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Digital Transformation and Changes in Organizational Structure

Empirical Evidence from Industrial Organizations

Industrial organizations must make structural changes in order to fully reap benefits from their digital transformation efforts.

Khuram Shahzad , Faisal Imran , and Aurangzeab Butt 

OVERVIEW: Despite the increased attention being given to digital transformation, scholars and practitioners have only realized limited insights concerning how industrial organizations are changing their structures to adopt digital transformation. Based on a multiple case study of three large industrial organizations, this article examines how industrial organizations are modifying their structures to attain meaningful outcomes from their digital transformation efforts. Building on a sociotechnical system view—that is, integration of digital technologies (technical system) into an organization’s operations and practices (social system)—this study explored the structural dimensions of formalization, hierarchy, and integration to examine the structural changes. The results revealed what structural challenges industrial organizations encounter with digital transformation and how they tackle them. This study also examined targeted performance outcomes to explain how structural changes help industrial organizations achieve agility, customer centricity, and collaboration through structural changes for digital transformation. We offer important insights for digital transformation practitioners to help them become aware of structural issues and suggestions on how to address them.

PRACTITIONER TAKEAWAYS:

- Rigid organizational structures impede digital transformation. Organizational leaders need to acknowledge this and, therefore, advocate for structural changes that can help create an environment for effective digital transformation.
- Leaders should minimize formalization and levels of hierarchy, empower teams, and employ digital tools that integrate internal and external stakeholders into a collaborative environment.
- Depending on their organizational goals, leadership may opt to create a new digital entity operating in parallel with other businesses or create new digital teams in each business unit to harmonize the digital initiatives across the organization.

KEYWORDS: Digital transformation, Organizational structure, Industrial organizations, Performance outcomes

Traditional rigid structures were suitable for industrial organizations operating in stable environments (De Smet, Lurie, and George 2018; Worley and Lawler 2006). The business

landscape has changed, however, and to stay competitive, industrial organizations are undergoing significant changes in the face of rapid technological advancements and changing

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customer demands (Sony and Naik 2020; Vial 2019). This shift challenges these organizations' existing structures (Mitki, Shani, and Greenbaum 2019), pushing them to transform digitally and leverage emerging technologies (Porter and Heppelmann 2015). In today's fast-paced, uncertain business world driven by digital transformation (Imran et al. 2021; Shahzad 2020), companies need a different structural approach.

Digital transformation is a sociotechnical process and a key strategy for deploying digital technologies in all organizational operations and practices (Mitki, Shani, and Greenbaum 2019; Sony and Naik 2020). In this article, we define *sociotechnical process* as changing organizational operations and practices through digital technologies. Sociotechnical process addresses digital-age challenges, harnesses opportunities, and enables improvements such as efficiency, agility, and innovation (Imran et al. 2021; Vial 2019). Insights from practice and recent academic research indicate that successful digital transformation requires more than just adopting new tools. It demands significant structural changes to align strategy, processes, and outcomes with digital objectives (Nambisan, Wright, and Feldman 2019; Sony and Naik 2020; Worley and Lawler 2006). Digital transformation means fewer hierarchical layers, less bureaucratic administrative control mechanisms, and higher cross-functional integration (Björkdahl 2020; Gehrke, Bonse, and Henke 2016), and encompasses organizational culture, digital mindset, and systems (Kretschmer and Khashabi 2020; Singh, Sharma, and Dhir 2021; Vial 2019).

Organizations often resist change, preferring instead traditional structures. This preference for business as usual can hinder progress and innovation (Matt, Hess, and Benlian 2015; Mierzejewska 2014; Worley and Lawler 2006). In the digital age, exploring and implementing structural changes for digital transformation is crucial to companies' survival and competitive advantage (Schwer and Hitz 2018). Debate exists regarding the best approach to integrate advanced technologies into an organization's structure. For instance, Gimpel et al. (2018) and Björkdahl (2020) found that many digital officers recognize the need for change but often lack comprehensive knowledge on how to scope digital transformation initiatives within existing structures. Several studies recognize that organizing for digital transformation is more complex than a mere technological advancement because of the associated organizational changes required (Mustafa et al. 2022; Sklyar et al. 2019; Smith and Beretta 2021). To benefit fully from digitalization, companies need to organize and shape organizational structures.

Several studies have viewed digitalization as an integral shaper of organizational function and structure (Ghani, Jayabalan, and Sugumar 2002; Mustafa et al. 2022). By contrast, some conceptual studies did not consider the specific context of digital transformation and did not offer practical insights regarding specific changes that organizations need to make to organizational structure dimensions in order to realize performance outcomes from digital transformation (Kretschmer and Khashabi 2020; Sony and Naik 2020; Vial

2019). Few studies have garnered practical insights regarding the intricate adjustments needed across different structural dimensions to enable successful digital transformation in diverse industrial sectors. In essence, practitioners have limited guidance to lead their organizational digital transformation journey. We propose that a multiple case study approach could provide tangible insights regarding how to implement structural changes in practice and enable various organizational functions to drive successful digital transformation initiatives. Scholars and practitioners have also called for a rigorous empirical analysis of the relationship between digital transformation and organizational structural changes (Björkdahl 2020; Horlacher, Klamer, and Hess 2016; Smith and Beretta 2021; Zhai, Yang, and Chan 2022).

We ask the following research question: *How do industrial organizations change their organizational structures to achieve success from implementing digital transformation?* Using evidence from three industrial organizations, this study offers a practical understanding of structural changes organizations need to make to ensure successful outcomes from digital transformation. We use sociotechnical system theory to identify these changes through multiple case studies. We consider a social imperative approach (Sarker et al. 2019), suggesting digital transformation outcomes are influenced by the firm's social factors—including formalization, hierarchy, and integration—which are considered important dimensions of organizational structure. This study responds to calls for expanding sociotechnical systems theory into new domains (Davis et al. 2014; Eason 2014), such as how organizations adapt to thrive in the digital era (Verma et al. 2023). We analyze structural dimensions and best practices for effective digital transformation. We also share key insights that practitioners can use to enhance their digital transformation efforts and optimize their outcomes.

Literature Review

An organization's structure includes the arrangement of people, departments, and subsystems such as projects and teams (Fry 1982). Matt, Hess, and Benlian (2015, 341) define changes in organizational structure as "variations in a firm's organizational setup, especially concerning the placement of the new digital activities within the corporate structures." An organization's structure ensures correct (accurate) functioning (Mierzejewska 2014) and helps an organization manage uncertainty and achieve goals (Burton and Obel 2018; Resca, Za, and Spagnoletti 2013). Traditional structures are hierarchical (Mrówka and Pindelski 2011), while modern ones are based on Lean management, outsourcing, re-engineering, knowledge management, and process management (Mierzejewska 2014). Modern technologies are significantly altering organizational operations and necessitating adjustments to organizational structures. For example, the Internet of Things (IoT) is optimizing business processes; digital platforms are creating ecosystems; artificial intelligence (AI) is leveraging big data and analytics to enable automated and algorithmic decision-making; and blockchain is enabling more transparent operations (Shahzad et al. 2024; Vial 2019).

Definitions

High formalization occurs when an organization has many rules and procedures; it tends to limit risk-taking; these rules help the organization identify changes in its environment.

Moderate formalization exists when an organization has some rules and procedures that help everyone understand what to do.

Low formalization occurs when there are few formal rules or procedures. Most tasks are handled informally; managers directly supervise employees and adjust to each other.

Hierarchy involves the different levels of authority, autonomy, and decision-making within an organization.

Integration refers to how different parts of an organization, like departments and teams, collaborate on specific topics.

Organizational structures have various characteristics. Mierzejewska (2014) reported five main parameters: specialization, standardization, formalization, centralization, and configuration. Other scholars have identified structure characteristics in different combinations—that is, vertical, horizontal participation, and formalization (Alexander and Randolph 1985); centralization, formalization, complexity, and specialization (Ford and Slocum 1977; Fry 1982); and management bureaucracy, hierarchy, and workforce flexibility (Kleinknecht et al. 2020). This study focuses on three dimensions of structure: formalization, hierarchy, and integration (see “Definitions” above). *Formalization* evaluates the extent to which an organization employs rules and procedures to regulate behavior (Liao, Chuang, and To 2011). *Hierarchy* deals with vertical layers—that is, authority, autonomy, and decision-making within an organization (Ford and Slocum 1977; Kleinknecht et al. 2020). *Integration* involves internal interactions and horizontal collaboration—for example, how closely different segments, departments, functions, and businesses work closely on any specific topic.

Researchers and practitioners alike have long viewed technology as a paramount reason to restructure industrial organizations to achieve performance outcomes (Vial 2019; Zhai, Yang, and Chan 2022). Sociotechnical system theory offers a theoretical perspective on the relationship between technology and organizational structures (Eason 2014; Morgan-Thomas, Dessart, and Veloutsou 2020). It examines the implications of digital technologies and offers distinct conceptions of how social systems—for example, organizational design and ways of organizing work—should be adjusted for such new technical systems, particularly organizational structures (Baxter and Sommerville 2011; Davis et al. 2014). Sociotechnical system theory facilitates organizing a change such as digital transformation (Imran et al. 2021; Imran and Kantola 2018) and promotes joint optimization of both social and technical systems (Appelbaum 1997). Scholars consider digital transformation a sociotechnical process (Mitki, Shani, and Greenbaum 2019; Sklyar et al. 2019; Sony and Naik 2020) that aims to change organizational operations and practices by using advanced digital technologies (Vial 2019) so that firms remain viable in this new digital landscape (Saarikko, Westergren, and Blomquist 2020).

According to Gehrke, Bonse, and Henke (2016), digital transformation’s major obstacles are the organization’s social

systems. As well, organizational structure needs to be designed carefully to ensure effective transformation (Imran et al. 2021; Imran and Kantola 2018; Verma et al. 2023). Digital transformation requires a flat, less hierarchical, and highly interconnected organizational structure (Kopp, Howaldt, and Schultze 2016) with flexible structures (Davies, Coole, and Smith 2017). Since most of the recent literature has focused on organizational change (Kretschmer and Khashabi 2020; Verhoef et al. 2021) or on the specific structural dimensions to see the effects of digital transformation on organizations (Bonanomi et al. 2020; Schwer and Hitz 2018), an opportunity exists to explore empirically overall structural changes in industrial organizations and how such changes help to achieve successful digital transformation.

Methodology

We conducted a qualitative multiple case study of three Nordic industrial organizations that launched digital transformation initiatives in 2017–2018, where the initiatives are still ongoing. The case selection method focused on the organizations that have launched their digital transformation initiatives in the past seven years. The contemporary, social, and ongoing nature of digital transformation and changing organizational structures makes a case study design suitable for this research (Dubé and Paré 2003; Yin 2018). A multiple case design also allows for data analysis across various contexts, grounding findings in diverse empirical evidence (Eisenhardt and Graebner 2007). Developed during the second industrial revolution, these firms are traditional organizations with rigid structures, which make them interesting cases for examining how digital transformation has impacted their structures, the measures they have taken, and how they are coping. Due to nondisclosure agreements, we created aliases for all participants. We provide more details about the organizations and interviewees (Table 1).

This study focuses on three dimensions of structure: formalization, hierarchy, and integration.

TABLE 1. Case organizations

	Case 1	Case 2	Case 3
Industry	Renowned player in smart technologies and complete lifecycle solutions for the marine and energy sectors	Market leader in its field and a pioneer of variable frequency drives, cooling and heating solutions, and energy management	A large player in the forest, wood, and paper industry; also expanding its business in the energy market
Digital transformation strategy	A separate dedicated digital organization was developed by hiring a chief digital officer (CDO) to lead digital transformation	Digital transformation responsibilities are dedicated to the business segments' heads	Digital transformation responsibilities are dedicated to unit heads
Sales in 2021	€ 4.8 billion (\$5.23 billion)	€ 7.5 billion (\$8.17 billion)	€ 9.8 billion (\$10.68 billion)
Number of employees	17,000	40,000	17,000
Interviewees	Upper management: 14 Middle management: 5	Upper management: 8 Middle management: 3	Upper management: 8 Middle management: 3

Data Collection

We began data collection using grounded theory-based logic (Gioia, Corley, and Hamilton 2013), which revealed that digital transformation is a continuous process rather than an end goal (Butt et al. 2024). The data collection was part of a broader research project aimed at understanding the digital transformation concept from a sociotechnical system perspective (Davis et al. 2014; Mitki, Shani, and Greenbaum 2019). We used a two-step data collection method (Gioia, Corley, and Hamilton 2013) for the entire project, conducted in 2019 and 2020 (Butt et al. 2024). Initial data collection involved gathering social media blogs, marketing materials, business reports, recorded executive interviews, and organization websites while searching for key informants through LinkedIn. We then leveraged our professional networks to contact these experts, sending emails that included the project's goals.

We selected 12 senior management professionals who confirmed their significant role in digital transformation programs and conducted a first round of open-ended interviews face-to-face or online. Through these steps we identified common enablers and targeted performance outcomes of digital transformation; we recognized organizational structure as an important enabler. For the second step of data collection the interviewees recommended other participants, whom we contacted through email. We conducted 29 semistructured interviews face-to-face or online. In total, we conducted 41 interviews that lasted between 50 and 90 min (Table 2). Two researchers conducted most interviews to ensure consistency (Guba and Lincoln 1994). We used a semi-structured interview guide to understand digital transformation as a phenomenon and its related effects on organizations. How digital transformation affects organizational structure or how structure enables digital transformation with the required organizational changes was part of these general interview questions. The focus was on the respondent's experiences and data collection ceased upon saturation (Butt et al. 2024).

Data Analysis

We read and coded both primary and secondary data to identify key themes. The transcribed interviews comprised more than 500 pages. We used an online transcription platform to

convert speech into text. In the initial stage, one researcher proofread the transcripts while listening to each recorded interview. For independent parallel analysis, two of the researchers conducted initial coding of the complete data by splitting the statements linked with the dimensions of structure and performance elements of structural changes. We based the initial coding on three main criteria: (1) Are interviewees' insights applicable to the organizational structures? (2) Do several interviewees provide insights? (3) Are the interviewees' insights interesting and useful?

Our initial analysis yielded 489 statements concerning organizational structures. The coding process categorized all these statements into first-order categories that were assigned labels with phrases that retained the interviewees' terminology. Further analysis yielded seven more abstract second-order theoretical-level themes (coinciding with relevant literature to record any novelty): structural challenges, formalization, hierarchy, integration, agility, customer centricity, and collaboration. We divided the themes into two aggregate dimensions: organizational structural changes for digital transformation and performance through structural changes for digital transformation (Gioia, Corley, and Hamilton 2013) (Figure 1). This method also aligns with the abductive theory-building approach suggested by several scholars (Alvesson and Kärreman 2007; Sætre and Van de Ven 2021). We also confirmed the replication of findings across all three cases (Eisenhardt and Graebner 2007; Yin 2018). Our cases prioritize these concepts and themes as strategic changes in organizational structure to achieve successful digital transformation.

Results

We divide our findings into the importance of structural changes in digital transformation; digital transformation strategy and new structures; challenges to structural changes; formalization; hierarchy; integration; and structural changes impact organizational performance.

The Importance of Structural Changes in Digital Transformation

Our results indicate that the case organizations understand the need for radical changes, especially in their organizational

TABLE 2. Interviewees with their key responsibilities

#	Expert	Key responsibilities	Length of interview (minutes)	Level of representation
1	Head of digital culture	Supports business strategy and growth through changes in digital knowledge, skills, and ways of working	50	Case 1: Upper management
2	Manager, digital transformation	Planning competence development actions; digital knowledge sharing	57	Case 1: Middle management
3	Senior project manager, digitalization	Leads digital projects	95	Case 1: Middle management
4	Manager, ITSM	IT service management	86	Case 1: Middle management
5	General manager	Mobilization and operation of digital products and related cloud infrastructure	85	Case 1: Upper management
6	Project manager	Digital product (platform) development	65	Case 1: Middle management
7	Senior manager, digital transformation	Driving a people-first, customer-centric, smart-tech-enabled, collaborative, and innovative culture	58	Case 1: Middle management
8	Vice president, digital product development	Key member of digital transformation team	66	Case 1: Upper management
9	Operational excellence director	Key member of digital transformation team	52	Case 1: Upper management
10	Director, digital development	Cocreating digital products and services with customers	74	Case 1: Upper management
11	General manager, operational development	Operational development portfolio management implementing business strategy and digitalization opportunities, site IT connectivity concept creation and implementation	72	Case 1: Upper management
12	Director, digital transformation	Driving the digital transformation and culture journey	84	Case 1: Upper management
13	General manager, business development	Providing support in the strategy roadmap	60	Case 1: Upper management
14	Director, areas and integrations	Transformation program leader	73	Case 1: Upper management
15	Director, head of digital R&D	Leads digital R&D	38	Case 1: Upper management
16	Senior digital product owner	Supports the digital and cultural transformation	77	Case 1: Upper management
17	Director, digital foundation	Product lifecycle management and robotic process automation	78	Case 1: Upper management
18	Vice president, open innovation	Digital culture and digital revenues	53	Case 1: Upper management
19	General manager, innovation	Leads innovation activities	65	Case 1: Upper management
20	Global head	Global product management	60	Case 2: Upper management
21	Senior manager, digitalization	Digital strategy work	81	Case 2: Middle management
22	Application software engineer	Model-based design	82	Case 2: Middle management
23	Vice president, global after-market service	Leads the global aftermarket service organization	71	Case 2: Upper management
24	Head of digital business and marketing	Innovative leader driving digital sales and improving customer experience	32	Case 2: Upper management
25	Head of digital experience program	Overall leader of the digital customer experience organization	57	Case 2: Upper management

(Continued)

TABLE 2. Continued

#	Expert	Key responsibilities	Length of interview (minutes)	Level of representation
26	Digitalization project manager	Helps organizations go digital	66	Case 2: Middle management
27	Senior director, IT innovation	IT innovation	67	Case 2: Upper management
28	Senior director, global technology	Plans and leads strategic development initiatives	71	Case 2: Upper management
29	Senior director, e-steering business	Head of a business unit	25	Case 2: Upper management
30	Director, platform architecture	Develops and implements an IoT strategy	79	Case 2: Upper management
31	Vice president, IT strategy and governance	Responsible for IT services	85	Case 3: Upper management
32	IT vendor manager	IT supply management and governance models	83	Case 3: Middle management
33	Director, digital stakeholder relations	Leads a team in stakeholder relations responsible for developing digital communications and marketing	68	Case 3: Upper management
34	Manager, maintenance development	Led developments in maintenance and asset management in all areas of technology	46	Case 3: Middle management
35	Manager, IT and digitalization	Energy IT expert	47	Case 3: Middle management
36	Director, stakeholder relations and digital officer	Responsible for communications, marketing, environment, and responsibility	52	Case 3: Upper management
37	Vice president, sourcing	Managing new supply chain and product ramp	46	Case 3: Upper management
38	Vice president, strategy and business development	Oversees strategic planning, commercial strategy, and sales development	83	Case 3: Upper management
39	Director, raw material execution	Heads raw material execution team	48	Case 3: Upper management
40	Chief information officer	Digitalization and IT strategy	71	Case 3: Upper management
41	Global head data management	Data management, data organization, and governance	36	Case 3: Upper management

structures, to elicit an effective digital transformation process. A vice president of open innovation from Case 1 explained, “Some of this reorganization that has happened is really about making sure that we can make more impact quickly. . . . Many organizations reorganize themselves in this [digital transformation] process because you try to organize around a new reality.” A general manager of innovation from Case 1 said, “Whenever you are transforming, the structural update is required . . . because we change how we do business; therefore, we reorganize. . . . Digital transformation enables us to do business differently; therefore, we adjust our structure

accordingly.” These views underscore how digital transformation requires structural change in an organization.

Digital Transformation Strategy and New Structures

We found that all three cases emphasize digital transformation as a key part of their business strategies. Case 1’s focus is on enhancing customer value and experience through digital intelligence, platforms, and cloud services, investing heavily in R&D, and investing in building physical and digital infrastructures to create an innovation ecosystem and culture that will foster collaboration. Case 2 aims to speed up decision-making and improve customer experience by integrating digital technologies such as digital service platforms and tools, digitalization of operations, and digital customer experience interfaces across operations, also dedicating significant R&D resources. This will result in addressing the complexity of operations by offering Lean and agile approaches. Case 3 prioritizes digital interfaces and data usage to sustain future business success, creating a rich

The study findings underscore how digital transformation requires structural change in an organization.

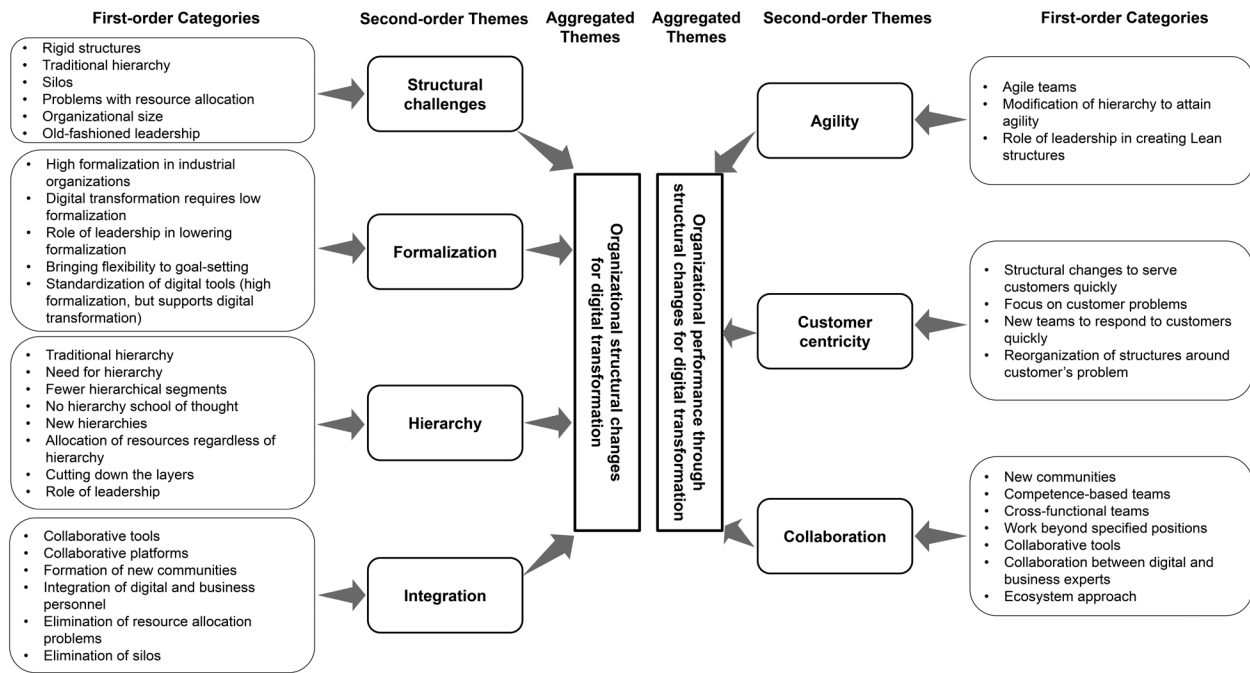


FIGURE 1. Data structure

portfolio of digital projects and fostering a collaborative innovation ecosystem.

The case organizations adopted two digital transformation strategies. Case 1 created a new digital organization with a new structure for digital transformation initiatives. It aimed to develop digital capabilities across the organization and hired a chief digital officer. Cases 2 and 3 opted instead to harmonize digital initiatives within their existing structures, respectively. Case 2 created a new digital team within each business segment, while Case 3 developed a small digital team for the entire organization. Similar to Case 1, Cases 2 and 3 aimed to track digital initiatives and provide needed digital capabilities. Case 1 made large investments, while Cases 2 and 3 started on a smaller scale with limited resources. We summarize these strategies (Table 3).

Challenges to Structural Changes

We identified several challenges related to structural changes, including the rigidity of hierarchical organizational structures

rooted in command-and-control management styles. Different segments within organizations prefer to work in silos due to internal competition, cost allocations, and performance goals, making resource allocation a significant challenge. Our interviewees indicated that while large organizations require processes and structures to manage their daily operations, they don't have to be rigid. Our data suggest that leadership styles rooted in command and control also hinder structural changes. We summarize the challenges identified from the study with representative quotations (Table 4).

Formalization

Our findings indicate that the case organizations generally are highly formalized and process oriented. They have well-defined processes to carry out any task or project. In contrast, digital transformation requires flexibility, goal orientation, and as little formalization as possible to reap maximum benefits. Despite being process-oriented companies with high formalization, our findings suggest the case

TABLE 3. Case organizations' digital transformation strategies

Case 1	Case 2	Case 3
Develop a separate digital organization	Delegate digital tasks to business heads	Delegate digital tasks to business heads
Hire a new chief digital officer (CDO)	Create a new digital team to coordinate digital activities within different functions of business units	Create a new digital team to coordinate digital activities across business units
Employ a mix of internal and external digital experts (new teams in the digital organization)	Employ a mix of internal and external digital experts (within business units)	Employ a mix of internal and external digital experts (within business units)
Support business projects by providing them with digital capabilities	Provide digital capabilities and harmonize digital activities within each business unit	Harmonize digital activities across business units
Develop a completely new structure parallel to the main business structures	Develop a new structure embedded within business units	Develop a new structure embedded within business units

TABLE 4. Structural challenges

Challenges	Representative quotations
Rigid structures	"We are still having very old traditional organizational structures and processes."—Director, digital transformation (Case 1)
Traditional hierarchy	"There is a cultural element in it that we are a very traditional organization, with a long history and being more hierarchical all the time."—Senior director, global technology (Case 2)
Silos	"All these business areas have worked pretty much independently [not only from the business side, [but] also from processes, systems, and tools' point of view, and that is challenging."—Director, raw material execution (Case 3)
Problems with resource allocation	"To deliver a complex project, you will need to have the capability of building networks quickly, regardless of how you are organized structurally. . . . In fact, one should think less in terms of their organizational home and instead gather around the problem to solve it together with others."—Director, digital development (Case 1)
Organizational size	"We have 20,000 people; it needs to be structured one way or another . . . but if you want to meet the pace of the world, you need to give up old practices—for example, setting up five meetings for making a decision around a product."—Director, head of digital R&D (Case 1)
Old-fashioned leadership	"It has a lot to do with this 1980s/1990s leadership style in the power game. They usually structure so they have the power. . . . Leadership needs to transform from power to empower [for digital transformation]."—Director, platform architecture (Case 2)

TABLE 5. Formalization in case organizations

Formalization	Representative quotations
High formalization in industrial organizations	"In our organization, one is given a very clear scope for a task and then you have to accomplish it accordingly."—Director, digital stakeholder relations (Case 3)
Digital transformation requires low formalization	"Whatever internal bureaucracy and complexity you have, you have to avoid it [for digital transformation]."—Senior director, e-steering business (Case 2) "If you have bureaucracy and heavy organization, there will be no transformation."—Manager, maintenance development (Case 3)
Role of leadership in lowering formalization	"I give them [team members] goals, and to some extent, they can achieve it in their own way."—Senior director, IT innovation (Case 2) "Leaders should coach and guide, but not define the processes in detail."—Operational excellence director (Case 1)
Bringing flexibility to goal-setting	"We set yearly goals for individuals. . . . Now we can change the existing goals based on how the environment has been changed. . . . Earlier, it was a taboo that you can't change yearly goals during the year, but now it's more flexible [due to digital transformation]."—Vice president, IT strategy and governance (Case 3)
Standardization of digital tools (high formalization, but supports digital transformation)	"Digitalization enable(s) us to operate in a much more centralized way [across the businesses]. . . . We need harmonized processes in place and only then we can be more centralized [in terms of systems and tools]."—Director, raw material execution (Case 3)

companies have undertaken many changes to reduce formalization to allow for digital transformation. We also found that each company's leadership's role is critical in this transformation. Most participants (approximately 90 percent) are promoting less formalized and more goal-oriented approaches within their areas of responsibility. This is a positive sign for these industrial organizations, as it will help them become goal-oriented. We also found evidence that the case organizations are standardizing digital tools, which contradicts the concept of low formalization: Industrial organizations want to standardize their digital systems and tools to operate harmoniously. According to the case organizations, this action will enhance integration among internal stakeholders and facilitate collaboration in terms of using similar tools across the organization. We summarize the interviewees' statements and provide representative quotations regarding formalization (Table 5).

Hierarchy

People generally perceive industrial organizations as very hierarchical, comprising several layers, which increases bureaucracy, complexity, and managerial red tape that slows down progress and halts digital transformation. Our results revealed mixed views regarding the hierarchical notion of organizational structure. Most interviewees (roughly 70 percent) viewed their organizations as very hierarchical and expressed preference for a less hierarchical structure. Some interviewees (around 20 percent) indicated support for hierarchy to manage big organizations, but favored a more flexible hierarchy with loosened structures to enable digital transformation. And some interviewees (approximately 30 percent) viewed their business segments as less hierarchical compared with other parts of the same organization.

Despite these mixed views on hierarchies, we identified some key changes in our data: (1) the formation of new digital organizations or teams to harmonize digital initiatives;

TABLE 6. Hierarchy overview of case organizations

Hierarchy	Representative quotations
Traditional hierarchy	"This is a big company, and it's hierarchical, having several group management layers and business management layers."—Vice president, strategy and business development (Case 3)
Need for hierarchy	"You will need hierarchy at some level, as it's impossible to manage hundreds of teams doing everything on their own."—Senior digital product owner (Case 1)
Fewer hierarchical segments	"In the business area where I am working, there is very little hierarchy." —Vice president, sourcing (Case 3)
No hierarchy school of thought	"We can't support hierarchy as 10 years ago. Because of digitalization, you connect daily and directly, and if you have bureaucracy and heavy organization, there will be no transformation."—Manager, maintenance development (Case 3)
New hierarchies	"My team is working on a transformation aspect, which is sort of a pop-up function in the organization. . . which is another layer of structure over the organization's traditional structure."—Director, digital transformation (Case 1)
Allocation of resources regardless of hierarchy	"Now they have been pulled out of their normal reporting structures and put into these functions."—Digitalization project manager (Case 2)
Cutting down the layers	"Now it's getting less hierarchical and more horizontally flatter."—Senior director, IT innovation (Case 2)
Role of leadership	"Traditionally, big companies are hierarchical, but I do not promote that. I have different layers, and they [subordinates] can reach the top manager easily; they are more independent and can make decisions by themselves."—Vice president, global after-market service (Case 2)

(2) these new functions are challenging existing hierarchies because they are formed by tapping into different resources/competencies regardless of their current position and location; (3) digital transformation has encouraged these organizations to revisit their traditional and long-term hierarchies and remove as many layers as possible to reap the full benefits of digital transformation, but these changes are limited to individual functions or business segments; and (4) as these initiatives are limited to the functional or business segment levels, leadership's role is critical in reducing hierarchical layers and promoting a flat or less hierarchical structure in their areas of responsibility. We summarize our results regarding hierarchy and include representative quotations (Table 6).

Integration

A manager, ITSM from Case 1 said, "Digital transformation is all about integration," which emphasizes the importance of this structural element. We found integration to be one of the notable structural dimensions in which the most changes have occurred due to digital transformation. Digital transformation has helped organizations integrate effectively: The digital collaborative tools and platforms it provides have enabled different internal and external stakeholders to collaborate more effectively on common initiatives and similar topics of interest regardless of their position and location within the organization. Digital transformation has facilitated the integration of digital and business personnel. The main objective of newly formed digital organizations and teams is to provide digital capabilities for business counterparts, which requires integration between both. Finally, by providing digital collaborative tools, digital transformation reduces resource allocation challenges, minimizes silos, and brings different competencies together through new communities regardless of their reporting lines. We summarize the interviewees' views on integration, including representative quotations (Table 7).

Structural Changes Impact Organizational Performance

We found that the case organizations, being process oriented and functioning on the slow-moving waterfall model, need agility to compete in the fast-paced digital environment. Becoming agile is a key goal in their respective digital transformation efforts. Since rigid structures can hinder agility, we noted that these organizations promote agile teams and empower them to work beyond structural constraints. They are also modifying their hierarchies to become more agile. Leadership role is crucial: We observed multiple examples of leaders promoting goal-oriented approaches to become agile. The organizations are trying to reduce formalization and hierarchy to become agile for digital transformation.

Regarding customer centricity, we found interviewees inclined to make structural changes to serve their customers better. Some respondents (approximately 25 percent) stressed the need for such teams on customer fronts, where every competency is combined so that they can respond to customers more efficiently. Our study findings also suggest that enhancing collaboration is a key objective of structural changes for impactful digital transformation. Ongoing structural changes foster collaboration by forming communities, lowering barriers among functions, and enabling stakeholders to problem solve together, all of which promotes a sense

The case study organizations are trying to reduce formalization and hierarchy to become agile for digital transformation.

TABLE 7. Integration views from case organizations.

Integration	Representative quotations
Collaborative tools	"I think probably the biggest contribution that comes in this regard is from systems like SAP that integrate whole organization(s). But also the biggest contribution comes from collaborative tools like video sessions on Zoom or Skype."—Director, digital development (Case 1)
Collaborative platforms	"We have integrated quite well; we have common [digital] platforms where we gather and share information."—Manager, maintenance development (Case 3)
Formation of new communities	"We are behind the biggest communities in our organization. For example, we started a community of software developers from five people, but it's now grown to 1,600 people. . . . Basically, we do community-driven approaches."—Senior director, IT innovation (Case 2)
Integration of digital and business personnel	"In data-driven projects, as a data scientist, you can prepare the pipelines, but this is just one part of the equation. You need business experts to be able to understand and comment if these models are valid or not. This is where integration of digital and business is required."—Director, digital development (Case 1) "We are in the middle of IT and business; we glue them together."—Head of digital experience program (Case 2)
Elimination of resource allocation problems	"We are now bringing the best of our organization on common projects for work and to make those successful. It does not matter what their reporting lines are; we are one company, and we should work for the same goals."—General manager, innovation (Case 1)
Elimination of silos	"Now, more and more, we are coming out of silos."—Operational excellence director (Case 1) "We are hoping that through arranging people on common topics, we will break silos."—Director, chief data architect (Case 3)

of shared organizational goals, regardless of hierarchy or position.

Efforts to cross-pollinate skills and work beyond specified roles, irrespective of reporting lines and hierarchies, enable the formation of optimal project teams and collaboration on dynamic projects. Our results highlight the importance of promoting cross-functional teams to enhance collaboration. Digital transformation's collaborative tools make collaboration across teams, units, departments, and so on easier compared with situations where every function uses its own specific tool. According to our findings, the additional new structure of digital organizations or support teams also has promoted collaboration between digital and business personnel to achieve digital transformation. We found the ecosystem approach effective in enhancing collaboration and solving common problems. We summarize the interviewees' views on agility, customer centricity, collaboration, and structural changes, including representative quotations (Table 8).

Discussion

Earlier in the article we presented the structural perspective of digital transformation based on the sociotechnical system view (Figure 2). We summarized the key themes identified in this study and their possible interaction with each other. According to our study, requirements for ongoing structural changes needed for digital transformation include the dimensions of formalization, hierarchy, and integration, while agility, customer centricity, and collaboration are the targeted performance elements achieved through structural changes for digital transformation.

Traditional industrial organizations face several challenges due to their structures, including rigidity, hierarchy, silos, resource allocation issues, size, and old-fashioned leadership (Mumford 2000). While rigid structures worked

in stable environments in the past, the rapid, unpredictable changes brought by disruptive digital technologies necessitate a different approach to structural changes (Shahzad 2020). Scholars have emphasized how crucial organizational structure is in managing digital transformation change (Verma et al. 2023), and our study findings reaffirm this. Each case study organization considered this need to adapt while planning and implementing its digital transformation strategies. Since digital transformation requires a flatter organizational structure that is more flexible and agile, organizations with rigid, traditional structures will inevitably struggle in the digital age unless they adapt. Our case companies show that industrial organizations are taking steps to modify their structures according to their digital transformation needs.

Aligned with Mumford's (2000) concept of a "wired world," we found that in the current digital age where complexity and uncertainty are high, industrial organizations need to adopt flexible structures to transform digitally to succeed in a competitive business environment. Our results highlight that organizations aim for the low formalization of structures, but their standardization of digital systems throughout the organization should be limited to minimum critical specifications to operate harmoniously.

Building multiskilled and multifunctional teams within flexible (formal to informal) structures supports digital transformation, which aligns with the sociotechnical system design principle (Cherns 1976; Verma et al. 2023). Our interviewees agreed that their organizations lagged behind in preparing their respective organizational structures for digital technologies. They understand that the rapid industrialization of digital technologies necessitates the continuous evolution of the business environment, competition, and performance expectations.

TABLE 8. Targeted organizational performance views from case organizations

Agility	Representative quotations
Reducing formalization and promoting less hierarchy to become agile for digital transformation	<p>“We have these virtual teams who work around developments and in an agile manner . . . although they are tied with some basic structure in the organization, they are empowered to proceed in an agile manner regardless of their cost centers.”—General manager, operational development (Case 1)</p> <p>“Over the traditional structure, there is coming another layer of structure which is more agile and more purpose-driven.”—Director, digital transformation (Case 1)</p> <p>“You have to cut down those layers—that is the only way to be faster.”—Senior director, IT innovation (Case 2)</p>
Leadership role in promoting a goal-oriented approach	<p>“I keep the structure as low as possible and try to operate in an agile manner for my team.”—Director, digital stakeholder relations (Case 3)</p> <p>“If you start defining processes in detail, then you are no longer agile.”—Senior director, IT innovation (Case 2)</p>
Customer centricity	<p>“Some of this reorganization that has happened is to make sure that we can make more impact quickly. . . . That’s why some people in the digital organization are not embedded into the business so that they can remain much closer to the customer projects.”—Vice president, open innovation (Case 1)</p> <p>“We try to look at this from a customer point of view—that is, what are their needs. . . . and it has an impact on how we structure the business.”—Director, digital transformation (Case 1)</p> <p>“You need to be able to have the right people and capabilities [on a team] to understand the customer and to be able to offer the right product, regardless of hierarchical layers. . . . By delayering the hierarchy, you can create such an organization or team that is self-sufficient to answer your customers’ demand(s) quickly.”—Director, stakeholder relations and digital officer (Case 3)</p>
Collaboration	<p>“We are now bringing the best of our organization on common projects for work and to make those successful. It does not matter what their reporting lines are. We are one company, and we should work for the same goals.”—Project manager (Case 1)</p> <p>“We are trying to open up our teams to drive more collaboration between different parts of the company, and more working in cross-functional teams.”—Vice president, open innovation (Case 1)</p> <p>“By working together in an ecosystem approach, we now work with our partners in new ways to solve different kinds of challenges. . . . You have to think beyond the boundary of your function or even organization, as the answer to your problem might lie at my customer’s end or supplier’s end.”—Vice president, open innovation (Case 1)</p>

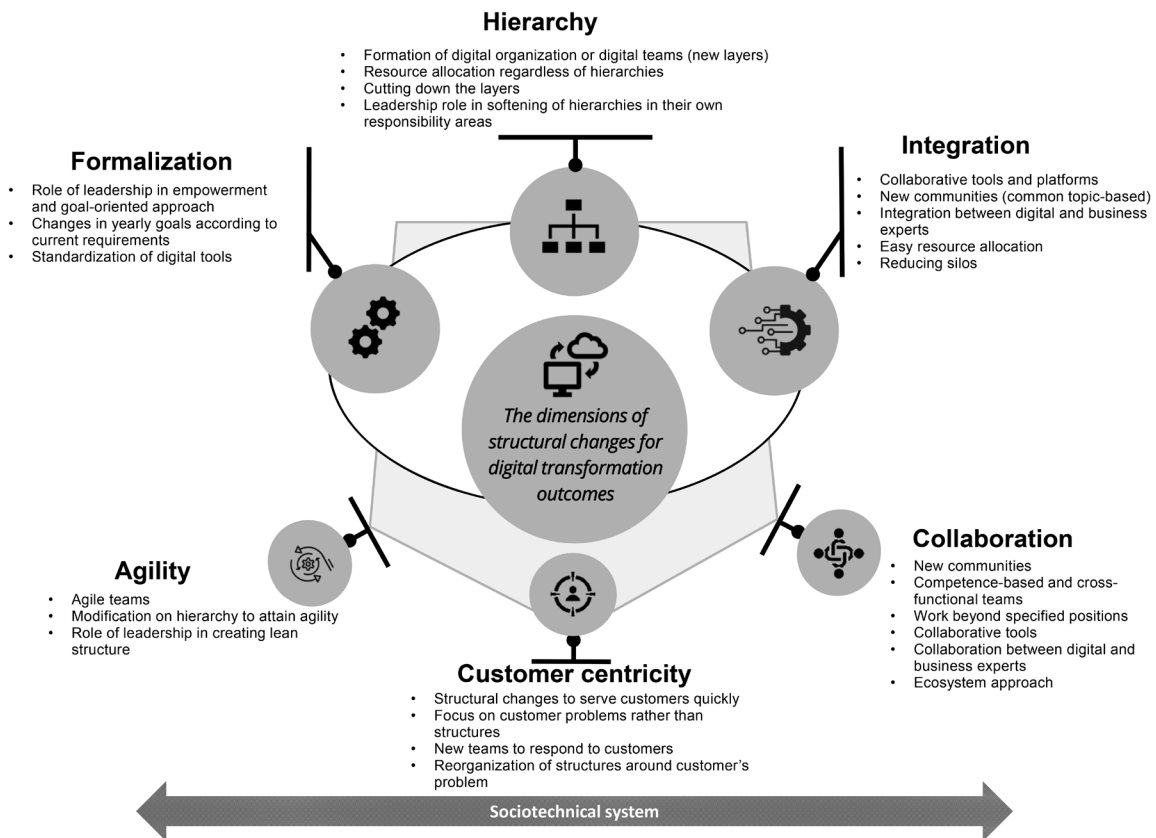


FIGURE 2. Digital transformation structural framework

Structural changes arising from digital transformation, our study suggests, can help an industrial organization achieve agility, customer centricity, and enhanced collaboration.

Our study highlights the fact that in order to develop digital capabilities, industrial organizations need to develop new structures that are parallel to existing business organizations, which is also known as “separation through dual structure” (Gupta, Smith, and Shalley 2006). Doing so not only helps in steering digital transformation and integrating various functional silos within the organization, but it also accelerates change, as noted by Svahn, Mathiassen, and Lindgren (2017). Our results highlight another approach—namely, integration within the existing organizational structure in which existing functions handle digital activities. We analyzed and documented a consistent pattern of structural changes occurring in both scenarios. Previously, organizations adopted the matrix organizations concept, which has more rules, regulations, and administrative control mechanisms (also known as management bureaucracy), which led to high formalization (De Smet, Lurie, and George 2018; Kleinknecht et al. 2020). To reduce formalization, leadership roles become imperative in promoting empowerment and goal-oriented approaches (Imran et al. 2020). Our study indicates industrial organizations are becoming flexible in goal setting to adapt to their digital transformation efforts.

We found that digital transformation requires fewer hierarchical layers, promoting quick detection of valuable technologies, and forming digital organizations or digital teams to harmonize digital initiatives and cope with fast-paced business environments. Rigid hierarchies provide structure in large industrial organizations, though Mrówka and Pindelski (2011) found that flat hierarchies can cause chaos in such organizations. Our findings indicate that industrial organizations need to find the right balance in their hierarchies so that they can remain intact without creating bottlenecks for digital transformation initiatives. Again, the leadership role becomes critical in reducing hierarchical layers and promoting flat or less hierarchy.

According to our study, digital technologies facilitate integration through their advanced collaborative tools, which promote interconnectedness between internal and external stakeholders, digital and business experts, and efficiency through forming new communities. This finding aligns with that of Beier et al. (2020), who suggest technologies facilitate integration between several stakeholders. We also observed that horizontal mechanisms facilitate cross-functional

integration, information sharing, and trust across the organization. Digital disruption blurs boundaries, promoting the integration of external stakeholders integration. Organizations, now networked entities, must frequently interact with external stakeholders, with digital technologies playing a key role. Several scholars have supported this notion that integration with external stakeholders through digital transformation can boost creativity and innovation by introducing industrial organizations to new ideas and competencies (Gimpel et al. 2018; Mitki, Shani, and Greenbaum 2019; Pasmore et al. 2019).

Structural changes arising from digital transformation, our study suggests, can help an industrial organization achieve agility, customer centricity, and enhanced collaboration. Our findings highlight the need for industrial organizations to have flexible structures and agility so they can respond effectively to ongoing rapid technological advancements and changes in the business environment. Verhoef et al. (2021) have also advocated for developing such flexible structures for agile organizations. Our study showed that the case organizations identified becoming an agile organization is a key agenda item in their respective digital transformation initiatives. A rigid, hierarchical structure with multiple layers of management perpetuates management bureaucracy and impedes innovativeness. A balanced formalization and a flatter hierarchy with agile teams would foster customer centricity and enhance customer value through cocreation.

Leadership plays a vital role in streamlining structures to enhance organizational agility. Our data revealed numerous instances of leaders advocating for more goal-oriented strategies to achieve agility. Although industrial organizations traditionally structure around products, customer centricity requires them to structure around customers. Digital transformation plays a key role in customer centricity, generating customer intelligence through data gathering and processing, and supporting customized marketing activities (Birch-Jensen, Gremyr, and Halldórsson 2020). It also enables system integration between customers and organizations through digital platforms, enhancing interaction convenience.

Enhancing collaboration is a key objective of structural changes for impactful digital transformation in our case study organizations. Our study highlights that digital transformation provides collaborative tools that facilitate collaboration within and across the organization by forming different communities based on common goals. This resulted in fewer barriers among different businesses, problem sharing and collaborative solution-finding through cross-pollination of skills among personnel, and creating a sense of achievement regardless of the existing hierarchy. From a structural perspective, we found that horizontal integration is a primary enabler of collaboration, which enhances internal collaboration across different functions and businesses as well as with external stakeholders, which aligns with studies by Oesterreich and Teuteberg (2016) and Imran et al. (2021, 2022). Our study demonstrates industrial organizations are promoting cross-functional collaboration and facilitating resource reallocation to enhance internal collaboration horizontally.

Managerial Implications

This study offers seven important implications for innovation leaders, managers, and practitioners involved in digital transformation:

1. Rigid organizational structures impede the implementation of new digital technologies. Therefore, innovation leaders need to recognize clearly and advocate for structural change and commit to creating an environment conducive to an effective digital transformation process.
2. Key structural changes should focus on formalization and changes in innovation processes, simplification or flattening of hierarchies, and integration of expert tools and resources. Innovation leaders and managers can help their organizations set and achieve goals of being more agile, customer-centric, and collaborative. They can encourage practitioners to embrace the use of digital tools and collaborate with colleagues in and across different business functions to solve problems or embrace common initiatives.
3. No one-size-fits-all approach exists to help industrial organizations implement effective digital transformation strategies and make the necessary structural changes to achieve their business objectives. Innovation leaders may opt to create a new digital entity led by a digital expert such as a chief digital officer that can operate in parallel with the main business organization. Another option is to create new digital teams within each business function or unit to harmonize digital initiatives across the organization. Innovation leaders, managers, and practitioners all have a role to play in developing digital capabilities across the organization.
4. Since digital transformation can reinforce classical power structures or enable distribution of information within the organization, innovation managers must define their objectives very carefully concerning what they aim to achieve through structural changes when implementing new digital technologies.

5. Structural change begins at the senior leadership level. Leadership is key in reducing formalization and levels of hierarchy, especially in the deep-rooted rigid structures in industrial organizations. Innovation leaders can empower their teams to help them adopt a goal-oriented approach. They can offer innovation managers leeway regarding how to create a flexible, agile environment in the business function or area they oversee, and encourage them to set a good example for others.
6. Integration is a central tenet of digital transformation and therefore innovation managers need to understand its importance in structural change. Managers can use digital collaborative tools and platforms to create new communities that integrate internal and external stakeholders.
7. Managerial commitment to making structural changes for digital transformation helps organizations become more agile, customer-centric, and collaborative.

We outline the key strategies, processes, and actions that can help practitioners implement digital transformation effectively and make structural changes within their organizations (Table 9).

Limitations and Future Research

This study focused on large industrial organizations, so the findings may not be generalizable to other types of organizations. A broader range of interviewees may yield different findings. Future research, such as a longitudinal study, could explore an organization's level of satisfaction with its structural changes and digital transformation outcomes. Cross-case analysis may also yield more insights. Future studies should explore the pros and cons of separate versus integrated digital organizations, validate findings quantitatively, and consider other organizational structure dimensions. While we highlighted leadership's role, more detailed study could focus on individual behaviors.

TABLE 9. Strategies, processes, and actions

Strategies	Processes	Actions
Recognize the need for structural change	Structural transformation	Commit to creating an environment conducive to effective digital transformation
Develop digital capabilities	Formalization and changes in innovation processes	Create a new digital organization led by a digital expert
Harmonize digital initiatives	Delaying or relayering of hierarchies	Form new digital teams in each business segment
Define clear objectives for structural changes	Integration of tools and resources	Carefully define objectives for structural changes
Promote leadership in reducing formalization	Leadership-driven structural change	Start structural change at the leadership level
Foster integration	Integration of internal and external stakeholders	Use collaborative tools and platforms to develop new communities
Commit to structural changes	Development of agile, customer-centric, and collaborative organization	Commit to changes in organizational structure

Conclusion

We explored and analyzed the structural changes that occurred in three global industrial organizations. We investigated the digital transformation effects on formalization, hierarchy, and integration, which help to achieve agility, customer centricity, and collaboration. Although one organization adopted an approach to digital transformation different from that of the other two, all had a similar pattern of making structural changes. Organizations focused on lowering the formalization, reducing the layers of hierarchy, and enhancing integration by bringing different departments and staff closer can achieve their digital transformation goals. Informal structures helps organizations attain the required structural flexibility to achieve agility, collaboration, and customer centricity. Innovation leaders, managers, and practitioners can use the implications provided to help their organizations navigate their digital transformation journeys and achieve success.

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