Article

Building Micro-Foundations for Digital Transformation: A Moderated Mediation Model of the Interplay between Digital Literacy and Digital Transformation

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Abstract: In an era where digital transformation (DGT) is pivotal for organizational resilience and competitiveness, integrating sustainability into the digitalization process has emerged as a strategic imperative. By employing the resource-based view (RBV) and the dynamic capability theory (DCT), this study delves into the micro-foundations of DGT in medium- and large-sized enterprises, highlighting the synergistic role of managerial digital literacy in fostering digital transformation through the mediation role of digital readiness and the moderation role of the top management team (TMT). To fulfill the objectives of this study, data were collected through a cross-sectional mail survey, yielding responses from 235 senior and mid-level managers across medium- and large-sized firms in various industries within Turkey. Results have confirmed that digital literacy significantly enhances digital transformation and readiness, laying the groundwork for successful digital transformation initiatives. Digital readiness significantly mediates the relationship between digital literacy and digital transformation, indicating that enhancing digital literacy is a crucial step that indirectly influences digital transformation through improving digital readiness. The moderating effect of top management team (TMT) behavioral integration on the digital literacy and digital readiness link is affirmed, highlighting its critical role in facilitating organizational digital adaptation. TMT behavioral integration does not positively moderate the direct relationship between digital literacy and digital transformation. The study's findings offer a novel lens on digital transformation, revealing that the interplay between digital literacy, readiness, and TMT behavioral integration crafts a strategic scaffold for enhancing organizational agility and competitive edge in the digital era.

Keywords: digital transformation; digital readiness; digital literacy; TMT behavioral integration; resource-based view theory; dynamic capability theory

1. Introduction

Digital technologies have a significant impact on the changing business environment. Turkey, situated at the intersection of European and Asian cultural and economic influences, provides a unique setting for digital transformation (DGT). This distinctive positioning impacts the digital transformation process of medium and large enterprises nationwide in diverse ways [1–3].

Turkey's diverse culture and complex economic landscape complicate the incorporation of digital technologies into its business industries. According to Bozkurt and Kalkan [4], it is crucial to comprehend the drivers and impediments of digital transformation initiatives in this context. Turkish companies are facing numerous challenges as they progress in their digital transformation. Human-centric challenges, representing 29% of all obstacles, involve workforce skills, attitudes, and behaviors. Organizational challenges, accounting for approximately 28% of the issues, are linked to the current structures, procedures, and culture within companies [5]. Studying sector-specific dynamics as well as Aydın and Baykal's [6] research on how organizational strategic trends affect individual resilience

helps to better understand the intricate process of digital transformation in Turkey. DGT fundamentally embodies change, reshaping the operational fabric of organizations. Its successful implementation hinges on visionary leadership and decisive actions that align digitalization with evolving organizational requisites [7,8].

DGT has transitioned from a technological prospect into an imperative for satisfying burgeoning customer demands. Moreover, it enables companies to capitalize on their inherent strengths over newly emerged digital rivals, leveraging existing customer bases, market intelligence, a skilled workforce, and financial assets [9–11]. DGT has emerged as a strategic necessity on the agendas of industrial organizations. Its impact extends beyond just altering product and service portfolios; it revolutionizes operational methodologies, necessitating comprehensive transformation initiatives within companies to adapt to the digital age [12,13]. DGT means the use of new and constantly shifting digital technologies to solve particular problems [14–16], and involves the changes in an organization's shape, methods, roles, and strategies caused by the implementation of digital technologies.

The existing literature has thoroughly examined the influence of digital transformation on external stakeholders with a focus on customer relationships, but has tended to neglect the crucial importance of workforce digital proficiency. This omission fails to consider how the digital skills of employees can greatly impact a company's performance and the successful utilization of technological investments [17,18]. It is crucial to acknowledge the significance of matching the employees' digital skills with organizational goals to fully utilize technological advancements. Alignment is crucial for creating a digital transformation-friendly environment and improving organizational performance [19,20]. Digital literacy is a crucial skill that equips individuals to navigate the digital age and lead organizational change for improved performance. Digital literacy has a significant impact on entrepreneurship, employee-driven digital governance and transformation (DGT) as well as individual and organizational performance. Moreover, the significance of digital literacy in improving customer interactions emphasizes its importance in the process of digital transformation, emphasizing the necessity of a thorough approach that includes both internal and external aspects of the organization [19].

To fill the research gap in digital transformation, it is crucial to examine the intricate relationship among digital literacy, digital readiness, and the overall digital transformation process in organizations. Although there has been thorough research on the effects of digital literacy in different areas, there is still a notable lack of understanding regarding how these factors collectively affect digital transformation initiatives, particularly within Turkey's distinct socio-economic environment. Current research has mainly concentrated on the external effects of digital transformation like customer interaction and market competitiveness, while overlooking important internal organizational elements such as digital literacy and readiness, which are crucial in shaping the digital transformation process [21]. The potential moderating role of top management team (TMT) behavioral integration in these relationships has not been thoroughly investigated. This oversight neglects important insights into how digital literacy not only prepares organizations for digital transformation, but also, when combined with digital readiness and effective TMT dynamics, propels successful digital transformation initiatives [22].

This research aims to fill these gaps by providing a thorough understanding of the internal mechanisms that either support or impede digital transformation initiatives. The study by Kozanoglu and Abedin [21] introduced a new framework for understanding digital literacy as a multi-dimensional organizational capability, and emphasized the need to evaluate digital literacy at both the individual and organizational levels to consider the surrounding factors influencing the use of digital technologies. Understanding this concept is essential for grasping the employees' role in the digital transformation process and the use of enterprise systems. The study by Çallı et al. [22] in the Marmara Region of Turkey explored how generative leadership and digital literacy in executive management impact digital maturity. They found that the digital literacy of executive management acts as a mediator in the connection between generative leadership and digital maturity. This discovery

highlights the importance of internal organizational factors such as top management team dynamics in influencing the process of digital transformation. The current study aims to enhance academic discourse and offer practical insights for practitioners in the changing digital environment by combining different viewpoints. It also highlights the crucial role of digital literacy, digital readiness, and TMT behavioral integration in driving successful digital transformation initiatives.

Presently, the landscape of research on firm performance has transformed due to digital advancements. The creation and implementation of digital business strategies are being undertaken by more and more companies using digital tools. However, there remains a scarcity of researchers bridging digital elements with firm performance metrics [23]. DL skills, constituting a cornerstone of digital inclusion, have the potential to cultivate DL, thus enhancing firm performance. This is particularly pertinent for SMEs, given their essential role in regional and national monetary development [24,25]. The continual rise in SMEs' contribution to the gross domestic product (GDP) underscores their strategic importance in driving economic growth [26–28].

The organizational dimension of employees' DL holds significance, as the individuals' proficiency and understanding of digital technologies often evolve through interactions with colleagues within the organization. Research has identified the organizational dimension of employees' DL as crucial, highlighting the necessity for organizations to foster an ongoing competence in digital workforce transformation and provide support for workforce development [29,30]. Establishing a strong cultural foundation is essential for enabling employees to effectively navigate the constantly changing landscape and respond to ongoing turbulence. To integrate both individual and organizational dimensions seamlessly, conceptualizing DL as an organizational affordance proves beneficial [14,21].

This approach aims to align with research that tries to explain how to make employees and new technologies work together, which allows for various operations and tasks in organizations [21]. DL is perceived as essential for the survival of small businesses as it enables them to access a broader customer base [31,32]. By leveraging information technology, entrepreneurs in SMEs can operate their businesses with greater efficiency and minimal physical assets compared to traditional business models [33,34]. Consequently, entrepreneurs must possess the capability to comprehend and evaluate the information they acquire. Proficiency in deciphering information is heavily reliant on the ability to navigate and retrieve digital information effectively [35].

The primary challenges associated with the adoption of digital technologies and Industry 4.0 projects can be reduced to a readiness gap, where organizations find it hard to precisely predict the advantages they can achieve [15,16]. Digital readiness (DGR) within companies can be defined as the capacity to effectively harness the potential of digitalization. This often necessitates the abandonment of outdated business models, investment in innovation, and potentially a fundamental transformation of the core business to attain optimal DGR [36]. Readiness, as an idea, means how much the organization's resources, methods, and actions show the organization's readiness to change from a present state to a wanted state. Both the organization as a whole and its stakeholders need to be adequately primed, motivated, and technically proficient to enact this change. This involves having the necessary processes, structures, and tools in place to facilitate the transition [37,38].

Additionally, individual readiness is crucial, serving as a precursor to intended behaviors. For managers and employees, readiness implies feeling equipped and prepared to embrace the desired changes [39,40]. The traits of the top management team (TMT) have a significant impact on corporate strategic decisions, especially those relating to DGT. These characteristics are indicative of the thinking and value systems of the TMT members, which then affect the actions and choices of the corporation. The decision-making process and the implementation of corporate DGT initiatives are both highly dependent on the role of the TMTs [41–43].

In addition, TMT characteristics are strongly linked to managers' incentives such as avoiding risk, copying others, and competing. These characteristics have a significant

influence on information sharing and resource obtaining that are essential for effective corporate DGT efforts [41,44–50]. The characteristics of the TMT members, which are both compatible and cohesive, are often seen as a dynamic interaction that drives the innovation process. Therefore, it follows that TMT characteristics inevitably influence decision-making and implementation regarding innovation [51,52].

The TMT assumes responsibility for strategic decision-making and serves as a driving force in the delivery of megaprojects. Exceptional TMTs are characterized not by individualistic executives, but by collaborative entities. The TMT's behavioral dynamics provide a more complete perception of organizational performance than an individual executive's actions. Social interactions among team members have an impact on behavioral integration (BI), a joint effort [53,54]. Therefore, BI becomes embedded within the relational network, promoting collaboration within the TMT, known as top management team behavioral integration (TBI) [55–60].

2. Theoretical Background and Hypotheses Development

2.1. Underpinning Theory

The digital transformation landscape offers unique opportunities and challenges for organizations globally. Two crucial theories that are central to navigating this intricate terrain are the resource-based view (RBV) and the dynamic capability theory (DCT). These frameworks provide valuable insights into how companies can use internal resources and capabilities to gain a lasting competitive advantage in the digital age [61,62]. The RBV theory posits that sustainable competitive advantage comes from the strategic allocation of distinctive and valuable resources within an organization [63]. In essence, organizations equipped with and proficiently utilizing these resources are more likely to surpass their competitors [64]. In DGT, DL has emerged as a pivotal strategic asset. DL encompasses the competence of leaders and managers in comprehending and harnessing digital technologies effectively [65]. In the modern digitalized business landscape, the capacity of organizational leaders to grasp and utilize the potential of digital technologies is of utmost importance [66]. This proficiency empowers firms to innovate, streamline processes, and strengthen overall competitiveness. Consequently, within the RBV framework, DL is recognized as a pivotal catalyst for DGT and empowers organizations to connect digital technologies as strategic assets, thereby securing a competitive advantage [67].

Scholarly research confirms the importance of the resource-based view (RBV) and dynamic capability theory (DCT) in the digital age, demonstrating their wide relevance in different industries and locations [68]. Zhu, Yu, and Yang [61] offer empirical proof of how digital startups in China leverage distinctive resources to gain a competitive edge, demonstrating the lasting principles of resource-based view (RBV). Ji, Zhou, and Zhang [69] studied how operational efficiency and innovation mediate the relationship between corporate sustainability and digital transformation, combining perspectives from RBV and DCT. Bhattacharyya and Jha [70] analyze the Indian MSME sector using resource-based view (RBV) and dynamic capability theory (DCT) to categorize innovations, highlighting the importance of these theories in promoting innovation and competitive strategies.

Ren, Jing, and Zhang [71] expanded the use of DCT by developing a multi-dimensional framework for digital transformation capabilities in manufacturing companies. They emphasized the importance of strategic adaptability and resource reconfiguration in the process of digital transformation. The contributions highlight how internal resources and capabilities interact with the external digital environment, emphasizing the important role of resource-based view (RBV) and dynamic capability theory (DCT) in managing the challenges of digital transformation. This research explores how utilizing RBV and DCT in the Turkish context can help firms gain and maintain a competitive advantage in the fast-changing digital environment.

Turkey's unique circumstances provide an ideal setting for implementing the resource-based view (RBV) and dynamic capability theory (DCT) in the realm of digital transformation. Turkey's digital infrastructure, which is characterized by rapid growth in Internet

and mobile usage, provides a solid foundation for digital projects. The country's industrial landscape includes both traditional sectors and emerging tech-driven industries [72], which present distinct challenges and opportunities for utilizing digital technologies. Cultural factors like organizational hierarchy and risk aversion can impact how resources are allocated strategically and how dynamic capabilities are developed for digital transformation. Comprehending these subtleties is essential for medium- and large-sized companies in Turkey as they maneuver through digital transformation. To gain a competitive advantage in the digital age, it is essential in the Turkish context to align internal resources and capabilities with external environmental changes in accordance with the fundamental principles of dynamic capability theory (DCT) and the resource-based view (RBV) [73,74].

Expanding upon the RBV theory, DCT centers on how an entity can adjust and regenerate its resource pool to align with shifts in its external environment [75]. Within the framework of DGT, this principle underscores the significance of organizational agility and ingenuity in harnessing digital capacities for enduring prosperity. DGT transcends singular occurrences, instead representing a perpetual journey of adjustment and advancement. To endure and thrive amidst the swiftly shifting digital terrain, entities must consistently refine their digital proficiencies [65]. DCT underscores the significance of DGR and TBI in fostering organizational agility and responsiveness to digital transformation challenges [76].

2.2. Digital Literacy

In the digital transformation era, digital literacy (DL) is crucial for leaders to comprehend and proficiently utilize digital technologies, playing a key role in organizational success. The proficiency of senior executives and managers in navigating digital environments significantly affects an organization's ability to leverage a wide range of technological innovations [22,77].

DL encapsulates the amalgamation of competencies, insights, and consciousness that managers require to execute operations using digital technologies [78]. Particularly within the field of SMEs, where the adoption of digital technologies tends to be inactive, the significance of digital literacy becomes even more pronounced [79]. DL aids companies in adjusting to the evolving technological landscape [80]. Managers who possess confidence in their DL skills are typically more prepared and inclined to utilize digital technologies for executing intricate job tasks [81]. Furthermore, problem-solving skills enable these managers to use digital technologies for better communication with co-workers and clients as well as for quicker issue resolution [82–84].

2.3. Digital Transformation

Digital transformation (DGT) signifies a fundamental change in how organizations in Turkey and other regions view, execute, and adjust to technological progress. This transformation goes beyond just using digital tools; it requires a comprehensive reassessment of business models, operational procedures, and customer interaction strategies. Medium and large enterprises in Turkey must adopt DGT not just as a technological advancement, but as a crucial strategy to stay competitive in a globalized and digital-focused economy [85].

DGT's core lies in integrating digital technologies with traditional business sectors to revolutionize corporate management practices. This integration sets the stage for groundbreaking innovations in production, operations, and administration, prompting organizations to implement significant reforms. This transformation opens up new opportunities for innovation, prompting companies to improve their technological capabilities and, as a result, their innovation outcomes [52,86].

DGT expands resource allocation by integrating data resources, leading to increased efficiency in utilizing innovation. It efficiently integrates digital technologies with the deployment of resources such as capital, talent, and materials, overcoming spatial, organizational, and technological obstacles [52,87,88]. By citing specific Turkish companies that have successfully managed this process, we can gain a clearer insight into the concrete advantages and obstacles of DGT. To fully utilize the benefits of digital transformation

for a lasting competitive edge, it is crucial to tackle these challenges directly, emphasizing leadership, culture, and skill enhancement.

2.4. Digital Literacy and Digital Transformation

The RBV theory suggests that firms can achieve a competitive edge by utilizing their distinctive resources and capabilities [89]. DL is a valuable resource in the context of DGT. Managers with a high level of DL can use digital technologies efficiently, comprehend the consequences of these technologies for their business, and decide wisely about the adoption and execution of digital technologies [90]. This can result in more efficient DGT strategies and provide firms with a competitive advantage [91]. DL can be seen as a dynamic capability that enables firms to adapt to the digital age and allows them to understand and leverage digital technologies, adapt their business processes, and create new value propositions [92].

Several studies support this hypothesis. For instance, Farias-Gaytan et al. [89] found that higher education institutions that incorporated digital literacy into their strategies were more successful in their DGT efforts. Similarly, a study by Audrin and Audrin identified DL as a key factor in digital learning and education [90]. In DGT, DL can be considered as a strategic resource. Managers who possess a deeper understanding of digital technologies are better equipped to identify opportunities for innovation, optimize processes, and effectively integrate digital tools into organizational strategies [93]. Empirical evidence supports the positive relationship between DL and DGT. A study by Li et al. [92] found that organizations with digitally literate leadership teams were more likely to achieve higher levels of DGT success. Similarly, Raisch et al. [94] highlighted the pivotal role of leadership competencies including digital literacy in driving organizational change and innovation. The positive effect of DL on DGT aligns with broader trends in the digital economy. As digital technologies continue to disrupt traditional business models and reshape industry landscapes, organizations must invest in developing digital capabilities among their leadership teams to remain competitive and adaptive [95]. The hypothesis is grounded in well-established theories and is supported by empirical evidence. Thus, it is posited that:

H1. *DL has a positive effect on DGT.*

2.5. Digital Literacy and Digital Readiness

This hypothesis suggests a strong positive relationship between digital literacy (DL) and organizational digital readiness (DGR), indicating that an increase in DL leads to an improvement in DGR. The theoretical underpinnings of this hypothesis can be explained through RBV theory and DCT. According to RBV, organizational performance and competitiveness are influenced by the strategic deployment of valuable and unique resources [63]. In the context of DGT, DL can be conceptualized as a valued resource that enables organizations to effectively leverage digital technologies for competitive advantage. By possessing the skills to understand and direct the digital landscape, managers can drive organizational initiatives aimed at enhancing DGR. DCT complements RBV by emphasizing the importance of organizational adaptability and innovation in response to changing external environments [96]. DGR can be viewed as an organizational capability that reflects the ability to adapt to and capitalize on digital opportunities. Digitally literate managers are better equipped to adopt the values of innovation, collaboration, and learning within their organizations, thereby enhancing DGR and enabling the organization to respond proactively to digital disruption [97].

In DGR, DL can be considered as a valuable resource. DL is an individual's skill to search, assess, use, distribute, and produce content using information technologies and the Internet [90]. DL can be seen as a DCT that enables individuals and organizations to adapt to the digital age and allows them to understand and leverage digital technologies, adapt their processes, and create new value propositions. A systematic review of DL

revealed an increasing trend of DL articles since 2013, with the main research methodology of the reviewed articles being qualitative [98]. Another study discovered that DGR for college students included the purposeful use of digital skills for academic work [99]. The hypothesis is grounded in well-established theories and is supported by empirical evidence. Based on this discussion, it is posited that:

H2. *DL has a positive effect on DGR.*

2.6. DGR and Digital Transformation

The hypothesis suggests that digital growth readiness (DGR) is positively connected to digital transformation (DGT), indicating that improved DGR promotes the effective implementation of digital strategies in organizations, leading to transformative digital results [100]. This hypothesis is grounded in DCT, which emphasizes the importance of organizational agility and innovation in leveraging digital capabilities for sustained success [96]. According to this theory, organizations with high DGR are better prepared to respond effectively to digital disruption, seize emerging opportunities, and adapt to changing market conditions. Several empirical studies provide support for this hypothesis by demonstrating the positive relationship between DGR and DGT outcomes. For example, a study by Vial [12] found that organizations with higher levels of DGR exhibited greater success in implementing DGT initiatives, resulting in improved organizational performance and competitive advantage. Similarly, a study by Bican and Brem [101] found that DGR significantly influenced the success of DGT efforts in sustainability, highlighting the importance of organizational preparedness in driving digitalization.

Furthermore, research by Nylén and Holmström [102] emphasized the role of DGR as a key factor in organizational agility and responsiveness to digital disruption. According to Nylén and Holmström [103], organizations that actively invest in developing digital capabilities and promoting a culture of innovation have an advantage in exploiting digital opportunities and reducing digital risks, thus improving their overall competitiveness in the digital era. DGR is the skill to adopt and apply digital technologies for different tasks [103]. It is a vital resource that can improve an organization's dimensions to execute and gain from DGT initiatives [104]. DGR can be viewed as a DCT that allows firms to adjust to the digital era. It allows firms to understand and leverage digital technologies, adapt their business processes, and create new value propositions. According to a study on technology modernization and DGT readiness, businesses with a well-run digital platform that benefits from foresight, leadership, and accountability were more successful in their DGT initiatives [100]. The multidimensional DGR and DGT outcomes highlight the importance of specific aspects of DGR in achieving successful DGT outcomes [105]. In conclusion, the hypothesis is grounded in well-established theories and is supported by empirical evidence. To this end, and in advancing the existing literature, it is posited that:

H3. *DGR has a positive effect on DGT.*

2.7. Digital Readiness as a Mediator

Organizational readiness plays a crucial role in driving the successful adoption and implementation of digital strategies, leading to improved outcomes of digital transformation [106]. This hypothesis is based on the theoretical framework of DCT, which stresses an organization's measurements to change and update its resource base in reaction to changing external environments [96]. DGR represents a dynamic capability that enables organizations to effectively leverage their digital resources and competencies to drive DGT initiatives. By creating an environment that encourages digital innovation and adoption, DGR makes it easier for DL to have real effects on an organization like better operational efficiency, more innovation, and a stronger competitive edge [107]. DL is the ability and knowledge to apply digital technologies efficiently and is the basis for DGR and transformation. The higher the digital literacy of the management and employees, the more

ready they are to execute and adjust to DGT [108]. DGT is the incorporation of digital technologies into all aspects of a business, radically altering how they operate and provide value to customers. This is a complicated process that demands substantial resources and effort [109].

The efficiency of the resource may depend on the firm's DGR, which can be viewed as a capability [110]. Previous research has confirmed that DGR acts as a bridge between DL and DGT [111] and found that the readiness of an organization for DGT affected both digital leadership and DGT success in small- and medium-sized businesses. Brunner et al. [112] demonstrated that DGR for digital change mediated between DL and DGT readiness in firms. Based on these arguments, the proposed hypothesis is:

H4. *DGR mediates the relationship between DL and DGT.*

2.8. TMT Behavioral Integration as a Moderator

The top management team plays a crucial role in the effectiveness of digital literacy (DL) in driving digital transformation (DGT). Their involvement is a key factor in improving the organization's readiness for digital readiness (DGR) [77]. The ideas behind this hypothesis come from DCT theory, which says that leadership cohesion and other organizational skills are very important for helping businesses adapt and come up with new ideas when their outside environments change [96]. DL is the ability to use digital technology effectively and is the foundation for DGR. The more digitally literate the management and employees are, the more prepared they are to implement and adapt to DGT [113].

DGR is the preparedness of an organization or individual to undergo DGT [107]. It represents a combination of cognitive skills, DL, and digital proficiency [114]. In this framework, TBI is a crucial element of an organization's dynamic capabilities, affecting its ability to efficiently use and apply digital resources and competencies for DGT [52]. Furthermore, previous research has established that the moderator of TBI signifies the DL and organizational outcomes. Chua et al. [115] found that TMT cohesion influenced digital leadership in Singaporean firms, while research by Grimpe et al. [116] showed that TMT cohesion influenced digital skills in Danish firms. TBI is the degree to which the top management team collaborates and maintains mutual and collective interaction. A high level of TBI implies that the team has a shared understanding and coordinated action toward the organization's goals. Therefore, based on theoretical insights from DCT and empirical evidence from previous research, it is reasonable to hypothesize that TBI moderates the relationship between DL and both DGR and DGT. By investigating these hypotheses within the framework of medium- and large-sized firms in Turkey, this study aims to provide further empirical validation for a deeper understanding of the role of leadership cohesion in driving successful DGT initiatives. Accordingly, the proposed hypotheses are:

H5. *TMT behavioral integration moderates the relationship between DL and DGR.*

H6. *TMT behavioral integration moderates the relationship between DL and DGT.*

The conceptual framework in Figure 1 outlines the theoretical underpinnings of the study, drawing primarily from RBV theory and DCT. These theories provide a basis for understanding how organizations can leverage digital literacy, digital readiness, and TBI to drive successful digital transformation initiatives. At its core lies digital literacy, representing the foundational capability of individuals and organizations to effectively navigate and utilize digital technologies. This serves as the starting point for exploring its impact on subsequent constructs. Positioned as a mediator in the framework is digital readiness, which encapsulates the organizational preparedness and capability to adopt and leverage digital technologies strategically. It is proposed to mediate the relationship between digital literacy and the outcome variable, digital transformation, suggesting that organizations with higher

levels of digital literacy and readiness are more likely to achieve successful transformation outcomes. Furthermore, the framework incorporates the moderating influence of TMT behavioral integration, signifying the extent to which top executives collaborate and align their actions. This moderates the relationships between digital literacy and readiness as well as between digital literacy and the transformation outcomes, suggesting that the effectiveness of digital literacy in driving transformation may vary based on the level of behavioral integration within the top management team. Together, these components form a comprehensive research framework that guide the empirical investigation and hypothesis testing, aiming to deepen our understanding of the micro-foundations underpinning successful digital transformation initiatives in contemporary organizations. The novelty and practical significance of this model lie in its integrated approach to exploring the micro-foundations of digital transformation. By considering digital literacy as a foundational capability, the model recognizes the importance of individual and organizational competencies in navigating the digital landscape. Moreover, the inclusion of digital readiness as a mediator highlights the crucial role of organizational preparedness in translating digital literacy into tangible transformation outcomes. The moderation effect of TMT behavioral integration further emphasizes the significance of leadership dynamics in shaping the effectiveness of digital initiatives.
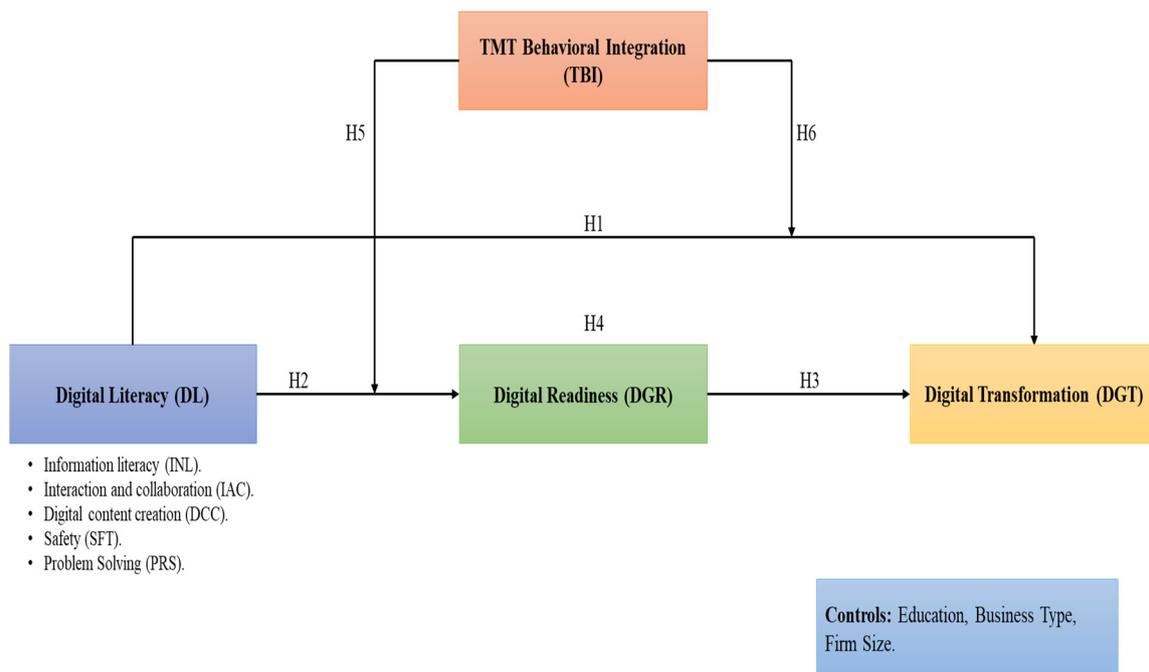
Figure 1. Research model.

In this research, control variables such as education, business type, and firm size were included to ensure the accuracy of the findings by accounting for potential external influences. Education levels among individuals within organizations can impact digital literacy and readiness, thus controlling for education helps isolate the effects of digital factors. Business type variation may affect digitalization efforts, and firm size can influence resources and capabilities. By including these controls, the study aims to provide precise insights into how digital literacy, readiness, and behavioral integration impact digital transformation across organizations.

3. Methodology

3.1. Study Site and Data Collection Procedure

The survey was conducted within the context of Turkey, a nation experiencing significant growth in its information and communication technology (ICT) sector. According

to Deloitte Turkey [117], the ICT market in Turkey reached a size of $29.9 billion in 2021, indicating a noteworthy 7% growth compared to the previous year. Within this expanding market, information technologies have been gaining momentum, with approximately 185,000 individuals employed in the ICT industries as of 2021 [117]. Despite the apparent openness of Turkish businesses to digital transformation, Izmen et al. [118] noted a significant gap in ICT infrastructure and expertise. This context establishes the backdrop against which our research seeks to explore the dynamics of digital transformation within medium- and large-sized firms in Turkey.

Recognizing the challenges faced by the Turkish ICT industry, particularly the shortage of a qualified workforce, lack of clear vision, and the costs associated with using ICT, as reported by Bayraktar et al. [119], our study aimed to shed light on the interplay between managerial digital literacy and digital transformation in this unique business landscape. The willingness to embrace digital transformation, coupled with the identified barriers, forms the basis for understanding the context in which the surveyed firms operate.

To ensure a representative sample, our data collection focused on medium- and large-sized firms from various industries in Turkey. To participate in the study, firms had to meet specific criteria including having more than 50 employees, operating as independent entities, and providing the fully available contact details of managers or employees [120]. Leveraging the Union of Chambers and Commodity Exchanges database of Turkey (TOBB), a random sample of 1000 top firms, identified by revenue, was selected. TOBB, as Turkey's largest non-governmental, non-profit organization, comprising 365 chambers and commodity exchanges [121], provided a robust framework for identifying and reaching out to key players in the Turkish business landscape [122].

The chosen data collection method involved a cross-sectional online survey instrument. Initially, an invitation letter was distributed via email to senior managers or medium-level managers of the identified 1000 firms, inviting their participation in the online survey. Three weeks prior to the commencement of data collection, proactive measures were taken to establish communication with the senior managers of participating companies, who were provided with a cover letter detailing the study's objectives and the confidentiality of responses, emphasizing the academic purposes of the research [122]. The data collection phase spanned from March 2023 to June 2023. To ensure a robust response rate and minimize non-responses, follow-up telephone calls were conducted to verify the availability of responses and facilitate survey pick-up. Leveraging the principles outlined by Dillman et al. [123] including two waves of data collection and a reminder, we received a total of 244 questionnaires. Among these, 235 were deemed usable, resulting in a commendable effective response rate of 23.5%. Table 1 succinctly summarizes the key characteristics of our sample.

Table 1. Characteristics of the sample.

Characteristics		Number	%
Gender	Male	149	63.4%
	Female	86	36.6%
Education	High school/diploma	16	6.8%
	Bachelor's degree	149	63.4%
	Master's degree	41	17.4%
	Doctorate degree	29	12.3%
Firm size	Less than 250 employees	59	25.1%
	251–500	57	24.3%
	501–1000	62	26.4%
	1001–5000	32	13.6%
	More than 5001	25	10.6%

Table 1. *Cont.*

Characteristics		Number	%
Firm age	Less than 5 years	9	3.8%
	5–10	94	40.0%
	11–30	65	27.7%
	31–50	41	17.4%
	More than 51	26	11.1%
Business type	Apparel, leather, and textile	20	8.5%
	Plastics, pharmaceutical, and chemicals	13	5.5%
	Machinery, electrical equipment, and consumer electronics	77	32.8%
	Food and beverages products	21	8.9%
	Media, telecommunication, and transportation	8	3.4%
	Wholesale and retail	20	8.5%
	Health and social services	18	7.7%
	Construction and real estate	14	6.0%
	Information systems and technology services	21	8.9%
	Financial services	9	3.8%
	Other	14	6.0%
Total		235	100%

3.2. Measurement of Constructs

In the pursuit of robust and valid measurements for the constructs under investigation, the survey instrument utilized in this study adhered to established methodologies and drew inspiration from previous research, particularly following the guidelines outlined by Dillman et al. [123]. To ensure content validity, the questionnaire constructs were adopted from the existing literature, providing a solid foundation for assessing the key variables in the context of digital transformation. The validation process, as recommended by Hair et al. [124], involved several steps to ascertain the relevance and accuracy of the chosen constructs.

To enhance the cultural relevance and specificity of the survey instrument, an iterative process was undertaken. Initially, five information technology managers were interviewed to gather insights into emerging issues in digital transformation within the Turkish business landscape. Subsequently, the initial survey questionnaire was crafted in English, underwent modification, translation to Turkish using a back-translation procedure [125], and refinement based on the feedback from expert academics. The finalization of the questionnaire involved a pre-test administered to 10 business professionals to ensure the clarity, comprehensibility, and cultural appropriateness of the survey instrument [126].

The measurement of digital literacy, a pivotal construct in this study, was executed using a multi-dimensional approach, as detailed in Appendix A. This construct comprised five dimensions, namely information literacy, interaction and collaboration, digital content creation, safety, and problem-solving, with a total of 18 items based on the work of Vuorikari et al. [127], adapted from Zahoor et al. [84]. The use of a five-point Likert scale ensured nuanced responses, allowing the participants to express the extent of their digital literacy across these diverse dimensions.

The three-part meta-construct of TMT behavioral integration was used to measure TMT collaborative behavior, information exchange, and joint decision-making. This is an important part of understanding how managerial dynamics and digital transformation interact. This framework was based on Simsek et al. [128] and had three items for each dimension. This provided a full picture of how TMT affects behavior [122].

Digital readiness, another focal point of this study, was gauged through a four-item scale drawn from recent studies by Chwiłkowska-Kubala et al. [129] and Hussain and

Papastathopoulos [130]. This construct aimed to capture the organizational preparedness for digital transformation, encompassing the necessary attributes and capacities.

Finally, the digital transformation was measured using a five-item scale based on the work of AlNuaimi et al. [131] and Nasiri et al. [132]. This scale showed how much organizations had embraced and put digital transformation plans into action.

To account for potential confounding variables, the study controlled for education, business type, and firm size, recognizing their potential impact on the dependent variables. Education was categorized into four levels, ranging from high school to postgraduate degree, while business type was classified into seven distinct groups. The number of employees served as a proxy for firm size, ensuring a thorough examination of the contextual factors influencing digital transformation within the Turkish firms surveyed.

3.3. Common Method Bias Assessment

To address the pervasive issue of common method bias in empirical research, this study systematically incorporated measures within both the study design procedure and statistical analyses. As acknowledged by Podsakoff et al. [133], systematic measurement errors can potentially introduce alternative explanations for research findings. To mitigate this bias, the study emphasized transparency and anonymity, assuring respondents that their answers would remain confidential, thereby encouraging honest responses [134]. Additionally, the authors executed supplementary statistical measures post-data collection to further diminish common biases. Harman's [135] single factor test was employed on all survey items using varimax rotation during exploratory factor analysis. The results revealed that all four factors accounted for a substantial 70.54% of the total variance, with the first factor explaining 21.75% of the variance. This outcome suggests the absence of a common general factor in the dataset, affirming the integrity of the collected data and mitigating concerns related to common method bias.

In line with contemporary advancements in CMB assessment, we utilized the method proposed by Kock [136], which offers a comprehensive approach to identify and address biases. By conducting the full collinearity test using variance inflation factors (VIFs) for all constructs, we followed Kock's [136] recommendation, complementing traditional CMB testing methods. As indicated in Table 2, all VIF values fell below the cut-off point of 5, with the more conservative threshold of 3.3 also adhered to, ranging from 1.362 to 2.952, indicating the absence of significant collinearity issues that could potentially confound the results.

Table 2. Evaluation of the measurement model.

Items	FL	VIF	AVE	CR	α	ID
Digital Readiness (DGR)			0.885	0.968	0.956	
DGR1	0.901	2.527				Retained
DGR2	0.957	2.713				Retained
DGR3	0.952	2.507				Retained
DGR4	0.952	2.285				Retained
Digital Literacy (DL)			0.548	0.950	0.944	
Information literacy (INL)			0.882	0.957	0.933	
INL1	0.925	2.439				Retained
INL2	0.940	2.845				Retained
INL3	0.953	2.667				Retained

Table 2. *Cont.*

Items	FL	VIF	AVE	CR	α	ID
Interaction and collaboration (IAC)			0.796	0.940	0.914	
IAC1	0.887	2.767				Retained
IAC2	0.896	2.932				Retained
IAC3	0.867	2.585				Retained
IAC4	0.918	2.877				Retained
Digital content creation (DCC)			0.723	0.886	0.806	
DCC1	0.773	1.362				Retained
DCC2	0.893	2.619				Retained
DCC3	0.880	2.542				Retained
Safety (SFT)			0.844	0.956	0.938	
SFT1	0.900	2.760				Retained
SFT2	0.935	2.642				Retained
SFT3	0.940	2.005				Retained
SFT4	0.899	2.589				Retained
Problem solving (PRS)			0.825	0.950	0.929	
PRS1	0.919	2.860				Retained
PRS2	0.888	2.212				Retained
PRS3	0.921	2.428				Retained
PRS4	0.905	2.457				Retained
TMT Behavioral Integration (TBI)			0.673	0.942	0.930	
TBI1	0.862	2.525				Retained
TBI2	0.760	2.054				Retained
TBI3	0.919	2.003				Retained
TBI4	0.819	2.952				Retained
TBI5	0.774	2.229				Retained
TBI6	0.705	1.859				Retained
TBI7	-	-				Deleted
TBI8	0.850	2.621				Retained
TBI9	0.853	2.700				Retained
Digital Transformation (DGT)			**0.774**	**0.932**	**0.902**	
DGT1	0.880	2.041				Retained
DGT2	0.854	2.215				Retained
DGT3	0.906	1.494				Retained
DGT4	0.878	2.476				Retained
DGT5	-	-				Deleted

Note: FL = factor loadings; VIF = variance inflation factor; AVE = average variance extracted; CR = composite reliability; α = Cronbach's alpha; ID = item decision.

4. Data Analysis

Upon the completion of the data collection, the ensuing analysis and presentation were executed utilizing the partial least squares structural equation modeling (PLS-SEM) tool, specifically SmartPLS 4 [137]. This methodological choice was underpinned by the study's comprehensive reasoning, which aimed at testing hypotheses rooted in a robust theoretical

framework. As highlighted by Hair and Sarstedt [138], PLS-SEM has proven advantageous in handling model complexity with fewer restrictions compared to alternative methods (e.g., AMOS). This flexibility is crucial, given the intricate nature of the relationships examined in this study. Moreover, the application of PLS-SEM aligns with the study's consideration for small and medium sample sizes, as emphasized by Chin [139], ensuring the reliability and validity of the results. The examination of the first- and second-order reflective constructs pertaining to digital literacy, encompassing information literacy, interaction and collaboration, digital content creation, safety, and problem-solving [84] was facilitated through a two-stage approach following Hair et al. [140]. Subsequently, adhering to the guidance of Hair and Sarstedt [138], the analysis unfolded in a systematic two-step process: the initial assessment of reflective measurement models, followed by the evaluation of the structural model.

4.1. Measurement Model Assessment

In the meticulous assessment of the first- and second-order reflective measurement model, the study employed established criteria for internal consistency, convergence, and discriminant validity, as advocated by Hair et al. [141]. Convergent validity was initially scrutinized using outer loadings and average variance extracted (AVE). Following the recommended threshold of an outer loading above 0.708 [140], items TBI7 and DGT5 were excluded. However, items with loadings less than 0.708 were retained, as their removal did not substantially affect the AVE and composite reliability (CR) of the construct. The next test, shown in Table 2, confirmed the reliability and convergent validity of the data. The AVE, CR, and Cronbach's alpha (α) values were all higher than the required levels of 0.7 (α and CR) and 0.5 (AVE), as stated by Fornell and Larcker [142] and Hair et al. [141].

The study also proved discriminant validity, as shown in Table 3. For each construct, the square root of AVE was higher than all of the correlation coefficients, which is what Fornell and Larcker [142] stated should occur. Additionally, as Henseler et al. [143] suggested, the heterotrait–monotrait (HTMT) values, which measure the ratio of inter-construct to intra-construct correlations, were below the threshold of 0.90, supporting the distinctiveness of the constructs. Furthermore, the bootstrapped confidence intervals, not containing the value one, provided additional evidence supporting the discriminant validity of the measurement model. This thorough evaluation shows how carefully the measurement model was checked to ensure that it was reliable and valid. It also sets the stage for a thorough look at the structural relationships in the later stages of the analysis.

Table 3. Discriminant validity.

	DCC	DGR	DGT	IAC	INL	PRS	SFT	TBI
DCC	**0.850** [a]	0.722 [b]	0.787	0.542	0.639	0.495	0.595	0.650
DGR	0.633 [c]	**0.941**	0.793	0.670	0.807	0.733	0.726	0.827
DGT	0.671	0.738	**0.880**	0.786	0.666	0.631	0.682	0.716
IAC	0.465	0.628	0.715	**0.892**	0.529	0.629	0.700	0.613
INL	0.555	0.764	0.614	0.493	**0.939**	0.707	0.759	0.690
PRS	0.428	0.691	0.578	0.581	0.661	**0.908**	0.708	0.813
SFT	0.519	0.688	0.629	0.650	0.711	0.662	**0.919**	0.739
TBI	0.561	0.784	0.663	0.574	0.729	0.766	0.790	**0.820**

Note: [a] The bold values indicate the square root of AVE; [b] The upper triangle indicates the HTMT values; [c] The lower triangle indicates the correlations between the constructs.

4.2. Structural Model Assessment

Prior to hypothesis testing, a critical examination of collinearity among exogenous latent variables was conducted, revealing that all of the inner variance inflation factor (VIF)

values fell below the established cutoff value of 3.3, as recommended by Hair et al. [141]. This ensured that collinearity did not exert an undue influence on the results of the structural model. The assessment of the model's predictive power was then conducted through the coefficient of determination (R^2), with values of 0.25, 0.50, and 0.75 interpreted as weak, moderate, and strong, respectively [144]. In this study, the R^2 values illustrated that digital readiness and digital transformation collectively accounted for 71.3% and 69.0% of the variance, respectively (see Figure 2).
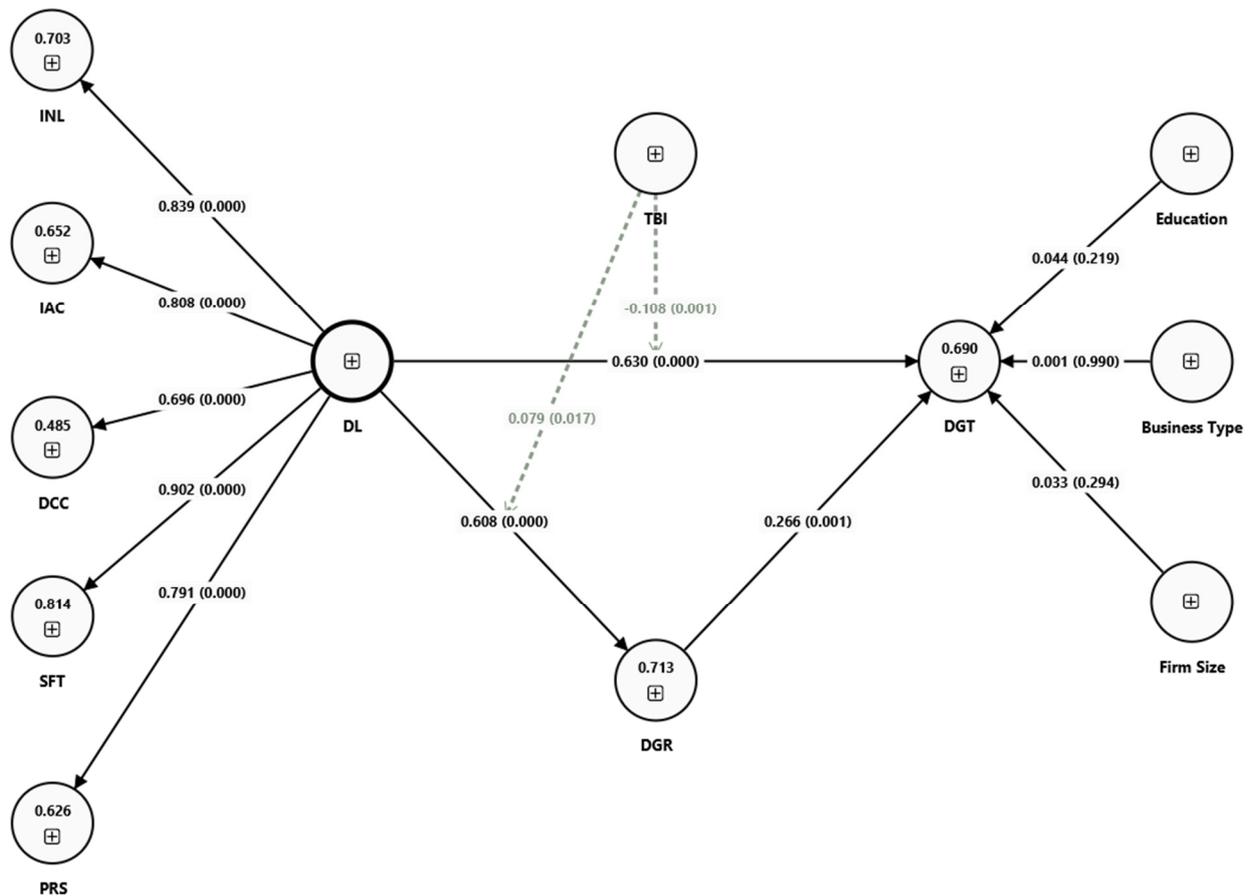
Figure 2. Structural model.

The solid lines represent the direct relationships between the constructs, whereas the dotted lines typically represent moderation effects within the model. In the structural model, the bold circle represents the second-order construct of digital literacy (DL), encompassing five dimensions: information literacy (INL), interaction and collaboration (IAC), digital content creation (DCC), safety (SFT), and problem-solving (PRS). Conversely, the straight-line circles represent the first-order constructs. In this model, education, business type, and firm size represent the control variables.

Moving to the structural model, the research hypotheses were tested, revealing a significant positive effect of digital literacy on both digital readiness (β = 0.608, *p* = 0.000) and digital transformation (β = 0.630, *p* = 0.000). This substantiated the support for the first and second hypotheses (H1 and H2). Additionally, digital readiness demonstrated a significant positive effect on digital transformation (β = 0.266, *p* = 0.001), corroborating the third hypothesis (H3).

To investigate the mediation effect posited in the fourth hypothesis (H4), suggesting that digital readiness mediates the relationship between digital literacy and digital transformation, bootstrapping was employed to analyze the indirect effects [145,146]. The

results were statistically significant (β = 0.162, *p* = 0.004), thus supporting the presence of mediation.

Turning to the fifth hypothesis (H5), which proposed that TMT behavioral integration moderates the relationship between digital literacy and digital readiness, the results, analyzed using a product indicator approach with PLS-SEM [147,148], indicated a significant interaction term (β = 0.079, *p* = 0.017), fully supporting H5. However, the sixth hypothesis (H6), suggesting that TMT behavioral integration moderates the relationship between digital literacy and digital transformation, yielded a negative and significant interaction term (β = −0.108, *p* = 0.001), contradicting H6.

Finally, we included control variables such as education, business type, and firm size to account for potential confounding factors that could influence the relationships between digital literacy, digital readiness, and digital transformation. As indicated by the results, these control variables had an insignificant effect on digital transformation, as depicted in Figure 2. The lack of statistical significance suggests that these control variables did not confound the observed relationships within our model, enhancing the validity of our results and affirming the robustness of the associations between digital literacy, digital readiness, and digital transformation. By incorporating these control variables and demonstrating their lack of significant impact, we provide a more comprehensive understanding of the factors influencing digital transformation dynamics in managerial settings. These comprehensive structural model results, as depicted in Table 4, provide valuable insights into the intricate relationships between digital literacy, digital readiness, TMT behavioral integration, and digital transformation within the context of the study.

Table 4. Evaluation of the structural model.

Direct Effect	Standardized Coefficients	Standard Errors	t-Values	*p*-Values	Confidence Intervals		Decision
					2.5%	97.5%	
Direct effect							
H1: DL → DGR	0.608	0.079	7.662	0.000	0.444	0.766	Supported
H2: DL → DGT	0.630	0.094	6.706	0.000	0.410	0.800	Supported
H3: DGR → DGT	0.266	0.081	3.265	0.001	0.176	0.499	Supported
Indirect effect							
H4: DL → DGR → DGT	0.162	0.056	2.907	0.004	0.098	0.334	Supported
Interaction effect							
H5: DL × TBI → DGR	0.079	0.033	2.396	0.017	0.019	0.149	Supported
H6: DL × TBI → DGT	−0.108	0.032	3.373	0.001	−0.166	−0.040	Not supported
Controls							
Education → DGT	0.044	0.036	1.229	0.219			
Business type → DGT	0.001	0.041	0.013	0.990			
Firm size → DGT	0.033	0.032	1.049	0.249			

Note: DL = digital literacy; DGR = digital readiness; DGT = digital transformation; TBI = TMT behavioral integration.

4.3. Strength of the Moderating Effect

To assess the strength of moderating effects in the study, a comparison between the main model's R^2 value and the R^2 value of the full model, which included both exogenous and moderating variables, was conducted, following the methodology proposed by Henseler and Fassott [149]. The examination of the moderating effect size was performed using Cohen's [144] formula for f^2, where f^2 is calculated as the difference in R^2 values between the model with the moderator and the model without the moderator, divided by 1 minus the R^2 value with the moderator. As suggested by Cohen [144] and Henseler

and Fassott [149], effect sizes of 0.02, 0.15, and 0.35 were considered weak, moderate, and strong, respectively. The results, as depicted in Table 5, indicated a small effect size (0.020). It is important to note, as emphasized in the academic literature [148], that a small effect size does not necessarily imply insignificance. Even small interaction effects can hold significance [150], particularly under extreme moderating conditions, where changes in beta values may carry meaningful implications. This nuanced interpretation underscores the importance of considering the contextual conditions and the potential practical significance of the moderating effects in the study's findings.

Table 5. Strength of moderating effects.

Interaction Effect	R^2		F^2	Effect Size
	R^2 with the Moderator	R^2 without the Moderator		
DL × TBI → DGR	0.713	0.687	0.090	Weak
DL × TBI → DGT	0.654	0.639	0.043	Weak

Figure 3 illustrates how TMT behavioral integration (TBI) reinforces the positive relationship between digital literacy (DL) and digital readiness (DGR). Conversely, Figure 4 portrays TBI's moderating effect, wherein it attenuates the positive relationship between DL and digital transformation (DGT). These findings provide valuable insights into the nuanced dynamics of managerial digital literacy and TMT behavioral integration, shedding light on their role in shaping organizational readiness and transformation within the surveyed Turkish firms.
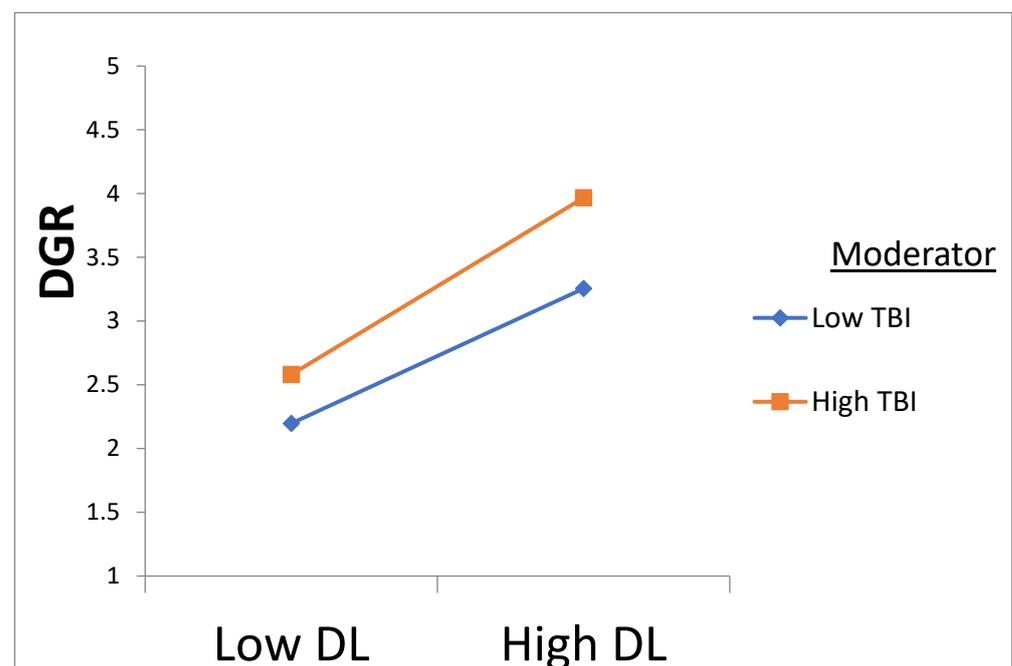
Figure 3. TBI strengthens the positive relationship between DL and DGR.
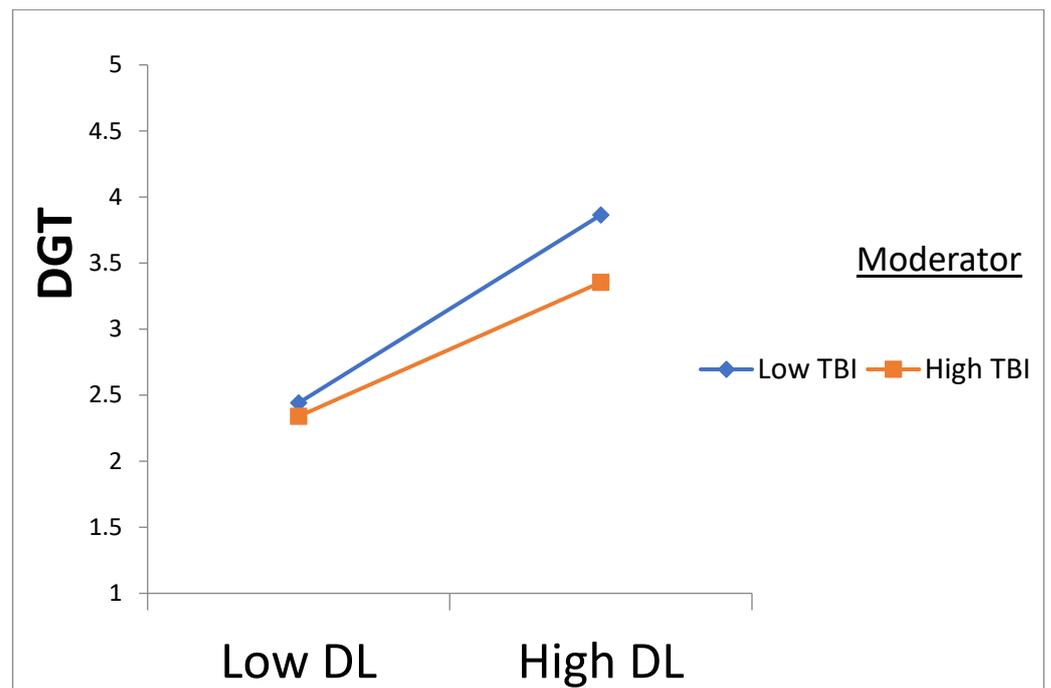
Figure 4. TBI weakens the positive relationship between DL and DGT.

5. Discussion

This study clarifies the unique contributions it makes to comprehend the dynamics of digital transformation (DGT) in medium and large enterprises in Turkey. This study provides important insights into the relationship between digital literacy (DL), digital readiness (DGR), top behavioral integration (TBI), and DGT success. In line with Hensellek [151] and Venugopal et al. [152], the results revealed a positive relationship between DL and DGT. This aligns with prior research by Marsh [153] and Çelik and Uzunçarşılı [154], emphasizing the pivotal role of DL in organizational change. However, the study extends this understanding by demonstrating that higher DL levels among managers lead to more effective DGT initiatives. Practical implications include targeted training programs to enhance DL skills. Specifically, the study underscores the strategic importance of DL as a key determinant of successful DGT initiatives within Turkish firms.

Moreover, the mediator of DGR in the association between DL and DGT provides valuable insights into the mechanisms through which leadership competency translates into tangible organizational outcomes. In line with DCT [155], the results showed that the effectiveness of DGT efforts is greatly affected by how ready an organization is to accept and carry out digital initiatives. The hypothesized mediation model suggests that DGR acts as a mediator between DL and DGT. This echoes the work of Montagasser et al. [11], who proposed that organizational readiness is a critical bridge in the transformation process. Organizations should put their efforts into developing DGR and making sure that their systems and personnel are ready for the difficulties that DGT will present. This highlights the importance of cultivating a conducive digital environment within organizations to capitalize on the expertise of digitally literate managers.

Furthermore, the moderating effect of TBI provides the dynamics of leadership cohesion in shaping DGT outcomes. By fostering alignment and collaboration among top executives, TMT behavioral integration enhances the efficacy of DL in driving DGT initiatives. This finding resonates with previous research emphasizing the critical role of leadership cohesion in facilitating organizational change [156,157].

The current study enhances the existing literature on digital transformation (DGT) by providing empirical evidence from the Turkish context and expanding theoretical knowledge in various important areas. Firstly, it demonstrates the significance of digital

literacy (DL) in driving successful digital transformation (DGT), supported by evidence from the resource-based view (RBV) theory. Shin, Mollah, and Choi [158] conducted a study showing the beneficial direct and indirect impacts of digital leadership on organizational performance. Their research emphasizes the strategic importance of digital leadership in utilizing organizational resources to enhance sustainable performance, in line with the RBV theory. The study demonstrates how digital readiness (DGR) acts as a mediator, explaining how leadership competency influences organizational outcomes in line with dynamic capability theory (DCT). The TMT behavioral integration (TBI) moderating effect shows how important leadership unity is in shaping digital transformation (DGT) outcomes. This adds to the growing body of research on how leaders interact in the digital age. The study presents TMT behavioral integration (TBI) as a moderator. High behavioral integration in top management teams (TMTs) amplifies the positive impact of DL on DGT. This is consistent with the resource-based view (RBV) theory proposed by Barney [63], which highlights the strategic importance of top management team (TMT) cohesion in maximizing organizational resources. The study highlights the crucial role of unified leadership in promoting successful digital projects. Wang, Lin, and Sheng [159] demonstrated that digital leadership has a significant impact on exploratory innovation. This influence is mediated by digital entrepreneurial orientation and digital organizational culture and is moderated by big data analytics capabilities. These findings emphasize the importance of leadership in cultivating an innovative culture and strategic direction to improve organizational performance and innovation.

6. Conclusions

6.1. Theoretical Contribution

This study showed the RBV by highlighting the strategic importance of DL as a key determinant of the success of DGT [63], extending the RBV framework to the domain of digitalization, and emphasizing the role of intangible resources such as leadership competencies in driving organizational performance. This is further supported by the work of Ming-Hsiung Hsiao [160], who offers a conceptual framework for understanding the process of digital transformation through resource integration and organizational capabilities for enhanced firm performance. By analytically representing the positive influence of DL on DGT outcomes, the research extends the RBV framework, a notion that is echoed in the findings of Volkan Öngel et al. [161], who examined the significant antecedent role of digital leadership on individual creativity and employee performance. The study enriches the theoretical understanding of DCT by elucidating the mediator of DGR in the association between DL and DGT, a concept that finds resonance in Abdelhak Senadjki et al.'s [162] investigation into the impact of digital leadership on the performance of a firm through digital transformation. Furthermore, the research contributes to advancing the understanding of leadership dynamics in the digital age by highlighting the moderating effect of TBI on the relationship between DL and DGT. This is complemented by Eman Mohammed Alhammadi and A. R. Romle's [163] study, which explored the impact of talent management practices on employee performance, with leadership competencies serving as a mediator. By demonstrating the importance of leadership cohesion and collaboration in amplifying the impact of DL, the study offers insights into the micro-foundations of DGT success and elucidates the relationship between individual competencies and collective leadership dynamics [164].

The theoretical contributions of this research lie in its ability to integrate insights from multiple theoretical perspectives, namely RBV and DCT, to provide a complete understanding of the mechanisms underlying DGT in medium- and large-sized firms in Turkey. Ming-Hsiung Hsiao [160] tested theoretical ideas in the real world, and Volkan Ongel et al. [161] and Abdelhak Senadjki et al. [162] looked into the dynamics of leadership competency, organizational readiness, and TMT cohesion. Both of these studies add to the theoretical discussion in the field of DGT.

6.2. Practical Implications

The findings of this research carry several practical implications for organizational leaders, managers, and policymakers involved in driving DGT initiatives within medium- and large-sized firms in Turkey. The research underscores the critical importance of investing in the development of DL. Organizational leaders should prioritize initiatives aimed at enhancing the digital competencies of managers and executives across all levels of the organization. Enhancing digital skills and promoting a mindset of constant learning and change may require offering educational courses, seminars, and guidance options.

The research emphasizes the importance of developing DGR in organizations. To make the most of the skills of managers who are proficient in digital technologies, companies need to guarantee that they provide adequate facilities, assets, and methods to facilitate the execution of digital projects. This may involve upgrading technological infrastructure, revising organizational policies and procedures, and promoting collaboration and knowledge sharing among employees. Furthermore, the research underscores the importance of fostering cohesion and collaboration among top executives in driving DGT efforts. Organizational leaders should prioritize efforts to build trust, communication, and alignment within the TMT to facilitate effective decision-making and the implementation of digital strategies. This may involve establishing regular communication channels, promoting transparency and openness, and fostering a shared vision and commitment to DGT goals.

Moreover, the findings suggest that organizational leaders should recognize the interconnectedness of individual competencies and collective leadership dynamics in driving DGT success. By fostering a culture of collaboration, empowerment, and innovation, firms can harness the collective intelligence and creativity of their workforce to navigate the complexities of digitalization and seize emerging opportunities. Additionally, policymakers and industry associations can play a vital role in supporting DGT initiatives by providing funding, resources, and expertise to facilitate knowledge sharing, collaboration, and best practice dissemination among firms. By promoting an enabling environment for digital innovation and entrepreneurship, policymakers can contribute to the growth and competitiveness of the digital economy in Turkey. The practical implications of this research underscore the importance of investing in DL, cultivating DGR, and fostering leadership cohesion to drive successful DGT initiatives within medium- and large-sized firms in Turkey.

6.3. Limitations and Future Direction

This study focused on medium- and large-sized firms in Turkey and identified a critical limitation that may impact the generalizability of its findings on digital transformation (DGT) processes in different industrial and geographical settings. In the future, researchers should focus on investigating a wider range of global firms and integrating sustainability into the DGT framework. Expanding the scope would improve the applicability of the results and deepen our comprehension of how DGT initiatives can be utilized to promote sustainable business models and practices.

Future research should focus on identifying and correcting measurement inaccuracies or biases when evaluating these concepts using more sophisticated measurement instruments and methodologies. This may involve using various informants to collect different viewpoints or incorporating objective performance metrics to determine the concrete effects of DGT. It is crucial to include sustainability metrics in these assessments to gain valuable insights into how DGT initiatives impact the achievement of sustainable business outcomes. Future research could investigate how improved digital literacy among managers impacts the uptake of green technologies or sustainable business practices, thus bolstering the environmental and social aspects of sustainability.

Future research should conduct cross-country analyses to look into how various cultural, regulatory, and economic environments affect the dynamics of DGT, focusing on sustainability. This comparative approach should analyze how various organizational settings and external factors impact the effectiveness and longevity of DGT efforts. Researchers

can analyze how digital literacy, readiness, and transformation relate to sustainability to pinpoint important factors that either support or hinder incorporating sustainable practices into a digital transformation strategy.

Nuanced investigations can offer valuable insights for policymakers and practitioners, helping to develop strategies and regulations that promote digital innovation and adoption while emphasizing sustainability. Comprehending how digital literacy contributes to sustainable digital transformation can help develop specific interventions and support systems for SMEs, aiding in the shift toward more sustainable and resilient business models in the digital age. This approach emphasizes the importance of integrating digital transformation efforts with overarching sustainability objectives to guarantee that the technological progress of companies has a positive impact on environmental conservation, social welfare, and economic sustainability.

Appendix A

Table A1. Measurement items.

Codes	Items
Digital Readiness (DGR)	
At work	
DGR1	I have access to a range of new technologies like cloud, mobile, social media, and big data analytics available to facilitate innovations.
DGR2	Our information technology infrastructure is stable, up-to-date, and reliable to facilitate innovations.
DGR3	The enterprise system/s is stable, up-to-date, and reliable.
DGR4	I have management based on digital technologies to communicate and collaborate with colleagues or customers in my daily work.
Digital Literacy (DL)	
Information literacy (INL)	
I am confident in	
INL1	. . .browsing, searching and filtering data, information, and digital content.
INL2	. . .evaluating data, information, and digital content.
INL3	. . .managing data, information, and digital content.
Interaction and collaboration (IAC)	
I can	
IAC1	. . .interact through digital technologies.
IAC2	. . .share through digital technologies.
IAC3	. . .engage in citizenship through digital technologies.

Table A1. *Cont.*

Codes	Items
IAC4	. . .collaborate through digital technologies.
Digital content creation (DCC)	
I can	
DCC1	. . .develop digital content.
DCC2	. . .integrate and re-elaborate digital content.
DCC3	. . .respect copyright and licenses.
Safety (SFT)	
I am aware of	
SFT1	. . .protecting devices.
SFT2	. . .protecting personal data and privacy.
SFT3	. . .protecting health and well-being.
SFT4	. . .protecting the environment.
Problem solving (PRS)	
I am able to	
PRS1	. . .solve technical problems.
PRS2	. . .identify needs and technological responses.
PRS3	. . .creatively use digital technologies.
PRS4	. . .identify digital competence gaps.
TMT Behavioral Integration (TBI)	
The extent to which TMT members . . .	
TBI1	Let each other know when their actions affect another team member's work.
TBI2	Have a clear understanding of the job problems and needs of other team members.
TBI3	Discuss their expectations of each other.
TBI4	Volunteer to help some team members, who are busy, to manage their workload.
TBI5	Are flexible about switching responsibilities to make things easier for each other.
TBI6	Are willing to help each other complete jobs and meet deadlines.
TBI7	Are effective in developing high-quality ideas.
TBI8	Are effective in generating high-quality solutions.
TBI9	Are effective in making decisions that require high levels of creativity and innovativeness.
Digital Transformation (DGT)	
In my organization	
DGT1	We aim to digitalize everything that can be digitalized.
DGT2	We collect large amounts of data from different sources.
DGT3	We aim to create stronger networking between the different business processes with digital technologies.
DGT4	We aim to enhance an efficient customer interface with digitality.
DGT5	We aim at achieving information exchange with digitality.

References

1. Hakan, K.Ö. Digital Transformation in Higher Education: A Case Study on Strategic Plans. *Высшее Образование России* **2020**, *3*, 9–23.
2. Yıldırım, A. An Evaluation on Turkey Within the Scope of Digital Transformation. In *Handbook of Research on Digital Violence and Discrimination Studies*; Özsungur, F., Ed.; IGI Global: Hershey PA, USA, 2022; pp. 315–332.

3. Sahin, S.B. Digital Transformation of Public Services as State Transformation: An Overview of the Experience in Turkey during the Pandemic. *Alternatives* **2023**, *48*, 191–205. [CrossRef] [PubMed]

4. Bozkurt, Ö.Ç.; Kalkan, A. Business Strategies of SME's, Innovation Types and Factors Influencing Their Innovation: Burdur Model. *Ege Acad. Rev.* **2014**, *14*, 189–198. [CrossRef]

5. Gajo, A.H.; Akyuz, G.A. Digital Transformation Implementation Challenges in Turkish Industrial Enterprises. *Int. J. Innov. Technol. Manag.* **2023**, *20*, 2350037. [CrossRef]

6. Aydın, A.G.; Baykal, E. The Impact of Organizational Strategic Trends on Individual-Based Resilience with a Digital Transformation Perspective. *Hum. Resour. Manag. Serv.* **2023**, *5*, 3359. [CrossRef]

7. Schwarzmüller, T.; Brosi, P.; Duman, D.; Welpe, I.M. How Does the Digital Transformation Affect Organizations? Key Themes of Change in Work Design and Leadership. *Manag. Rev.* **2018**, *29*, 114–138. [CrossRef]

8. Urs, N.; Nisioi, I.; Roja, A. Leading the Way: How Leaders Facilitate Digital Transformation in Organizations. In Proceedings of the Central and Eastern European eDem and eGov Days, New York, NY, USA, 14–15 September 2023; pp. 145–152.

9. Sainger, G. Leadership in Digital Age: A Study on the Role of Leader in this Era of Digital Transformation. *Int. J. Leadersh.* **2018**, *6*, 1.

10. Porter, M.E.; Heppelmann, J.E. How Smart, Connected Products are Transforming Competition. *Harv. Bus. Rev.* **2014**, *92*, 64–88.

11. Montasser, D.; Prijadi, R.; Balqiah, T.E. The Mediating Effect of IT-Enabled Dynamic Capabilities and Organizational Readiness on the Relationship between Transformational Leadership and Digital Business Model Innovation: Evidence from Indonesia Incumbent Firms. *SAGE Open* **2023**, *13*, 21582440231181588. [CrossRef]

12. Vial, G. Understanding Digital Transformation: A Review and a Research Agenda. *Manag. Digit. Transform.* **2021**, *20*, 13–66. [CrossRef]

13. Imran, F.; Shahzad, K.; Butt, A.; Kantola, J. Digital Transformation of Industrial Organizations: Toward an Integrated Framework. *Anagement. Chang. Manag.* **2021**, *21*, 451–479. [CrossRef]

14. Sarı, T.; Güleş, H.K.; Yiğitol, B. Awareness and Readiness of Industry 4.0: The Case of Turkish Manufacturing Industry. *Adv. Prod. Eng. Manag.* **2020**, *15*, 57–68. [CrossRef]

15. Butt, J. A Conceptual Framework to Support Digital Transformation in Manufacturing Using an Integrated Business Process Management Approach. *Designs* **2020**, *4*, 17. [CrossRef]

16. Butt, J. Exploring the Interrelationship between Additive Manufacturing and Industry 4.0. *Designs* **2020**, *4*, 13. [CrossRef]

17. Madzimure, J.; Baloyi, G.T.M. An Exploratory Study into the Impact of Digital Workforce on Organisational Performance at the Road Accident Fund. *SciRise Pedagog. Educ.* **2022**, *2*, 4–12. [CrossRef]

18. Zlatanović, S.S.; Jovanović, P. Workforce Aging and Decent Work in the Era of the Digital Economy–Towards a Holistic Public Policy Approach. *Stanovništvo* **2023**, *61*, 53–68. [CrossRef]

19. Sahu, N.; Deng, H.; Mollah, A. Investigating the Critical Success Factors of Digital Transformation for Improving Customer Experience. Doctoral Dissertation, RMIT University, Melbourne, Australia, 2019.

20. Nadeem, A.; Abedin, B.; Cerpa, N.; Chew, E. Digital Transformation and Digital Business Strategy in Electronic Commerce-The Role of Organizational Capabilities. *J. Theor. Appl. Electron. Commer. Res.* **2018**, *13*, 1–8. [CrossRef]

21. Cetindamar Kozanoglu, D.; Abedin, B. Understanding the Role of Employees in Digital Transformation: Conceptualization of Digital Literacy of Employees as a Multi-Dimensional Organizational Affordance. *J. Enterp. Inf. Manag.* **2021**, *34*, 1649–1672. [CrossRef]

22. Calli, B.A.; Ozsahin, M.; Coşkun, E.; Arik, A.R. Do Generative Leadership and Digital Literacy of Executive Management Help Flourishing Micro and Small Business Digital Maturity? *Int. J. Organ. Leadersh.* **2022**, *11*, 307–332. [CrossRef]

23. Bouwman, H.; Nikou, S.; de Reuver, M. Digitalization, Business Models, and SMEs: How do Business Model Innovation Practices Improve Performance of Digitalizing SMEs? *Telecommun. Policy* **2019**, *43*, 101828. [CrossRef]

24. Çallı, B.A.; Çallı, L. Relationships Between Digital Maturity, Organizational Agility, and Firm Performance: An Empirical Investigation on SMEs. *Bus. Manag. Stud. Int. J.* **2021**, *9*, 486–502. [CrossRef]

25. Rexhepi Mahmutaj, L.; Jusufi, N. The Importance of Digital Skills in Firms' Innovation: The Case of Western Balkans. *J. Technol. Manag. Innov.* **2023**, *18*, 98–102. [CrossRef]

26. Chi, M.; Lu, X.; Zhao, J.; Li, Y. The Impacts of Digital Business Strategy on Firm Performance: The Mediation Analysis of E-collaboration Capability. *Int. J. Inf. Syst. Change Manag.* **2018**, *10*, 123–139. [CrossRef]

27. Radovanović, D.; Holst, C.; Belur, S.B.; Srivastava, R.; Houngbonon, G.V.; Le Quentrec, E.; Noll, J. Digital Literacy Key Performance Indicators for Sustainable Development. *Soc. Incl.* **2020**, *8*, 151–167. [CrossRef]

28. Supriadi, Y.N.; Desmintari, D.; Resti, A.A.; Siregar, Z.M.E. The Impact of Digital Economy Literacy Strategy Model on Firm Performance of Small Medium Enterprises. *BIRCI-J.* **2021**, *4*, 10698–10710.

29. Sameer, S.K. The Interplay of Digitalization, Organizational Support, Workforce Agility and Task Performance in a Blended Working Environment: Evidence from Indian Public Sector Organizations. *Asian Bus. Manag.* **2022**, *23*, 266–286. [CrossRef]

30. Eden, R.; Burton-Jones, A.; Casey, V.; Draheim, M. Digital Transformation Requires Workforce Transformation. *MIS Q. Exec.* **2019**, *18*, 1–17. [CrossRef]

31. Ollerenshaw, A.; Corbett, J.; Thompson, H. Increasing the Digital Literacy Skills of Regional SMEs through High-Speed Broadband Access. *Small Enterp. Res.* **2021**, *28*, 115–133. [CrossRef]

32. Ebuka, A.A.; Nzewi, H.N.; Gerald, E.; Ezinne, K.M. Digital Literacy in a Post Coronavirus Era: A Management Perspective for Small Businesses in Africa. *Ann. Manag. Organ. Res.* **2020**, *1*, 203–212. [CrossRef]

33. Hasanah, A.U.; Shino, Y.; Kosasih, S. The Role of Information Technology in Improving the Competitiveness of Small and SME Enterprises. *IAIC Trans. Sustain. Digit. Innov.* **2022**, *3*, 168–174. [CrossRef]

34. Zhang, B. Research of Information Technology Improving Service Efficiency in SMEs. In Proceedings of the 2011 International Conference on Computer Science and Service System (CSSS), Nanjing, China, 27–29 June 2011; IEEE: Piscataway, NJ, USA, 2011; pp. 1548–1551.

35. Rakib, M.; Azis, M.; Najib, M.; Isma, A. Impact of Digital Literacy, Business Innovation, Competitive Advantage on the Existence of SMEs: A quantitative study in Makassar City, Indonesia. *Calitatea* **2024**, *25*, 277–283. [CrossRef]

36. Lassnig, M.; Müller, J.M.; Klieber, K.; Zeisler, A.; Schirl, M. A Digital Readiness Check for the Evaluation of Supply Chain Aspects and Company Size for Industry 4.0. *J. Manuf. Technol. Manag.* **2022**, *33*, 9. [CrossRef]

37. Adam, M.; Hanafi, A. Readiness for Organizational Change. In Proceedings of the 7th Sriwijaya Economics, Accounting, and Business Conference (SEABC 2021*), Online, 16–17 November 2021; Atlantis Press: Amsterdam, The Netherlands, 2022; pp. 360–368.

38. Mathur, M.; Kapoor, T.; Swami, S. Readiness for Organizational Change: The Effects of Individual and Organizational Factors. *J. Adv. Manag. Res.* **2023**, *20*, 730–757. [CrossRef]

39. Gigliotti, R.; Vardaman, J.; Marshall, D.R.; Gonzalez, K. The Role of Perceived Organizational Support in Individual Change Readiness. *J. Chang. Manag.* **2019**, *19*, 86–100. [CrossRef]

40. Gfrerer, A.; Hutter, K.; Füller, J.; Ströhle, T. Ready or not: Managers' and Employees' Different Perceptions of Digital Readiness. *Calif. Manag. Rev.* **2021**, *63*, 23–48. [CrossRef]

41. Zhang, X.; Du, X. Industry and Regional Peer Effects in Corporate Digital Transformation: The Moderating Effects of TMT Characteristics. *Sustainability* **2023**, *15*, 6003. [CrossRef]

42. Yang, L.; Wang, D. The Impacts of Top Management Team Characteristics on Entrepreneurial Strategic Orientation: The Moderating Effects of Industrial Environment and Corporate Ownership. *Manag. Decis.* **2014**, *52*, 378–409. [CrossRef]

43. Thys, K.; Vandekerkhof, P.; Steijvers, T.; Corten, M. Top Management Team and Board of Directors as the Strategic Leadership System: The Effect of Behavioral Integration on Strategic Decision-Making Quality. *Eur. Manag. J.* **2023**, *in press*. [CrossRef]

44. Salamzadeh, Y.; Farzad, F.S.; Salamzadeh, A.; Palalić, R. Digital Leadership and Organizational Capabilities in Manufacturing Industry: A Study in Malaysian Context. *Period. Eng. Nat. Sci.* **2021**, *10*, 195–211. [CrossRef]

45. Cerqueti, R.; Lucarelli, C.; Marinelli, N.; Micozzi, A. Teams in new ventures: Gender, human capital and motivation. *Int. J. Gend. Entrep.* **2020**, *12*, 145–171. [CrossRef]

46. Firk, S.; Gehrke, Y.; Hanelt, A.; Wolff, M. Top Management Team Characteristics and Digital Innovation: Exploring Digital Knowledge and TMT Interfaces. *Long Range Plan.* **2022**, *55*, 102166. [CrossRef]

47. Chen, Y.; Li, R.; Song, T. Does TMT Internationalization Promote Corporate Digital Transformation? A Study Based on the Cognitive Process Mechanism. *Bus. Process Manag. J.* **2023**, *29*, 309–338. [CrossRef]

48. De Lomana, G.G.; Strese, S.; Brinckmann, J. Adjusting to the Digital Age: The Effects of TMT Characteristics on the Digital Orientation of Firms. *Acad. Manag. Proc.* **2019**, *2019*, 13589. [CrossRef]

49. Hambrick, D.C.; Mason, P.A. Upper Echelons: The Organization as a Reflection of its Top Managers. *Acad. Manag. Rev.* **1984**, *9*, 193–206. [CrossRef]

50. Shepherd, D.A.; Mcmullen, J.S.; Ocasio, W. Is That an Opportunity? An Attention Model of Top Managers' Opportunity Beliefs for Strategic Action. *Strateg. Manag. J.* **2017**, *38*, 626–644. [CrossRef]

51. Li, H.; Li, J. Top Management Team Conflict and Entrepreneurial Strategy Making in China. *Asia Pac. J. Manag.* **2009**, *26*, 263–283. [CrossRef]

52. Zhang, Q.; Yang, M. Digital Transformation, Top Management Team Heterogeneity, and Corporate Innovation: Evidence from A Quasi-Natural Experiment in China. *Sustainability* **2023**, *15*, 1780. [CrossRef]

53. Meng, C.; Ge, Y.; Abrokwah, E. Developing Sustainable Decision Performance for Science and Technology Industries in China. *Sustainability* **2020**, *12*, 2068. [CrossRef]

54. Luo, B.; Zheng, S.; Ji, H.; Liang, L. Ambidextrous Leadership and TMT-Member Ambidextrous Behavior: The Role of TMT Behavioral Integration and TMT Risk Propensity. *Int. J. Hum. Resour. Manag.* **2018**, *29*, 338–359. [CrossRef]

55. Wan, J.; Le, Y.; Wang, G.; Xia, N.; Liu, X. Carrot or Stick? The Impact of Paternalistic Leadership on the Behavioral Integration of Top Management Teams in Megaprojects. *Int. J. Manag. Proj. Bus.* **2020**, *13*, 937–960. [CrossRef]

56. Yun, L.; Wan, J.; Wang, G.; Bai, J.; Zhang, B. Exploring the Missing Link between Top Management Team Characteristics and Megaproject Performance. *Eng. Constr. Archit. Manag.* **2020**, *27*, 1039–1064. [CrossRef]

57. Carmeli, A.; Schaubroeck, J.; Tishler, A. How CEO Empowering Leadership Shapes Top Management Team Processes: Implications for Firm Performance. *Leadersh. Q.* **2011**, *22*, 399–411. [CrossRef]

58. Yitzhack Halevi, M.; Carmeli, A.; Brueller, N.N. Ambidexterity in SBUs: TMT Behavioral Integration and Environmental Dynamism. *Hum. Resour. Manag.* **2015**, *54*, s223–s238. [CrossRef]

59. Guo, C.; Sheng, Z. Infrastructure Mega-Project Management on the Hong Kong-Zhuhai-Macao Bridge Project. *Front. Eng. Manag.* **2018**, *5*, 1–3. [CrossRef]

60. Wang, G.; Locatelli, G.; Wan, J.; Li, Y.; Le, Y. Governing Behavioral Integration of Top Management Team in Megaprojects: A Social Capital Perspective. *Int. J. Proj. Manag.* **2021**, *39*, 365–376. [CrossRef]
61. Zhu, X.; Yu, S.; Yang, S. Leveraging Resources to Achieve High Competitive Advantage for Digital New Ventures: An Empirical Study in China. *Asia Pac. Bus. Rev.* **2023**, *29*, 1079–1104. [CrossRef]
62. Zhiyia, Z.; Hongye, Z. Digital Capability and Sustainable Development of Enterprises: The Role of Long-Term Competitive Advantage. *Acad. J. Bus. Manag.* **2023**, *5*, 71–75. [CrossRef]
63. Barney, J. Firm Resources and Sustained Competitive Advantage. *J. Manag.* **1991**, *17*, 99–120. [CrossRef]
64. Emeagwali, O.L.; Aljuhmani, H.Y. Introductory Chapter: Strategic Management—A Dynamic Approach. In *Strategic Management: A Dynamic View*; IntechOpen: London, UK, 2019. [CrossRef]
65. Bharadwaj, A.; El Sawy, O.A.; Pavlou, P.A.; Venkatraman, N.V. Digital business Strategy: Toward a Next Generation of Insights. *MIS Q.* **2013**, 471–482. [CrossRef]
66. Neiroukh, S.; Aljuhmani, H.Y.; Alnajdawi, S. In the Era of Emerging Technologies: Discovering the Impact of Artificial Intelligence Capabilities on Timely Decision-Making and Business Performance. In Proceedings of the 2024 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETSIS), Online, 28–29 January 2024; pp. 1–6. [CrossRef]
67. Wade, M.; Hulland, J. The Resource-based View and Information Systems Research: Review, Extension, and Suggestions for Future Research. *MIS Q.* **2004**, *28*, 107–142. [CrossRef]
68. Alsafadi, Y.; Aljuhmani, H.Y. The Influence of Entrepreneurial Innovations in Building Competitive Advantage: The Mediating Role of Entrepreneurial Thinking. *Kybernetes*, 2023, *ahead-of-print*. [CrossRef]
69. Ji, Z.; Zhou, T.; Zhang, Q. The Impact of Digital Transformation on Corporate Sustainability: Evidence from Listed Companies in China. *Sustainability* **2023**, *15*, 2117. [CrossRef]
70. Bhattacharyya, S.S.; Jha, S. Mapping Micro Small and Medium Enterprises from the resource-Based View and Dynamic Capability Theory Perspectives and Innovation Classification. *Int. J. Entrep. Small Bus.* **2015**, *25*, 331–350. [CrossRef]
71. Ren, X.; Jing, H.; Zhang, Y. Construction of Digital Transformation Capability of Manufacturing Enterprises: Qualitative Meta-Analysis Based on Current Research. *Sustainability* **2023**, *15*, 14168. [CrossRef]
72. Aljuhmani, H.Y.; Ababneh, B.; Emeagwali, L.; Elrehail, H. Strategic Stances and Organizational Performance: Are Strategic Performance Measurement Systems the Missing Link? *Asia-Pac. J. Bus. Adm.* **2024**, *16*, 282–306. [CrossRef]
73. Civelek, M.; Krajčík, V.; Ključnikov, A. The Impacts of Dynamic Capabilities on SMEs' Digital Transformation Process: The Resource-based View Perspective. *Oecon. Copernic.* **2023**, *14*, 1367–1392. [CrossRef]
74. Götz, F.; Hamann, C.; Buck, C.; Oesterle, S.; Eymann, T.; Meckl, R. Dynamic Capabilities as the Key Approach to Investigate Digital Ecosystems. In Proceedings of the Entwicklungen, Chancen und Herausforderungen der Digitalisierung: Proceedings der 15. Internationalen Tagung Wirtschaftsinformatik, WI 2020-Zentrale Tracks, Potsdam, Germany, 9–11 March 2020; pp. 1396–1411. [CrossRef]
75. Teece, D.J.; Pisano, G.; Shuen, A. Dynamic Capabilities and Strategic Management. *Strateg. Manag. J.* **1997**, *18*, 509–533. [CrossRef]
76. Weill, P.; Woerner, S.L. Thriving in an increasingly digital ecosystem. *MIT Sloan Manag. Rev.* **2015**, *56*, 27.
77. Arsal, R.E.; Durdu, H.T.; Tongarlak, M.H. Organizational Enablers of Data-Driven Digital Transformation: A Case Study from Banking Industry. In Proceedings of the 2022 IEEE Technology and Engineering Management Conference (TEMSCON EUROPE), Izmir, Turkey, 25–29 April 2022; IEEE: Piscataway, NJ, USA, 2022; pp. 210–216. [CrossRef]
78. Scuotto, V.; Nicotra, M.; Del Giudice, M.; Krueger, N.; Gregori, G.L. A Microfoundational Perspective on SMEs' Growth in the Digital Transformation Era. *J. Bus. Res.* **2021**, *129*, 382–392. [CrossRef]
79. Adomako, S.; Amankwah-Amoah, J.; Tarba, S.Y.; Khan, Z. Perceived Corruption, Business Process Digitization, and SMEs' Degree of Internationalization in Sub-Saharan Africa. *J. Bus. Res.* **2021**, *123*, 196–207. [CrossRef]
80. Rialti, R.; Zollo, L.; Ferraris, A.; Alon, I. Big Data Analytics Capabilities and Performance: Evidence from a Moderated Multi-Mediation Model. *Technol. Forecast. Soc. Chang.* **2019**, *149*, 119781. [CrossRef]
81. Neumeyer, X.; Liu, M. Managerial Competencies and Development in the Digital Age. *IEEE Eng. Manag. Rev.* **2021**, *49*, 49–55. [CrossRef]
82. Cetindamar, D.; Abedin, B.; Shirahada, K. The Role of Employees in Digital Transformation: A Preliminary Study on How Employees' Digital Literacy Impacts use of Digital Technologies. *IEEE Trans. Eng. Manag.* **2024**, *71*, 7837–7848. [CrossRef]
83. Cetindamar, D.; Phaal, R. Technology Management in the Age of Digital Technologies. *IEEE Trans. Eng. Manag.* **2021**, *70*, 2507–2515. [CrossRef]
84. Zahoor, N.; Zopiatis, A.; Adomako, S.; Lamprinakos, G. The Micro-foundations of Digitally Transforming SMEs: How Digital Literacy and Technology Interact with Managerial Attributes. *J. Bus. Res.* **2023**, *159*, 113755. [CrossRef]
85. Elçiçek, M.; Kahyaoğlu, M. Postgraduate Theses on Digital Literacy in Turkey: A Content Analysis Study. *J. Learn. Teach. Digit. Age* **2022**, *7*, 30–41.
86. Gan, Y.; Sun, T.; Chen, Y.; Wu, T.; Liu, Y.; Wang, S.; Zhang, J. The Impact of Corporate Digital Transformation on Green Technological Innovation in the Context of "Dual-Carbon" Goals. *Adv. Econ. Dev. Manag. Res.* **2023**, *1*, 97–103. [CrossRef]
87. Liu, K.; Liu, X.; Wu, Z. Nexus between Corporate Digital Transformation and Green Technological Innovation Performance: The Mediating Role of Optimizing Resource Allocation. *Sustainability* **2024**, *16*, 1318. [CrossRef]
88. Suhodoeva, L.F.; Nemova, O.A.; Khizhnaya, A.V.; Valentinovna, K.T.; Maltseva, S.M.; Svadbina, T.V. Transformation of Resource Allocation Processes based on Digital Technologies. *Int. J. Criminol. Sociol.* **2020**, *9*, 2095–2101. [CrossRef]

89. Farias-Gaytan, S.; Aguaded, I.; Ramirez-Montoya, M.S. Digital Transformation and Digital Literacy in the Context of Complexity within Higher Education Institutions: A Systematic Literature Review. *Humanit. Soc. Sci. Commun.* **2023**, *10*, 1–11. [CrossRef]

90. Audrin, C.; Audrin, B. Key Factors in Digital Literacy in Learning and Education: A Systematic Literature Review Using Text Mining. *Educ. Inf. Technol.* **2022**, *27*, 7395–7419. [CrossRef]

91. Farias-Gaytan, S.; Aguaded, I.; Ramirez-Montoya, M.S. Transformation and Digital Literacy: Systematic Literature Mapping. *Educ. Inf. Technol.* **2022**, *27*, 1417–1437. [CrossRef]

92. Li, W.; Liu, K.; Belitski, M.; Ghobadian, A.; O'Regan, N. E-Leadership through Strategic Alignment: An Empirical Study of Small-and Medium-Sized Enterprises in the Digital Age. *J. Inf. Technol.* **2016**, *31*, 185–206. [CrossRef]

93. Raisch, S.; Birkinshaw, J.; Probst, G.; Tushman, M.L. Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. *Organ. Sci.* **2009**, *20*, 685–695. [CrossRef]

94. Westerman, G.; Bonnet, D.; McAfee, A. *Leading Digital: Turning Technology into Business Transformation*; Harvard Business Press: Boston, MA, USA, 2014.

95. Teece, D.J. Explicating Dynamic Capabilities: The Nature and Micro Foundations of (Sustainable) Enterprise Performance. *Strateg. Manag. J.* **2007**, *28*, 1319–1350. [CrossRef]

96. Horrigan, J.B. Digital Readiness Gaps. *Pew Res. Cent.* **2016**.

97. Tinmaz, H.; Lee, Y.T.; Fanea-Ivanovici, M.; Baber, H. A Systematic Review on Digital literacy. *Smart Learn. Environ.* **2022**, *9*, 1–18. [CrossRef]

98. Hong, A.J.; Kim, H.J. College Students' Digital Readiness for Academic Engagement (DRAE) Scale: Scale Development and Validation. *Asia-Pac. Educ. Res.* **2018**, *27*, 303–312. [CrossRef]

99. Trischler, M.; Li-Ying, J. Exploring the Relationship between Multi-Dimensional Digital Readiness and Digital Transformation Outcomes. *Int. J. Innov. Manag.* **2022**, *26*, 2240014. [CrossRef]

100. Bican, P.M.; Brem, A. Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There a Sustainable "Digital"? *Sustainability* **2020**, *12*, 5239. [CrossRef]

101. Nylén, D.; Holmström, J. Digital Innovation Strategy: A Framework for Diagnosing and Improving Digital Product and Service Innovation. *Bus. Horiz.* **2015**, *58*, 57–67. [CrossRef]

102. Aminah, S.; Saksono, H. Digital Transformation of the Government: A Case Study in Indonesia. *J. Komun. Malays. J. Commun.* **2021**, *37*, 272–288. [CrossRef]

103. Nguyen, D.K.; Broekhuizen, T.; Dong, J.Q.; Verhoef, P.C. Are You Ready for Digital Transformation? Digital Readiness Configurations and Business Value across Industries. In Proceedings of the International Conference on Information Systems Proceedings, Austin, TX, USA, 12–15 December 2021; Association for Information Systems (AIS): Atlanta, GA, USA, 2021; Volume 7.

104. Machado, C.G.; Winroth, M.; Almström, P.; Ericson Öberg, A.; Kurdve, M.; AlMashalah, S. Digital Organisational Readiness: Experiences from Manufacturing Companies. *J. Manuf. Technol. Manag.* **2021**, *32*, 167–182. [CrossRef]

105. Ling, K.C.; Lee Siew Cheng, M.; May Ling, A.Y.; Kai Sin, C.; Li, Z. Readiness of Digital Transformation among Malaysian Digital Talents. *Int. J. Bus. Manag.* **2023**, *18*, 161. [CrossRef]

106. Huang, Y. The Role of Digital Readiness Innovative Teaching Methods in Music Art E-learning Students' Satisfaction with Entrepreneur Psychological Capital as a Mediator: Evidence from Music Entrepreneur Training Institutes. *Front. Psychol.* **2022**, *13*, 979628. [CrossRef] [PubMed]

107. Erdem, C.; Oruç, E.; Atar, C.; Bağcı, H. The Mediating Effect of Digital Literacy in the Relationship between Media Literacy and Digital Citizenship. *Educ. Inf. Technol.* **2023**, *28*, 4875–4891. [CrossRef]

108. Slavković, M.; Pavlović, K.; Mamula Nikolić, T.; Vučenović, T.; Bugarčić, M. Impact of Digital Capabilities on Digital Transformation: The Mediating Role of Digital Citizenship. *Systems* **2023**, *11*, 172. [CrossRef]

109. Radovanović, D. Rethinking Digital Literacy. In *Digital Literacy and Inclusion: Stories, Platforms, Communities*; Springer International Publishing: Cham, Switzerland, 2023; pp. 1–12.

110. Kor, Y.Y.; Mahoney, J.T.; Michael, S.C. Resources, Capabilities and Entrepreneurial Perceptions. *J. Manag. Stud.* **2007**, *44*, 1187–1212. [CrossRef]

111. Brunner, M.; Gonzalez-Castañé, G.; Ravesteijn, P. How Digital Leadership Competences and IT Capabilities Affect an Organization's Ability to Digitally Transform and Adopt New Technologies. *J. Int. Technol. Inf. Manag.* **2021**, *30*, 139–156. [CrossRef]

112. Negi, A.; Sain, S.K. Digital Literacy for the 21st Century: Rethinking and Redesigning the Roles of Libraries. *Int. J. Innov. Sci. Res. Technol.* **2023**, *8*, 1042–1047.

113. Wei, Z. Navigating Digital Learning Landscapes: Unveiling the Interplay between Learning Behaviors, Digital Literacy, and Educational Outcomes. *J. Knowl. Econ.* **2023**, 1–31. [CrossRef]

114. Peng, D.; Yu, Z. A Literature Review of Digital Literacy over Two Decades. *Educ. Res. Int.* **2022**, *2022*, 1–8. [CrossRef]

115. Chua, R.Y.; Roth, Y.; Lemoine, J.F. The Impact of Culture on Creativity: How Cultural Tightness and Cultural Distance Affect Global Innovation Crowdsourcing Work. *Adm. Sci. Q.* **2015**, *60*, 189–227. [CrossRef]

116. Grimpe, C.; Sofka, W.; Kaiser, U. Competing for Digital Human Capital: The Retention Effect of Digital Expertise in MNC Subsidiaries. *J. Int. Bus. Stud.* **2023**, *54*, 657–685. [CrossRef]

117. ICT. ICT—Invest in Türkiye. Presidency of the Republic of Turkey Investment Office. 2023. Available online: https://www.invest.gov.tr/en/sectors/pages/ict.aspx (accessed on 21 March 2023).

118. Izmen, U.; Kilicaslan, Y.; Gurel, Y.U. *TÜBİSAD Turkey's Digital Transformation Index*; Informatics Industry Association (TÜBİSAD): Istanbul, Turkey, 2021.

119. Bayraktar, E.; Tatoglu, E.; Aydiner, A.S.; Delen, D. Business Analytics Adoption and Technological Intensity: An Efficiency Analysis. *Inf. Syst. Front.* 2023. [CrossRef]

120. Salamah, E.; Alzubi, A.; Yinal, A. Unveiling the Impact of Digitalization on Supply Chain Performance in the Post-COVID-19 Era: The Mediating Role of Supply Chain Integration and Efficiency. *Sustainability* **2024**, *16*, 1. [CrossRef]

121. Aydiner, A.S.; Tatoglu, E.; Bayraktar, E.; Zaim, S.; Delen, D. Business Analytics and Firm Performance: The Mediating Role of Business Process Performance. *J. Bus. Res.* **2019**, *96*, 228–237. [CrossRef]

122. Aljuhmani, H.Y.; Emeagwali, O.L.; Ababneh, B. The Relationships between CEOs' Psychological Attributes, Top Management Team Behavioral Integration and Firm Performance. *Int. J. Organ. Theory Behav.* **2021**, *24*, 126–145. [CrossRef]

123. Dillman, D.A.; Smyth, J.D.; Christian, L.M. *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method*, 4th ed.; Wiley: New York, NY, USA, 2014.

124. Hair, J.F.; Money, A.H.; Samouel, P.; Page, M. Research Methods for Business. *Educ. Train.* **2007**, *49*, 336–337. [CrossRef]

125. Brislin, R.W. The Wording and Translation of Research Instruments. In *Field Methods in Cross-Cultural Research*; Lonner, W.J., Berry, J., Eds.; Sage Publications, Inc.: Thousand Oaks, CA, USA, 1986; pp. 137–164.

126. Flynn, B.; Pagell, M.; Fugate, B. Editorial: Survey Research Design in Supply Chain Management: The Need for Evolution in Our Expectations. *J. Supply Chain. Manag.* **2018**, *54*, 1–15. [CrossRef]

127. Vuorikari, R.; Punie, Y.; Gomez, S.C.; Brande, G.V.D. DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model. JRC Research Reports, Article JRC101254. Available online: https://ideas.repec.org/ /p/ipt/iptwpa/jrc101254.html (accessed on 21 March 2023).

128. Simsek, Z.; Veiga, J.F.; Lubatkin, M.H.; Dino, R.N. Modeling the Multilevel Determinants of Top Management Team Behavioral Integration. *Acad. Manag. J.* **2005**, *48*, 69–84. [CrossRef]

129. Chwiłkowska-Kubala, A.; Cyfert, S.; Malewska, K.; Mierzejewska, K.; Szumowski, W. The Impact of Resources on Digital Transformation in Energy Sector Companies. The Role of Readiness for Digital Transformation. *Technol. Soc.* **2023**, *74*, 102315. [CrossRef]

130. Hussain, M.; Papastathopoulos, A. Organizational Readiness for Digital Financial Innovation and Financial Resilience. *Int. J. Prod. Econ.* **2022**, *243*, 108326. [CrossRef]

131. AlNuaimi, B.K.; Kumar Singh, S.; Ren, S.; Budhwar, P.; Vorobyev, D. Mastering Digital Transformation: The Nexus between Leadership, Agility, and Digital Strategy. *J. Bus. Res.* **2022**, *145*, 636–648. [CrossRef]

132. Nasiri, M.; Ukko, J.; Saunila, M.; Rantala, T. Managing the Digital Supply Chain: The Role of Smart Technologies. *Technovation* **2020**, *96–97*, 102121. [CrossRef]

133. Podsakoff, P.M.; MacKenzie, S.B.; Lee, J.-Y.; Podsakoff, N.P. Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *J. Appl. Psychol.* **2003**, *88*, 879–903. [CrossRef]

134. Chang, S.-J.; van Witteloostuijn, A.; Eden, L. From the Editors: Common Method Variance in International Business Research. *J. Int. Bus. Stud.* **2010**, *41*, 178–184. [CrossRef]

135. Harman, H.H. *Modern Factor Analysis*, 3rd ed.; University of Chicago Press: Chicago, IL, USA, 1976.

136. Kock, N. Common Method Bias in PLS-SEM: A Full Collinearity Assessment Approach. *Int. J. E-Collab.* **2015**, *11*, 1–10. [CrossRef]

137. Ringle, C.M.; Wende, S.; Becker, J.M. *SmartPLS 4*; SmartPLS GmbH: Hambburg, Germany, 2022.

138. Hair, J.F.; Sarstedt, M. Factors Versus Composites: Guidelines for Choosing the Right Structural Equation Modeling Method. *Proj. Manag. J.* **2019**, *50*, 619–624. [CrossRef]

139. Chin, W.W. The Partial Least Squares Approach for Structural Equation Modeling. In *Modern Methods for Business Research*; Marcoulides, G.A., Ed.; Lawrence Erlbaum Associates Publishers: Mahwah, NJ, USA, 1998; pp. 295–336.

140. Hair, J.; Sarstedt, M.; Ringle, C.M.; Gudergan, S.P. *Advanced Issues in Partial Least Squares Structural Equation Modeling*, 2nd ed.; SAGE Publications Inc.: New York, NY, USA, 2023.

141. Hair, J.F.; Risher, J.J.; Sarstedt, M.; Ringle, C.M. When to Use and How to Report the Results of PLS-SEM. *Eur. Bus. Rev.* **2019**, *31*, 2–24. [CrossRef]

142. Fornell, C.; Larcker, D.F. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]

143. Henseler, J.; Ringle, C.M.; Sarstedt, M. A New Criterion for Assessing Discriminant Validity in Variance-based Structural Equation Modeling. *J. Acad. Market. Sci.* **2015**, *43*, 115–135. [CrossRef]

144. Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed.; Erlbaum Associates: Mahwah, NJ, USA, 1988.

145. Hayes, A.F. Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Commun. Monogr.* **2009**, *76*, 408–420. [CrossRef]

146. Preacher, K.J.; Hayes, A.F. SPSS and SAS Procedures for Estimating Indirect Effects in Simple Mediation Models. *Behav. Res. Methods Instrum. Comput.* **2004**, *36*, 717–731. [CrossRef] [PubMed]

147. Awwad, R.I.; Aljuhmani, H.Y.; Hamdan, S. Examining the Relationships between Frontline Bank Employees' Job Demands and Job Satisfaction: A Mediated Moderation Model. *Sage Open* **2022**, *12*, 21582440221079880. [CrossRef]

148. Chin, W.W.; Marcolin, B.L.; Newsted, P.R. A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. *Inf. Syst. Res.* **2003**, *14*, 189–217. [CrossRef]

149. Henseler, J.; Fassott, G. Testing moderating effects in PLS path models: An illustration of available procedures. In *Handbook of Partial Least Squares: Concepts, Methods and Applications*; Vinzi, V.E., Chin, W.W., Henseler, J., Wang, H., Eds.; Springer: Berlin, Germany, 2010; pp. 713–735.

150. Al-Geitany, S.; Aljuhmani, H.Y.; Emeagwali, O.L.; Nasr, E. Consumer Behavior in the Post-COVID-19 Era: The Impact of Perceived Interactivity on Behavioral Intention in the Context of Virtual Conferences. *Sustainability* **2023**, *15*, 8600. [CrossRef]

151. Hensellek, S. Digital Leadership: A Framework for Successful Leadership in the Digital Age. *J. Media Manag. Entrep.* **2020**, *2*, 55–69. [CrossRef]

152. Venugopal, A.; Krishnan, T.N.; Upadhyayula, R.S.; Kumar, M. Finding the Microfoundations of Organizational Ambidexterity-Demystifying the Role of Top Management Behavioural Integration. *J. Bus. Res.* **2020**, *106*, 1–11. [CrossRef]

153. Marsh, E. Understanding the Effect of Digital Literacy on Employees' Digital Workplace Continuance Intentions and Individual Performance. In *Research Anthology on Digital Transformation, Organizational Change, and the Impact of Remote Work*; Management Association, Information Resources, Ed.; IGI Global: Hershey PA, USA, 2021; pp. 1638–1659.

154. Çelik, D.; Uzunçarşılı, Ü. Is the Effect of Organizational Ambidexterity and Technological Innovation Capability on Firm Performance Mediated by Competitive Advantage? An Empirical Research on Turkish Manufacturing and Service Industries. *SAGE Open* **2023**, *13*, 21582440231206367. [CrossRef]

155. Bhardwaj, R.; Srivastava, S.; Taggar, R.; Bindra, S. Exploring Micro-Foundations of Dynamic Capabilities for Social Enterprises. *Soc. Enterp. J.* **2022**, *18*, 451–469. [CrossRef]

156. Denison, D.R.; Haaland, S.; Goelzer, P. Corporate Culture and Organizational Effectiveness: Is Asia Different from the Rest of the World? *Organ. Dyn.* **2004**, *33*, 98–109. [CrossRef]

157. Bojesson, C.; Fundin, A. Exploring Microfoundations of Dynamic Capabilities—Challenges, Barriers and Enablers of Organizational Change. *J. Organ. Chang. Manag.* **2021**, *34*, 206–222. [CrossRef]

158. Shin, J.; Mollah, M.A.; Choi, J. Sustainability and Organizational Performance in South Korea: The Effect of Digital Leadership on Digital Culture and Employees' Digital Capabilities. *Sustainability* **2023**, *15*, 2027. [CrossRef]

159. Wang, T.; Lin, X.; Sheng, F. Digital Leadership and Exploratory Innovation: From the Dual Perspectives of Strategic Orientation and Organizational Culture. *Front. Psychol.* **2022**, *13*, 902693. [CrossRef]

160. Hsiao, M.H. Resource Integration and Firm Performance through Organizational Capabilities for Digital Transformation. *Digit. Transform. Soc.* 2024, *ahead-of-print*. [CrossRef]

161. Öngel, V.; Günsel, A.; Gençer Çelik, G.; Altındağ, E.; Tatlı, H.S. Digital Leadership's Influence on Individual Creativity and Employee Performance: A View through the Generational Lens. *Behav. Sci.* **2023**, *14*, 3. [CrossRef]

162. Senadjki, A.; Au Yong, H.N.; Ganapathy, T.; Ogbeibu, S. Unlocking the Potential: The Impact of Digital Leadership on Firms' Performance through Digital Transformation. *J. Bus. Socio-Econ. Dev.* **2024**, *4*, 161–177. [CrossRef]

163. Alhammadi, E.M. The Impact of Talent Management Practices on Employee Performance: Leadership Competencies as a Mediator. *Int. J. Prof. Bus. Rev.* **2023**, *8*, 2. [CrossRef]

164. Avolio, B.J.; Kahai, S. Adding the "E" to E-leadership: How it may Impact Your Leadership. *Organ. Dyn.* **2003**, *31*, 325–338. [CrossRef]