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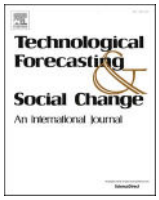

Corporate governance for digital transformation: The role of ownership and the board of directors

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ABSTRACT

Drawing on board-member surveys and stage-specific text analyses of annual reports from 150 Stockholm-listed firms, this study distinguishes three stages of digital transformation (DT)—digitization, digitalization, and digital maturity—to examine how board roles and ownership structures shape firms' DT ambitions. Cross-sectional and two-year lag regressions show that boards emphasizing strategic resource provision consistently promote broader DT, whereas monitoring-oriented boards dampen it, with these effects strengthening over time. Ownership dispersion further amplifies DT, while dominant or highly concentrated blocks dampen it. Stage-specific analyses reveal that governance matters most during digitalization: strategic boards and dispersed ownership accelerate progress, while monitoring boards and concentrated ownership slow it down. In contrast, early-stage digitization appears largely insensitive to governance, while late-stage digital maturity depends more on board size and firm capabilities. This study advances corporate governance and technology strategy research by clarifying when and how governance mechanisms enable or constrain DT and by introducing a replicable, stage-specific DT metric for future studies.

1. Introduction

Technological advances, particularly those related to digitalization, are reshaping the competitive landscape of firms (Hanelt et al., 2021; Verhoef et al., 2021). The rapid diffusion of digital technologies—such as cloud computing, artificial intelligence (AI), and big data analytics—creates new opportunities while challenging firms to adjust their strategies, business models, and organizational structures (Kraus et al., 2021a; Omol, 2024; Verhoef et al., 2021). The demands of digital transformation (DT) were evident prior to Covid-19, but the pandemic acted as a catalyst, accelerating digitalization and exposing critical strategic vulnerabilities (Amankwah-Amoah et al., 2021; He et al., 2024). The urgency of DT has intensified further with the ongoing AI revolution (Holmström, 2022). However, for many firms, DT constitutes a disruptive strategic and organizational change (Baiyere et al., 2020; Singh et al., 2020), marked by high uncertainty and risk (Baiyere et al., 2020; Ceipek et al., 2021; Singh et al., 2020). Even firms with strong strategic foresight must commit substantial resources and managerial attention to successfully implement DT initiatives and maintain their competitive advantage (Warner and Wäger, 2019).

The decision to undertake DT ultimately rests with the firms' board of directors (hereafter, the board), given their authority and accountability over strategic decisions (Daily et al., 2003; McNulty and Pettigrew, 1999). Yet, research on DT often focuses on technological and strategic aspects while overlooking how corporate governance—particularly the board's strategic roles and corporate ownership structures—can facilitate or hinder this critical process (Alkaraan et al., 2023; Legner et al., 2017; Singh et al., 2020). This is notable given the established role of governance structures in guiding major strategic decisions under conditions of uncertainty and rapid technological change (Ceipek et al., 2021; Kraus et al., 2021a; Verhoef et al., 2021).

The role of boards has long been central to corporate governance research, typically examined from two perspectives: control and monitoring (Aguilera et al., 2016; Jensen and Meckling, 1976) versus strategic and advisory, which frames boards as strategic resources and partners in decision-making (Boivie et al., 2021; McNulty and Pettigrew, 1999). While both perspectives are important, evidence suggests they can often conflict, assigning boards different roles and expectations (Shen et al., 2022). Ownership structure further shapes board roles, strategic decisions, and investment preferences, particularly in relation

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to strategic initiatives such as DT (Brunninge et al., 2007; Federo et al., 2020). The increasing stakes of institutional investors in publicly listed firms worldwide have strengthened shareholder influence on corporate strategy (OECD, 2021), raising critical questions about how ownership concentration affects long-term strategic choices related to DT (Soluk and Kammerlander, 2021).

DT is a complex, multi-stage process encompassing digitization (conversion of analog data to digital formats), digitalization (use of digital technologies to modify existing processes), and digital maturity (complete business model innovation driven by digital technologies) (Verhoef et al., 2021; Warner and Wäger, 2019). While governance structures may affect the three stages differently, empirical research on these nuanced relationships remains limited. By examining how distinct board roles and ownership structures shape the various stages of DT, this study addresses calls for deeper integration of governance perspectives into technology-focused research (Hanelt et al., 2021; Kraus et al., 2021a).

Our study makes three main contributions. First, we develop and validate a novel, text-based measure of DT that captures the three stages identified by Verhoef et al. (2021): digitization, digitalization, and digital maturity. We then corroborate the measure's substantive validity by demonstrating a positive correlation with firms' technology-related intangible asset intensity. This operationalization enables us to examine the importance of governance mechanisms at each stage of DT. Second, we show that boards focused on strategic resource provision are positively associated with firms' digitalization progress and may influence digital maturity over time. In contrast, boards that emphasize control and monitoring hinder such forward-looking transformation (Grant and Visconti, 2006; McNulty and Pettigrew, 1999). Third, we find that, relative to dominant or highly concentrated ownership, dispersed ownership supports riskier, innovation-driven DT initiatives, highlighting that ownership concentration can constrain strategic flexibility (McNulty and Nordberg, 2016).

Our research draws on unique, firsthand survey evidence from board members of 150 companies listed on the Nasdaq OMX Stockholm exchange (hereafter NOS). We combine this data with an innovative, keyword-based methodology derived from rigorous theoretical conceptualizations (Holmström, 2022; Verhoef et al., 2021) to measure firms' DT levels across the three stages. This enhances the transparency and rigor of our research design, providing clear methodological insights into the relationship between corporate governance and DT at different stages. Our empirical findings are robust and consistent, with strengthened effects observed after a two-year lag, confirming the strategic and long-term nature of governance influence on DT outcomes.

2. Theory and hypotheses

2.1. Corporate governance and digitalization strategy

"The definition of corporate governance differs depending on one's view of the world" (Gillan, 2006, p. 382). Corporate governance scholars generally focus on the formal and informal mechanisms that corporate actors use to shape the way a firm is directed and controlled, such as resource allocation, balancing risks and returns, and managing stakeholder interests (e.g., Daily et al., 2003). The board is the central governance mechanism and holds ultimate responsibility for guiding the firm's strategic direction, overseeing management execution, and ensuring that risks and returns are balanced (Aguilera et al., 2016; Jonnergård and Stafsudd, 2011; Gillan, 2006).

Boards are generally ascribed two important roles: monitoring and strategic. Although these roles are often considered distinct or even competing, they may also coexist depending on a firm's context, stage of development, and environmental uncertainty (Adams and Ferreira, 2007; Sundaramurthy and Lewis, 2003). For instance, boards may provide strategic guidance and maintain oversight to ensure alignment and accountability, particularly in regulated or high-stakes industries (Shen et al., 2022). However, when these roles become imbalanced, such as when monitoring dominates, risk-taking and innovation may be suppressed (Hillman and Dalziel, 2003).

Understanding how boards navigate this balance is especially relevant for DT, which requires both strategic foresight and disciplined implementation. In this study, we address this tension and examine how each role, individually and across different stages of DT, shapes firms' digitalization strategies.

Despite substantial governance research, the strategic role of boards, particularly in resource allocation, remains underexplored (Boivie et al., 2021). Scholars have also underscored the need to better understand how shareholders influence board-level strategic decisions (Aguilera et al., 2016; Federo et al., 2020; McNulty and Nordberg, 2016). In addition, while studies on DT have extensively addressed the technological and strategic perspectives, corporate governance mechanisms have received considerably less attention as determinants or obstacles of DT (Hanelt et al., 2021; Omol, 2024). Recent literature nonetheless shows that governance structures significantly shape how firms navigate DT, particularly in managing strategic risks, investing in technology-driven innovation, and achieving digital maturity (Ceipek et al., 2021; Kraus et al., 2021a; Warner and Wäger, 2019).

This paper addresses these gaps by explicitly analyzing the role of boards and shareholders in firms' strategic DT decisions. In doing so, we move beyond the predominant focus on the technological and organizational dimensions of DT to highlight corporate governance as a critical but understudied enabler or barrier to successful digitalization (cf. Hanelt et al., 2021; Omol, 2024). We specifically emphasize how distinct governance roles—control versus strategic advisory—and ownership structures shape adoption and advancement through the three stages of DT: digitization, digitalization, and digital maturity (Verhoef et al., 2021). By integrating governance insights into the DT discourse, this study contributes to a more holistic understanding of strategic decision-making in digitally transforming firms.

2.2. The firm's digital transformation as a key strategic decision

DT is a strategic decision that enables firms to leverage digital technologies to improve business models, create new value, and strengthen long-term competitiveness in rapidly changing environments (Singh et al., 2020; Verhoef et al., 2021). Over the past decade, DT has become a pivotal strategic initiative, with its urgency and pace accelerated due to the Covid-19 pandemic and recent advances in AI (Amankwah-Amoah et al., 2021; Haefner et al., 2023; Matt et al., 2015).

DT is multifaceted, extending beyond technological infrastructure to reshape operations, customer relations, value generation, and managerial decision-making (Hanelt et al., 2021; Omol, 2024; Warner and Wäger, 2019). Recent scholarship emphasizes that DT should be understood as an extensive organizational change involving strategic, cultural, and structural realignments across the firm, not merely as a technological upgrade (Butt et al., 2024; Hanelt et al., 2021; Kraus et al., 2021a).

DT unfolds in three distinct stages (Verhoef et al., 2021). The first stage, digitization, converts analog information into digital formats, emphasizing efficiency gains without fundamentally changing business models (Kraus et al., 2021a; Porfírio et al., 2021; Warner and Wäger, 2019), minimally disrupting operations, while laying the groundwork for more complex transformations.

The second stage, digitalization, uses novel digital technologies to enhance and adapt existing business processes, reshaping internal practices, and improving cost efficiency, customer experience, and operational effectiveness (Ceipek et al., 2021; Hanelt et al., 2021; Kraus et al., 2021a). Examples include adopting cloud computing, integrating IoT technologies, and leveraging data analytics to optimize decision-making. At this stage, firms often experience cultural shifts toward data-driven decisions and increased organizational agility, while their core business logic generally remains the same (Butt et al., 2024; Omol,

2024).

Digital maturity is the third and most advanced stage, representing a full strategic transformation through the creation and adoption of digitally driven business models and value propositions (Warner and Wäger, 2019). Achieving digital maturity requires substantial cultural adaptation, innovative organizational design, and strategic agility, as firms integrate emerging technologies such as AI, blockchain, and advanced data analytics to fundamentally redefine value creation and capture (Butt et al., 2024; Holmström, 2022; Kraus et al., 2021a). At this stage, governance structures and leadership play a critical role in fostering innovation, encouraging experimentation, and enabling agile decision-making to navigate heightened uncertainty and risk (Ceipek et al., 2021; Omol, 2024).

Importantly, DT across all three stages relies heavily on the vision and support of corporate governance, particularly the board of directors and shareholders, which shape strategic risk-taking, resource allocation, managerial incentives, and the organization's capacity to manage and sustain transformational change (Kraus et al., 2021a; Omol, 2024; Warner and Wäger, 2019). However, empirical evidence directly linking governance structures to the distinct stages of DT remains limited. Examining how governance enables or constrains progress across digitization, digitalization, and digital maturity can therefore substantially deepen our understanding of effective corporate governance in a digitally transforming world (Hanelt et al., 2021; Kraus et al., 2021a; Warner and Wäger, 2019).

2.3. The board's control and monitoring role

Earlier corporate governance research emphasized the control and monitoring role of boards (Jensen and Meckling, 1976). Grounded in economics and legal perspectives, this view portrays the board as a safeguard that reduces agency costs resulting from conflicts of interest between management and shareholders (Cornelli et al., 2013; Zattoni and Pugliese, 2019). Scholars argue that structural characteristics such as board independence, separation of the chair and CEO roles, and relevant professional expertise strengthen a board's power and monitoring effectiveness (Castaner and Kavadis, 2013; Haynes et al., 2019). Through this lens, monitoring reduces managerial risk-taking in strategic and financial decisions, thereby potentially improving shareholder returns (Castaner and Kavadis, 2013; Doan and Nguyen, 2018).

However, extensive control and stringent monitoring may constrain managerial willingness to pursue innovation and riskier strategies (Goranova et al., 2017) and limit information sharing, thereby undermining the quality of strategic decision-making (Adams and Ferreira, 2007).

Even in the early stages of digitization or digitalization, DT constitutes a multi-layered strategic shift encompassing technologies, operations, and organizational structures (Kraus et al., 2021a; Verhoef et al., 2021), often requiring substantial investments with delayed or ambiguous returns, generating organizational uncertainty, and demanding cultural adaptation (Hanelt et al., 2021; Omol, 2024). As such, DT challenges conventional governance frameworks that prioritize short-term performance metrics and low-risk exposure. Although boards emphasizing control and monitoring are vital for mitigating agency problems, they may struggle to support the experimentation and flexibility that DT requires (Adams and Ferreira, 2007; Goranova et al., 2017). Their preference for predictability and reduced managerial discretion may discourage the initiation or continuation of digital initiatives, particularly when outcomes are uncertain or deviate from established business models (cf. Ponomareva et al., 2019). We therefore hypothesize:

H1. The board's control and monitoring role reduces the firm's propensity to promote DT strategies.

Recognizing the nuanced nature of DT, we differentiate its three stages as distinct strategic orientations that may be differently influenced by board monitoring roles and propose three additional hypotheses.

Digitization, characterized by basic technology adoption and incremental operational adjustments, entails minimal strategic disruption and relatively low risk. This stage emphasizes efficiency, transparency, risk management, and operational control, attributes typically associated with monitoring-oriented boards (Kraus et al., 2021a; Omol, 2024). We thus posit:

H1a. The board's control and monitoring role enhances the firm's propensity to promote digitization strategies.

Digitalization involves substantial process improvements and optimization through digital tools. While it presents moderate risk, it also delivers tangible operational benefits in the short to medium term. However, because it introduces organizational change and challenges established control mechanisms, digitalization may conflict with monitoring-oriented governance preferences (Butt et al., 2024; Hanelt et al., 2021). Therefore, we posit:

H1b. The board's control and monitoring role reduces the firm's propensity to promote digitalization strategies.

Digital maturity, characterized by strategic innovation and business model transformation, involves high risk, substantial resource commitments, and uncertain outcomes. Achieving this stage requires experimentation, risk-taking, and openness to radical innovation, all of which are often constrained by strict board control (Ceipek et al., 2021; Omol, 2024; Warner and Wäger, 2019). Thus, we hypothesize:

H1c. The board's control and monitoring role reduces the firm's propensity to promote digital maturity strategies.

2.4. The board's strategic and advisory role

Strategic governance focuses on maximizing firm value, effectively managing risks, and balancing competing stakeholder interests (Daily et al., 2003; Schmidt and Brauer, 2006). Resource dependence theory (Pfeffer and Salancik, 1978) conceptualizes the board as a strategic asset that actively shapes, advises on, and oversees the execution of critical strategic decisions (McNulty and Pettigrew, 1999).

Recent empirical and practical insights underscore the pivotal role of boards in organizational effectiveness (Boivie et al., 2021; Grant and Visconti, 2006; Jonnergård and Stafsudd, 2011). Scholars and policymakers advocate strengthening the strategic role of boards to maximize value creation and optimize resource allocation (OECD, 2018). Effective strategic governance relies on close board-management collaboration, which enhances information exchange, fosters meaningful strategic dialogue, and ultimately strengthens decision-making (Adams and Ferreira, 2007; Westphal, 1999).

This strategic orientation is especially important in the context of DT, as it reshapes technological adoption, firm capabilities, customer relationships, organizational structures, and strategic logics (Hanelt et al., 2021; Kraus et al., 2021a; Verhoef et al., 2021). Even in the early stages, DT requires new resource configurations, exposes firms to unfamiliar risks, and demands cross-functional coordination (Nadkarni and Prügl, 2021; Omol, 2024). Boards engaged in strategic governance can facilitate DT by providing long-term vision, mobilizing internal and external resources, and legitimizing change efforts. By looking beyond short-term performance fluctuations, strategically oriented boards are well positioned to steer firms through the uncertainty, trade-offs, and experimentation inherent in DT. We therefore hypothesize:

H2. The board's strategic resource-provision role enhances the firm's propensity to promote DT strategies.

Recognizing that DT unfolds across distinct stage, we develop stage-specific hypotheses.

Digitization, which entails adopting relatively basic technologies to

improve efficiency and operations, is typically viewed by strategically oriented boards as a necessary foundation for more advanced transformation (Kraus et al., 2021a; Omol, 2024). Thus, we propose:

H2a. The board's strategic resource-provision role enhances the firm's propensity to promote digitization strategies.

Digitalization entails moderate strategic shifts to improve business processes and customer experiences, requiring resource mobilization, strategic alignment, and organizational adaptation. Strategically oriented boards are well positioned to facilitate these conditions (Butt et al., 2024; Hanelt et al., 2021). Thus, we posit:

H2b. The board's strategic resource-provision role enhances the firm's propensity to promote digitalization strategies.

Digital maturity is attained through profound transformation, involving business model reinvention and sustained innovation. It demands long-term vision, strategic risk tolerance, and close board-management collaboration, conditions that strategically oriented boards provide (Ceipek et al., 2021; Warner and Wäger, 2019). Therefore, we hypothesize:

H2c. The board's strategic resource-provision role enhances the firm's propensity to promote digital maturity strategies.

2.5. Ownership typology and digitalization decisions

Initially, corporate governance research sought to understand the role of shareholders in modern corporations. Berle and Means (1932) famously highlighted the separation of ownership and control, emphasizing the tension between shareholders' profit-oriented objectives and managers' operational discretion. This foundational work has evolved into two theoretical streams: agency theory (Fama, 1980; Jensen and Meckling, 1976) and property rights theory (Demsetz, 1983; Holderness, 2009).

Agency theory suggests that separating ownership and control can enhance efficiency. Diversified shareholders act mainly as risk bearers, while managerial actions are disciplined by market mechanisms (Fama, 1980). In contrast, property rights theory takes a more skeptical view, emphasizing that concentrated ownership creates stronger incentives and mechanisms to ensure managerial accountability (Alchian and Demsetz, 1973; Holderness, 2009). Empirical evidence supports the importance of concentrated ownership across governance systems (La Porta et al., 1999; Holderness, 2009).

Contemporary listed corporations exhibit diverse ownership structures, from dispersed ownership in line with the Berle and Means (1932) framework, to concentrated ownership where a dominant shareholder wields significant influence over strategic direction (Pedersen and Thomsen, 2003). These ownership forms play a crucial role in shaping the firm's corporate governance and strategic outcomes.

DT is a particularly revealing context for studying these dynamics. As a strategic, resource-intensive investment, DT entails long time horizons, uncertain returns, and significant organizational change (Ceipek et al., 2021; Hanelt et al., 2021). Consequently, DT initiatives may resonate differently with dispersed versus concentrated shareholders. Dispersed shareholders, holding diversified portfolios with relatively small stakes, are thought to tolerate greater risk and favor growth-oriented or innovative strategies, as their potential losses are mitigated by diversification (Fama, 1980; McNulty and Nordberg, 2016). Conversely, concentrated shareholders, holding substantial, often illiquid, firm-specific stakes, may prefer conservative strategies that prioritize value preservation and predictable cash flows (Aguilera et al., 2016; Holderness, 2009). Given that DT initiatives often involve experimentation, resource reallocation, and novel business models, ownership structure is likely a key determinant of a firm's strategic willingness to pursue transformation. We therefore hypothesize:

H3. Dispersed ownership (compared to concentrated or dominant shareholder ownership) enhances the firm's propensity to promote DT strategies.

Recognizing the heterogeneity of DT across the three stages, we propose more stage-specific hypotheses:

Digitization, the conversion of analog information and processes into digital formats, is primarily efficiency-oriented, producing predictable operational benefits without fundamentally changing the firm's core business logic (Kraus et al., 2021a; Verhoef et al., 2021). As a low-risk, incremental stage, it aligns well with the preferences of concentrated shareholders, who favor performance improvements without major strategic disruption (Omol, 2024).Thus, we propose:

H3a. Concentrated ownership (compared to dispersed or dominant shareholder ownership) positively influences the firm's propensity to promote digitization strategies.

Digitalization, a more transformative use of digital technologies to redesign processes, enhance customer experiences, or reconfigure parts of the business model, requires more substantial investment and organizational adaptation (Hanelt et al., 2021; Butt et al., 2024). While riskier than digitization, these initiatives still offer tangible medium-term payoffs. Given their diversification and growth orientation, dispersed shareholders are more likely to support such moderate-risk strategies (McNulty and Nordberg, 2016). Hence, we propose:

H3b. Dispersed ownership (compared to concentrated or dominant shareholder ownership) positively influences the firm's propensity to promote digitalization strategies.

Digital maturity, the most advanced stage of DT, entails radical business model innovation and deep organizational transformation, including AI-driven platforms, ecosystem partnerships, or data monetization strategies (Ceipek et al., 2021; Holmström, 2022; Warner and Wäger, 2019). These initiatives carry high uncertainty, require substantial resources, and involve long payback periods. Dispersed shareholders are generally more tolerant of such risks due to portfolio diversification and long-term growth orientation, whereas concentrated owners often view them as threatening to stability and control. Hence, we hypothesize:

H3c. Dispersed ownership (compared to concentrated or dominant shareholder ownership) positively influences the firm's propensity to promote digital maturity strategies.

Fig. 1 presents the overarching research model.

3. Method

3.1. Sample and data collection

Our study relies on multiple sources of data. We tested the hypotheses using a sample of listed Swedish corporations. Data on board roles were collected in 2018 via a mail survey sent to 1480 board members of all corporations listed on NOS at the beginning of that year ($N = 321$). After two follow-up reminders, 293 questionnaires were returned, yielding a response rate of 20 %. This is considerably higher than the 7–15 % response rates typically reported in comparable board-level surveys (e.g., Jonnergård and Stafsudd, 2011; Umans, 2013). Of these, 234 questionnaires were usable. Since multiple responses were received from board members at 68 firms, the final dataset covers 150 listed corporations, representing 47 % of the total population. This is comparable to and, in some cases, exceeds prior survey-based studies in similar governance contexts (e.g., Jonnergård and Stafsudd, 2011; Umans, 2013).

Ownership data were obtained from the Holding database, which contains ownership information for all stock-listed Swedish corporations. These data were used to categorize ownership structures and explore potential non-response bias. Information on board and firm

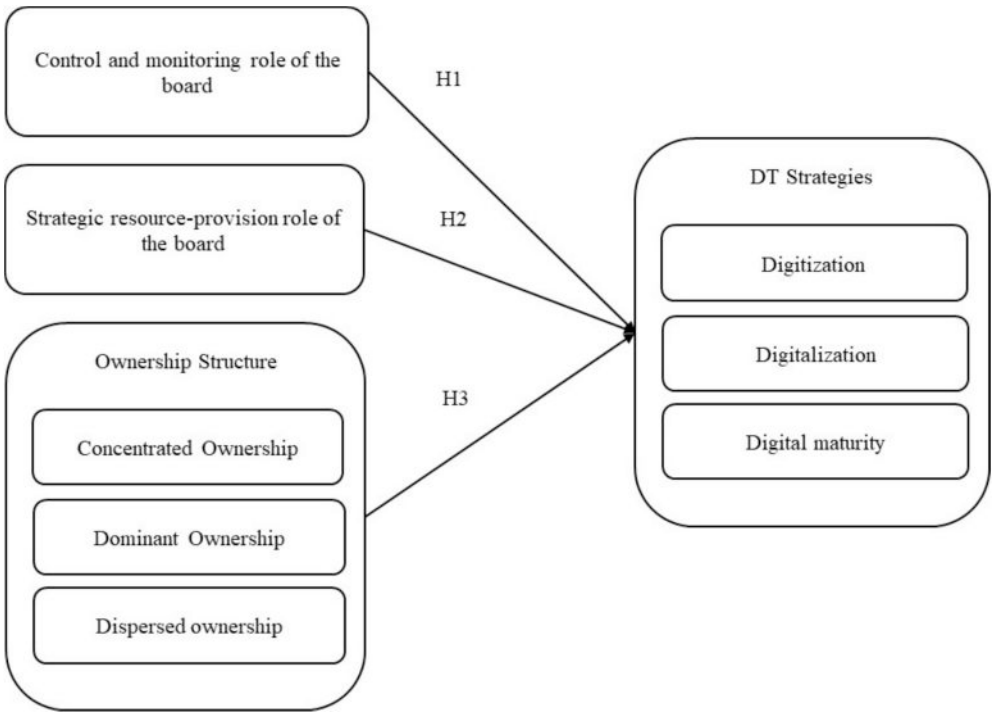

Fig. 1. The research model.

characteristics was manually collected from consolidated financial statements in annual reports from 2017 and 2018. Data on DT strategy were manually extracted from annual reports from 2019 and 2020 for the 150 corporations that responded to the survey. The latter were derived from narrative strategy disclosures, which are subject to standardized requirements under EU Directive 2014/95/EU on non-financial and diversity reporting. This directive provides consistent, machine-readable textual material for our word-count measure of digitalization. Data for all 321 corporations were collected at the firm level to construct control variables and assess non-response bias.

The Swedish context is particularly relevant for examining the relationship between board roles, ownership, and DT strategies for three reasons. First, Sweden consistently ranks among the most innovative EU countries (European Innovation Scoreboard; European Commission, 2023) and is reflective of, as well as a driver of, the digital transformation of its listed corporations. Second, the Swedish corporate governance model combines Anglo-American and Continental traditions (Jonnergård and Larsson-Olaison, 2016), and it is distinctive in that shareholder-based nomination committees nominate boards (Carlsson, 2007). This creates a unique dynamic between boards and owners. Third, since 2017, all large Swedish issuers have been required to comply with the EU Non-Financial Reporting Directive (EU Directive 2014/95/EU, 2014), which mandates a narrative management report covering strategy, risks, and future outlook. These standardized text sections, present in our 2019–2020 sample, provide consistent, machine-readable material from which our word-count measure of DT is derived and are similarly available for listed firms across all EU member states.

3.2. Operationalization

3.2.1. Independent variables

3.2.1.1. Board monitoring role and board strategic resource-provision role. To measure these roles, we drew on Minichilli et al. (2012). We asked board members to evaluate how their specific board engages in monitoring and strategic resource provision, using a seven-point Likert-type scale (1 = strongly disagree, 7 = strongly agree). The monitoring role items captured tasks related to financial control and oversight, while the strategic resource provision items reflected advisory and strategic functions. Both constructs achieved acceptable reliability, with Cronbach's α of 0.65 for monitoring and 0.75 for strategic resource provision, exceeding the suggested minimum threshold of 0.6 (cf. Broberg et al., 2013). Since the data were collected at the individual level but analyzed at the firm level, we followed the recommendations of Mathieu and Chen (2011) for aggregation. For firms with multiple respondents, we used the mean of board members' responses. For firms with a single respondent, we used that response to represent the board, consistent with Lachowicz et al. (2015).

3.2.1.2. Ownership. Ownership structures were classified into three categories, following Federo et al. (2020). Using cutoff points of 20 % and 50 % of voting rights, we distinguished between: dispersed ownership, where no individual or group controls 20 % or more of the votes (dummy variable); dominant ownership, where one shareholder controls 21–49 % of the votes (dummy variable); and concentrated ownership, where a single shareholder controls at least 50 % of the votes (dummy variable).

3.2.2. Dependent variable

3.2.2.1. DT strategy. To measure each firm's DT strategy, we use a text-analysis approach based on annual reports, following established methodologies that use corporate disclosures to capture technology-related initiatives (e.g., Cao et al., 2025; Cheng et al., 2024). Specifically, we conducted keyword searches that reflected the conceptual differences between digitization, digitalization, and digital maturity (Holmström, 2022; Verhoef et al., 2021).

3.2.2.2. Keyword development and dictionary. We compiled an initial pool of DT-related keywords from the literature (e.g. Holmström, 2022; Kraus et al., 2021a; Porfírio et al., 2021; Warner and Wäger, 2019) selecting terms that could be clearly assigned to the three DT stages identified by Verhoef et al. (2021). We supplemented this pool with

keywords suggested by studies using textual indicators of firm-level digital initiatives (e.g. Aversa et al., 2021; Ceipek et al., 2021; Singh et al., 2020). In an iterative pilot phase with seven firms we refined the dictionary by removing ambiguous or overly generic terms (e.g. automation) to ensure robust coverage of each DT stage

3.2.2.3. Text search procedure. In line with previous studies (e.g., Cheng et al., 2024), we conducted keyword searches across entire annual reports rather than specific sections. Digital initiatives can appear throughout reports, including in strategy discussions, operational updates, risk analyses, and technology-specific disclosures. For each firm-year, we counted the occurrences of stage-specific keywords and normalized these counts by the total number of words in the report. This yielded three stage-level indicators—a digitization score, a digitalization score, and a digital maturity score. We summed these scores to create an overall DT strategy measure, capturing the firm's engagement across all stages while preserving the individual scores for testing the stage-specific hypotheses (H1a–c, H2a–c, H3a–c).

3.2.2.4. Validity checks. To ensure that keyword mentions capture substantive strategic activity rather than superficial references, we implemented three validation checks:

1. Manual review. We manually examined a subsample of firm-year observations with unusually high or low keyword counts to confirm alignment with substantive discussions of new technologies or initiatives (rather than generic or boilerplate language).
2. External investment proxy. We tested whether higher DT scores were correlated with a larger ratio of intangible assets to turnover, a widely used proxy for technology-driven investment (Omol, 2024). A positive and statistically significant correlation (Pearson $r = 0.28$, $p < 0.01$) supports the validity of the measure.
3. Time lags. To account for delays in the effects of governance on strategy, we took DT measures from the two years following the survey (2019 and 2020). This is consistent with prior work showing that structural governance factors typically affect strategic outcomes with at least a one-year lag (Collin et al., 2013; Minichilli et al., 2012).

Table 1 presents the keywords used to capture each stage of DT strategy.

3.2.3. Control variables

Several control variables were included to account for factors that could influence DT strategy. We controlled for board size because larger boards may pursue more expansive corporate strategies (e.g., Achtenhagen et al., 2018). We included board tenure, measured as the mean tenure of directors, because longer tenures could influence strategic orientations (cf. Sun and Bhuiyan, 2020). We used a dichotomous variable to account for industry effects, where 1 represents technology firms and 0 other firms. This reflects literature suggesting that boards in technology-oriented firms play distinct roles and that such firms are more likely to pursue expansive digitalization strategies (Bertoni et al., 2014; Garg, 2020; Soluk and Kammerlander, 2021). We measured firm size using the natural logarithm of total assets in 2017 based on the assumption that larger firms have the capacity to implement expansive digital strategies (Goranova et al., 2017; Soluk and Kammerlander, 2021). Finally, we measured firm performance using return on equity (ROE) in 2017 based on the assumption that higher-performing firms are better positioned to pursue ambitious digitalization initiatives (Khanna et al., 2014; Martín-Peña et al., 2019).

3.2.4. Sample representativeness and non-response bias

The sample closely mirrors the distribution of firms listed on the Swedish stock exchange in terms of firm size: 26 % large-cap (NOS 2018: 30 %), 47 % mid-cap (NOS 2018: 39 %), and 27 % small-cap (NOS 2018: 31 %). To assess non-response bias, we conducted three independent sample *t*-tests comparing responding and non-responding firms. The results indicate no significant differences in firm size, firm performance, or ownership types, suggesting the sample is representative.

3.2.5. Data processing

All analyses were conducted using IBM SPSS Statistics 24. We computed descriptive statistics, Pearson correlations, independent-

Table 1
DT strategy – keywords.

Digitization	References
computer	Verhoef et al., 2021; Warner and Wäger, 2019
digital assets	Hanelt et al., 2021; Verhoef et al., 2021
digital survey	Verhoef et al., 2021
email	Porfírio et al., 2021
information technology	Hanelt et al., 2021; Porfírio et al., 2021
internet	Aversa et al., 2021

Digitalization	References
cloud	Ceipek et al., 2021; Verhoef et al., 2021
digital*	Hanelt et al., 2021; Verhoef et al., 2021; Warner and Wäger, 2019
digitalization/ digitalisation	Hanelt et al., 2021; Verhoef et al., 2021; Warner and Wäger, 2019
Internet of Things/IOT	Ceipek et al., 2021; Porfírio et al., 2021; Verhoef et al., 2021
mobile	Hanelt et al., 2021; Singh et al., 2020
online	Hanelt et al., 2021
robot*	Hanelt et al., 2021

Digital maturity	References
3D printing	Warner and Wäger, 2019
artificial intelligence	Ceipek et al., 2021; Kraus et al., 2021a
augmented reality	Ceipek et al., 2021
automated automation/ automatic	Crittenden et al., 2019; Singh et al., 2020; Soluk et al., 2021
big data	Ceipek et al., 2021; Hanelt et al., 2021; Kraus et al., 2021a
blockchain	Hanelt et al., 2021; Warner and Wäger, 2019
cyber	Ceipek et al., 2021
data analytics	Kraus et al., 2021a; Soluk et al., 2021
data driven	Soluk et al., 2021
digital business model	Hanelt et al., 2021; Prügl and Spitzley, 2021; Soluk et al., 2021; Verhoef et al., 2021
digital connect*	Gawer, 2021; Hanelt et al., 2021
digital customer/ consumer	Hanelt et al., 2021
digital disruption	Ceipek et al., 2021; Prügl and Spitzley, 2021
digital economy/ ecosystem	Hanelt et al., 2021; Soluk et al., 2021
digital infrastructure	Warner and Wäger, 2019; Hanelt et al., 2021
digital innovation	Hanelt et al., 2021; Soluk et al., 2021; Aversa et al., 2021
digital platform	Aversa et al., 2021; Hanelt et al., 2021; Soluk et al., 2021; Warner and Wäger, 2019
digital revolution	Warner and Wäger, 2019
digital service	Crittenden et al., 2019; Porfírio et al., 2021; Soluk et al., 2021; Warner and Wäger, 2019
digital tools	Singh et al., 2020
digital transaction	Crittenden et al., 2019
digital transformation	Ceipek et al., 2021; Prügl and Spitzley, 2021; Verhoef et al., 2021; Warner and Wäger, 2019
industry 4.0	Ceipek et al., 2021; Kraus et al., 2021a; Warner and Wäger, 2019
interact*	Hanelt et al., 2021
machine learning	Hanelt et al., 2021
virtual	Crittenden et al., 2020

Note:
* denotes a wildcard, capturing different endings of a word.

sample t-tests, and multiple linear regression analyses to test the hypotheses.

4. Results and analyses

4.1. Descriptive statistics

Table 2 presents the descriptive statistics for the sample. Directors perceive their boards as engaging in monitoring (mean = 5.97) and strategic resource provision (mean = 5.57), with a slightly greater emphasis on monitoring. Ownership structures indicate that 66 % of the sampled firms have concentrated ownership, 19 % have dispersed ownership, and 15 % have a dominant shareholder. The average board size is seven members, with an average tenure of approximately 6.5 years. Technology firms constitute 26 % of the sample, which is slightly above their 20 % representation on the Stockholm Stock Exchange in 2018. Regarding digital transformation, the average DT strategy score, as reflected in annual report disclosures, increased from 46.99 words in 2019 to 55.03 words in 2020. We observed similar upward trends across the stage-specific sub-strategies (digitization, digitalization, and digital maturity), indicating increased attention to DT initiatives over time (see Table 2).

4.2. Pearson correlations

Table 3 reports several significant correlations among the independent, dependent, and control variables. The two board roles are positively correlated, suggesting that stronger engagement in monitoring is associated with a greater emphasis on strategic resource provision (0.461**). As expected, the three ownership categories are negatively correlated due to their mutually exclusive, dichotomous coding. Larger boards (0.257**) and larger firms (0.188*) both exhibit positive correlations with the board's strategic resource-provision role, which in turn is positively correlated with time-lagged DT strategy in 2020 (0.188). Average board tenure shows a weakly significant negative correlation with dispersed ownership (−0.209*) and dominant shareholder ownership (−0.160†), but a positive correlation with concentrated ownership (0.293**). Board size correlates positively with firm size (0.578**), firm performance (0.176*), and DT strategies in both 2019 (0.307**) and 2020 (0.346**), but negatively with the industry control variable (−0.193*), indicating that technology firms tend to have smaller boards. Consistent with this, technology firms are also smaller in size (−0.392**) and exhibit lower performance (−0.325**) compared to firms in other industries. As anticipated, firm size and firm performance are positively correlated (0.317**), and both are positively associated with DT strategy in 2019 (0.232** and 0.263**, respectively) and 2020 (0.261** and 0.282**, respectively). Finally, the correlation matrix reveals strong path dependency, with DT strategy in 2019 highly and positively correlated with DT strategy in 2020 (0.856**).

When examining correlations with the sub-strategies, we find that the board's monitoring role is not significantly related to any, whereas the strategic resource-provision role shows weakly significant positive correlations with digital maturity in both 2019 (0.144†) and 2020 (0.144†), as well as with digitalization in 2020 (0.168†). Board size is positively correlated with nearly all digitalization sub-strategies in 2019 and 2020, with the exception of digitalization in 2019. Interestingly, digitalization in 2019 is the only sub-strategy significantly and positively correlated with the industry variable (0.245). Firm size is positively associated with digital maturity in 2019 and 2020 (0.314** and 0.187*), and with digitalization in 2020 (0.263**). Finally, almost all digitalization sub-strategies, except digitization in both 2019 and 2020, exhibit positive correlations with firm performance (Table 3).

Table 2
Descriptive statistics.

	Variables	Min	Max	Mean	Std.
1.	Board monitoring	3.80	7	5.97	0.72
2.	Board resource provision	2.50	7	5.57	0.72
3.	Ownership: Dispersed	0	1	0.19	0.39
4.	Ownership: Dominant Shareholder	0	1	0.15	0.35
5.	Ownership: Concentrated	0	1	0.66	0.47
6.	Board size	3	11	6.81	1.54
7.	Board tenure	1	22.4	6.50	3.60
8.	Industry	0	1	0.26	0.44
9.	Firm size	8.66	19.54	12.92	1.97
10.	Firm performance (Log)	−1.40	0.48	0.06	0.29
11.	Digital strategy 2019	1	213	46.99	50.72
12.	Digital strategy 2020	0	214	55.03	51.08
13.	Digitization 2019	1	175	8.88	17.72
14.	Digitalization 2019	1	148	28.33	33.33
15.	Digital maturity 2019	1	98	14.42	18.07
16.	Digitization 2020	0	189	8.95	19.15
17.	Digitalization 2020	0	155	30.18	33.62
18.	Digital maturity 2020	0	96	15.89	17.91

4.3. Regression analysis

All hypotheses were tested using linear multiple regression analysis. Model 1 examined the immediate relationship between board roles, ownership, and DT strategy, while Model 2 assessed the relationship with DT strategy one year later (t + 1). Both models showed no concern for multicollinearity, with the highest VIF values at 1.761 (Model 1) and 1.790 (Model 2), well below the recommended cut-off of 4 (Pallant, 2013).

The results of Model 1 indicate that the board monitoring role is weakly and negatively associated with DT strategy in 2019 (Std. $\beta = -0.147$, $p < 0.1$), while the board's strategic resource-provision role is weakly and positively associated (Std. $\beta = 0.146$, $p < 0.1$). Among the controls, board size (Std. $\beta = 0.227$, $p < 0.05$), belonging to the technology industry (Std. $\beta = 0.318$, $p < 0.01$), and firm performance (Std. $\beta = 0.291$, $p < 0.01$) all show significant positive associations with DT strategy 2019. Ownership shows no significant effects. Taken together, this suggests that when considering short-term board influence (i.e., one-year lag), H1 and H2 (board roles) are supported, while H3 (ownership) is not. Model 1 explains 21 % of the variance in DT strategy ($R^2 = 0.208$), with $N = 147$ due to three missing firm-level observations.

The results of Model 2 (t + 1) strengthen these findings. The board monitoring role shows a strong negative association with DT strategy 2020 (Std. $\beta = -0.255$, $p < 0.01$), while the board's strategic resource-provision role remains positively associated (Std. $\beta = 0.224$, $p < 0.05$). Ownership effects now become significant: both dominant shareholder ownership (Std. $\beta = -0.206$, $p < 0.05$) and concentrated ownership (Std. $\beta = -0.185$, $p < 0.01$) are negatively associated with DT strategy, implying that dispersed ownership is relatively more conducive to digital transformation. As in Model 1, board size (Std. $\beta = 0.248$, $p < 0.01$), technology industry membership (Std. $\beta = 0.252$, $p < 0.01$), and firm performance (Std. $\beta = 0.301$, $p < 0.01$) all show significant positive associations. Thus, when considering a longer-term perspective (i.e., two-year lag), all three hypotheses—H1, H2, and H3—are supported. Model 2 explains 26 % of the variance in DT strategy ($R^2 = 0.261$), with $N = 137$ due to 13 missing firm-level observations (see Table 4).

To test our sub-hypotheses (H1a–c, H2a–c, H3a–c), we estimated additional linear multiple regression models for each of the three DT stages. We analyzed the models separately for 2019 to capture short-term effects (Models 3–5) and for 2020 to capture longer-term effects (Models 6–8). The results are summarized in Table 5.

For the 2019 models (3–5), neither the board's monitoring role nor its strategic resource-provision role significantly influenced firms' digitization (Model 3) or digitalization (Model 4). By contrast, in the digital maturity model (Model 5), both board size and firm performance show significant positive effects, suggesting that larger and more successful firms are better positioned to engage in deeper digital transformation. Ownership structure had no significant effect across any of the 2019 sub-strategy models.

Table 3
Correlations.

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Board monitoring																	
2.	Board resource provision	0.461**																
3.	Ownership: Dispersed	−0.026	−0.076															
4.	Ownership: Dominant Shareholder	0.023	−0.028	−0.199*														
5.	Ownership: Concentrated	0.004	0.084	−0.678**	−0.586**													
6.	Board size	0.02	0.247**	−0.107	−0.034	0.114												
7.	Board tenure	−0.014	−0.101	−0.209*	−0.160†	0.293**	−0.026											
8.	Industry	−0.044	−0.127	0.106	0.055	−0.129	−0.193*	0.024										
9.	Firm size	0.06	0.214**	−0.105	−0.02	0.101	0.578**	−0.022	−0.392**									
10.	Firm performance (Log)	0.075	0.105	−0.079	−0.022	0.081	0.176*	−0.005	−0.325**	0.317**								
11.	DT strategy 2019	−0.059	0.133	0.042	−0.071	0.019	0.307**	0.078	0.13	0.232**	0.263**							
12.	DT strategy 2020	−0.11	0.188*	0.107	−0.11	−0.003	0.346**	0.05	0.06	0.261**	0.282**	0.856**						
13.	Digitization 2019	−0.042	0.083	−0.017	−0.026	0.034	0.144†	0.128	0.098	−0.007	0.087	0.547**	0.454**					
14.	Digitalization 2019	−0.079	0.008	0.085	−0.047	−0.036	0.122	−0.022	0.245**	0.137	0.190*	0.870**	0.709**	0.200*				
15.	Digital Maturity 2019	−0.032	0.144†	−0.017	−0.079	0.073	0.383**	0.131	−0.057	0.314**	0.245**	0.695**	0.623**	0.136	0.425**			
16.	Digitization 2020	−0.003	0.073	0.105	−0.058	−0.041	0.169*	0.059	−0.01	0.05	0.084	0.391**	0.457**	0.877**	0.071	0.099		
17.	Digitalization 2020	−0.123	0.168†	0.118	−0.065	−0.046	0.219*	−0.006	0.1	0.187*	0.263**	0.718**	0.867**	0.112	0.789**	0.423**	0.067	
18.	Digital Maturity 2020	−0.081	0.144†	−0.028	−0.13	0.121	0.393**	0.092	−0.005	0.339**	0.221*	0.676**	0.736**	0.142	0.443**	0.869**	0.107	0.525**

Note:
** $p < 0.01$.
* $p < 0.05$.
† $p < 0.1$.

Table 4
Regression models: H1 and H2.

	Model 1		Model 2	
	DT strategy 2019		DT strategy 2020	
Variables	Std. B	Std. E	Std. B	Std. E
Board monitoring	−0.147†	5.911	−0.255**	6.208
Board strategic resource provision	0.146†	6.165	0.224*	6.451
Ownership: Dominant Shareholder	−0.111	13.158	−0.206*	13.464
Ownership: Concentrated	−0.109	10.306	−0.185†	10.819
Board size	0.227*	3.020	0.248**	3.006
Board tenure	0.102	1.089	0.092	1.0099
Industry	0.318**	9.555	0.252**	9.760
Firm size	0.118	2.508	0.099	2.504
Firm performance	0.291**	13.722	0.301**	13.913
Constant	−49.947	44.049	−12.574	44.384
F-value	5.268**		6.327**	
Adj. R^2	0.208		0.261	
VIF value, highest	1.761		1.790	
	N = 147		N = 137	

Note:
** $p < 0.01$.
* $p < 0.05$.
† $p < 0.1$.

become more consequential as firms progress to the riskier and more resource-intensive stages of digitalization and digital maturity.[1]

5. Discussion

Digitalization is a megatrend that "embrace[s] all aspects of our private and professional life" (Legner et al., 2017, p. 301), as reflected in the expanding literature on DT across multiple disciplines (e.g., Kraus et al., 2021b; Nadkarni and Prügl, 2021; Vial, 2019). However, the role of corporate governance in shaping DT has remained comparatively understudied, prompting recent calls for empirical investigation (Hanelt et al., 2021). This paper answers that call by examining how board roles and ownership structures affect firms' DT strategies, using a unique combination of survey data from Swedish listed boards, manually coded DT disclosures from annual reports, and ownership information from the Holding database. Our overall regression models (Models 1 and 2) indicate that a board's strategic resource-provision role fosters more expansive DT strategies, whereas its monitoring role constrains them, particularly when accounting for time-lagged effects (2020). This aligns with prior research emphasizing the board's critical influence on forward-looking strategic choices (Grant and Visconti, 2006; McNulty and Pettigrew, 1999). In 2019, by contrast, the governance variables

Table 5
Regression models: H1a, H1b, H1c and H2a, H2b, H2c.

	Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Digitization 2019		Digitalization 2019		Digital maturity 2019		Digitization 2020		Digitalization 2020		Digital maturity 2020	
Variables	Std. B	Std. E	Std. B	Std. E	Std. B	Std. E	Std. B	Std. E	Std. B	Std. E	Std. B	Std. E
Board monitoring	−0.099	2.389	−0.135	4.306	−0.113	2.195	−0.034	2.711	−0.276**	4.270	−0.171†	2.254
Board resource provision	0.128	2.470	0.086	4.921	0.132	2.356	0.062	2.816	0.247*	4.437	0.109	2.342
Ownership: Dominant Shareholder	−0.013	5.177	−0.152	9.800	−0.096	5.007	−0.142	5.878	−0.171†	9.260	−0.117	4.889
Ownership: Concentrated	−0.025	4.034	−0.120	7.676	−0.091	3.892	−0.179	4.723	−0.174†	7.441	−0.012	3.928
Board size	0.193†	1.190	0.052	2.240	0.293*	1.127	0.204†	1.312	0.118	2.067	0.267**	1.091
Board tenure	0.140	0.425	−0.032	0.819	0.154†	0.418	0.099	0.480	0.037	0.756	0.087	0.399
Industry	0.133	3.833	0.385**	7.043	0.126	3.598	0.018	4.261	0.270**	6.712	0.191*	3.544
Firm size	−0.129	0.985	0.187†	1.835	0.115	0.965	−0.083	1.093	0.099	1.722	0.184†	0.909
Firm performance	0.134	5.352	0.266**	14.184	0.202*	5.173	0.089	6.075	0.306**	9.569	0.189*	5.052
Constant	0.403	17.433	−10.708	32.940	−28.389	16.548	0.768	19.378	6.712	30.525	−20.053	16.115
F-value	1.375		3.313**		4.356**		0.959		4.605**		4.949**	
Adj. R^2	0.023		0.140		0.181		−0.003		0.193		0.207	
VIF value, highest	1.785		1.747		1.858		1.790		1.790		1.790	
	N = 142		*N* = 129		*N* = 138		N = 137		N = 137		N = 137	

Note:
** $p < 0.01$.
* $p < 0.05$.
† $p < 0.1$.

Turning to the 2020 models (6–8), clearer governance effects emerged for digitalization and digital maturity. In Model 7 (digitalization 2020), board monitoring is negatively associated with firms' digitalization efforts (Std. $\beta = -0.276$, $p < 0.01$), while the strategic resource-provision role is positively associated (Std. $\beta = 0.247$, $p < 0.05$). These results support H1b and H2b, indicating that intensive monitoring can constrain medium-risk digital initiatives, whereas strategic advising encourages them. Ownership concentration also shows marginally negative effects, suggesting that dispersed ownership is more conducive to digitalization, consistent with H3b.

For digital maturity in 2020 (Model 8), the monitoring role again showed a negative (albeit marginally significant) effect, partially supporting H1c, while neither strategic resource provision nor ownership variables reached significance, offering no support for H2c or H3c. Board size, however, remained positively associated with digital maturity, reinforcing the view that larger boards facilitate more complex forms of DT.

Taken together, these sub-strategy results suggest that governance mechanisms exert little influence at the early digitization stage, but show no significant associations with DT strategy. This timing nuance likely reflects reporting cycles, as inputs measured in 2018 may only surface in firms' initiatives and disclosures the following year. The pre-Covid context may also have muted immediate effects, with clearer governance-strategy patterns emerging in 2020. The positive influence of board size, firm performance, and being in a technology-driven industry further reinforces these findings. Larger boards provide broader expertise to support DT processes (Hillman and Dalziel, 2003; Vial, 2019), and financially stronger firms have fewer constraints when pursuing costly digital investments (Karhade and Dong, 2020). Meanwhile, technology firms exhibit a structurally higher baseline propensity to exploit digital opportunities. Our dichotomous industry control

[1] Since the three ownership categories are mutually exclusive, we re-estimated all regression models, including only one ownership dummy variable at a time and using the remaining firms as the reference group. The direction, magnitude, and significance of all coefficients—including those for the board-role variables—remained unchanged, and the overall model fit was virtually identical.

accounts for this gap, meaning the observed board- and ownership-effects should be interpreted as within-industry governance effects rather than technology-only dynamics. Consistent with our ownership hypotheses, the 2020 model further shows that dispersed ownership—compared with dominant-shareholder and highly concentrated structures—supports more ambitious DT strategies, whereas tighter blocks of control appear to constrain them.

Taken together, these findings highlight both complementarities and tensions: dispersed owners can amplify the benefits of advisory-oriented boards for digitalization, while concentrated blocks, especially when paired with monitoring-heavy boards, tend to favor cash-preserving strategies that constrain more transformative DT initiatives.

One plausible explanation is the growing influence of large institutional investors (pension, mutual, and insurance funds) in Sweden's dispersed ownership category. With highly diversified portfolios, these investors bear less firm-specific downside risk and thus show greater tolerance for the long timeframes and uncertain returns typical of DT projects (McNulty and Nordberg, 2016). Recent stewardship practices, such as coordinated voting and collective engagement, further enhance their capacity to encourage boards to adopt innovation-intensive strategies (Federo et al., 2020). Conversely, concentrated block-holders, whose wealth is often tied to firm-specific cash flows, tend to favor stability and tighter capital rationing, which can constrain more transformative DT initiatives (Anderson et al., 2012).

However, our data combination also allows us to look beyond generic DT measures and determine how governance and ownership influences vary across the three distinct stages of DT identified in previous studies (Holmström, 2022; Verhoef et al., 2021; Warner and Wäger, 2019). At the first stage, digitization, there is no difference between board roles. Since digitalization has become embedded in everyday professional and personal life (e.g., Legner et al., 2017), basic digitization, which focuses on converting analog data to digital, appears largely noncontroversial. Consequently, whether boards emphasize monitoring and control or strategic resource provision makes little difference for firms' DT strategies at this stage.

By contrast, the second stage, digitalization, which involves leveraging digital technologies to reconfigure business processes, shows clear governance effects. A monitoring role impedes progress, whereas a strategic resource-provision role is positively associated with digitalization. This suggests that boards oriented toward oversight may struggle to support the innovation and risk-taking required at this stage, while boards acting as strategic partners can provide valuable guidance based on their industry experience (Kor and Misangyi, 2008). Such guidance is critical because successful digitalization depends on technology, skilled people (Nadkarni & Prügl, 2021), and overcoming managerial reluctance to digital change (Wang et al., 2025). Leveraging board expertise as a strategic resource can prevent siloed digital solutions and foster integration across functional boundaries (Bömelburg and Gassmann, 2024). Consistent with our regressions, dispersed ownership accelerates digitalization; however, its effect disappears in the later maturity stage.

At the third stage, digital maturity, the board's strategic resource role becomes insignificant. Several factors may explain this. First, the foundation for deeper transformation is laid during digitalization, and not all firms or industries require a full-scale business model transformation to remain competitive. Second, digital maturity may be more influenced by industry dynamics, organizational culture, value-chain position, and the demands on top management to make rapid decisions enabled by real-time data and, increasingly, AI (Mazzei and Noble, 2017; Parvarandeh et al., 2025). This broader complexity may also explain the marginally negative effect of board monitoring at this stage.

Taken together, these stage-specific patterns affirm our core argument that governance mechanisms at the board and ownership levels not only determine whether firms engage in digital transformation, but also how far they progress along the digitization-digitalization-maturity continuum. By unpacking these mechanisms, we demonstrate that DT is not simply a technological challenge, but a governance-contingent strategic choice.

5.1. Theoretical contributions

This study extends current knowledge on DT in several ways. First, we develop a novel, stage-specific approach to measure the level of DT adopted by firms, capturing how they adapt their business models at varying paces and scopes using different types of digital technologies, reflecting an increasing level of digital maturity (e.g., Alkaraan et al., 2023; Hanelt et al., 2021; Verhoef et al., 2021). Unlike prior studies that combine all DT-related language into one index, our dictionary distinguishes between terms associated with digitization, digitalization, and digital maturity, enabling a theory-driven, phase-by-phase analysis. This text-analytical index can serve as a scalable, early-warning indicator, helping scholars and practitioners to forecast which firms are poised to accelerate digital investments in the future.

Our method systematically tracks corporate progress along the DT continuum by analyzing how stage-specific keywords are used in annual reports. To ensure that the measure reflects substantive strategy rather than rhetorical window-dressing, we manually audited reports with unusually high or low scores, and validated that the composite score correlates positively with an external investment proxy: technology-intangible intensity ($r = 0.28$, $p < 0.01$). By combining insights from both the digitalization and governance literature, this tool allowed us to explore how organizations convey DT strategy. While governance regulations typically emphasize financial and compliance reporting as an indicator of effective governance, scholars highlight the importance of corporate self-reporting to capture ongoing strategic processes (Achtenhagen et al., 2018; Grant and Visconti, 2006). As theoretical understanding of DT processes is still developing, our research responds to calls for methods that measure and investigate the DT stages (Verhoef et al., 2021) by offering a tool grounded in both DT and governance theory, based on firms' self-reported strategic emphasis on DT.

Second, our study contributes to corporate governance research by providing new insights into boards' strategic resource-provision and control roles (Westphal and Zajac, 2013). While prior work has largely emphasized the board's monitoring and control function, our findings provide empirical evidence of the limitations of this perspective (cf. Goranova et al., 2017). Digitalization has become increasingly regarded as the "new normal" for post-Covid-19 businesses (Carroll and Conboy, 2020), and firms with pre-existing strategic capabilities to adopt DT were better positioned to adapt to this external shock (Soluk et al., 2021; Warner and Wäger, 2019). Our research extends this line of inquiry by showing that boards emphasizing their strategic resource-provision role actively promote decisions that enhance strategic value, whereas boards focused on monitoring tend to impede such initiatives. These findings reinforce the importance of boards serving as strategic resources (Boivie et al., 2021), while highlighting that the board's control and monitoring role should be balanced or moderated depending on contingency factors such as context, external conditions, or the firm's stage in its lifecycle (Bertoni et al., 2014; Garg, 2020).

Finally, we contribute to the evolving corporate governance literature by examining how different ownership structures influence firms' strategic direction (McNulty and Nordberg, 2016). While prior research has largely focused on the board's relationship with management, the impact of varying ownership structures on strategic postures has remained underexplored (Federo et al., 2020). This is particularly relevant given the recent global shifts in ownership patterns, with institutional investors and blockholders gaining substantial influence over listed corporations (OECD, 2021). By linking property rights theory and agency theory to DT processes, we underscore the critical role of shareholders in shaping strategic decision-making, especially in today's technology-driven business environment (Gillani et al., 2024; Garg, 2020).

5.2. Practice and policy implications

Our study offers several actionable takeaways for practitioners. For example, shareholders seeking to advance strategic initiatives such as DT should consider appointing directors who embrace a strategic stewardship role and possess the expertise to guide the firm in that direction (Aguilera et al., 2016; McNulty and Nordberg, 2016). These directors tend to prioritize long-term value creation over routine monitoring, using their industry experience and professional knowledge to support management. Investors can also use these insights. Those focused on long-term value creation may prefer portfolio companies with boards that demonstrate these strategic capabilities. In contrast, investors oriented toward near-term returns may favor boards that emphasize control. For directors, our findings suggest that maximizing strategic value requires prioritizing advisory responsibilities while fulfilling monitoring duties (Boivie et al., 2021). Additionally, regulators should be aware that an exclusive focus on compliance may crowd out the board's strategic contribution (Grant and Visconti, 2006; OECD, 2018).

Three policy measures follow from these findings. First, since boards create more digital value when acting as strategic stewards rather than mere monitors, national governance codes could complement compliance requirements with guidance asking boards to explain how they cultivate long-term digital capabilities. Second, securities regulators could encourage listed firms to demonstrate board-level digital competence by appointing technology-literate directors or providing certified digital strategy training, so directors can advise on transformation. Third, policymakers could pilot a voluntary "Digital Transition Statement" in annual reports to position each firm along the digitization-to-maturity continuum. This statement would describe the board mechanisms overseeing progress and provide investors and stakeholders with a transparent basis for evaluating commitment.

At the operational level, boards should treat DT oversight as a dual mandate, setting guardrails (e.g., risk appetite, stage gates, and milestone reviews), while granting management sufficient flexibility to explore and pivot (cf. Shen et al., 2022). Board composition and ownership both matter. Boards should expand their capital by increasing size and diversity and including digital expertise as needed. They should also calibrate owner influence. For example, dispersed investors could underwrite exploration, and blockholders could ring-fence an "innovation risk budget" with milestone-based monitoring. This ensures governance enables rather than constrains DT. These levers highlight the need for further research into which arrangements best reconcile monitoring and strategic flexibility across sectors and ownership regimes.

5.3. Limitations and future research

Our study has several limitations that highlight avenues for future research. First, the analysis is based on a relatively small number of firms, albeit representing a substantial portion of companies traded on NOS (47 %). Future research could expand the sample size and include additional ownership forms, such as family-owned businesses in manufacturing sectors, which often face challenges in implementing DT (Soluk and Kammerlander, 2021). Such studies could provide deeper insights into how different ownership types shape strategic decision-making (Federo et al., 2020).

Second, our data is limited to Swedish firms. While the sample includes small-, mid-, and large-cap firms and a significant proportion of technology companies, the external validity beyond Sweden, particularly in emerging markets with different ownership concentrations, investor protections, and disclosure regimes, remains uncertain. The Swedish governance context exerts multifaceted influences on board roles (Jonnergård and Larsson-Olaison, 2016), so future studies examining firms in countries with alternative governance systems could better clarify the boundary conditions of our findings. Furthermore, larger cross-national samples would enable researchers to test generalizability and explicitly examine ownership-board role interactions, which our study could not address due to sample constraints.

Third, although our empirical data uniquely combines firsthand board-level survey responses with archival firm-level data—a combination rarely accessible (Boivie et al., 2021)—our design primarily answers the "how" question. The "why" behind the influence of board roles and ownership on digital transformation strategy remains unexplored. Future research could complement survey and archival data with qualitative approaches, such as interviews with board members or observations of board meetings, to illuminate the decision-making processes underlying strategic digital initiatives.

Finally, one of our main contributions is developing and applying a new tool that uses textual analysis of annual reports to assess the DT stages. Although Sweden is considered a "role model" in terms of corporate governance codes and compliance (Achtenhagen et al., 2018), firms may still manage the disclosure of information about their initiatives strategically. Future research could test the robustness and applicability of this tool in different national and organizational contexts to further validate its usefulness in measuring firm-level DT strategies.

Although we strengthened the validity of our text-based DT index through manual checks and its positive correlation with the intangible assets-to-turnover ratio, the measure may still capture rhetorical signaling rather than substantive action. Future research should combine text analytics with concrete evidence, such as firm-level IT capital expenditures, digital technology patent families, and adoption of cloud and AI platforms, once such data is consistently available. Our sample size also limited the ability to estimate separate models by industry, firm age, or innovation intensity. Similarly, a dichotomous technology indicator cannot fully capture heterogeneity within the non-technology group (e.g., manufacturing, services, utilities), leaving sector-specific governance-DT dynamics for future investigation. Larger multi-industry or cross-country panels could explore whether the ownership-DT relationship differs between technology-intensive and traditional sectors, or between stages of the corporate life cycle, thereby refining and extending our insights.

The timing of our data should also be considered. The board survey was conducted in 2018, and DT strategy was measured in annual reports for 2019 (pre-Covid) and 2020 (coinciding with the onset of the pandemic). The absence of ownership and board effects in 2019 and the stronger presence of these effects in 2020 likely reflect reporting lags and may also capture crisis-induced adjustments that we cannot fully disentangle.

Finally, our study addresses calls to examine the factors that influence DT processes across different strategic dimensions (Matt et al., 2015; Nylén and Holmström, 2015). Given that digital technologies drive comprehensive changes in corporate processes, structures, and business models, insights from corporate governance offer an important complement to the information systems literature (Levén et al., 2014; Hanelt et al., 2021).

6. Conclusion

Digital transformation is one of the most significant strategic processes through which firms adapt to a changing business environment (Nylén and Holmström, 2015). The pace, scope, and intensity of this transformation depend on a firm's strategic posture and the resources it allocates. As a strategic decision that influences not only overall operations but also the business model, DT is shaped by the board, which must balance long-term value creation with perceived risks. Our study contributes to the literatures on corporate governance and DT by shedding light on how board and shareholder characteristics enable firms to pursue and advance their DT initiatives.

CRediT authorship contribution statement

Nurit Nahum: Writing – review & editing, Writing – original draft, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation. **Ulf Larsson-Olaison:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Timur Uman:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Leona Achtenhagen:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT to assist with language editing (i.e., grammar, phrasing, and overall clarity). Following the use of this tool, the authors reviewed and revised the content as necessary and take full responsibility for the final content of the publication.

Declaration of competing interest

Authors have nothing to declare.

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Data availability

The data that has been used is confidential.

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