leader driving digital sales and improving customer experience	30
25	HDEP	Head of Digital Experience Program	Overall leader of the Digital Customer Experience (DCE) organization	55
26	DPM	Digitalization Project Manager	Help organizations go digital	65
27	SDIT	Senior Director of IT Innovation	IT innovation	65
28	SDGT	Senior Director, Global Technology	Plan and lead strategic development initiatives.	70
29	SDSB	Senior Director eSteering business	Head of a business unit	25
30	DPA	Director Platform Architecture	Develop and implement an IoT strategy	80
31	VPITS	Vice President, IT Strategy and Governance	Responsible for IT services	85
32	ITVM	IT Vendor Manager	IT supply management. Responsible for governance models	85
33	DDSR	Director, Digital Stakeholder Relations	Leading a team in stakeholder relations responsible for developing digital communications and marketing	70
34	MMD	Manager, Maintenance Development	Lead developments in maintenance and asset management in all areas of technology	45
35	MITD	Manager IT and Digitalization	Digital transformation projects and operational change management support	45
36	DSR	Director, Stakeholder Relations, and Digital Officer	Responsible for communications, marketing, environment & responsibility	50
37	VPS	Vice President Sourcing	Managing new supply chain and product ramp	45
38	VPSD	Vice President, Strategy and Business Development	Responsible for strategic planning, commercial strategy, and sales development,	85
39	DRME	Director, Raw Material Execution	Heading Raw Material Execution team	50
40	CIO	Chief Information Officer	Digitalization and IT strategy	70

(continued on next page)

(continued)

#	NVivo code	Expert position	Digital transformation key responsibilities	Recording (Minutes rounded to the dividend of 5)
41	LDM	Global Head Data Management	Data management, data organization and governance	35

**APPENDIX B**

Summary of thematic data analysis of the case data.

Cultural Layer	1st Order Concept Based on interview excerpts	2nd Order Theme	Strategic design
<b>Artefacts</b>	Celebrating fails	Celebration rituals	Purpose
	Celebration giving sense of belongingness		
	Sense of respect in learning from fails		
	Leaders are coaching the right behaviors	Rewards for desired behaviors	
	Rewards for building new behaviors		
	Rewards for sharing learning from mistakes		
	Mistakes are not punished		
	Work on same goals and get rewarded	Team incentives for value creation	Governance
	Individual bonuses are part of full incentives		
	Bonus tied with business value creation		
	People prefer time-wide incentives		
	Learnings from mistakes	Punishment discouraged	
	Discouragements to punish mistakes		
	Acknowledgments that punishment ruins digital transformation		
	Fame for learning from failed attempts		
Failure post-mortem reports to spread learning			
Idea incubation with ecosystem partners	Physical space for collaborative decision-making	Ecosystem	
Acceleration centers to drive decisions			
Co-creation and co-development projects			
Together with partner, new ways to collaborate			
Collaborate in same room, not necessarily under same boss			
Digital platform to connect partners	Digital space for accelerated collaboration		
Digital platform for idea management			
Websites and digital labs to work with partners			
Digi force	Purpose-driven informal structures	Organization	
2nd layer of structure to drive the digitalization purpose			
Acquired businesses collaborate with old hierarchy			
Combine people and knowledge from anywhere in the organization			
Create new function in all businesses	Formal functional hierarchies		
Reduce/simplify traditional hierarchies			
Combine functions and business units			
Robotic process automation	Digital-supported way of working		
Multi-dimensional analytics tool			
Digital concept development model			
Machine learning and AI deployment in solutions			
New methods and processes			
Development & preparations			
VR tool usage in day-to-day work			
Ways of working to concentrate customer value	Customer inclusive way of working		
VR for customer co-creation			
A dedicated team for testing new services with customers.			
Customers best know their challenges	Co-create with customer	Purpose	
Common journey with customer			
Close to customer and collaborate			
Business need people	Approach holistically		
Build lifecycle approach			
Cross functional thinking about ecosystem			
Initiatives to create high and higher value	Renew the business value		
People contribution is high for organization			
Encourage trail and renew			
History of excellence			

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