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Ilya Ivaninskiy

DIGITAL TRANSFORMATION OF BUSINESS AND ITS IMPACT ON CORPORATE GOVERNANCE MECHANISMS

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Motivation

For more than 40 years since the publication of the seminal paper [Jensen and Meckling, 1976], agency conflict between shareholders and management has been at the center of corporate governance research. Currently certain trends appear to be exacerbating this conflict indicating a "lack of balance" in the application of corporate governance mechanisms. Firstly, we are observing the growth of shareholder activism [Foldsey et al., 2015; Cohn et al., 2018]. Secondly, researchers have demonstrated that the growth of index investment funds encourages a more passive behavior among retail investors [Fich et al., 2015], and this behavior is at the core of the conflict [Roe, 1991]. Shareholders, therefore, are either becoming exceedingly passive or tend to proceed towards activism.

At the same time, digital transformation of business (or simply digitalization) which became a feature *sine qua non* for firms and their governing bodies [Grove, Clouse, Schaffner, 2018] has a potentially mitigating impact upon the conflict. Technologies as blockchain and artificial intelligence create efficiency gains for adopters, enhancing their competitive advantages [Westerman et al., 2012]. However, two important questions remain unanswered with regards to impact of digitalization for corporate governance. Firstly, while theoretical / conceptual literature suggests that digitalization has an improving impact on corporate governance [e.g. Yermack, 2017; Byström, 2019], there are indications that the opposite may be true [Kaal, 2019]. Furthermore, direct empirical evidence is scarce. Thus management, lacking evidence may refrain from digitalization as a way to generate shareholder value.

Secondly, while there is a discussion on the technical aspects of digitalization, there is no evidence on how business models should change to maximize the impact on corporate governance. Globally business models are evolving towards the adoption of platform/ecosystem models relying on digital technologies. Researchers interpret this as "the end of corporate governance, hello platform governance" [Fenwick et al., 2019]. At the time of this research, the most highly valued firms (by market capitalization) were operating as ecosystems (e.g. Apple, Amazon, etc.). Several authors have argued that digitalization and platform/ecosystem models are mutually reinforcing [Yrjölä, 2020; Chong et al., 2019]. Hence, the firms leveraging both opportunities would reap the most benefits for governance. However, some features of ecosystems may make the existing governance mechanisms unapplicable. As with overall impact of digitalization, there is yet scarce direct empirical evidence on the topic.

The motivation of the research is three-fold. First, to obtain empirical evidence on the digitalization - agency conflict relationship. Second, to explore whether certain business models are especially beneficial for corporate governance when applied together with digitalization. Third, to provide practitioners as boards of directors with evidence on implications of leveraging digital transformation and business model innovation: a) whether they should expect an increased conflict with shareholders resulting from digitalization which is considered risky decision; b) whether digital transformation and new business models should be applied in parallel for maximum effects for corporate governance.

Key Concepts

This research draws on several key concepts. *Principal-agent or agency conflict.* [Jensen and Meckling, 1976] define agency relationship "as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent". The authors show that "if both parties to the relationship are utility maximizers, there is good reason to believe that the agent will not always act in the best interests of the principal". In the case of management and shareholders, diverging objectives result in managerial decisions suboptimal for shareholders. Moreover, there is evidence that managers may make decisions suboptimal for themselves, e.g., invest less in innovation [Aghion et. al., 2013]. The conflict can be directly observed in proxy fights [Ertimur et al., 2010] and other forms of activism [Brav et al., 2008]. We appreciate that the conflict is not limited to shareholders and management, it also involves majority - relationship with minority shareholder's e.g., [La Porta, Lopez-de-Silanes et al., 2002], bondholders, etc. However, we limit the definition to this one as the most well researched.

Corporate governance. According to OECD, corporate governance "involves a set of relationships between a company's management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined" [OECD, 2015]. Better governance creates value even in emerging markets and non-listed firms (see e.g. [Spenger, Lazareva, 2022]). Most authors agree that one of its key goals is principal-agent conflict mitigation [see e.g., Jensen and Meckling, 1976; Khan, 2011; Yermack, 2017; Brav et. al., 2008]. Hence, when discussing impact of digitalization on the corporate governance mechanisms and the extent that it "reinforces" or "improves" them, we will be referring to the effect on the ability to mitigate the conflict.

Digital transformation or digitalization. We define digitalization as the implementation of transformative digital technologies for transformation of internal processes of a firm. There are multiple technologies with significant impact on the business and corporate governance. Examples of technologies commonly surveyed in literature include artificial intelligence, big data, 3D printing, and blockchain [Zhu, 2019; Grove, Clouse, Schaffner, 2018].

Platform and ecosystem business models. There is no universally accepted definition for platform and ecosystem models yet and certain authors use the terms interchangeably [Tsujimoto et al., 2018] or use the term "platform ecosystems" [Karminsky and Voytov, 2022]. [Fenwik et al., 2019] define platform businesses as the ones that "leverage networked technologies to facilitate economic exchange, transfer information and connect people". [Kamargianni and Matyas, 2017] define business ecosystems as "the wider network of firms that influences how a focal firm… creates and captures value". Both platforms and ecosystems rely on the network of 3rd parties to generate value for direct customers as well as the overall network of partners. In this research we do not differentiate between the two terms.

Brief Literature Review

This section contains the review of existing literature on implications of digital transformation for corporate governance and its connection to business model innovation. As mentioned earlier, digitalization is an application of a digital technology for business transformation. While there are many transformative digital technologies, research shows that artificial intelligence (AI) and blockchain have a particularly strong impact on corporate governance [Zhu, 2018; Fenwick and Vermeulen; 2018; Grove, Clouse, Schaffner, 2018]. According to [Swan, 2015] the "blockchain concept… is a new organizing paradigm for the discovery, valuation, and transfer of all quanta (discrete units) of anything, and potentially for the coordination of all human activity…". AI is defined as "a technology that applies systems to machines so that machines can think like humans" [Go et al., 2020]

Of the two technologies, we selected blockchain for this research. Firstly, several authors maintain that blockchain offers the highest transformative potential [Yermack, 2017; Cong and He, 2019]. Blockchain creates systems where users interact without the need for a central authority [Hawlitschek et. al., 2018]. This reduces costs and increases speed and accuracy of transactions – both within a firm and with external stakeholders. Therefore, blockchain changes the ways how industries and corporate functions work. Secondly, this technology is mature enough to be acknowledged and applied even by governments. It was said at the 2021 World Economic Forum that "86% of central banks are exploring the benefits and drawbacks of central bank digital currency"[1]. Prominent investors as Warren Buffet acknowledge the importance of blockchain[2]. Thirdly, there are multiple applications of blockchain designed for corporate governance improvement and already in the process of testing [Lafarre and Van der Elst, 2018]. Examples of such applications are using blockchain for corporate voting [Mainelli, Milne, 2016], using blockchain to register transactions with securities on exchanges [Caytas, 2016], etc.

Applications of blockchain for corporate governance

With regards to corporate governance, there are multiple propositions of potential blockchain impact. However, it must be noted that most propositions are conceptual and not yet empirically tested. Firstly, it makes the governance mechanisms more effective. The key lever to achieve this is increases in transparency and restriction of information asymmetry abuse by management. Examples include blockchain applications to optimize voting procedures at shareholder meetings [Van der Elst and Laffare, 2017] or to create greater clarity in the ownership structure of firms, preventing such strategies as "empty voting" [Yermack, 2017]. Authors argue that higher ownership transparency would create more trust towards processes among shareholders and hence, make them more involved in governance. However, while using blockchain for voting and annual meetings is a promising opportunity, there are sceptics.

[1] https://www.weforum.org/agenda/2021/02/key-takeaways-on-digital-currency-from-the-davos-agenda/

[2] [2] De N. Warren Buffet: Bitcoin Is a 'Delusion' But Blockchain Is 'Ingenious. Coindesk. 2019. Available at https://www.coindesk.com/warren-buffet-bitcoin-is-a-delusion-but-blockchain-is-ingenious., accessed on 28.02.2021. Full interview to CNBC is available at https://www.youtube.com/watch?v=2hdDE7XYr30 accessed on 11.10.2021

E.g., [De Falco et al., 2019] show that industry practitioners are skeptical about it. [Magnier and Barban, 2018] argue that blockchain increases transparency of ownership, which may not be desirable.

Secondly, there are applications automating certain functions of management and governance bodies. Blockchain enables automation of certain Board of Directors functions as internal audit [Peters and Panayi, 2016; Byström, 2019]. It can even enable the creation of companies without management known as "decentralized autonomous organizations" (DAOs) [DuPont, 2017; Kristof, 2017]. Automation, even partial, may reduce information asymmetry and hence improve the governance efficiency. This application could prevent corporate scandals when management commits fraud against shareholders, like a relatively recent Wirecard[13]. However, the opposite may also be true. There are a lot of risks associated with blockchain implementation. [Rückeshäuser, 2017] and [Kaal, 2019] argue that blockchain may be manipulated fraudulently by management. [Kristof, 2017] describes a failed DAO investment fund undermining the idea of DAOs.

Thirdly, blockchain may have implications of shareholder activism which is an extreme form of shareholder involvement. On the one hand, it could make it less frequent. A) increased ownership transparency would make activism more difficult [Yermack, 2017]. B) Blockchain-associated hype generates abnormal returns. There are examples of share prices' extreme growth following the change of a firm's name or a statement that it is focusing on blockchain [Pollock, 2018]. C) Investment banks as J.P. Morgan suggest that firms would benefit from blockchain, creating confidence for the investors [Rooney, 2018]. D) Blockchain may serve as take-over defense. In contrast to traditional tools as poison pills that have negative entrenchment effects [Holmén, Nivorozhkin, Rana, 2014], blockchain would not have these issues. On the other hand, there is a lack of legal clarity of blockchain [Kajtazi and Moro, 2018; Fry, 2018]. This may result in shareholders opposing management efforts in implementing it.

Fourthly, even if not applied to corporate governance, digitalization (not necessarily via blockchain) may improve the governance mechanisms. [Westerman et al., 2012] show that firms committed to digital transformation are, on average, "by 9% to 26% more profitable than their average industry competitors on a basket of measures, including EBIT margin and net profit margin". [Dranev et. al., 2019] show that share prices experience short-term abnormal returns after M&A with a fintech. Therefore, digitalization may create performance improvement expectations. Hence, firms will generate more value to be shared, which may lead to more active shareholder participation in decision making to capture the value hence, and to a weaker principal-agent conflict [Parrino et. al., 2003].

As we see, there is no consensus on the impact of digitalization for governance. Still, we believe that firms active in digitalization should have overall better functioning governance mechanisms and shareholders more actively involved in governance. It is important to underline that most papers in this

[3] https://www.reuters.com/article/us-germany-wirecard-inquiry-timeline-idUSKBN2B811J

field are conceptual in nature. Hence, by establishing a direct empirical link between digitalization and corporate governance this research provides an important contribution.

Blockchain and business model innovation

There are multiple papers discussing technical aspects of blockchain implementation such as the size of a block on the blockchain, configuration of blockchain (open vs closed), etc. There is also discussion on what capabilities organizations should possess to successfully implement a blockchain. [Beck and Müller-Bloch, 2017] argue that an organization needs to possess a skillset for radical innovations. However, to the best of our knowledge there is no evidence or suggestions for the selection of business model of a firm to maximize efficiency of blockchain implementation for governance improvement.

Within the business model innovation research, topic of ecosystem models is receiving a growing attention. Research shows that ecosystems generate a tangible business opportunity, while ignoring them creates a tangible threat. A recent BCG survey shows that a quarter of executives believe that within three years digital ecosystems will account for over 60% of sales in their industries. According to the survey, executives expect ecosystems in such industries as telecommunications, media and technology, finance, consumer goods and healthcare to be particularly urgent and relevant, while industrials and energy are seen to be less urgent and relevant [Bhatnagar et al., 2021]. However, certain authors (e.g., [Fenwick and Vermulen, 2018]) argue that no one is immune from this threat: "The rule is straightforward: 'You either become a platform, or you will be killed by one'."

There are two major ways in which ecosystems may influence governance mechanisms. Firstly, the key difference between ecosystems and traditional business models is the value generation process. Traditional companies generate value by building a closed, centralized structure with "a clear boundary between the firm and the 'outside world'" [Fenwik et al., 2019]. Platforms generate value by sharing information rather than hiding it. An important feature of ecosystems is trust among stakeholders, which is key for a large firm [La Porta, Lopez-de-Silanes et al., 1996] Hence, it is reasonable to expect ecosystems to generate transparency and trust and better functioning governance mechanisms.

Secondly, certain authors (e.g., [Bainbridge, 2003; European Commission, 2018]) argue that ecosystems may on average have a stronger agency conflict due to the fact that traditional governance mechanisms are not well-suited to ecosystem-based businesses. Furthermore, recent legal scrutiny faced by platform companies (see e.g. [Avdasheva and Korneeva, 2019]) may also increase the conflict.

There is strong interaction between ecosystem models and blockchain. Both create greater trust among stakeholders (incl. suppliers, clients, etc.). Blockchain reduces the reliance on human decisions while ecosystem models create an environment where value is created by exchange of information among the stakeholders. Blockchain shifts the "center of trust" from the ecosystem founder towards the underlying technology [Xia et al., 2017]. Since trust and transparency are key sources of value for

ecosystem-based businesses, researchers argue that digitalization and business model innovation are mutually reinforcing [Yrjölä, 2020; Schweiger et al., 2016; Fehrer et al., 2018; Schweiger et al., 2016]. It is reasonable, therefore, to expect the impact of digitalization on corporate governance to be more significant for companies which leverage ecosystem business models. Given that we expect digitalization, as mentioned above, to have an improving impact on governance, it is reasonable to expect companies which leverage both trends to experience even better functioning mechanisms. However, as in the case of digitalization, empirical evidence regarding the implications of ecosystem-based business models for corporate governance is limited. This research is an attempt to fill this gap.

Summing up, we see several gaps in existing research. Firstly, there is no empirical evidence on the implications of digitalization overall and in the form of blockchain in particular for the effectiveness of governance mechanisms. Moreover, evidence is available neither for the level of shareholder involvement in governance, nor for the level of shareholder hostility towards management. Secondly, the literature review shows the absence of empirical evidence on the combined effect of blockchain application and business model innovation upon the effectiveness of governance mechanisms.

Objectives of the Research

The goal of the research is to identify the impact of digitalization on the corporate governance mechanisms. To fulfill it, we attain several objectives:

1. Analyze the existing research on the role of digital transformation of business in a form of blockchain implementation and its implications for the corporate governance to identify the gaps.
2. Select the most relevant corporate governance mechanism and its determinants to measure the impact of digitalization and propose a way to measure the impact of blockchain implementation.
3. Determine the impact of digitalization on the level of shareholder involvement in corporate governance using the selected corporate governance mechanisms
4. Determine the impact of digitalization on the level of shareholders' hostility toward management
5. Determine the implications of business model innovation for the impact of digitalization on corporate governance mechanisms.

Research Structure and Methodology

Given the objectives, the research was organized in three steps, each resulting in a published paper, covering the research objectives listed above.

Step 1. Analysis of the existing literature on the topic of blockchain implications for corporate governance *(Objective 1)*. Overall, 91 papers covering both technical and practical aspects of blockchain and its implications for corporate governance focusing have been reviewed. Based on the review, three common topics were detected: level of shareholder involvement into corporate governance; level of conflict between shareholders and management; ways to maximize the value of blockchain implementation. Gaps in literature focused on implications of blockchain for governance were identified.

For each gap arguments in favor and against mitigating impact of blockchain on corporate governance mechanisms were shown. Based on the analysis, the research hypotheses were developed:

H1: blockchain involvement should make shareholders more involved into corporate governance.

H2: blockchain involvement should not create more shareholders' hostility towards management.

The results of literature analysis are presented in the paper: Ivaninskiy I. The impact of digital transformation of business on corporate governance. Overview of recent studies // Journal of Corporate Finance Research. 2019. Vol. 3.P.35-47 https://doi.org/10.17323/j.jcfr.2073-0438.13.3.2019.35-47

Step 2. Analysis of blockchain implications for the agency conflict *(Objectives 2, 3, 4)*. Several corporate governance mechanisms were analyzed for the suitability for the research. Shareholder and management-sponsored proposals for annual shareholder meetings were selected as the most relevant mechanism. Usage of proposals was analyzed through a 2-step approach. First, the implications of blockchain for the level of shareholder activity were explored. As mentioned before, we expect the firms active in digitalization to have better functioning governance mechanisms and more involved shareholders. Hence, in case of shareholder-sponsored proposals, we expect to see firms active in digitalization receive more proposals. Second, level of shareholder hostility towards the management was measured. The determinants of the selected mechanism were identified: 1) firm size, 2) growth, 3) profitability, 4) valuation, 5) leverage, 6) institutional ownership, 7) insider ownership. Additional determinants may also include Board of Directors composition and ownership concentration. The data on the additional determinants was not available at the time of research, but will be analyzed once it is.

To capture the involvement of a firm into blockchain, we applied a binary variable "blockchain", equaling 1, if a firm had any confirmed blockchain involvement and 0 otherwise.

Two approaches were used to measure the impact of blockchain on the level of shareholders' involvement into governance. First following [Renneboog, Szilagyi, 2011] the logistic regression on the likelihood of receiving a shareholder-sponsored proposal was used. Second, following [Iliev et al., 2018] number of shareholder-sponsored proposals received for voting was analyzed. To measure the level of hostility of shareholders following [Renneboog, Szilagyi, 2011] we looked at the share of proposals that pass the vote using a linear regression. Data on US publicly traded firms for the year 2018 was used.

The results are presented in the paper Ivaninskiy I., Ivashkovskaya I., McCahery J. Does digitalization mitigate or intensify the principal-agent conflict in a firm? // Journal of Management and Governance. 2021. P.1-31 https://doi.org/10.1007/s10997-021-09584-8. The author was responsible for the literature survey, data collection and quantitative analysis, and results interpretation.

Step 3. Analysis of implications of business model innovation for the impact of digitalization on corporate governance mechanisms *(Objectives 4 and 5)*. At this step, the analysis was extended to include the implications of business model innovation on digitalization and corporate governance. Based on the additional literature review, the hypothesis was formed.

H3: blockchain should have maximum effect when it is applied jointly with business model innovation in a form of application of ecosystem-based business models.

Additionally, the research sample was extended by adding data on years 2015-2019. The research consisted of 2 parts: first the analysis of the full sample (all firms for all the years) was conducted to ensure the previous results' robustness. Second, the analysis was broken down to individual sectors (all the firms within a given sector for all the years) to explore the implications of business model innovation. As with the Step 2 of the research, the impact of digitalization on the level of shareholder activity and hostility was estimated. To measure the level of shareholders' involvement, the logistic regression with the dependent variable that captured the fact of receiving at least 1 shareholder proposal and a linear regression with the dependent variable expressed by the number of shareholder proposals received, were used. To measure the impact on the level of shareholder hostility towards management the share of management-sponsored proposals that pass the vote was used. We found that the results were consistent with the Step 2: blockchain has an improving impact on the governance efficiency. The extended sample improved the results by allowing additional control of the lack of endogeneity using the lagged values of the blockchain variable (i.e. using the values of the blockchain variable for the years, preceding the year of vote) following e.g. [Tang et al., 2014; Griffith et al., 2017].

To capture the implications of business model innovation, the sectors most strongly affected by ecosystem business models were identified. The regressions by sector were run to test the hypothesis that the impact of digital transformation would be the most significant in sectors where platforms are more widespread. The implications for the agency conflict were measured based on the level of shareholder activity and the level of shareholders' hostility towards management. The level of shareholder activity was analyzed using both logistic and linear regressions. Finally, regressions on the share of management-sponsored proposals that pass the voting were applied to assess the interconnection between blockchain and ecosystem business models with regard to level of shareholder hostility.

The results are presented in the paper Ivaninskiy I., Ivashkovskaya I. Are blockchain-based digital transformation and ecosystem-based business models mutually reinforcing? The principal-agent conflict perspective. // Eurasian Business Review. 2022, Volume 12, Issue 2, June 2022. .

Author was responsible for literature survey, data collection, analysis, and results interpretation.

Empirical setting. The dataset was evolving as the research progressed. At the *step 2*, the sample consisted of 2813 NYSE, Nasdaq and AMEX-traded firms for the year 2018. At step 3 the sample was extended. Final dataset was panel data on a set of 2,481 companies over a period of 2015-2019. In order to arrive at the final sample, we began with the set of all traded companies and cleared potentially erroneous data (e.g., data with missing values). We chose this data range, since it is marked by the rapid adoption of digital technologies driven by increased data availability (e.g., [Miklosik et al., 2019] showed that 90% of data had been generated over the previous 2 years). The choice of region for the

sample was determined by data availability. As we shall see below, the total number of companies adopting the blockchain technology still remains relatively low. Hence, an analysis of US-traded companies guarantees that data is sufficient, in order to draw conclusions.

The data on blockchain involvement was collected using the following approach: first we studied annual reports by firms; then we explored the official websites; and, finally, looked at news feeds on the companies. We recorded the fact that a given company has adopted blockchain technology and the year in which blockchain technology was first mentioned. The sectors stronger affected by ecosystem-based models are identified based on the survey by BCG. The survey shows that a quarter of executives believe that within three years digital ecosystems will account for over 60% of sales in their industries. According to the survey, executives expect ecosystems in industries as telecommunications, media and technology, finance, consumer goods and healthcare to be particularly urgent and relevant, while industrials and energy are seen to be less urgent and relevant [Bhatnagar et al., 2021].

When comparing the number of shareholder-sponsored proposals received by adopters and non-adopters, it can be seen that the former group receives a much higher number of proposals: an average of 0.9 proposals per meeting vs. only 0.2 proposals. Remarkably, when comparing adopters to non-adopters within each sector, we see that the difference is highest in sectors more strongly affected by ecosystems (with the notable exception of energy). This seems to indicate that firstly, shareholders of blockchain-adopting firms indeed have shareholders more involved into governance and secondly, the presence of reinforcement effect between digital transformation and business model innovation.

When analyzing the share of management-sponsored proposals passing the vote, we do not see significant differences between blockchain adopters and non-adopters. This indicates that shareholders are not more hostile towards the management. A comparison between sectors shows the same results.

An analysis of control variables shows that blockchain adopters have a higher market capitalization ($56.5 bln for adopters vs. $8.2 bln for non-adopters) and are more profitable, as measured by the EBITDA margin (20% for blockchain adopters vs. 10% for non-adopters), while other variables have similar averages. This suggests that digital transformation requires both scale and resources.

Table 1. Descriptive statistics

	Blockchain adopters			**Blockchain non-adopters**		
Statistic	*N*	*Mean*	*St. Dev.*	*N*	*Mean*	*St. Dev.*
Company size	405	9.1	2.5	10,038	7.1	2.1
Market capitalization	405	56.5	111.4	10,038	8.4	31.6
Growth rate	405	0.1	0.2	10,038	0.1	0.2
Profitability	405	0.2	0.3	10,038	0.1	0.2
Market to book ratio	405	4.2	11.0	10,038	3.9	42.0
Leverage	405	1.2	3.7	10,038	1.1	12.2
Institutional ownership	405	0.7	0.2	10,038	0.6	0.3
Insider ownership	405	0.1	0.2	10,038	0.1	0.1
At least 1 shareholder proposal	405	0.4	0.5	10,038	0.1	0.3
Number of shareholder proposals	405	0.9	1.6	10,038	0.2	0.8
Share of management proposals passed	405	1.0	0.1	10,038	1.0	0.1

Figure 1. Difference in the number of shareholder-sponsored proposals received by sector

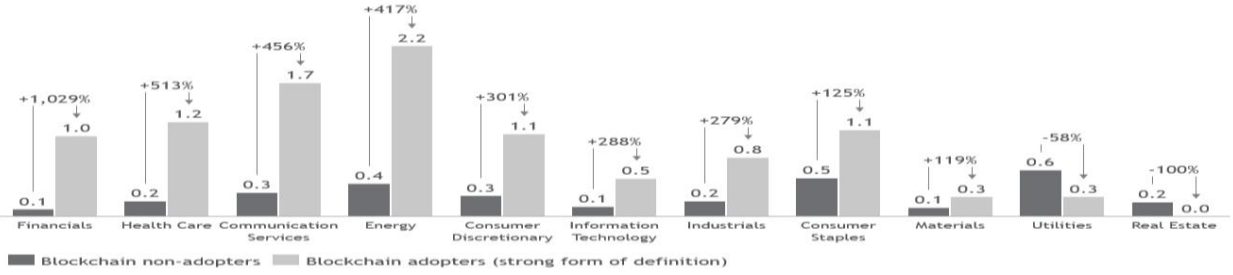
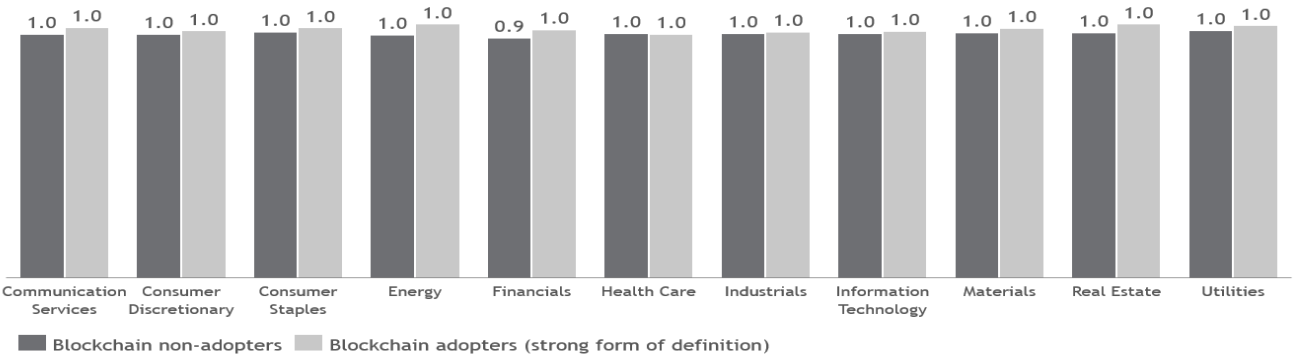


Figure 2. Difference in the share of management-sponsored proposals that pass the vote



Main Findings

1. Based on the literature review, proposals submitted for the annual meetings were chosen as the most relevant corporate governance mechanism. Shareholder-sponsored proposals allow to measure the level of shareholder involvement in governance. Approval rate for management-sponsored proposals allows to measure the level of shareholder hostility towards management. Based on the literature review, the determinants of the selected mechanism were identified: 1) firm size, 2) growth, 3) profitability, 4) valuation, 5) leverage, 6) institutional ownership, 7) insider ownership.

There are multiple governance mechanisms designed to manage the agency conflict, see e.g. [Singh et al., 2003] for a review. The mechanisms are split into indirect, when shareholders delegate control to third parties and direct when shareholders get directly involved into governance [Gillan and Starks, 2007]. Indirect mechanisms include boards of directors, external audit firms, etc. Most indirect mechanisms are legally mandatory. Direct mechanisms discussed in literature range from soft, such as selling shares — "voting with feet" [Parrino et al., 2003] to hard actions as buyout or takeover [Fama and Jensen, 1983]. For the purpose of the analysis the direct mechanisms are better suited since they allow direct observation of shareholder behavior and are quicker affected by a measure taken by a firm.

Since the 1940s, shareholders have the right to submit proposals for voting. The shareholder proposals serve as *aurea mediocritas* in terms of "hardness" in a shareholder's toolkit for the direct involvement. Literature is split between proponents and opponents of shareholder proposals as governance mechanisms. For example, [Bebchuk, 2005] argues that shareholder proposals mitigate agency problems. [Thomas and Cotter, 2007] highlight that 40% of proposals that pass the vote are

implemented despite their non-binding nature. [Renneboog, Szilagyi, 2011] point out that the "firms that ignore passed proposals have been shown to draw negative press, receive downgrades by rating firms". However, some authors argue that activist shareholders do not necessarily have the 'proper' objectives. Shareholders may have their own agendas [Prevost et al. 2012] or may not have enough information. Some authors argue that shareholder proposals may be harmful for firms [Bainbridge, 2006].

We believe that proposals suit well for the research: a) they are a direct way for involvement; b) they are common as opposed to more rare events as a proxy fight; c) they serve as a reasonably hard measure for involvement. The following approach was used for the analysis. Shareholder-sponsored proposals serve as a metric of shareholders' involvement into governance. Level of shareholders' support for management-sponsored proposals serves as a measure of shareholder support for management. There is a consensus among the researchers on the determinants of selected mechanism. [Karpoff, Malatesta and Walkling, 1996; Thomas, Cotter, 2007] among others use the following set of firm characteristics: 1) firm size, 2) growth, 3) profitability, 4) valuation, 5) leverage, 6) institutional ownership, and 7) insider ownership. Definitions and data sources are provided in the Appendix.

2. Analysis of the models on the levels of shareholder activity showed that shareholders of the firms active in digitalization are in general more involved into the governance of the firms. They are more likely to submit a shareholder-sponsored proposal for voting and submit on average more proposals than the firms that do not implement blockchain technology.

Analysis of impact of digitalization on the likelihood of receiving a shareholder-sponsored proposal showed that even when accounting for control variables, blockchain has a significant positive impact. The results indicate that shareholders of companies committed to digitalization are more active. To test the robustness, a linear regression on the number of shareholder proposals received was run. The results confirm that blockchain has a positive impact. Hence, it is concluded that shareholders of blockchain adopters not only are more likely to submit the proposal, but also submit more proposals.

To ensure absence of endogeneity a set of control regressions was run where instead of blockchain variable for the same period as voting, the value lagged by 1 period was used (e.g., for the 2019 voting 2018 values of blockchain variable was used). The results are summarized in the Table 2. We see that the results are similar to those presented in the first two columns, indicating absence of endogeneity. Since the control variables are relatively standard a dedicated endogeneity checks for them were not run.

The results indicate that shareholders of blockchain adopters are more involved into governance. This indicates that information asymmetry in such firms is less, which is a characteristic of better functioning governance. Hence, we may conclude that digitalization has an improving impact on corporate governance. This result also indicates that shareholders seeing the value generated by digitalization are more prone to actively participate in decisions related to value distribution. This is an

important implication for boards of directors. The boards should encourage management to pursue the digitalization for corporate performance improvement and information asymmetry reduction.

However, the level of shareholders' activity is not sufficient to fully assess the implications of digitalization for corporate governance quality. More evidence is required to assess whether a higher level of shareholder involvement is an indication of more hostility and dissatisfaction with management.

Table 2. Regressions' results on level of shareholders' involvement on overall sample of firms

	Logistic regression on likelihood of receiving a shareholder proposal	**Logistic regression on likelihood of receiving a shareholder proposal** *(endogeneity check)*	**Linear regression on the number of shareholder proposals received**	**Linear regression on the number of shareholder proposals received** *(endogeneity check)*
	At least 1 shareholder proposal	At least 1 shareholder proposal	Number of shareholder proposals	Number of shareholder proposals
Blockchain	0.569*** (0.139)		0.382*** (0.043)	
Blockchain (lag by 1 year)		0.733***(0.202)		0.423***(0.062)
Company size	0.817*** (0.026)	0.814***(0.029)	0.171*** (0.005)	0.176*** (0.006)
Growth rate	-1.560*** (0.237)	-1.206***(0.261)	-0.186*** (0.036)	-0.163*** (0.042)
Profitability	-0.525** (0.240)	-0.514*(0.279)	-0.146*** (0.044)	-0.118** (0.053)
Market to book ratio	0.0001 (0.001)	-0.002(0.003)	-0.0001 (0.0002)	-0.0001(0.001)
Leverage	0.001 (0.002)	0.002 (0.004)	0.001 (0.001)	0.0001 (0.001)
Institutional ownership	-0.175 (0.185)	-0.618*** (0.221)	-0.525*** (0.036)	-0.661*** (0.043)
Insider ownership	0.099 (0.374)	-0.326 (0.454)	-0.189*** (0.065)	-0.381*** (0.083)
sector_energy	0.314 (0.265)	0.089 (0.316)	0.260*** (0.059)	0.205***(0.067)
sector_materials	-0.077 (0.269)	-0.036(0.309)	-0.125** (0.058)	-0.159** (0.066)
sector_industrials	0.546** (0.231)	0.659**(0.268)	0.037 (0.050)	0.031 (0.057)
sector_cons_discr	0.690*** (0.235)	0.730***(0.273)	0.101** (0.051)	0.071 (0.059)
sector_cons_stapl	0.827*** (0.259)	0.769** (0.300)	0.143** (0.061)	0.130* (0.069)
sector_healthcare	0.315 (0.243)	0.343 (0.281)	-0.004 (0.053)	-0.011 (0.061)
sector_finance	-0.208 (0.247)	-0.165 (0.286)	-0.118** (0.050)	-0.148** (0.058)
sector_IT	-0.321 (0.242)	-0.266 (0.279)	-0.054 (0.050)	-0.060 (0.058)
sector_communication	0.526* (0.285)	0.598* (0.329)	0.184*** (0.062)	0.206*** (0.071)
sector_utilities	1.129*** (0.252)	1.074*** (0.290)	0.131** (0.066)	0.038 (0.075)
Constant	-8.781*** (0.339)	-8.428*** (0.388)	-0.635*** (0.057)	-0.543***(0.066)
Observations	10,443	8,033	10,443	8,033
	Log Likelihood = -2,713.648	Log Likelihood = -2,121.759	R^2 = 0.142	R^2 = 0.142
	Akaike Inf. Crit. = 5,465.295	Akaike Inf. Crit.= 4,281.518	Adjusted R^2 = 0.140	Adjusted R^2 = 0.140
			Residual Std. Error (df = 10424) = 0.832	Residual Std. Error (df = 8014) = 0.826
			F Statistic (df = 18; 10424) = 95.604***	F Statistic (df = 18; 8014) = 73.740***

Note: results of the logistics regression on the likelihood of receiving the shareholder-sponsored proposal; results of the linear regression on the number of receiving the shareholder-sponsored proposal; results of the linear regression on the share management-sponsored proposals that pass the meeting. Value in parenthesis next to the coefficients is standard error. Dependent variables: *At least 1 shareholder proposal* is a dummy variable equal to 1 if in the given year the given firm received at least one shareholder-sponsored proposal and 0 otherwise; *Number of shareholder proposals* is the number of shareholder-sponsored proposals received by the firm in a given year; *Share of management proposals passed* is the share of passed management-sponsored proposals at the meeting. Blockchain is the variable reflecting whether the company is engaged in active digitalization in a form of blockchain implementation; *Company size, Growth rate, Profitability, Market to book ratio, Leverage, Institutional ownership, Insider ownership* are control variables reflecting the size, growth rate, profitability, market capitalization, size of the leverage as well as the institutional and insider ownership of the firm; *sector_energy and other* is the set of dummy variables for the main sector of operations of the firm. *p<0.1; **p<0.05; ***p<0.01

3. Analysis of the models of shareholders' hostility showed that shareholders of firms implementing blockchain are not more hostile towards the management. This finding combined with finding 2 suggests that firms active in digitalization indeed have better corporate governance.

To assess the implications of blockchain for the level of shareholders' hostility towards management, a regression was run on the share of management-sponsored proposals passing the voting. The results show that blockchain has a positive impact on this share. Most of the control variables are significant. As before, to ensure the absence of endogeneity we run a control regression where blockchain variable was lagged by 1 period. The results are shown in Table 3.

Table 3. Regression results on level of shareholders' support for management on overall sample of firms

	Linear regression on share of proposals passed	**Linear regression on share of proposals passed** *(endogeneity check)*
	Dependent variable: Share of management proposals passed	
Blockchain	0.009* (0.005)	
Blockchain (lagged by 1 year)		0.014* (0.007)
Company size	0.004*** (0.001)	0.004***(0.001)
Growth rate	0.007 (0.004)	0.005 (0.005)
Profitability	0.004 (0.006)	-0.004 (0.006)
Market to book ratio	-0.00000 (0.00003)	-0.00003 (0.0001)
Leverage	-0.00002 (0.0001)	0.0001 (0.0001)
Institutional ownership	0.023*** (0.004)	0.021***(0.005)
Insider ownership	0.043*** (0.008)	0.042***(0.010)
sector_energy	-0.004 (0.007)	-0.001 (0.008)
sector_materials	0.004 (0.007)	0.002 (0.008)
sector_industrials	0.0004 (0.006)	0.0002 (0.007)
sector_cons_discr	-0.005 (0.006)	-0.006(0.007)
sector_cons_stapl	0.006 (0.008)	0.002 (0.008)
sector_healthcare	0.0002 (0.007)	-0.002 (0.007)
sector_finance	-0.011* (0.006)	-0.011 (0.007)
sector_IT	0.001 (0.006)	-0.002 (0.007)
sector_communication	-0.001 (0.008)	-0.007 (0.008)
sector_utilities	0.011 (0.008)	0.009 (0.009)
Constant	0.916*** (0.007)	0.915*** (0.008)
Observations	10,443	8,033
	$R^2 = 0.018$	$R^2 = 0.017$
	Adjusted $R^2 = 0.017$	Adjusted $R^2 = 0.015$
	Residual Std. Error (df = 10424) = 0.104	Residual Std. Error (df = 8014) = 0.098
	F Statistic (df = 18; 10424) = 10.789***	F Statistic (df = 18; 8014)) = 7.635***

Note: results of the logistics regression on the likelihood of receiving the shareholder-sponsored proposal; results of the linear regression on the number of receiving the shareholder-sponsored proposal; results of the linear regression on the share management-sponsored proposals that pass the meeting. Value in parenthesis next to the coefficients is standard error. Dependent variables: *At least 1 shareholder proposal* is a dummy variable equal to 1 if in the given year the given firm received at least one shareholder-sponsored proposal and 0 otherwise; *Number of shareholder proposals* is the number of shareholder-sponsored proposals received by the firm in a given year; *Share of management proposals passed* is the share of passed management-sponsored proposals at the meeting. Blockchain is the variable reflecting whether the company is engaged in active digitalization in a form of blockchain implementation; *Company size, Growth rate, Profitability, Market to book ratio, Leverage, Institutional ownership, Insider ownership* are control variables reflecting the size, growth rate, profitability, market capitalization, size of the leverage as well as the institutional and insider ownership of the firm; *sector_energy and other* is the set of dummy variables for the main sector of operations of the firm.
*p<0.1; **p<0.05; ***p<0.01

The results indicate that shareholders of firms active in digitalization are not more hostile towards the management. This finding combined with the Finding 2 leads us to conclusion that not only the shareholders are more involved into governance, but the higher level of involvement is not driven by dissatisfaction with the management's actions. Hence, it is confirmed that digitalization in the form of blockchain implementation has an improving effect on the corporate governance mechanisms. This result has an important practical implication for the management. It may be concluded that management should pursue the digitalization efforts without a fear of facing more hostility from the shareholders.

4. Analysis of sector-specific models showed that there is a synergetic effect in mitigation of agency conflict between blockchain-based digitalization and business model innovation in a form of ecosystem business models. Analysis of the models of shareholder activity showed that the level of shareholder's involvement in corporate governance is significantly affected mostly in sectors stronger impacted by business model innovation. Analysis of the models of the level of shareholders' hostility showed that the level of hostility towards the management is equally not affected across all the sectors.

As mentioned earlier, data on business models at the firm level is not available yet. Therefore, to assess whether digitalization has a stronger impact when coupled with business model innovation, an analysis by sector is conducted: firstly, of shareholders' involvement in governance and then of shareholders' hostility towards management. Results are presented in Tables 4, 5, 6.

Results of likelihood of receiving at least one shareholder proposal differ by sector. Only in three sectors does the blockchain variable have a significant impact on the likelihood of receiving a shareholder-sponsored proposal. At the same time, there is no significant impact in several sectors where we had expected it (Finance, Consumer, Healthcare). As in the previous subsection, to verify the robustness of the results, a set of regressions on the number of shareholder-sponsored proposals received was run. Blockchain variable is significant in most sectors affected by ecosystems. The only exceptions where we do not see the expected impact are in the consumer staples sector, where there is no significant impact, and industrials, where there is a significant impact, yet ecosystems are relatively less spread. Significance of the control variables differs by sector, indicating that analysis by sector requires dedicated specifications by sector.

Overall, it can be concluded that digital transformation has the strongest impact on the level of shareholder activity in the sectors affected by the ecosystems. This shows that information asymmetry reduction is the strongest when digitalization is coupled with business mode innovation.

To test whether the conclusion holds for the level of the conflict, the final set of regressions on the share of management-sponsored proposals that pass the voting was run. The results are provided in the Table 6. Blockchain variable is significant in neither of the sectors analyzed. This leads to conclusion that the results that received when analyzing the overall sample hold on the sector level as well – the level of shareholder hostility is not affected by digitalization.

Table 4. Results of regression on the likelihood of receiving a shareholder-sponsored proposal

Results of logistic regression by sector

	Dependent variable:										
	At least 1 shareholder proposal										
	IT	Communications	Finance	Consumer discretionary	Consumer Staples	Health care	Industrials	Energy	Materials	Utilities	Real estate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Blockchain	0.587*	1.275**	0.208	0.364	0.154	0.600	1.096***	0.701	1.976*	-0.952	-11.547
	(0.304)	(0.608)	(0.321)	(0.414)	(0.535)	(0.494)	(0.353)	(1.057)	(1.139)	(0.927)	(882.744)
Company size	0.829***	0.722***	1.017***	0.706***	0.668***	0.832***	1.083***	0.895***	1.133***	1.080***	-0.047
	(0.079)	(0.128)	(0.075)	(0.064)	(0.089)	(0.079)	(0.078)	(0.122)	(0.198)	(0.199)	(0.190)
Growth rate	-3.645***	-1.010	-0.466	-2.795***	-1.997	-1.321*	-0.161	-3.620***	-3.107*	-7.868***	0.435
	(0.933)	(1.403)	(0.433)	(0.886)	(1.266)	(0.686)	(0.675)	(0.982)	(1.791)	(2.770)	(0.967)
Profitability	-0.603	2.011	-0.897	0.746	-1.065	-0.182	-1.034	0.407	-6.126***	2.724	-1.303
	(0.647)	(1.667)	(0.653)	(0.915)	(1.020)	(0.566)	(0.810)	(0.730)	(1.727)	(1.765)	(0.957)
Market to book ratio	-0.050***	0.052	-0.005	-0.0003	-0.008	0.011	-0.0004	-0.205	-0.125**	-0.291	0.044
	(0.017)	(0.044)	(0.021)	(0.008)	(0.010)	(0.009)	(0.004)	(0.142)	(0.056)	(0.222)	(0.094)
Leverage	0.022	-0.030	0.033**	0.001	0.121**	-0.062*	-0.014	0.214**	0.162*	0.467*	0.252*
	(0.066)	(0.079)	(0.014)	(0.008)	(0.059)	(0.033)	(0.023)	(0.100)	(0.083)	(0.255)	(0.144)
Institutional ownership	-0.164	0.932	-0.480	0.454	-1.281**	-0.483	-0.700	1.629	0.780	1.063	-0.649
	(0.617)	(0.811)	(0.492)	(0.479)	(0.590)	(0.638)	(0.501)	(1.172)	(1.001)	(1.086)	(0.939)
Insider ownership	-1.233	-2.508	0.140	0.818	-0.601	-1.408	1.288	4.421***	-2.001	-11.320	-6.174*
	(1.446)	(1.835)	(0.987)	(0.823)	(1.010)	(1.802)	(0.938)	(1.693)	(3.908)	(26.337)	(3.288)
Constant	-8.740***	-8.798***	-10.566***	-7.823***	-5.792***	-8.411***	-10.169***	-11.000***	-11.153***	-11.932***	-1.227
	(0.891)	(1.315)	(0.681)	(0.691)	(0.857)	(0.911)	(0.799)	(1.751)	(1.878)	(2.168)	(1.205)
Observations	1,497	380	2,269	1,354	460	1,083	1,745	462	533	285	375
Log Likelihood	-288.595	-88.777	-366.608	-457.684	-192.305	-286.216	-450.782	-118.949	-124.836	-121.482	-95.560
Akaike Inf. Crit.	595.189	195.554	751.217	933.369	402.610	590.432	919.565	255.898	267.673	260.964	209.120

Note: results of the logistics regression on the likelihood of receiving the shareholder-sponsored proposal. Value in parenthesis next to the coefficients is standard error. Dependent variable *At least 1 shareholder proposal* is a dummy variable equal to 1 if in the given year the given firm received at least one shareholder-sponsored proposal and 0 otherwise; *Number of shareholder proposals* is the number of shareholder-sponsored proposals received by the firm in a given year; Blockchain is the variable reflecting whether the company is engaged in active digitalization in a form of blockchain implementation; *Company size, Growth rate, Profitability, Market to book ratio, Leverage, Institutional ownership, Insider ownership* are control variables reflecting the size, growth rate, profitability, market capitalization, size of the leverage as well as the institutional and insider ownership of the firm *p<0.1; **p<0.05; ***p<0.01

Table 5. Results of regression on the number of shareholder-sponsored proposals

Results of linear regression by sector

	Dependent variable:										
	Number of shareholder proposals										
	IT	Communications	Finance	Consumer discretionary	Consumer Staples	Health care	Industrials	Energy	Materials	Utilities	Real estate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Blockchain	0.184***	0.972***	0.623***	0.428**	0.076	0.593***	0.280***	0.632	0.148	-0.381	0.176
	(0.064)	(0.218)	(0.064)	(0.168)	(0.296)	(0.127)	(0.088)	(0.668)	(0.205)	(0.330)	(0.858)
Company size	0.133***	0.230***	0.135***	0.163***	0.275***	0.136***	0.216***	0.342***	0.059***	0.295***	-0.108**
	(0.011)	(0.033)	(0.008)	(0.018)	(0.033)	(0.011)	(0.011)	(0.039)	(0.021)	(0.046)	(0.043)
Growth rate	-0.432***	0.216	-0.059	-0.274	-0.635*	-0.068	-0.369***	-0.455	-0.119	-2.027**	0.293
	(0.096)	(0.323)	(0.041)	(0.179)	(0.361)	(0.052)	(0.103)	(0.285)	(0.168)	(0.852)	(0.233)
Profitability	-0.085	0.314	-0.266***	-0.182	-0.442	0.077	-0.334**	-0.330	-0.319	1.614***	0.074
	(0.085)	(0.355)	(0.084)	(0.287)	(0.410)	(0.063)	(0.132)	(0.222)	(0.207)	(0.543)	(0.219)
Market to book ratio	-0.006**	0.056***	-0.005	-0.001	-0.008**	-0.0002	0.001	-0.070*	-0.005	-0.180**	-0.015
	(0.002)	(0.013)	(0.004)	(0.003)	(0.003)	(0.001)	(0.001)	(0.041)	(0.008)	(0.070)	(0.025)
Leverage	0.008	-0.086***	0.003*	0.002	0.075**	-0.008	-0.002	0.015	0.007	0.354***	0.087**
	(0.009)	(0.021)	(0.002)	(0.003)	(0.030)	(0.005)	(0.003)	(0.045)	(0.011)	(0.082)	(0.040)
Institutional ownership	-0.514***	-0.501**	-0.292***	-0.199	-0.948***	-0.506***	-0.832***	-1.187***	0.047	-0.703**	-0.113
	(0.075)	(0.239)	(0.049)	(0.127)	(0.251)	(0.083)	(0.077)	(0.324)	(0.117)	(0.327)	(0.230)
Insider ownership	-0.180	-0.375	-0.027	0.238	-0.097	-0.395**	-0.320**	-0.223	0.267	2.153**	-0.788*
	(0.133)	(0.344)	(0.094)	(0.232)	(0.323)	(0.174)	(0.141)	(0.572)	(0.298)	(1.072)	(0.443)
Constant	-0.375***	-1.109***	-0.644***	-0.752***	-1.039***	-0.406***	-0.643***	-0.973***	-0.318**	-2.097***	1.023***
	(0.067)	(0.234)	(0.052)	(0.139)	(0.265)	(0.084)	(0.082)	(0.301)	(0.149)	(0.437)	(0.286)
Observations	1,497	380	2,269	1,354	460	1,083	1,745	462	533	285	375
R^2	0.129	0.296	0.187	0.087	0.175	0.204	0.214	0.170	0.023	0.293	0.075
Adjusted R^2	0.124	0.280	0.184	0.081	0.160	0.198	0.211	0.155	0.008	0.273	0.055
Residual Std. Error	0.649 (df = 1488)	1.130 (df = 371)	0.551 (df = 2260)	1.002 (df = 1345)	1.268 (df = 451)	0.608 (df = 1074)	0.679 (df = 1736)	1.586 (df = 453)	0.571 (df = 524)	0.899 (df = 276)	0.851 (df = 366)
F Statistic	27.454*** (df = 8; 1488)	19.463*** (df = 8; 371)	65.036*** (df = 8; 2260)	15.955*** (df = 8; 1345)	11.966*** (df = 8; 451)	34.365*** (df = 8; 1074)	59.181*** (df = 8; 1736)	11.558*** (df = 8; 453)	1.535 (df = 8; 524)	14.320*** (df = 8; 276)	3.697*** (df = 8; 366)

Note: results of the linear regression on the number of received shareholder-sponsored proposal. Value in parenthesis next to the coefficients is standard error. Dependent variable *Number of shareholder proposals* is the number of shareholder-sponsored proposals received by the firm in a given year. Blockchain is the variable reflecting whether the company is engaged in active digitalization in a form of blockchain implementation; *Company size*, *Growth rate*, *Profitability*, *Market to book ratio*, *Leverage*, *Institutional ownership*, *Insider ownership* are control variables reflecting the size, growth rate, profitability, market capitalization, size of the leverage as well as the institutional and insider ownership of the firm. *p<0.1; **p<0.05; ***p<0.01

Table 6. Results on the share of management-sponsored proposals that pass the voting

Results of regression on share of management-sponsored proposals passed by sector

	Dependent variable:										
	Share of management proposals passed										
	IT	Communications	Finance	Consumer discretionary	Consumer Staples	Health care	Industrials	Energy	Materials	Utilities	Real estate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Blockchain	-0.001	0.015	0.016	0.004	0.017	0.001	-0.001	0.041	0.008	0.006	0.008
	(0.009)	(0.016)	(0.018)	(0.015)	(0.017)	(0.016)	(0.011)	(0.039)	(0.024)	(0.019)	(0.074)
Company size	0.004***	0.002	0.005*	0.006***	0.002	0.002	0.006***	0.003	0.002	0.002	0.008**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.004)
Growth rate	-0.003	-0.007	0.017	-0.027	-0.008	0.006	0.028**	-0.032*	0.016	0.098*	-0.012
	(0.013)	(0.024)	(0.012)	(0.016)	(0.021)	(0.006)	(0.013)	(0.017)	(0.020)	(0.050)	(0.020)
Profitability	0.020*	0.002	-0.046*	-0.027	0.024	0.006	-0.054***	0.073***	-0.019	-0.037	-0.007
	(0.011)	(0.026)	(0.024)	(0.026)	(0.024)	(0.008)	(0.016)	(0.013)	(0.024)	(0.032)	(0.019)
Market to book ratio	-0.0003	-0.001	0.001	-0.001*	-0.0001	-0.0001	0.00001	-0.002	-0.0003	-0.0004	0.001
	(0.0003)	(0.001)	(0.001)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.002)	(0.001)	(0.004)	(0.002)
Leverage	-0.0003	0.002	0.001	0.0004	0.001	0.0003	-0.00003	0.005*	-0.00003	-0.003	-0.004
	(0.001)	(0.002)	(0.001)	(0.0003)	(0.002)	(0.001)	(0.0003)	(0.003)	(0.001)	(0.005)	(0.003)
Institutional ownership	-0.011	0.016	0.078***	-0.016	-0.010	0.010	0.015	-0.014	0.012	0.031	-0.007
	(0.010)	(0.018)	(0.014)	(0.011)	(0.014)	(0.010)	(0.009)	(0.019)	(0.014)	(0.019)	(0.020)
Insider ownership	0.020	-0.024	0.159***	-0.027	0.001	0.013	0.009	-0.016	0.078**	-0.002	0.001
	(0.018)	(0.025)	(0.027)	(0.021)	(0.019)	(0.022)	(0.017)	(0.034)	(0.035)	(0.063)	(0.038)
Constant	0.937***	0.946***	0.857***	0.940***	0.960***	0.942***	0.917***	0.935***	0.941***	0.952***	0.916***
	(0.009)	(0.017)	(0.015)	(0.013)	(0.015)	(0.010)	(0.010)	(0.018)	(0.017)	(0.026)	(0.025)
Observations	1,497	380	2,269	1,354	460	1,083	1,745	462	533	285	375
R^2	0.016	0.023	0.036	0.016	0.010	0.010	0.023	0.090	0.012	0.045	0.032
Adjusted R^2	0.011	0.002	0.033	0.010	-0.007	0.002	0.019	0.074	-0.003	0.018	0.011
Residual Std. Error	0.086 (df = 1488)	0.084 (df = 371)	0.159 (df = 2260)	0.090 (df = 1345)	0.073 (df = 451)	0.075 (df = 1074)	0.083 (df = 1736)	0.093 (df = 453)	0.066 (df = 524)	0.053 (df = 276)	0.073 (df = 366)
F Statistic	3.086*** (df = 8; 1488)	1.088 (df = 8; 371)	10.610*** (df = 8; 2260)	2.732*** (df = 8; 1345)	0.585 (df = 8; 451)	1.337 (df = 8; 1074)	5.125*** (df = 8; 1736)	5.611*** (df = 8; 453)	0.779 (df = 8; 524)	1.640 (df = 8; 276)	1.503 (df = 8; 366)

Note: results of the linear regression on the share management-sponsored proposals that pass the meeting. Value in parenthesis next to the coefficients is standard error. Dependent variable *Share of management proposals passed* is the share of passed management-sponsored proposals at the meeting; Blockchain is the variable reflecting whether the company is engaged in active digitalization in a form of blockchain implementation; *Company size*, *Growth rate*, *Profitability*, *Market to book ratio*, *Leverage*, *Institutional ownership*, *Insider ownership* are control variables reflecting the size, growth rate, profitability, market capitalization, size of the leverage as well as the institutional and insider ownership of the firm. *p<0.1; **p<0.05; ***p<0.01

Contribution

1. For the first time, implications of a firm's involvement into blockchain for corporate value creation were quantitatively analyzed using a specially designed methodology that permitted to fill the gaps in the existing research literature on blockchain. Blockchain involvement was demonstrated to be a significant driver of corporate governance quality and therefore shareholder value creation.

2. For the first time, digitalization was empirically demonstrated to be a significant determinant of efficiency of proposals submitted for annual shareholders' meetings as a governance mechanism.

3. For the first time, the implications of digitalization for the level of shareholder involvement in the corporate governance were quantitatively assessed. Digitalization was proven to have a significant positive impact on the level of shareholder involvement, which indicates a better governance in a firm.

4. For the first time, the implications of digitalization for the level of shareholders' hostility towards management were quantitatively assessed. The digitalization was shown to have no impact on the level of hostility.

5. For the first time, the choice of a business model was analyzed as a driver of effectiveness of blockchain implementation. For the first time it was quantitatively shown that digitalization has maximum positive effect for corporate governance when implemented together with ecosystem-based business models. These models therefore, "increase the leverage" created by digitalization to improve corporate governance.

Scientific and Practical Significance

The research results contribute to the conceptual and practical literature on relationship between shareholders and management, corporate governance, and roles of boards of directors and management.

New methodological and empirical approaches to analyze the agency conflict and effectiveness of corporate governance mechanisms designed to mitigate it were proposed and empirically tested.

The first empirical evidence on the implications of digitalization for corporate governance was obtained. The evidence proves that digitalization has a positive impact on the corporate governance mechanisms' efficiency.

For the first time business model innovation was suggested and empirically tested as a driver of blockchain implementation's efficiency for corporate governance improvement.

The first empirical evidence, confirming the existence of a mutually reinforcing influence between blockchain technology and ecosystem-based business models in increasing the corporate governance mechanisms' efficiency was obtained.

The results have important implication for management and boards of directors. Overall, they indicate that leveraging the emerging transformative digital technologies is an opportunity that should not be missed out as it is beneficial not only for corporate performance, but also for governance quality. Firstly, we see that active digitalization creates corporate environment where shareholders are more

involved in governance of their firms. Hence, there are fewer chances for information asymmetry abuse. This results also indicates that shareholders see value generated by digitalization and hence are more prone to participate in decisions related to value distribution. This is a particularly important input for boards of directors.

Secondly, we see that while shareholders become more active, they do not become more hostile towards management as a result of active digitalization despite the risks associated with innovative technologies. This is a particularly important conclusion for management that may be hesitant to pursue the new opportunities due to the potential negative attitude of shareholders.

Thirdly, we demonstrated that from the corporate governance perspective positive impact of digitalization is maximized when it is applied jointly with business model innovation. This means that management seeking to maximize the shareholder value should consider leveraging both opportunities.

Research limitations

The research has a number of limitations. Firstly, a general proxy for digital transformation is used – any application of blockchain technology. The analysis would have been more accurate if only applications specific to corporate governance were considered since blockchain by itself is just a basic technology, not a governance mechanism and analysis of specific applications as well as separate corporate governance components or ratings would be beneficial. Secondly, blockchain is just one example of a technology and the analysis would have benefited from a robustness check with other technologies. Thirdly, the analysis would benefit from more proxies for digital transformation as well as exploration of potential non-linear relationships between blockchain and corporate governance. Fourthly, since an explicit proxy at corporate level for the adoption of an ecosystem-based business model is not available, the analysis remained at the sector level. Even in sectors unaffected overall by platform business models, individual companies are adopting the platform business model. Moreover, platform business models implementation may be an indication of a generally more active firm, with more active shareholders. Fifthly, there may be other unobserved corporate characteristics such as certain actions taken by the management that result in higher numbers of shareholder-sponsored proposals, not currently captured by the analysis. Sixthly, once the data becomes available, the set of control variables could be further extended to include parameters as concertation of ownership and composition of a board of directors as well as additional robustness checks. Seventhly, the cause-effect relationship needs further exploration. Investments in digital technologies are typically long-term and the analysis is currently limited to relatively short-term period. Eighthly, due to data availability the analysis is based on a sample of US-traded firms. Expanding the analysis to other geographies and other research methods (e.g., case studies) may provide additional important insights. Nevertheless, we believe that the analysis is a valuable contribution to the literature on both corporate governance and business digitalization and intend to overcome the identified limitations in the subsequent research.

Approbation of Research Results

The results have been presented in the following conferences:

1. Report “Do shareholders see value generated by digitalization and ecosystem business models? Empirical evidence” on AMEC 2021, Dec. 2021
2. Report “What impact do digitalization and ecosystem-based business models have on the principal-agent conflict?” on 18th EIASM workshop on corporate governance, Oct. 2021
3. Report “Do digitalization and ecosystem business models complement each other? Corporate governance perspective” on 37th EBES Conference, Oct. 2021
4. Report “Do digitalization and ecosystem-based business model mitigate the principal-agent conflict?” on World Finance Conference, Sep. 2021
5. Report “Does Blockchain Investment Mitigate or Intensify the Principal-Agent Conflict in a Firm?” on 2021 EURAM annual conference, Jun. 2021
6. Report “What Impact does Blockchain have on the Principal-agent Conflict?” World finance & banking symposium, Dec. 2020
7. Report “Digital-driven business transformation and its impact on the principal-agent conflict. Empirical evidence EURAM 2020 online conference, Dec. 2020
8. Report “Impact of digital transformation on Corporate Governance. Empirical evidence” on AMEC 2020, Nov. 2020
9. Report “Impact of blockchain on the principal-agent conflict” on Boca Corporate Finance and Governance Conference, Florida Atlantic University, Nov. 2020
10. Report “Does corporate governance benefit from the artificial intelligence? review of the recent studies” on the 3rd Workshop on governance and management of digitalization, Nov. 2020
11. Report “Impact of blockchain on the principal-agent conflict” on the 17TH EIASM Workshop on corporate governance, held in online, Nov. 2020
12. Report “Digital-driven business transformation and its impact on corporate governance mechanisms” on EURAM Early Career Colloquium, Mar. 2020
13. Report “The impact of digital transformation of business on corporate governance” on the 2nd EIASM Workshop on governance and management of digitalization, Brussels, Oct. 2019.

In addition, the work was presented at several PhD workshops:

1. Report “Impact of blockchain on the principal-agent conflict” on British Academy of Management 2020 Doctoral symposium, Sep. 2020
2. Report “Impact of blockchain technology on corporate governance. Preliminary empirical evidence" on PhD-Workshop "Financial markets and corporate strategies:” part of XXI April International Academic Conference of HSE, May 2020

3. Report “Digital transformation of business and its impact on corporate governance mechanisms” on AMEC PHD workshop in applied economics, Sep. 2019.

Publications

Ivaninskiy I. The impact of digital transformation of business on corporate governance. overview of recent studies // Journal of Corporate Finance Research. 2019. Vol. 3. P. 35-47 https://doi.org/10.17323/j.jcfr.2073-0438.13.3.2019.35-47

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Ivaninskiy I., Ivashkovskaya. I. Are blockchain-based digital transformation and ecosystem-based business models mutually reinforcing? The principal-agent conflict perspective. // Eurasian Business Review. 2022, Volume 12, Issue 2, June 2022.
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Appendix. Variables used in the research

Variable	Description
Blockchain	Dummy variable equal to 1 if a company has a confirmed blockchain initiative, such as participation in a consortium or development of a in-house blockchain solution [Source: open sources, internet search]
At least 1 shareholder proposal	Dummy variable equal to 1 if a company received at least one shareholder-sponsored proposal for the annual meeting [source: ISS voting database]
Number of shareholder proposals	Number of shareholder-sponsored proposals received by a firm for the annual meeting [source: ISS voting database]
Share of management proposals passed	% of passed management-sponsored proposals at the meeting [source: ISS voting database]
Company size	Natural logarithm of the company's market capitalisation [Source: CapitalIQ]
Growth rate	Compound annual growth rate of revenues for 3 years prior to the meeting[Source: CapitalIQ]
Profitability	Company's EBITDA divided by the company's revenues [Source: CapitalIQ
Market to book ratio	Ratio of company's market capitalisation to the company's book value of equity [Source: CapitalIQ]
Leverage	Ratio of company's total debt to the total book value of equity [Source: CapitalIQ]
Institutional ownership	Fraction of company's shares owned by institutions [Source: CapitalIQ]
Insider ownership	Fraction of company's shares owned by company's insiders [Source: CapitalIQ]
Sector dummies	Set of variables identifying the main sector of operations for a firm (Energy, Materials, Industrials, Consumer discretionary, Consumer staples, Healthcare, Financials, IT, Communication services, Utilities, Real Estate) as reported in CapitalIQ database [Source: CapitalIQ]