




Digitalization trends and organizational structure: bureaucracy, ambidexterity or post-bureaucracy?

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Abstract

Nowadays, the vast majority of forward-looking organizations is activating under the imperative of embracing digital transformation. This study aims to contribute to a more fine-grained understanding of the relationship between digitalization and organizing processes, with a particular emphasis on organizational structure. Espousing the bureaucratic, ambidextrous, and post-bureaucratic views of structure based on the individual dimensions of centralization, formalization, skill variety, interdependence and integration, we ask which structural arrangement is more suitable for leveraging the benefits of digitalization. Two consecutive studies were conducted drawing on samples of 117 digital natives and 141 older-generation managers employed by various organizations located in Norway. Our empirical findings provide consistent cross-study support for the relevance of post-bureaucratic structure in the context of digitalization. We highlight the contributions of our research to extant knowledge in the field and discuss specific implications for theory and practice.

Keywords Digitalization · Technological dynamism · Organizational structure · Bureaucracy · Post-bureaucracy · Ambidexterity

1 Introduction

Digitalization has become a strategic priority for a large number of organizations (Iansiti & Lakhani, 2014; Porter & Heppelmann, 2015), due to its widely-documented positive effects on operational effectiveness and performance outcomes (Claggett & Karahanna, 2018; Faraj et al., 2018). Nonetheless, it has been argued that companies cannot fully tap into the benefits of digital technologies unless

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they are aligned with the other key resources and capabilities of the organization (Cenamor et al., 2019; Meske & Junglas, 2020; Salleh et al., 2017). Many scholars acknowledge the need to understand how the digitalization–performance relationship relates to matters of internal organization, with a specific examination of corporate designs, strategies, and capabilities that are required for harnessing the strengths of digital infrastructures (Bailey et al., 2019; Khan, 2016). Therefore, established businesses are increasingly challenged to foster simultaneously the technological and strategic dimensions of digitalization (Elia et al., 2020; Yeow et al., 2018).

An impressive body of literature has developed to date on various intra-firm implications of digitalization in terms of talent management (Khoreva et al., 2019), employee competencies (Gekara & Nguyen, 2018), and business models (Laudien & Pesch, 2019). Organizational design was shown to play a critical role in molding firm-level capabilities and resources (Spraggon & Bodolica, 2017), but the current understanding of how corporate designs are associated with digital technologies is limited. A core element of organizational design is structure, which influences how companies mobilize and exploit their resources to gain value and competitive advantage (Siggelkow & Rivkin, 2005). Although many seminal studies viewed technology as an essential shaper of corporate form and function (Orlikowski & Scott, 2008; Zammuto et al., 2007), with a particular emphasis on firm structure (Ghani et al., 2002), they did not consider the specific context of digitalization.

Due to the mounting pressure for businesses to embrace digital transformation, scholars renew their call for a more fine-grained analysis of the relationship between digitalization trends and organizing processes (Bailey et al., 2019). Earlier research has mostly focused on the role of digital technologies as an internal organizational factor (Laudien & Pesch, 2019), paying little attention to the role of digitally-induced technological dynamism in the external environment. Previously, it has been noted that digital transformation strategies comprise both intra-organizational and external facets (Lin et al., 2019; Parviainen et al., 2017). Because the development of resources and capabilities is contingent upon internal factors as well as external forces, there is a need for further research on organizational structure in the broader context of digitalization. Since structure influences intra-firm communication, learning, knowledge creation and sharing (Felin et al., 2012; Pertusa-Ortega et al., 2010), this line of research is particularly valuable for organizations operating in the knowledge-based economy (Lee & Edmondson, 2017).

The purpose of this paper is to contribute to a more fine-grained understanding of how digital transformation trends in the external environment shape the organizational structure. By considering three types of firm structure—bureaucracy, ambidexterity, and post-bureaucracy—and their individual dimensions—centralization, formalization, skill variety, interdependence and integration—we ask which structural arrangement is more compatible with digitalization. Two separate studies were undertaken using survey-generated data samples composed of 117 digital natives and 141 older-generation managers employed by various companies located in Norway. Both a disaggregated and combined analysis of separate dimensions was performed to shed light on the structural characteristics of organizations that aim to fully leverage the benefits of digitalization. The empirical findings provide consistent support for the relevance of post-bureaucratic structure in the context

of digitalization from the perspective of both digital natives and older-generation managers.

Our investigation offers important insights into the way Norwegian entities are approaching and attempting to master the internal structural challenges associated with the digital shift. The study attempts to contribute to the literature in several ways. First, we extend the current research on the organizational and managerial effects of digitalization beyond the prior emphasis on aspects, such as business models, coordination mechanisms, employee competencies, and talent management (Claggett & Karahanna, 2018; Gekara & Nguyen, 2018; Khoreva et al., 2019). Second, in line with recent calls to explore how the developments in digital technologies might influence the organizing process (Bailey et al., 2019), we elucidate the role of technology in shaping firm structure (Ghani et al., 2002) by considering the specific context of digitalization. And third, contrary to the prevalent treatment of digitalization as an internal variable (Laudien & Pesch, 2019), this study offers a more fine-grained understanding of how digital transformation trends in the external environment influence the organizational structure. In the final sections of this paper, we discuss several implications for theory and practice, and propose avenues for future research in the field.

2 Theoretical background and hypothesis

2.1 Organizational structure

Formalization, centralization, specialization (Burns & Stalker, 1961), interdependence and integration (Lee et al., 2015; Siggelkow & Rivkin, 2005) have been recognized as the core dimensions of organizational structure. Based on different combinations of these dimensions, scholars identified three structural forms, namely bureaucracy, post-bureaucracy, and ambidexterity (Dischner, 2015). Featuring high degrees of centralization, formalization, and task specialization, the bureaucratic structure has been associated with benefits, such as precision, rationality and predictability (Weber, 1958). Yet, scholars found that bureaucracy hampers firm flexibility and ability to innovate, which are survival imperatives in dynamic environments (Heckscher, 1994). In today's increasingly turbulent world, even classic bureaucracies, such as universities, have been forced to become more flexible in the face of changing market conditions (Bolin & Harenstam, 2008). Recently, post-bureaucracy received a lot of advocacy as a new form of organization (Heckscher, 1994; Maravelias, 2003). Post-bureaucratic structures stand in contrast to Weber's (1958) ideal bureaucracy, relying on high skill variety, low formal standardization, decision-making autonomy, collaboration, teamwork, networks and relationships (Dischner, 2015; Oberg & Walgenbach, 2008).

Early organization theorists (Lawrence & Lorsch, 1967) argue that the appropriateness of an organizational structure is dependent on the extent to which it fits certain contingencies, such as technology or market environment. Burns and Stalker (1961) offer a classification of mechanistic and organic structures, which are distinguished based on the level of formality, hierarchical communication and control,

and the degree of functional specialization. These two structural types, which parallel bureaucratic and post-bureaucratic concepts of structure, better fit stable environments and changing conditions, respectively. Mintzberg's (1979) configurational hypothesis suggests that organizations tend to be dominated by one of the five archetypes: simple structure, machine bureaucracy, professional bureaucracy, divisionalized form, and adhocracy. The simple structure and adhocracy, which rely on highly flexible project-based configurations, are classified as organic structures, and are argued to be suitable for volatile environments due to their high innovative capability. The other three archetypes are less likely to fit conditions that demand novelty and change (Lam, 2011).

Recent research demonstrates that the mechanistic structure is appropriate for stable environments, while organizations that employ organic structures flourish under dynamic conditions (Verle et al., 2014; Wilden et al., 2013). Since mechanistic and organic structures represent paradoxical features, traditionally scholars argued against the possibility of their combining in a single organization. There are, however, many proponents of a hybrid form of structure, which incorporates idiosyncratic features of both bureaucracy and post-bureaucracy (Josserand et al., 2006; Styhre & Lind, 2010). Hybrid structures may resolve conflicting dualities, such as high formalization and low centralization, or formal hierarchy and elements of flexibility, which may be useful for fostering innovation (Bodolica & Spraggon, 2020). The assertion that opposing structures can be reconciled is echoed in the contemporary debate about ambidextrous organizations (Andriopoulos & Lewis, 2009; Tushman et al., 2010), with their benefits being supported by many recent studies (Lee & Edmondson, 2017; Mustafa et al., 2019).

2.2 Digitalization and organizational structure

Digitalization refers to “the manifold sociotechnical phenomena and processes of adopting and using digital technologies in broader individual, organizational, and societal contexts” (Legner et al., 2017, p. 301). It implies a transformation process (Rogers, 2016) that goes beyond using digital technologies as a support tool by incorporating changes in practices and strategies, and tasks and values (Hinings et al., 2018; Matt et al., 2015). Although technology tools, such as databases and digital platforms, are the main enablers of digitalization, they must be aligned with other firm resources, dynamic capabilities and informal networks to achieve knowledge integration and generate innovative outcomes (Legner et al., 2017; Yunis et al., 2018). Yet, since changes in firm capabilities are not on par with rapid developments of technology, it became a challenge for organizations to foster both the technological and non-technological dimensions of digitalization (Yeow et al., 2018).

Digitalization has several distinctive features that set it apart from prior technological developments. Digital applications enable businesses to more directly and quickly reach their customers, opening avenues for new approaches to innovation and collaboration within and across organizations (Bailey et al., 2019). Digital phenomena alter consumer behavior, disrupt the competitive landscape, enhance the accessibility to networks, and boost the availability of data in the value chain (Roger,

2016; Rolandsson et al., 2019; Vial, 2019). Featuring increased interconnectedness, diminished time lags, hierarchy removal and dissolution of interpersonal barriers (Khan, 2016), digitalization represents a new market logic that calls for proactivity, adaptability, and change of strategic orientation. To compete effectively in the digital era, organizations need to develop strategic flexibility that would enable a quick and adequate response to dynamic technological conditions.

Prior research on structural responses of organizations in the digital context shows a greater preference for flexible arrangements that are enabled through team-based collaboration, horizontal communication in social networks, and low hierarchical controls (Perez-Valls et al., 2016). Digital technologies signify disruptive changes in the external environment, which require companies to achieve control via lateral coordination mechanisms and self-organizing, instead of relying on formal hierarchy (Ostrom, 2010; Snow et al., 2017). Since digitalization requires continuous improvement and adaptation (Parviainen et al., 2017), organizations with rigid bureaucratic structures are less capable of responding to such changing external demands (Petković & Lukić, 2014). The pervasiveness of digital technologies demands improvisation, a lower reliance on narrowly-defined roles, and fewer hierarchical controls to foster innovation (Nylén & Holmström, 2015). Moreover, digitally-transformed companies that employ flexible work arrangements and adopt team-based and networked structures are enabled to generate positive employee outcomes (Meske & Junglas, 2020).

2.2.1 Centralization

Centralization is defined as the degree to which the decision-making authority is concentrated at the top of the organization. Prior studies show that a decentralized structure improves information flows, facilitating recognition of changes in customer demands, market opportunities and technological developments that occur in a digital economy (Hempel et al., 2012). To succeed in the era of digitalization, all the employees across the organization must contribute ideas and information about the problem to be solved (Lee & Edmondson, 2017). By encouraging a constant exchange of communication, a decentralized structure creates a work milieu that is favorable for pursuing creative ideas and fostering innovation (Rangus & Slavec, 2017). The sole reliance on authority creates little opportunity for generation of new knowledge (Spraggon & Bodolica, 2008, 2012), because a hierarchical structure focuses on routine actions that hinder interpersonal communication.

Digitalization induces a faster flow of information that results in shorter timeframes for decision-making and real-time management (Rogers, 2016). Digital technologies allow organizations to quickly respond to the rapidly changing customer needs, implying a logic of malleability rather than managerial control and hierarchical reporting. A decentralized structure tends to enhance flexibility at the operational level, which enables a faster recognition of emerging opportunities based on market feedback (Mihalache et al., 2014) and a more efficient use of knowledge (Foss et al., 2015). By allowing a greater proportion of job-related tasks to be done away from the physical workplace, digitalization induces greater employee autonomy and discretion, which are facilitated by a decentralized structure.

2.2.2 Formalization

Formalization refers to the establishment of specific rules and procedures that dictate decision-making in organizations. A formal structural arrangement often breeds rigidity and conformity to work rules, limiting employee discretion, decision-making authority, and creativity (Lee & Choi, 2003). Being more suitable for routinized tasks and stable conditions, organizations that are high on formality are unable to respond effectively to changes in the environment (Katsikea et al., 2011). Yet, by promoting a greater use of open processes that emphasize innovation and creative problem-solving, digitalization represents a departure from the bureaucratic effort to create rigid rules and limit worker discretion.

Digital tools enable employees to access information and construct knowledge-based methods for managing various uncertainties and contingencies (Spraggon & Bodolica, 2018). When formalization is low, decision making is driven by emerging requirements of the situation, and guidelines for solutions are unprogrammed and mutually adjustable (Bechky & Okhuysen, 2011; Harrison & Rouse, 2014). In environments that value knowledge work, informal practices empower actors to use their autonomy when making decisions (Spraggon & Bodolica, 2021), and companies with less formalized structures are better equipped to leverage the benefits of modern technologies (Petković & Lukić, 2014).

2.2.3 Specialization

Specialization refers to the extent to which employees' work is divided into narrowly-defined tasks, implying very low levels of skill variety. When jobs are highly specialized, firm members may lack shared knowledge and understanding of the role others play in the holistic work process. Actors with distinct functional responsibilities may have difficulty in communicating and coordinating (Dougherty, 1992), because their communication patterns become mostly profession-focused, rather than project- or goal-focused. The boundaries associated with different knowledge backgrounds from various disciplines create coordination problems and hamper the integration of new information (Kotlarsky et al., 2015).

Yet, digitalization has blurred the distinction between work roles, such as blue collar and white-collar workers (Rolandsson et al., 2019). The digital capacity to automate task-related processes and manage an extensive amount of data is associated with opportunities to reorganize work in teams, enhance job rotation, or engage in more inclusive forms of collaboration. Digitalization suggests a redefinition of firm structure, where boundaries between functions are reduced, employees assume additional tasks and processes beyond their original roles and expertise, and work is organized around cross-functional project teams (Corso et al., 2018).

2.2.4 Integration and interdependence

Integration indicates whether different units, departments, or partners tightly coordinate their activities, while interdependence implies a high degree of intra-organizational workflows' interrelatedness that requires cooperation among groups. In

a digital milieu, these structural features are important for several reasons. Digital platforms facilitate interactions between stakeholders, allowing businesses to distribute massive amounts of knowledge (Constantinides et al., 2018). Digitalization has pushed an ever-increasing number of companies to operate in the knowledge economy, where ideas and expertise act as the primary value sources. With the spread of digital technologies, the focus of value creation has shifted from the linear value chain to intertwined networks (Karimi & Walter, 2015; McIntyre & Srinivasan, 2017) of intra- and inter-firm relationships and information flows. However, to leverage the benefits of digital technologies, organizations need to possess network capabilities to manage effectively internal and external interdependencies (Battistella et al., 2017). Digital platform capabilities allow integrating shared knowledge, while reconfiguring internal and external resources to better fit the realities of an evolving environment (Helfat & Raubitschek, 2018; Teece, 2018). This advances the objective of integrating functionally distinct, but highly interdependent, organizational activities (Hamel & Zanini, 2018).

Digitalization may also have far-reaching implications for the nature of work and firm structure. In the digital economy, the number of people working normal hours in co-located spaces with a supervisor and long-term colleagues will decline, and more and more employees will only virtually connect to their workspaces (Ashford et al., 2018). Since it becomes less common for teams to be co-located, organizations need virtual tools to facilitate collaboration and communication with people from diverse backgrounds. The relational benefits of digital tools can only be leveraged if companies create an enabling structure. As organizing digitally means more collaboration among different entities, flexible and organic structures facilitate knowledge sharing opportunities (Kessler et al., 2017) via an egalitarian access to knowledge acquisition, transfer, and cocreation in a networked environment (Adler et al., 2011).

2.3 Structure–digitalization compatibility

The above discussion suggests that the bureaucratic structure, with its individual dimensions of centralization, formalization, specialization, low interdependence, and low integration, do not fit the digitalization logic. Conversely, extant literature seems to indicate that the post-bureaucratic view of structure, being characterized by decentralization, low formalization, skill variety, interdependence and integration, is more compatible with digitalization trends. However, worth noting is that an increasing number of recent studies highlight the importance of adopting hybrid or ambidextrous structures in dynamic environments of heightened innovation and digitalization.

For instance, organizations that radically decentralize authority are shown to employ highly formalized role definitions for control purposes (Lee & Edmondson, 2017). Clement and Puranam (2018) argue that, in the absence of formal structure, intra-firm interactions are prone to decline, because maintaining interactions requires formal coordination. Some scholars posit that formalization and decentralization are not mutually exclusive, as they positively influence the innovation process

(Daugherty et al., 2011) allowing knowledge workers to use both routinized and unstructured coordination practices, even in high uncertainty and fast decision-making contexts (Claggett & Karahanna, 2018). A formalized set of integration mechanisms is necessary to enhance cooperation between units during the introduction of new technology (Ingstad & Karlsen, 2016). Moreover, to leverage the benefits of malleability of digital technologies, structure and flexibility may need to be balanced effectively through the adoption of an ambidextrous structure (Nylén & Holmström, 2015). Nonetheless, much of the existing research hints at the suitability of a post-bureaucratic structure in the context of digitalization.

Therefore, drawing on the extant literature, we suggest the following hypothesis:

H1. In the wake of digitalization, organizations will adopt a post-bureaucratic structure over a bureaucratic or an ambidextrous structure.

3 Methods

We collected empirical data in 2018 from organizations located in the *Møre and Romsdal* region of Norway. *Møre and Romsdal* is one of the most important business regions in Norway and is home to a broad variety of business activities in different industries. According to the Confederation of Norwegian Enterprise (NHO), the region is known for the adaptability, innovative thinking, willingness to take risk and forward-looking nature of its firms that compete in the global market. Thus, the region provides an appropriate context for examining how digitalization may affect organizational structure. To remove the generational effects of digitization and enhance the generalizability of our findings, we conducted two studies by surveying younger employees (digital natives) and older-generation managers. The preference for a post-bureaucratic structure by digital natives might be viewed as a reflection of their particular expectations of work practices and tendencies to look at the world from a flat and collaborative perspective (Balda & Moora, 2011). By replicating our study using a group of older managers, we can confirm if our assumption that digitalization induces organizations to adopt a post-bureaucratic structure gets a consistent support for different generations.

3.1 Study 1

In study 1, we approached the attendees of the *Rock and Research Festival*—a workshop organized for the youth employed in various entities in the region—to request their approval to participate. Subsequently, our questionnaire was sent via email to 145 participants and 117 completed surveys were received, representing a response rate of 80.6%. The final sample included 60 males and 57 females, whose age ranged between 20 and 35 years, with an average age of 30.2 years. Most respondents (52.1%) had a bachelor's degree, with the remaining 35% and 12.9% reporting a master's and secondary/upper-secondary level studies, respectively. Also, participants represented different industry types, such as production (28%), banking and

finance (16.7%), marketing and sales (6.2%), public enterprises, health and education (30.7%), and other types (18.4%).

3.1.1 Measures

The original questionnaire was developed in English and later translated into Norwegian. The translation was initially performed by a Norwegian academic who is fluent in English. Then, another Norwegian scholar, a professor of organizational studies, checked its quality using back-translation. Participants' responses were captured on a 7-point Likert scale, ranging from "strongly disagree" to "strongly agree".

To measure our 'digitalization' variable, technological dynamism was used a proxy for external digital transformation. We captured the effects of digitalization on structural responses of organizations in two ways. Our first approach drew on the assessment of the extent to which study respondents expected a particular structural dimension to be of high/low relevance in companies operating in digitally-transformed environments. In the second approach, we examined which structural arrangement is more effective for succeeding under the condition of digitalization. Since there are no specific scales available to capture industry-level digital transformation, we based our measurement of digitalization on the technological dynamism scales (Jaworski & Kohli, 1993; Schilke, 2014), with a particular emphasis on the rapid developments in digital technologies. This approach is consistent with prior research that suggests that digitalization embraces an external side of change that transforms industries and markets (Lin et al., 2019).

To assess the 'organizational structure' variable, we drew on the five structural dimensions, namely centralization, formalization, specialization, interdependence, and integration. Respondents' opinions were solicited about how important these dimensions are for organizations operating in digitally-transformed contexts. Centralization was captured with a five-item scale developed by Jaworski and Kohli (1993), formalization was estimated using Deshpande and Zaltman's (1982) three-item scale, while skill variety was measured based on the scale of Hackman and Oldham (1975). We assessed interdependence and integration with three and five items, respectively, relying on the scales of Sethi (2000), Stank et al. (2001), and Wong et al. (2011).

3.1.2 Construct reliability, validity, and common source bias

The psychometric properties of our study measures were assessed using SmartPLS software. We used factor loadings and composite reliability (CR) as measures of reliability assessment. For accepting item loadings, we used the minimum level of 0.500 (Barclay et al., 1995). After eliminating items with low loadings, the loadings for the rest of the indicators exceeded 0.616, which included three items for technological dynamism, three for centralization, two for skill variety, three for interdependence, four for integration, and one for formalization. Each CR was above the threshold value of 0.700 (Fornell & Larcker, 1981), confirming the construct reliability. Further, the average variance extracted (AVE) for all the constructs exceeded the cut-off value of 0.500, demonstrating convergent validity. The square root of

AVE for all the variables was greater than the correlations between pairs of constructs, suggesting discriminant validity (Fornell & Larcker, 1981). Tables 1 and 2 report the factor loadings, AVE, CR, and discriminant validity coefficients.

Since data on all the variables were collected from a single source, common method bias could be a potential issue. We tested for collinearity among any variables by calculating the variance inflation factor (VIF). All factor-level VIFs from a full collinearity test were lower than 3.3, which is an indication that there are no common method bias issues (Kock, 2015). We also applied Harman's one-factor method (Podsakoff et al., 2003) to evaluate the possible impact of common method variance (CMV). After putting all construct items into an unrotated principal components analysis, no single factor emerged from this analysis and the largest factor accounted for only 23% of variance, corroborating that our findings are not likely to be affected by CMV-related issues.

3.1.3 Results of study 1

Table 3 reports participants' responses, regarding the importance of each structural dimension for organizations operating under digital transformation realities, by expressing agreement or disagreement with statements capturing that dimension. The results show that there is a high level of agreement with respect to interdependence, integration, and skill variety dimensions. This implies that our young respondents perceive these characteristics of structure as important for companies that activate in the context of digitalization. As far as centralization and formalization are concerned, the study participants did not express a clear preference, with less than 50% reporting either agreement or disagreement.

The mean scores for interdependence (5.9), integration (5.7), and skill variety (5.8) are higher than for centralization (3.9) and formalization (4.06). To assess if the lower scores on formalization and centralization significantly differ from the higher scores on interdependence, integration, and skill variety, we performed paired-samples t-tests. These tests report statistically significant differences between the above mean scores, suggesting that respondents attribute a higher importance to the latter three dimensions.

Then, we ran five separate regressions to examine the association between digitalization (proxied by technological dynamism) and: centralization (model 1), formalization (model 2), skill variety (model 3), interdependence (model 4), and integration (model 5). We controlled for the effects of respondents' gender, education, and industry type. The addition of technological dynamism to models 3, 4, and 5 enhanced the explanatory power of each model, resulting in significantly positive relationships for skill variety ($t=3.33$, $p<0.001$), interdependence ($t=3.45$, $p<0.01$), and integration ($t=3.45$, $p<0.01$). The regression outcomes for centralization and formalization turned out to be insignificant ($t=1.68$, $p>0.05$ and $t=1.49$, $p>0.05$, respectively). Table 4 summarizes the results for each regression model.

Thus, younger employees' preferences are consistent with the post-bureaucratic view of structure, providing support for hypothesis H1. Study participants consider the dimensions of interdependence, integration, and skills variety of high importance for leveraging the benefits of digitalization, but do not view formalized work

Table 1 Factor loadings, AVE and CR

Constructs and items	Loadings	AVE	CR
<i>Technological dynamism</i>		0.577	0.803
Digitally-induced environmental demands on organizations are constantly changing	0.763		
Digital technologies are changing rapidly	0.705		
Technological developments in our industry are rather high	0.805		
<i>Centralization</i>		0.651	0.847
There will be little action taken until a supervisor makes a decision	0.713		
Even small matters will be referred to someone with higher up for a final decision	0.791		
Any decision an employee makes will have to have his or her manager's approval	0.905		
<i>Formalization</i>		1	1
Most people will have to follow written work rules for their job	1		
<i>Interdependence</i>		0.610	0.822
Information and expertise of other departments will be important for members to successfully do their jobs	0.842		
Members will need to have cooperation of other members to successfully do their jobs	0.840		
Members will be required to jointly make important project-related decisions	0.645		
<i>Integration</i>		0.618	0.801
Organizations will maintain an integrated database and access method to facilitate information sharing	0.667		
Organizations will effectively share operational information between departments	0.798		
Organizations will have adequate ability to share standardized and customized information internally	0.746		
Organizations will emphasize on information and physical flows among departments within the organization	0.616		
<i>Skill variety</i>		0.505	0.762
One's job will provide opportunities to do different things	0.867		
There will be enough variety in an employee's job	0.696		

Table 2 Discriminant validity coefficients

Constructs	(1)	(2)	(3)	(4)	(5)	(6)
(1) Technological dynamism	0.760					
(2) Centralization	0.177	0.807				
(3) Formalization	0.159	0.320	1			
(4) Interdependence	0.327	0.101	0.093	0.781		
(5) Integration	0.342	0.102	0.072	0.285	0.710	
(6) Skill variety	0.362	0.117	0.065	0.512	0.317	0.786

Table 3 Means, levels of (dis)agreement and values for paired-samples t-tests

Dimensions	Mean	Agree, %	Disagree, %	t-values for mean differences	
Centralization	3.97	40.7	38.7	Centralization vs interdependence	– 13.954***
Formalization	4.06	47.4	35.4	Centralization vs integration	– 12.797***
Interdependence	5.93	90	4	Centralization vs skill variety	– 13.988***
Integration	5.74	82.2	7.5	Formalization vs interdependence	– 11.352***
Skill variety	5.84	90	3	Formalization vs integration	– 10.169***
				Formalization vs skill variety	– 10.908***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 4 Results of regression analysis on structural dimensions for study 1

Variables (control and independent)	Model 1 Centralization	Model 2 Formalization	Model 3 Skill variety	Model 4 Interdependence	Model 5 Integration
Gender	0.141	– 0.115	0.005	0.036	0.147
Education					
Masters	– 0.032	0.067	0.012	0.241	– 0.018
Bachelors	0.119	0.231	0.202	0.238	– 0.020
Industry					
Production	0.169	0.091	0.049	0.168	– 0.059
Banking and finance	0.086	0.091	0.033	0.043	0.207
Marketing and sales	– 0.042	– 0.064	0.001	0.190	0.118
Public enterprise, health and education	0.059	0.202	0.165	0.062	0.191
Technological dynamism	0.167	0.146	0.369***	0.318**	0.324**
R^2	0.087	0.116	0.186	0.156	0.179
ΔR^2	0.025	0.019	0.123***	0.091**	0.095**

Entries are standardized beta coefficients; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Female, secondary/upper-secondary education, and other (industry type) were used as referents

practices and centralized decision-making arrangements as compatible with digital trends. Yet, these results could be interpreted in light of respondents' idiosyncratic characteristics, such as their belonging to the generation of digital natives. Therefore, we undertook another study using a sample of older-generation managers.

3.2 Study 2

Study 2 was conducted three months after study 1, with the purpose of testing the same relationships. We administered an online survey to 673 senior and mid-level managers, of whom only 141 returned their completed surveys, representing a response rate of 21%. The final sample consisted of 94 males and 46 females, who were 38–80 years old (i.e., non-digital natives), with an average age of 51.4 years. More than a half of the entire sample (53.9%) held a master's degree, followed by those who completed their bachelor's degree (31.9%), upper-secondary school education (10.6%), and doctorate studies (2.8%). The respondents were associated with different industry types, such as production (18.7%), banking and finance (16.6%), consulting and management (15.1%), marketing and sales (8.6%), health and education (21.6%), and other types (19.4%).

For measurement equivalence, we employed the same scales as in study 1 and retained only those items that fulfilled the reliability and validity tests. The results of the psychometric properties' assessment of study measures indicated that factor loadings (0.535–0.914), and AVE (0.518–0.692) and CR (0.806–0.866) values were within the recommended range (Fornell & Larcker, 1981). Further, the discriminant validity requirement was also fulfilled, since the square root of AVEs for all the variables exceeded the correlations between pairs of constructs. Moreover, Harman's one-factor test and all VIF values (1.36 being the highest) indicated that there was no occurrence of CMV issues (Knock, 2015; Podsakoff et al., 2003).

3.2.1 Results of study 2

Table 5 reports the paired-samples t-test values between each of the two and three dimensions specific to the bureaucratic and post-bureaucratic structures, respectively. The mean scores on centralization (3.5) and formalization (4) were

Table 5 Paired-samples t-test values for study 2

Dimensions	t	df
Centralization vs skill variety	– 14,297***	139
Centralization vs Interdependence	– 16,695***	139
Centralization vs integration	– 15,897***	139
Formalization vs skill variety	– 14,657***	139
Formalization vs Interdependence	– 17,383***	139
Formalization vs integration	– 16,700***	139

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

df degrees of freedom

relatively low compared to the mean scores on interdependence (5.7), integration (5.5), and skills variety (5.5). Moreover, the t-test results show that the means of all the paired samples are significantly different, suggesting that the perceived compatibility of the former structural characteristics with external digitalization trends is much smaller than of the latter.

Then, we ran the same five regression models as we did in study 1, including control variables for respondents' gender and education, and industry type (see Table 6). The addition of the (digitally-induced) technological dynamism variable to models 1 through 5 enhanced the explanatory power of each model. The resulting digitalization-related relationships were significantly negative for centralization ($t = -2.42$, $p < 0.05$) and formalization ($t = -2.27$, $p < 0.05$), but significantly positive for skill variety ($t = 6.03$, $p < 0.001$), interdependence ($t = 4.43$, $p < 0.001$), and integration ($t = 3.63$, $p < 0.001$). These outcomes are consistent with the findings of study 1, providing support for hypothesis H1.

To further verify our findings, we examined the relationship between digitalization and the bureaucratic, ambidextrous and post-bureaucratic structures in three separate regressions. We computed three variables using additive interaction of different combinations of five structural dimensions, a procedure which is consistent with the measurement used in prior research (Lubatkin et al., 2006). The bureaucratic structure was based on a combination of centralization, formalization, and the reversed scores on skill variety, interdependence and integration. For the ambidextrous structural form, we combined the scores on centralization and formalization with skill variety, interdependence and integration. To compute the post-bureaucratic variable, we used the additive interaction of skill variety,

Table 6 Results of regression analysis on structural dimensions for study 2

Variables (control and independent)	Model 1 Centralization	Model 2 Formalization	Model 3 Skill variety	Model 4 Interdependence	Model 5 Integration
Gender	0.024	0.042	- 0.002	- 0.105	- 0.018
Education					
Masters and above	- 0.219	- 0.220	0.375**	0.133	0.060
Bachelors	- 0.088	- 0.091	0.300*	0.080	0.126
Industry					
Production	- 0.134	- 0.134	- 0.049	0.080	0.185
Banking and finance	- 0.008	- 0.074	0.122	- 0.027	0.072
Consulting and management	0.055	- 0.046	0.025	- 0.071	0.080
Marketing and sales	- 0.116	- 0.167	0.196*	0.037	0.083
Health and education	0.098	- 0.129	0.041	- 0.120	0.030
Technological dynamism	- 0.214*	- 0.200*	0.471***	0.368***	0.368***
R ²	0.078	0.080	0.278	0.182	0.129
Δ R ²	0.042*	0.037*	0.204***	0.125***	0.089***

Entries are standardized beta coefficients; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Female, secondary/upper-secondary education, and other (industry type) were used as referents

interdependence and integration, and the reversed scores on centralization and formalization.

The results of the three regression models are reported in Table 7. The technological dynamism variable was negatively related to the bureaucratic structure ($t = -5.84$, $p < 0.001$), but positively associated with the post-bureaucratic structure ($t = 5.74$, $p < 0.001$), corroborating the hypothesis H1. Moreover, the relationship between technological dynamism and ambidextrous structure ($t = 1.24$, $p > 0.05$) was not significant. In sum, older-generation managers in our study exhibit an overt preference for a less hierarchical or formalized structure and a more collaborative, decentralized, and inclusive work milieu.

Since there was a wide age spectrum in study 2, we performed a one-way between groups multivariate analysis of variance (MANOVA) to investigate age differences in structural dimensions. Participants were divided into three groups according to their age—group 1: 38–50 years; group 2: 51–60 years; group 3: above 60 years. The Levene's test showed that none of the variables recorded significant values, suggesting that the equality of variance assumption was not violated. The multivariate tests indicated that there was no statistically significant difference between the three age groups on the combined dependent variables, as suggested by the significance level associated with Wilk's Lambda = 0.87, $p = 0.176$ and Pillai's Trace values = 0.133, $p = 0.181$. We have considered the results for the dependent variables separately by applying the Bonferroni adjusted Alpha level of 0.01, which we calculated by dividing the Alpha level of 0.05 by the number of dependent variables (Tabachnick & Fidell, 2013). An inspection of the mean scores indicated very small differences for all structural dimensions, except for formalization for which the above 60 years' group ($M = 5.0$) reported a higher level than group 1 ($M = 3.8$).

Table 7 Results of regression analysis on different structures for study 2

Variables (control and independent)	Model 1 Bureaucracy	Model 2 Ambidexterity	Model 3 Post-bureaucracy
Gender	0.034	– 0.008	– 0.052
<i>Education</i>			
Masters and above	– 0.288	– 0.083	0.312*
Bachelors	– 0.206	0.073	0.211
Industry			
Production	– 0.152	– 0.056	0.121
Banking and finance	– 0.064	0.002	0.084
Consulting and management	– 0.002	0.007	0.017
Marketing and sales	– 0.147	– 0.010	0.169
Health and education	– 0.005	– 0.046	0.006
Technological dynamism	– 0.466***	0.124	0.449***
R^2	0.245	0.047	0.243
ΔR^2	0.200***	0.014	0.194***

Entries are standardized beta coefficients; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Female, secondary/upper-secondary education, and other (industry type) were used as referents

Subsequently, we conducted two separate one-way between groups analyses of variance (one-way ANOVA) to explore the difference between the three age groups in their bureaucracy and post-bureaucracy scores. The mean scores for three age groups (group 1: $M=2.80$; group 2: $M=2.99$; and group 3: $M=3.00$) did not significantly differ from each other on bureaucracy scores: $F(2, 102)=1.20$, $p=0.305$. Similarly, the difference in mean scores between the three age groups for post-bureaucracy (group 1: 5.14; group 2: 4.94; group 3: 4.88) did not reach statistical significance: $F(2, 102)=0.605$, $p=0.217$. Compared to the other two groups, the oldest age group scored slightly higher and lower on bureaucracy and post-bureaucracy, respectively, although the actual difference was very small.

4 Discussion

While extant research has greatly improved our understanding of organizational design, there has been limited scholarly conversation on the intersection of digitalization and firm structure. Our paper aims to respond to recent calls in the literature (Bailey et al., 2019) by integrating these study domains to examine the impact of digital trends on organizational structure. We provide empirical evidence that demonstrates the relevance of the post-bureaucratic structure in the context of digital transformation. In the following sections, these findings are discussed in light of the extant knowledge in the field and specific implications for theory and practice are elucidated.

4.1 Implications for theory

In our study, the perspectives shared by both digital natives and older-generation employees point to a decentralized and unformalized structural arrangement, which requires skill variety, interdependence and integration for successfully navigating through digital trends. The benefits of digitalization may be harnessed when organizations build structures that nurture cooperation and exchange of information among work groups, support integration within and across functions, foster bottom-up involvement, employ flexible rules and procedures, and avoid narrowly-defined skills and functional roles. Our findings extend prior literature in the context of digitalization that underscores the relevance of flexible and agile structural responses, rather than hierarchical mechanisms of coordination and control, to enable organizational learning and adaptation (Snow et al., 2017).

These results are also inscribed in earlier research that uncovers the prevailing behaviors and preferences of digital natives. Being particularly attracted to collaborative workplaces, this generation is motivated by high levels of freedom at work (Hewlett et al., 2009), prefers bidirectional flows of communication (Myers & Sadaghiani, 2010), and is inclined to be part of autonomous and self-regulated work groups (Barzilai-Nahon & Mason, 2010). Digital natives view the world from a flat and collaborative perspective, favoring a direct access to information to engage in knowledge cocreation in a networked environment (Balda & Mora, 2011). This is

the reason why a firm structure that nurtures a rigid managerial hierarchy is seen as antithetical to millennial work habits.

Our study goes beyond these generational trends, because older-generation managers exhibit similar structural preferences. Digitalization has pushed organizations to operate in the knowledge economy in which the generation of ideas by the employees at all levels is critical for firm survival and success (Lee & Edmondson, 2017). Businesses need to foster both intra- and inter-organizational relationships as sources of knowledge that require an adequate structural capability for fostering interdependencies across institutional boundaries (Cenamor et al., 2019). Low formalization better serves employee autonomy by offering increased chances for firm members to communicate and interact with one another, and generate new ideas that are essential in the realm of digitalization. Xu et al. (2017) argue that companies that facilitate interactions via informal socialization witness more novel outcomes, as voluntary communication and sharing of diverse knowledge are more likely to occur in such settings. Digital developments require continuous reskilling and upgrading of work, that resulted in blurred job boundaries, by reorganizing work in teams, enhancing job rotation, and avoiding narrow functional roles (Rolandsson et al., 2019).

Overall, our findings suggest that organic structures are better aligned with rapid technological changes in the industry in which companies operate. This resounds earlier assertions that posit that dynamic environments induce firms to develop dynamic capabilities (Li & Liu, 2014) and organizations with an exploratory orientation are more efficient at coping with such environments (Soto-Acosta et al., 2018). Our empirical outcomes reverberate recent assertions that the benefits of digitalization can be harnessed when businesses employ less hierarchical structures (Mirković et al., 2019; Petkovic & Lukic, 2014) that rely on self-organizing and decision-making empowerment to achieve coordination (Snow et al., 2017). Many scholars (Karimi & Walter, 2015; Yunis et al., 2018) highlighted the need of aligning information technology tools with other firm resources in order to secure valuable outcomes.

Although ambidexterity has found some support under dynamic circumstances (Bodolica & Spraggon, 2021), many authors suggest that organizing in this manner is less useful for adequately predicting technological changes in the environment (Khan & Mir, 2019; Schilke, 2014). Under today's rapidly evolving market realities, firms must have the ability to constantly update themselves and renew their management insight. To survive in highly competitive and technologically-daunting environments, companies ought to develop a strategic flexibility. Perez-Valls et al. (2016) posit that firms that use horizontal linkages, enable cross-unit project teams, use job rotation, and establish within-unit communication channels for the purpose of knowledge transfer are high on strategic flexibility. This suggests that a post-bureaucratic structure that features collaboration and participation, interdependence, organic coordination, and relational and social connectivity captures fully the current digital realities (Adler et al., 2011).

Furthermore, our respondents' keen preference for organizations to operate in a highly relational and networked mode, and to apply the levers of power in a less hierarchical way represents an accurate portrayal of the cultural values and practices

of Norwegian society. The desire for a flat and organic structure is consistent with the findings of Cagliano et al. (2011), who showed that North European countries tend to rely on empowerment, teamwork, and horizontal work arrangements. Norwegian culture is low on power distance, and high on femininity and institutional collectivism (Hofstede, 2001; House et al., 2004), and management practices in Norway mirror its unique cultural characteristics (Warner-Söderholm, 2012). Prior research finds that organizations from low power-distance cultures have fewer hierarchical layers and higher degrees of employee involvement in decision-making processes (Newman & Nollen, 1996).

In the same vein, feminine cultures are argued to be more receptive to work practices that are characterized by multi-skilling and job rotation. Femininity tends to induce a higher preference for delegation, autonomy and teamwork, increasing the likelihood of a higher span of control and, consequently, a decentralized firm structure (Cagliano et al., 2011). A strong preference for an interdependent and collaborative form of organization may emerge from Norwegian society's feminine orientation and its institutional collectivist values and practices. This is consistent with earlier research that finds that people in feminine cultures are more socio-centric and have an interdependent view of the self, and in countries high on institutional collectivism, societal and organizational practices encourage collective action (Hofstede, 2001; House et al., 2004).

4.2 Practical implications

The results of this study may contribute to the development of a more accurate understanding of how organizations might be restructured or redesigned to take advantage of the digital transformation. Under the current realities, companies tend to focus exclusively on boosting their investments in technological infrastructures and enhancing their digital knowledge. However, organizations are urged to pay adequate attention to the creation of an appropriate firm design to ensure the success of their digitalization initiatives. Our findings suggest that the ability to organize in a post-bureaucratic manner for an optimal use of internal capabilities may help businesses harvest the benefits of digitalization by adopting an optimal response to the technological challenges. Thus, both the internal and external business contexts should represent the points of attention for managers of corporations that are aiming to design effective structural configurations. Decision makers in today's organizations should know that post-bureaucratic structures are better equipped for both overcoming the challenges and tapping into the benefits created by digital developments in dynamic environments.

5 Conclusion

This study has certain limitations that could be addressed in future research endeavors in the field (Bodolica & Spraggon, 2018). First, our findings might be specific to the national characteristics of Norway that is known for its low power-distance

culture, high economic development, political stability, and strong institutional mechanisms. Prior research shows that many country-level factors, such as culture, economic development, literacy levels, social sustainability and political environment, influence the design of organizational structure (Cagliano et al., 2011; Mellor & Gupta, 2002). This implies that specific country conditions may play a notable role in explaining empirical results. A multi-country sampling frame could be used to provide an international perspective on whether differences in culture and other nation-level factors matter in the adoption of organizational designs in the context of digitalization.

Second, our study focused on participants' opinions about structure, without confirming whether a particular structural arrangement is actually effective in the digital context. Future research should examine the unique and interdependent effects of structural dimensions on firm outcomes to verify if organizing in a post-bureaucratic manner rather than in an ambidextrous or bureaucratic way leads to heightened benefits for organizations. Further, we captured formalization without distinguishing between the enabling and constraining aspects of this dimension. This made it difficult to assess whether formalization in all its manifestations is incompatible with digitalization, or whether an enabling form that was found valuable in past research offers some benefits when combined with decentralization (Foss et al., 2015).

We also consider it a limitation that we captured respondents' preferences about how modern organizations should look like, instead of how they actually behave to cope with the challenges of digitalization. Further, this research espouses an idealized picture of structure in the context of digital transformation, which makes it difficult to understand whether one type of structural form is suitable for businesses at different levels of digitalization. Longitudinal inquiries into the actual structural responses of organizations in the digital era could enrich extant scholarly knowledge on the topic.

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