

# The Strategic Role of Top Management Team (TMT) Digital Orientation in Digital Transformation of Manufacturing Industry

Muhyudi Muhyudi<sup>1,\*</sup>, Mira Maulida<sup>1</sup>, Komang Aryasa<sup>1</sup>

<sup>1</sup>Swiss German University, Tangerang 15143, Indonesia

\*Corresponding author. Email: muhyudimuhyudi@gmail.com

## ABSTRACT

Indonesia's manufacturing industry accounts about 20% of the country's GDP, while the country has also an opportunity to capture a bigger share of global manufacturing activity. The major challenge is productivity. Thus, Indonesian manufacturing industry needs to step up its productivity through transformation that known as Industry 4.0. Meanwhile, the state-of-art of manufacturing industry also transforms network capabilities of 5G, the greater push for IoT, Industry 4.0, machine learning and predictive analytics. The emergence of the "digital age" fundamentally challenges the nature and functioning of multi-business firms, in terms of their corporate strategies as well as theory of the firm. Furthermore, the impact of the coronavirus disease (COVID-19) pandemic is unprecedented. At a firm level, the crisis has been hugely disruptive and complex that requires further stimulated firms into action by increasing their awareness and action to accelerate digital transformation. Digital transformation has become a strategic imperative on leadership agendas, but there is lack of empirical research that examine how firms are digitally transformed. Digital transformation is fundamentally not about technology, but about strategy. It implies shifts in organizational structures and cultures, such as shifting to data-driven, new way of decision-making, interdisciplinary collaboration, agility, and improvisation. Amidst the digital transformation research, it is rare to find that focused on the strategic role the Top Management Team (TMT) as the main driver of the integrated process. The objective of our study is to explore the role of TMT digital orientation in optimizing digitalization, digital innovation capability, and business model innovation capability to achieve optimum firm performance. This study combines the dynamic capability and open innovation framework under the umbrella of resource-based view (RBV) theory relates to upper-echelon theory. We use structural equation model utilizes data from 195 of mid-to top- level managers in manufacturing industry in Indonesia. We find that TMT digital orientation plays a strategic role toward firm performance through digitalization, digital innovation capability, and business model innovation capability. Furthermore, our finding shows the key elements of TMT digital orientation are: 1) setting formal context of digitalization, 2) leading change, and 3) understanding digitalization. Our study contributes to the strategic management literature relates to the top managers' contribution in the digital age, and its implications for strategy and organizational change, particularly the digital transformation in manufacturing industry.

**Keywords:** *Top Management Team, Digital Orientation, Digital Transformation, Digitalization.*

## 1. INTRODUCTION

Indonesia's manufacturing industry accounts about 20% of the country's GDP, while the country has also an opportunity to capture a bigger share of global manufacturing activity. The major challenge is productivity [1]. Thus, Indonesian manufacturing industry needs to step up its productivity through transformation that known as Industry 4.0. Meanwhile,

the state-of-art of manufacturing industry also transforms network capabilities of 5G, the greater push for IoT, Industry 4.0, machine learning and predictive analytics. Nevertheless, the challenges around the COVID-19 pandemic have further stimulated firms into action by increasing their awareness and action in accelerating digital transformation.

Digital transformation has become a strategic imperative on leadership agendas [2] [3], but there is lack of empirical research that examine how firms are digitally transformed [4]. Digital transformation is defined as organizational change that is triggered and shaped by the wide-spread diffusion of digital technologies [5]; other defines as ‘a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm [6]. Rogers (2016) argues that “digital transformation is fundamentally not about technology, but about strategy” [7]. Refers to its strategic importance [8], it presumes that digital transformation affects and challenges managers across industries and contexts [9], [10].

Top managers have decisive role of strategic decision making in digital transformation practice. It has mainly been discussed within upper echelons theory [11]. Previous scholars find that top managers have a significant impact on firm strategies and performance [12]-[14]. Rogers (2016) argues that, in digital transformation, Top Management Team (TMT) must find ways to innovate business model that optimize customer needs and experiences [7].

There are multiple reasons for why creating a clear role in the TMT to cope with digital transformation is important [15]. First, digital transformation relates to corporate strategy shifting toward discrepancy value creation from digital resources [16]. Firms should adjust their core competencies that creates substantial strategic challenges. This is the reason why digital transformation should be placed at the top of the management agenda [17]. Second, digital transformation creates time pressures due to market demand and also new forms of competitions. Third, digital transformation beyond the boundaries of functional and divisional [18], thus it is the role of TMT to orchestrate the overall endeavour [19]. Simultaneously, Hanelt et al. (2021) provides a multi-dimensional digital transformation framework which create organizational designs that enable continuous adaptation [5];. Nevertheless, Schneider and Kokshagina (2021) suggests further attention from researchers in the overview of skills required for digital transformation, including TMT [20].

This study aims to investigate the role of TMT digital orientation in optimizing digitalization, digital innovation capabilities, and business model innovations capabilities to achieve optimum firm performance, in a framework of digital transformation. Our study enriches the strategic management and also the upper echelon theory, that focusing on the role of TMT digital orientation to achieve firm competitive advantages through dynamic capabilities and open innovation framework. From managerial point of view, our model can be used by firms which have plan to do digital transformation as a strategy for enhancing firm competitiveness through innovation and digitalization.

The basic theory of this study is Resource-based theory (RBT) that has become one of dominant perspective in strategic management as a basis of firm’s competitive advantage [21], while firm capabilities are rooted in the ability of the firms to reconfigure and recombine organizational resources [22]. Therefore, Helfat (2000), Helfat and Peteraf (2003), and Teece et al. (2014) support the idea of changing firm capabilities over time, including Dynamic Capabilities (DC) and technological change, so called “dynamic RBV” [23]-[25]. Given the disruptive nature of digitalization, Warner and Wager (2019) argues that the DC framework is a powerful lens to examine the digital transformation of the firms [26].

### ***1.1. Dynamic Capabilities and Open Innovation Framework for Digital Transformation***

Helfat et al. (2007) defines DC as the capacity of a firm to purposely create, extend, or modify its resource base; that consists: (1) sensing opportunities (and threats), (2) seizing opportunities, and (3) transforming the firm’s business model and extend resource base. DC are innovation based and provide the capacity to create, extend, and modify a firm’s resource base [27]. Thus, this study is also influenced by Open Innovation (OI) framework. Tynnhammar (2017) defines OI as knowledge sharing across organization, as part of a business model during development process [28] It is vital to develop firm’s innovation capabilities in responding competitive dynamic environment for firm’s sustainable competitive advantage [29] Innovation capabilities is defined as the ability to transform knowledge and ideas into new products, processes and systems to achieve effective performance [30].

In the context of DC for digital transformation, sensing and seizing capabilities help to create and discover opportunities; but to execute a digital strategy, firms need transforming capabilities to optimize full potential of strategic change [18], [31]. Dong et al. (2016) argues that firm requires to build sensing capabilities that use technologies in generating and explaining unpredictable events and/or unexpected trends [32]. In line, Nylén and Holmström (2015) mentions that to pursuit digital innovation, firms require sensing capabilities in digital evolution scanning to gather information through updated digital devices, supported by emerging user behaviours [33]. Further, Day and Schoemaker (2016) posits that “seizing” is an experimental capability that supports action and commitment by using techniques to balance risk and reward effectively, including digitalization [34]. Digitalization has encouraged firms to seize opportunities by (1) decoupling (i.e., regulating asset specificity of power relations), (2) disintermediation (i.e., reducing the power of established intermediaries), and (3) the generativity (i.e., unprompted innovative outputs) of existing value chains, that create radical business model innovations [35].

### **1.2. Upper Echelon Perspective and the Role of TMT Digital Orientation in Digital Transformation**

The upper echelons perspective introduced by Hambrick and Mason (1984) states that strategic decisions in firms are a consequence of executives' values and preferences and that these values and preferences can be predicted on the basis of observable characteristics like age, tenure and education [11]. As a consequence, these characteristics should influence a firm's strategic posture such as digital orientation. Since the emergence of the upper echelons perspective, studies have been done in the effect of executives, especially the Chief Executive Officer (CEO) [36], [37], Chief Digital Officer (CDO) [15] [43], Chief Strategy Officer (CSO) [38], but also the entire TMT [39], [40] on firm performance and on the strategic positioning of firms, such as digital transformation.

Wrede et al., (2020) finds that high-level managers respond to the digital transformation through accomplishing three key movements: know-how digitalization, placing the formal context for digitalization, and main alternate [41]. In fact, TMT plays a critical role in firms' digital transformation. Previously, DeLomana et al. (2019) introduces the construct of digital orientation and develops a theoretical model that examines how TMT's composition determines firm's digital orientation. Digital orientation is defined as a firm's strategic orientation to foster the enablement and usage of digital technologies in products and services for the customer and to digitalize the firm's internal and inter-firm processes and infrastructure to an effort to achieve competitive advantage [42]. In this study, TMT Digital Orientation is measured by: understanding digitalization, setting the formal context of digitalization, and leading change [43].

Previous literatures posit that TMTs promote higher level digital transformation through TMT digital orientation of the firm [42], [43] towards effective digitalization [44]–[46], digital innovation capabilities [41][47]–[52], and business model innovation capabilities [53]–[55]. Nonetheless, the logic of search breadth further motivates our hypothesis on TMT digital orientation:

*Hypothesis 1 (H1): Greater TMT digital orientation positively increases effective digitalization*

*Hypothesis 2 (H2): Greater TMT digital orientation positively increases firm's digital innovation capabilities*

*Hypothesis 3 (H3): Greater TMT digital orientation positively increases firm's business model innovation capabilities*

### **1.3. Digitalization**

An effective digitalization explains the synchronization of business and IT strategy of an organization and the incorporation of information technology into the business strategy [56]. Digitalization is defined as the phenomenon of transforming analogue information into digital language; which, in turn, would enhance business relationships between client and firms, bringing introduced cost to the entire economy and community [57]. In this study, digitalization is measured by: 1) digital technology identification, 2) IT adoption, 3) IT adaptation, 4) IT development, and 5) Innovative Digital Technology Management [58].

Previous studies posit that digitalization relates to digital innovation capabilities [59], [60] and business model innovation capabilities [54], [61]. Therefore, we hypothesize:

*Hypothesis 4 (H4): The higher effectiveness of digitalization positively increases firm's digital innovation capabilities*

*Hypothesis 5 (H5): The higher effectiveness of digitalization positively increases firm's business model innovation capabilities*

### **1.4. Digital Innovation Capabilities**

In the digitalization era, firms need to have a transformative navigation impact of digital technologies [60], [62] in dealing with innovative digital technologies as part of organizational change process, named digital transformation [58]. Thus, this study is also influenced by the Open Innovation (OI) framework. Tynnhammar (2017) defines OI as knowledge sharing across organizational borders, as part of a business model with a variety of working partners during development process. It is vital to develop firm's innovation capabilities [28] in responding to a competitive dynamic environment for firm's sustainable competitive advantage. Lawson and Samson (2001) defines innovation capabilities as the ability to transform knowledge and ideas into new products, processes and systems to achieve effective performance. Accordingly, digital innovations require dedicated capabilities that purposely focus on the tasks and activities related to digital innovations development and management [30].

Digital Innovation Capabilities (DIC) is defined as organization's ability to create novel digital products and services, organizational processes and structures, or business models through the innovative use of digital technologies [60]. In this study, DIC is measured by: 1) digital evolution, 2) digital infrastructure, 3) digital strategy, and 4) IT business partnership [60]. Previous researches argue that digital innovation capabilities

relates to business model innovation capabilities [63], [64], and also firm performance [65]–[67]. Thus, we hypothesize that:

*Hypothesis 6 (H6): Greater firm's digital innovation capabilities positively increases firm's business model innovation capabilities*

*Hypothesis 7 (H7): Greater firm's digital innovation capabilities positively increases firm performance*

### **1.5. Business Model Innovation Capabilities**

A business model articulates how a firm creates and promises cost to customers. Foss and Saebi (2018) and Teece (2010) argue that the business model and business model innovation are basically about the firm's fee advent, transport and seize mechanisms [68] [69]. Foss and Saebi (2018) defines Business Model Innovation Capabilities (BMIC) as realignment of activities, relations, routines, and contracts which results in a new configuration of how the firm creates and captures value that is the new to the product/service market in which the firm competes [68]. In this study, BMIC is measured by: 1) sensing customer needs, 2) sensing technological conceptualizing and experimenting, 4) collaborating, and 5) business model innovation strategies [70]. In theory, the key factor of business models is complementarity between those mechanisms; while business model innovation is novel adjustments of complementarity to enhance firm performance [71]–[73]. So, we hypothesize that greater business model innovation capabilities generate greater firm performance.

*Hypothesis 8 (H8): Greater firm's business model innovation capabilities positively increases firm performance*

### **1.6. Firm Performance**

The overall performance of a firm in strategic level, mostly it is used as a dependent variable. From the strategic management perspective, it is a method which targets at maximizing the use of assets when it comes to firm's goals which can be appropriate with the demands of the firm environment. Selvam et al., (2016) expands a complete construct (model) on firm performance that identify determinants for firm performance [74]. In this study, firm overall performance measured with the aid of 1) profitability performance, 2) growth performance, 3) customers' satisfaction, and 4) employees' satisfaction.

## **2. MATERIALS AND METHODS**

This study is using deductive research paradigm that is generating conclusions by data analysis in order to test whether the hypotheses are supported or not supported, with a research strategy focuses on primary data taken

through questionnaires. This study applies a quantitative research method with cross-sectional data where the questionnaires spread in two phases; the first phase is running a pilot test to decide if further revisions on the measurement are necessary, and on the second phase is the actual data collection using the revised questionnaires to different participants from those who have participated in the pilot test within the target population. Each construct is measured based on data collection from the questionnaire and analyzed using statistical tools.

### **2.1 Sampling Design**

Target sample in this study are middle- top managers of manufacturing industry (food and beverages, textile, automotive, electrical, furniture, and others) in Indonesia. This study applies probability sampling using simple random sampling method that every item in the population has an equal chance of being included in sample [75].

### **2.2 Data Collection and Questionnaire Development**

This study uses primary data that are collected through questionnaire. Primary data are collected through questionnaires that distribute all at once to the target participants. We use online questionnaire through Google Form. We ask individuals in the population to participate in the survey by send the information containing the survey and distributed through email and WhatsApp platform. Likert scale is developed to measure attitudinal scales to measure character and personality traits by relevant questions.

We develop questionnaire refer to the structure of: 1) defining research objectives, (2) identifying population and sample target, (3) deciding on how collecting feedbacks, (4) designing questionnaire by adopting from questionnaire that have been use in the previous study, (5) running pilot survey, (6) carrying out the main survey and (7) analyzing the data [76]. Questionnaires are adopted from relevant previous studies then it is translated into Indonesian language then a back-translation of the questionnaire items. It refers to Brislin (1970) to make sure the questionnaires have similar meanings with the original ones.

### **2.3 Data Processing**

This study uses statistical programs such as IBM SPSS version 25 and LISREL 8.8 to organize and analyze the data. The second stage is post-test which shared to 216 participants. Questionnaire distributes on 10 June 2021 to 25 June 2021 through google form in the form of electronic questionnaire. Hence, the questionnaire link can be easily shared via social media, such as WhatsApp broadcast message, Line and Facebook to the participants. Total of 216 participants were collected during the distribution period which resulted to 195 total

valid participants used as research data. Invalid questionnaires caused by not passing the screening questions about 21 participants

Data screening uses to recognize missing or incorrect data, in order to improve reliability of statistical analysis technique [77]. Our study uses 4- point Likert Scale to examine respondents' interpretation of the observed variables and analyze using SPSS to process the data screening which includes defining normality, linearity problems and identifying outliers. These data screening process generates more accurate estimate results [78].

Missing data obtained from questionnaire collected from 204 participants through Google forms application are checked by SPSS. Possible invalid participants clean in data screening process. Since data are collected from specific selected participants (mid-top managers of manufacturing industry in Indonesia) and the answer applied to all questionnaires, this study may avoid data missing or invalid participants.

We do validity test to test research instrument to make sure it valid to measure the research objective [79], in terms of its content validity, face validity, construct validity, and external validity. We also do the reliability test to measure consistency of survey [79] with coefficient of 0,70 as a minimum requirement for reliability degree. Since our study uses measurements that have been used in the past studies, it shows that the measurements are valid and reliable. Our study uses confirmatory factor analysis (CFA) to test how fit the measurement theory to the actual data used Structural Equation Modelling, or SEM.

#### 2.4 Data Analysis

Partial Least Square (PLS) is used to analyse the influence between exogen and endogen variables. PLS SEM can use small sample sizes, that does not require randomization of the sample thus selected samples with non-probability approaches. On the predictor side, PLS can handle many independent variables, even when predictors display multicollinearity [80]. In SEM model formulation is a statistical modelling technique are cross sectional and general based on the theory use path analysis handling causal paths relating predictors as well as paths relating the predictors to the response variable, whereas 37 partials least square (PLS) as an alternative method of estimating the model for managing SEM based on theory and previous study.

#### 2.5 Variable Measurements

In this study, latent variables are measured by several measurements refer to previous references.

**Table 1. Variable Measurement**

Variables	Measurements
TMT digital orientation	Understanding digitalization, Setting the formal context of digitalization, Leading change [41]
Digitalization	Digital technology identification, IT adoption, IT adaption, IT development, Innovative digital technology management [58]
Digital innovation capabilities	Digital evolution, Digital infrastructure, Digital strategy, IT business partnership [60]
Business model innovation	Sensing customer needs, Sensing technological options, Conceptualizing and experimenting, Collaborating, BMI strategy [70]
Firm performance	Profitability performance, Growth performance, Customer satisfaction, Employee satisfaction [74]

All dimensions above are validated by adequate convergent validity in measurements.

### 3. RESULTS AND DISCUSSION

#### 3.1. Results

The Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (BTS) are used to test the data validity. All variables in Table 2 have: 1) KMO value that greater than 0.50, and 2) BTS value less than 0.05; so then can be continued to factor analysis.

**Table 2. Validity and Reliability Analysis**

Variable	Validity		Reliability
	KMO	BTS	Cronbach
TMT	0.697	0.000	0.865
DIG	0.790	0.000	0.913
DIC	0.846	0.000	0.928
BMIC	0.895	0.000	0.965
FP	0.840	0.000	0.939

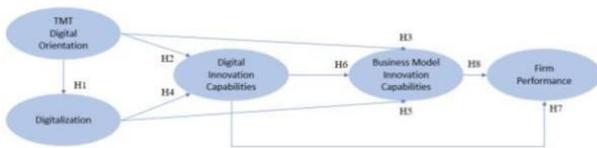
*Structural Equation Measurement (SEM) Analysis*

Our hypotheses testing result (Table 3) shows that the statistical results are positive, and significantly support the hypothesis.

**Table 3. Hypothesis Testing**

Hypothesis	Path Coefficient	P Value	Result
H1	.647	0.00	Positive relations, Supported, Significant
H2	.299	0.00	
H3	.189	0.05	
H4	.530	0.00	
H5	.399	0.00	
H6	.187	0.07	
H7	.456	0.00	
H8	.336	0.00	

Full research model is shown in Figure 1 below:



**Figure 1. Research Model**

**3.2. Discussion**

The implementation of Industry 4.0 will bring great opportunity to revitalize the manufacturing sector and become an accelerator to reach Indonesia’s vision to be the world’s top 10 economies in 2030 through digital transformation (Indonesia Investment Board Ministry, 2021). Our study shows that TMT digital orientation plays a vital role in endorsing higher level of firm’s digital transformation. It supports previous researches of deLomana et al. (2019) and Singh and Hess (2017). Our empirical result shows that key dimensions that affect TMT digital orientations are: 1) setting the formal context of digitalization, 2) leading change, and 3) understanding digitalization.

TMT digital orientation positively enhances firm performance, through the implementation of 1) effective firm’s digitalization (H1), digital innovation capabilities (H4), business model innovation capabilities (H6), and firm performance (H8); with total path coefficient 1.700 (Table 4); and 2) with the absence of business model innovation capabilities (total path coefficient 1.633). Both reveal the strategic

role of TMT digital orientation as the main driver, while the digitalization strategy and digital innovation capabilities are the main mediating variables to achieve optimum firm performance; whether it is supported or not supported by business model innovation capabilities.

Our first hypothesis result shows that TMT digital orientation positively influences digitalization ( $\beta$  value 0,647). It supports previous study of Haffke et al. (2016), Lopez-Munoz and Escriba-Esteve (2017), Preston & Karahanna (2009). It also supports Preston and Karahanna (2009) which mention that Alignment of Information Systems (AIS) strategy with business strategy is a top concern of the Chief Information Officer (CIO) and TMT of organizations. Our study extends the concept of Top Management Support in previous study with the imbrication metaphor to define the construct of TMT-IT imbrication, which allows us to account for a tighter and continuous entwining of the TMT and IT to create IT value.

Our second hypothesis result reveals that TMT digital orientation positively influences digital innovation capabilities ( $\beta$  value of 0,299). It is in line with previous researches (Cortellazzo et al., 2019; Elenkov et al., 2005; Garms & Engelen, 2018; Smith & Tushman, 2005; Wrede & Dauth, 2020). Wrede et al. (2020) that suggest top managers play a crucial role in firms' innovation efforts. Specifically, Wrede and Dauth (2020) argues that firms with internationally experienced TMTs are associated with a higher level of innovativeness. Nevertheless, Wiesböck and Hess (2018) conceptualizes that digital innovation capabilities allows managers to identify the necessary capabilities for digital innovation success.

In relations with capabilities in business model innovation, our empirical result shows that TMT digital orientation positively influences business model innovation capabilities ( $\beta$  value of 0,189). It supports previous scholars that argue TMTs directly influence innovation process in firms by determining recognize new business opportunities [53], [81]. Rogers (2016) also posits that “digital transformation is fundamentally not about technology, but about strategy,” which means TMT must discover methods to capitalize on new and unexpected business model innovations that optimize client needs and experiences.

Digitalization finds as the main activity of digital transformation process, that positively influences digital innovation capabilities ( $\beta$  value of 0,530) and business model innovation capabilities significantly ( $\beta$

value of 0,339). Our study finds the key dimensions of digitalization success are IT adoption, IT development, IT adaptation, digital technology identification, and innovative digital technology management; while the key dimensions of digital innovation capabilities are: IT business partnerships, digital strategy, digital infrastructure, and digital evolution. Firms need to understand innovative digital technologies based on their capabilities to develop innovative digital solutions (IT adoption) through IT business partnerships and digital strategy. Later, firms also need to complete their innovative digital infrastructure with innovative digital business concepts (IT development). Thus, the evolution from an abstract digital technology to a concrete digital solution represents firm's digitalization (IT adaptation). It supports previous study of Jakhar et al. (2020) and Wiesböck and Hess (2018).

Digitalization also considers as the important value proposition to the network in determining the perceived available options for business model innovation. Furthermore, organizational capabilities and employee competences identify as future challenges that will be faced by industries [82]. Our study finds the key dimensions of business model innovation capabilities are conceptualizing and implementing, business model innovation strategy, collaborating, sensing technology options, and sensing customer needs. In line with previous study [54], [57], [61], our study indicates that digitalization influences business model innovation capabilities in Indonesia manufacturing industry refers to conceptualizing and implementing work-shifting preference as the effect of Industry 4.0 implementation that develop not only to manufacturing sector but also into the supply chain, logistics, and R&D sectors as the business model innovation strategy. With the use of the latest technology and internet-based, there is also require sensing technology options and customer needs that involve a lot of demand for new types of work that can operate robot technology for industrial production processes to create higher efficiency, reduce production time and cost, minimize human-errors, and improve product quality and accuracy.

Furthermore, our study finds that digital innovation capabilities positively influence business model innovation capabilities ( $\beta$  value of 0,187), and firm performance ( $\beta$  value of 0,456). It supports previous study of Nwankpa and Roumani (2016) that posit digital transformation positively influences innovation and firm performance while innovation is reaffirmed

as having a positive implication on firm performance. Also same with previous study, our study proves that digitalization has positively influence to firm performance in manufacturing industry Indonesia. Our study also extends previous research that mention digital innovation capabilities relates to the knowledge transfer in a form of business model innovation capabilities [61].

Last, our eighth hypotheses shows that business model innovation capabilities positively influence firm performance ( $\beta$  value of 0,336). Our result finds the key dimensions of firm performance are customer satisfaction, employee satisfaction, growth performance, and profitability performance. Previous researches posit that business model innovation conceive as novel (i.e. new to the state-of-art) transaction architectures positively influences firm performance, even when the environment switches from resource- rich to resource-poor [83]. It also establishes that both business model innovation and product innovation interact positively to firm performance [84]. In the context of manufacturing industry in Indonesia, it requires sets of concepts, business model innovation strategy, collaboration, and implementation to support Industry 4.0 characters.

#### **4. CONCLUSION**

TMT digital orientation plays a vital role in endorsing higher level of firm's digital transformation. It significantly enhances firm performance, through the implementation of effective firm's digitalization, digital innovation capabilities, and business model innovation capabilities. Firm's digitalization strategy and digital innovation capabilities are the main mediating variables to achieve optimum firm performance; whether it is supported or not supported by business model innovation capabilities.

#### **AUTHORS' CONTRIBUTIONS**

Our study contributes to the literature of TMT consequences in the digital age and digital transformation implications for strategy and organizational change during COVID-19 pandemic. Practically, it also provides valuable insights and recommendations for digital transformation in manufacturing industry.

We limit our study to several sectors of manufacturing industry in Indonesia (not focused in a specific industry sector), which has broad range of digitalization readiness. Thus, we suggest our further recommendation for long-term impact of TMT digital orientation before, during and post- COVID-19 pandemic in a specific

industry sector. Considering TMT digital orientation and digitalization are two variables that can't be separated; nevertheless, in this disruptive era it requires further research on the digitalization development and TMT readiness on digitalization in emerging markets.

## REFERENCES

- [1] V. Argawal, V. Lath, and M. Mancini. "Confronting Indonesia's Productivity Challenge". 2017.
- [2] M Fitzgerald, N. Kruschwitz, D. Bonnet, and M. Welch. "Embracing Digital Technology: A New Strategic Imperative". *MIT Sloan Review*, 55(2), 1-12. 2014.
- [3] T. Hess, C. Matt, A. Benlian, and F. Wiesbock. "Options for Formulating a Digital Transformation Strategy". *MIS Quarterly Executive*, 15(2), 123-139. 2016.
- [4] A. Singh, and T. Hess. "How Chief Digital Officers Promote the Digital Transformation of their Companies". *MIS Quarterly Executive*, 16(1), 1-17. 2017.
- [5] A. Hanelt, R.Bohnsack, D. Marz and C.A. Marante. "A Systematic Review of the Literature on Digital Transformation: Insights and Implications for Strategy and Organizational Change". *Journal of Management Studies*. doi:10.1111/joms.1263. 2021.
- [6] P.C. Verhoef, T. Broekhuizen, Y. Bart, A. Bhattacharya, J.Q. Dong, N. Fabian, and M. Haenlein. "Digital Transformation: A Multidisciplinary Reflection and Research Agenda". *Journal of Business Research*, <https://doi.org/10.1016/j.jbusres.2019.09.022>. 2019.
- [7] D.L. Rogers. "The Digital Transformation Playbook: Rethink Your Digital Business for The Digital Age". *Columbia Business School Publishing*. 2016.
- [8] A. Singh, P. Klarner, and T. Hess, "How Do Chief digital officers pursue digital transformation activities? The role of organization design parameters," *Long Range Plan.*, vol. 53, no. 3, 2020.
- [9] M. J. Benner and J. Waldfogel, "Changing the channel: Digitalization and the rise of 'middle tail' strategies." *Strategic Management Journal*. 2020.
- [10] Correani, Alessia, A. De Massis, F. Frattini, A. M. Petruzzelli, and A. Natalicchio, "Implementing a Digital Strategy: Learning from the Experience of Three Digital Transformation Projects," *Calif. Manage. Rev.*, vol. 62, no. 4, pp. 37–56, 2020.
- [11] D. C. Hambrick and P. A. Mason, "Upper Echelons: The Organization as a Reflection of Its Top Managers," *Acad. Manag. Rev.*, vol. 9, no. 2, pp. 193–206, 1984.
- [12] S. Finklestein, D. C. Hambrick, and B. Cannella, "Strategy Leadership: Theory and Research on Executives, Top Management Teams, and Boards," *Oxford Univ. Press*, 2009.
- [13] S. Finklestein and D. C. Hambrick. "Strategic Leadership: Top Executives and Their Effects on Organizations." *St. Paul, Minneapolis: West Publishing Company*, 1996.
- [14] D. C. Hambrick, "Upper Echelons Theory: An Update," *Acad. Manag. Rev.*, vol. 32, no. 2, pp. 334–343, 2007.
- [15] S. Firk, S. Richter, and M. Wolff, "Does Value-Based Management Facilitate Managerial Decision-Making? An Analysis of Divestiture Decisions," *Manag. Account. Res.*, vol. 51, 2021.
- [16] S. Mithas, A. Tafti, and W. Mitchell, "How a Firm's Competitive Environment and Digital Strategic Posture Influence Digital Business Strategy," *MIS Q.*, vol. 37, no. 2, pp. 511–536, 2013.
- [17] L. Love, R. I. Priem, and G. T. Lumpkin, "Explicitly Articulated Strategy and Firm Performance Under Alternative Levels of Centralization," *J. Manage.*, vol. 28, no. 5, pp. 611–627, 2002.
- [18] A. Bharadwaj, O. A. El Sawy, P. A. Pavlou, and N. Venkatraman, "Digital business strategy: Toward a next generation of Insights," *MIS Q.*, vol. 37, no. 2, pp. 471–482, 2013.
- [19] J. Joseph, R. Klingebiel, and A.J. Wilson. "Organizational Structure and Performance Feedback: Centralization, Aspirations and Termination Decisions". *Organization Science*, 27(5). 2016.
- [20] S. Schneider and O. Kokshagina. "Digital Transformation: What We Have Learned (thus far) and What is Next". *Creativity and Innovation Management*, Vol. 30 / Issue 2 (2021-01-06) , S. 384-411 ; eissn:1467-8691. 2021.

- [21] J. Barney, "Firm Resource and Sustained Competitive Advantage," *J. Manage.*, vol. 17, pp. 99–120, 1991.
- [22] G. D. Bhatt, "A Resource-Based Perspective of Developing Organizational Capabilities for Business Transformation," *J. Corp. Transform.*, vol. 7, no. 2, pp. 119–129, 2000.
- [23] C.E. Helfat. Guest editor's introduction to the special issue: the evolution of firm capabilities. *Strategic Management Journal*, Vol. 21(10-11). pp 955-959. 2000.
- [24] C.E. Helfat and M.A. Peteraf. "The Dynamic Resource-Based View: Capability Lifecycles". *Strategic Management Journal*, Vol. 24(10), pp. 997-1010. 2003.
- [25] D.J. Teece. "A Dynamic Capabilities-based Entrepreneurial Theory of the Multinational Enterprise." *Journal of International Business Studies*, Vol. 45, pp 8–37. 2014.
- [26] K.S.R. Warner, and M. Wäger. "Building Dynamic Capabilities for Digital Transformation: An Ongoing Process of Strategic Renewal." *Long Range Planning*, Vol. 52, pp 326–349. 2019.
- [27] C.E. Helfat, S. Finkelstein, W. Mitchell, M Peteraf, H Singh, D. Teece, and S Winter. "Dynamic Capabilities: Understanding Strategic Change in Organizations". *Blackwell*, London. 2007.
- [28] M. Tynhammar. "Open Innovation and Its Definitions". The XXVIII ISPIM Innovation Conference – Composing the Innovation Symphony, Austria, Vienna on 18-21 June 2017. The publication is available to ISPIM members at [www.ispim.org](http://www.ispim.org). 2017.
- [29] M Saunila and J Ukko. "A Conceptual Framework for the Measurement of Innovation Capability and its Effects". *Baltic Journal of Management Vol 7(4)*, pp 355-375. 2012.
- [30] B. Lawson and D. A. Samson, "Developing innovation capability in organization: A dynamic capabilities approach," *Int. J. Innov. Manag.*, vol. 5, no. 03, pp. 377–400, 2001.
- [31] D. J. Teece and G. Linden, "Business models, value capture, and the digital enterprise," *J. Organ. Des.*, vol. 6, no. 1, p. 8, 2017.
- [32] X Dong, Y. Yu, and N. Zhang. "Evolution and Coevolution: Dynamic Knowledge Capability for Catching-Up in Emerging Economies." *Management and Organization Review*, 12(4), 717-745. 2016.
- [33] D. Nysten, and J. Holmstrom. "Digital Innovation Strategy: A Framework for Diagnosing and Improving Digital Product and Service Innovation". *Kelley School of Business, Indiana University*. Published by Elsevier Inc. 2014.
- [34] G.S. Day and P. Schoemaker. "Adapting to Fast-Changing Markets and Technologies". *California Management Review*, 58(4):59-77. 2016.
- [35] E. Autio, S. Nambisan, L. D. W. Thomas, and M. Wright, "Digital Affordances, Spatial Affordances, and The Genesis of Entrepreneurial Ecosystems," *Strateg. Entrep. J.*, vol. 12, no. 1, pp. 72–95, 2018.
- [36] A. Chatterjee and D. C. Hambrick, "It's all about Me: Narcissistic chief executive officers and their effects on company strategy and performance," *Adm. Sci. Q.*, vol. 52, no. 3, pp. 351–386, 2007.
- [37] P. Miller, "Strategic human resource management: An assesment of progress," *Hum. Resour. Manag. J.*, vol. 1, no. 4, pp. 23–39, 1991.
- [38] M. Menz and C. Scheef, "Chief Strategy Officers: Contingency Analysis of Their Presence in Top Management Teams," *Strateg. Manag. J.*, vol. 35, no. 3, 2014.
- [39] M. A. Carpenter, M. Geletkanycz, and W. G. Sanders, "Upper echelons research revisited: Antecedents, elements, and consequences of top management team composition," *J. Manage.*, vol. 30, no. 6, pp. 1–39, 2004.
- [40] S. Finklestein and D. C. Hambrick, "Top-management-team tenure and organizational outcomes: The moderating role of managerial discretion," *Adm. Sci. Q.*, vol. 35, no. 3, pp. 484–503, 1990.
- [41] M. Wrede, V. K. Velamuri, and T. Dauth, "Top management in the digital age: Exploring the role and practices of top managers in firm's digital transformation," *Manag. Decis. Econ.*, vol. 41, no. 8, pp. 1549–1567, 2020.
- [42] G. G. DeLomana, S. Strese, and J. Brinckmann, "Adjusting to the Digital Age: The Effects of TMT Characteristics of the Digital Orientation of Firms," 2019.
- [43] A. Singh and T. Hess, "How chief digital officers promote the digital transformation of their

- companies,” *MIS Q. Executive*, vol. 16, no. 1, pp. 1–17, 2017.
- [44] I. Haffke, B. Kalgovas, and A. Benlian, “The Role of The CIO and The CDO in An Organization’s Digital Transformation,” 2016.
- [45] J. F. Lopez-Munoz and A. Escriba-Esteve, “An Upper Echelons Perspective On Information Technology Business Value,” *Eur. Res. Manag. Bus. Econ.*, vol. 23, no. 3, 2017.
- [46] D. S. Preston and E. Karahanna, “Antecedents of IS Strategic Alignment: A Nomological Network,” *Inf. Syst. Res.*, vol. 20, no. 2, pp. 159–179, 2009.
- [47] L. Cortellazzo, E. Bruni, and R. Zampieri, “The role of a leadership in a digitalized world: A Review,” *Front. Psychol.*, vol. 10, 2019.
- [48] D. Elenkov, W. Q. Judge, and P. Wright, “Strategic leadership and executive innovation influence: An international multi-cluster comparative study,” *Strateg. Manag. J.*, vol. 26, no. 7, pp. 665–682, 2005.
- [49] F. P. Garms and A. Engelen, “Innovation and R&D in The Upper Echelons: The Association Between The CTO’s Power Depth and Breadth and The TMT’s Commitment to Innovation,” *J. Prod. Innov. Manag.*, vol. 36, no. 2, 2018.
- [50] W. K. Smith and M. L. Tushman, “Managing strategic contradictions: A top management model for managing innovation streams,” *Organ. Sci.*, vol. 16, no. 5, pp. 522–536, 2005.
- [51] M. Wrede and T. Dauth, “A temporal perspective on the relationship between top management team internationalization and firm’s innovativeness,” *Manag. Decis. Econ.*, vol. 41, no. 4, pp. 542–561, 2020.
- [52] M. Nasiri, M. Saunila, T. Rantala, and J Ukko. “Sustainable Innovation among Small Businesses: The Role of Digital Orientation, the External Environment, and Company Characteristics”. *Sustainable Development*, 1-10. 2021.
- [53] C. M. Christensen, D. Van Bever, and T. Bartman, “The Hard Truth About Business Model Innovation,” *Sloan Manage. Rev.*, vol. 58, no. 1, pp. 30–40, 2016.
- [54] L. W. Mihardjo, S. Sasmoko, F. Alamsjah, and E. Djap, “Digital Leadership Role in Developing Business Model Innovation and Customer Experience Orientation in Indsutry 4.0,” *Manag. Sci. Lett.*, vol. 9, no. 2019, pp. 1749–1762, 2019.
- [55] D. L. Rogers, *The Digital Transformation Playbook: Rethink Your Digital Business for The Digital Age*. New York: Columbia Business School Publishing, 2016.
- [56] V. Udovita, “Conceptual review on dimensions of digital transformation in modern era,” *Int. J. Sci. Res. Publ.*, vol. 10, no. 2, 2020.
- [57] J. C. G. dos Reiss, M. Amorim, N. Melao, Y. Cohen, and M. Rodrigues, “Digitalization: A literature review and research agenda,” in *Proceedings on 25th International Joint Conference on Industrial Engineering and Operations Management - IJCIEOM The Next Generation of Production and Service Systems*, 2020, pp. 443–456.
- [58] C. Legner *et al.*, “Digitalization: Opportunity and challenge for the business and information system engineering community,” *Bus. Inf. Syst. Eng.*, vol. 59, no. 4, pp. 301–308, 2017.
- [59] S. K. Jakhar, A. Bhattacharya, H. Rathore, and S. K. Mangla, “Stakeholder Pressure for Sustainability: Can ‘Innovative Capabilities’ Explain The Idiosyncratic Response in The Manufacturing Firms?,” *Bus. Strateg. Enviroment*, vol. 29, no. 6, pp. 2635–2653, 2020.
- [60] F. Wiesbock and T. Hess, “Understanding the capabilities for digital innovations from a digital technology perspective,” Munich, 1, 2018.
- [61] R. B. Bouncken, S. Kraus, and N. Roig-Tierno, “Digital innovation and venturing: An introduction into the digitalization of entrepreneurship,” *Rev. Manag. Sci.*, vol. 13, no. 1, 2019.
- [62] R. Kohli and N. P. Melville, “Digital innovation: A review and synthesis,” *Inf. Syst. J.*, vol. 29, no. 1, pp. 200–223, 2018.
- [63] P. M. Bican and A. Brem, “Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There A Sustainable ‘Digital’?,” *Sustanability*, vol. 12, no. 13, 2020.
- [64] M. Kotarba, “Digital Transformation of Business Models,” *Found. Manag.*, vol. 10, no. 1, pp. 123–142, 2018.
- [65] J. K. Nwankpa and Y. Roumani, “IT Capability and Digital Transformation: A Firm Performance Perspective,” 2016.

- [66] P. D. Weill and S. Aral, "IT Assets, Organizational Capabilities, and Firm Performance: How Resource Allocations and Organizational Differences Explain Performance Variation." *Organ. Sci.*, vol. 18, no. 5, pp. 763–780, 2007.
- [67] J. Wu, B. Guo, and Y. Shi, "Customer knowledge management and IT-enabled business model innovation: A conceptual framework and a case study form China," *Eur. Manag. J.*, vol. 31, no. 4, pp. 359–372, 2013.
- [68] N. J. Foss and T Saebi. "Business Models and Business Model Innovation: Between Wicked and Paradigmatic Problems". *Long Range Planning*, 51(1), 9-21. 2018.
- [69] D. J. Teece. "Business Models, Business Strategy and Innovation". *Long Range Planning*, 43(2-3), 172-194. 2010.
- [70] D. Ibarra, A. Z. Bigdeli, J. I. Igartua-Lopez, and J. Ganzarain, "Business Model Innovation in Established SMEs: A Configuration Approach," *J. Open Innov. Technol. Mark. Complex.*, vol. 6, no. 76, 2020.
- [71] T. Clauss, M. Abebe, C. Tangpong, and M. Hock-Doepgen, "Strategic agility, business model innovation, and firm performance: An empirical investigation," *IEEE Trans. Engineering Manag.*, vol. 99, pp. 1–18, 2019.
- [72] Q. Huang, H. Liu, W. Ke, and K. K. Wei, "The Moderating Effect of E-Business Capability in The Relationship Between Market Orientation and Firm Performance," 2012.
- [73] I. V. Kastilla, B. Van Looy, and A. Neely, "Steering Manufacturing Firms Towards Service Business Model Innovation," *Calif. Manage. Rev.*, vol. 56, no. 1, pp. 100–123, 2013.
- [74] M. Selvam, G. J., V. Vinayagamoorthi, and L. Kasilingam, "Determinants of firm performance: A subjective model," *Int. J. Soc. Sci. Stud.*, vol. 4, no. 7, 2016.
- [75] H. Taherdoost, "How to design and create an effective survey/questionnaire: A step by step guide," *Int. J. Adv. Res. Manag.*, vol. 5, pp. 18–27, 2016.
- [76] T. F. Burgess, *Guide to the Design of Questionnaires*. Leeds: University Of Leeds, 2001.
- [77] J. A. DeSimone, P. D. Harms, and A. J. DeSimone, "Best practice recommendation for data screening," *J. Organ. Behav.*, vol. 36, no. 2, pp. 171–181, 2015.
- [78] L. R. Odom and R. Henson, "Data screening: Essential techniques for data review and preparation," 2002.
- [79] U. Sekaran and R. Bougie, *Research Methods for Business: A Skill Building Approach*, 7th ed. New York: John Wiley & Sons, 2016.
- [80] G. D. Garson, *Partial Least Squares: Regression and Structural Equation Models*. Statistical Associate Publishing, 2016.
- [81] D. A. Shepherd, J. S. McMullen, and W. Ocasio, "Is that an opportunity? An attention model of top manager's opportunity beliefs for strategic action," *Strateg. Manag. J.*, vol. 38, no. 3, 2016.
- [82] M. Rachinger, R. Rauter, C. Ropposch, and W. Vorraber, "Digitalization and its influence on business model innovation," *J. Manuf. Technol. Manag.*, vol. 30, no. 3, 2018.
- [83] C. Zott and R. Amit, "Business model design and the performance of entrepreneurial firms," *Organ. Sci.*, vol. 18, no. 2, pp. 181–199, 2007.
- [84] R. H. Amit and C. Zott, "Business model innovation: Creating value in times of change," *SSRN Electron. J.*, vol. 23, no. 23, 2010.