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A Metaorganizations Perspective on Digital Innovation and Corporate Social Responsibility: Evidence from China

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Abstract: This research investigates the relationship between DI and CSR from the metaorganizational perspective. Metaorganizations represent collectives of organizations that function collectively to achieve shared goals and objectives. The study underscores the significant influence of DI on CSR initiatives, suggesting that firms should strategically align their digital innovation endeavors with their CSR objectives. Alignment between digital innovation and CSR objectives can cultivate a more integrated strategy that delivers both business and societal value. Furthermore, our findings reveal that firms operating under conditions of higher value appropriation, partner concentration, and environmental uncertainty tend to be more proactive in their CSR efforts within the DI context. This observation stems from a noticeable shift in primary focus: value creation and capture are no longer exclusive goals, but, rather, there is an increased emphasis on social benefits. This change necessitates a strategic recalibration by firms to incorporate a more robust focus on sustainability and social responsibility within their business models in the digital era. Our hypotheses are substantiated by results obtained from a longitudinal sample of Chinese listed firms. The contribution of this study is that it offers novel insight into the interplay between digital innovation and CSR through the lens of metaorganizations.

Keywords: digital transformation; non-market strategy; Chinese manufacturing firm; prosocial preferences of digitalization

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1. Introduction

Digital innovation (DI) is a vital source of dynamism and innovation for many technologies, products, and services in the global economy. Owing to the connectivity and integration of digital technology [1], DI accelerates the value interaction across organizational boundaries, which improves the efficiency of firms through joint innovation and fosters an amicable collective exchange relationship [2,3]. Precisely because of this, to establish effectiveness, firms and stakeholders are required to disclose parts of their own knowledge and resources to other actors in the DI process [4,5]. This underscores the social and public nature of DI and fosters more sustainable, open, but complex relationships between organizations and stakeholders [6,7]. Thus, firms in DI process find themselves under continuous pressure to adapt their strategic initiatives in line with the principles of digital coordination and co-creation. In this context, corporate social responsibility (CSR), regarded as a key strategy for maximizing shared value during collaborative processes, is theorized to be the basic task and common goal for organizations initiating a digital movement. This movement aims toward a more sustainable, democratic, and inclusive economy [8,9]. Consequently, our research aims to explore the interconnections between DI and CSR.

The mechanisms driving CSR in a digital context are different from those in traditional settings. The pervasive nature of digital technologies in innovation changes the original cooperation and coordination routines between firms by reshaping the original technical

infrastructures and associated value chain systems [10]. In these circumstances, firms can leverage digital technology to open their innovation processes to external stakeholders while designing and producing products. This approach facilitates the formation of complements that can bind multistakeholder technical resources, such as the Android and Apple Store platforms. We theorize that firms, following digital design rules, can aggregate and allocate diversified stakeholders to achieve higher allocation efficiency of shared value. This can be described through the analogy of "baking and slicing the cake." To establish mutually beneficial exchange relationships with stakeholders, firms may need to promote value exchange or other non-market strategies. Consequently, a growing body of theoretical literature considers that factors related to digitalization as crucial elements may have a significant influence on CSR [9,11]. While this understanding is generally well established, existing literature has not fully explored the potential mechanism that underlies the relationship between DI and CSR. A significant research gap exists in explaining why some firms exhibit higher altruistic behavior than others in the process of digitization [2,12]. Therefore, our understanding of how DI affects CSR remains rudimentary, and, as of now, there is scarce empirical evidence underpinning these contentions [9].

To bridge the above gap, we draw on metaorganizations theory to validate the relationship between DI and CSR by explicating the mechanism and boundary conditions from a metaorganizations perspective. Metaorganizations theory posits that DI, which connects multiple organizations, actors, activities, and interfaces, is underpinned by interrelated social value propositions, essentially forming an "organization of organizations" [13,14]. Organizations often band together to form a collective or consortium with a specific goal or shared interest in mind. While these constituent organizations may have their unique objectives and strategies, within the metaorganization, they collaborate, pool resources, and work collectively based on a shared value proposition [15]. In this sense, the prosocial motivation of a firm in the digital environment is significantly influenced by the value proposition shaped by organizational collaboration, coordination, and integration [16]. Firms involved in the DI process may actively engage in CSR pursuits to foster stable network relationships, which we will detail further in the next section. Additionally, when some firms provide more social benefits through the DI process than others, we must also consider what factors enhance the prosocial motivation of firms in DI. Metaorganization theory underscores that firms must strategize by considering the mutual-way dynamics among organizations and the environment. In this paper, we separately investigate the influence of these three factors (i.e., value exclusivity, partner stability, and environmental uncertainty) as crucial boundary conditions in the relationship between DI and CSR.

Our key contributions can be summarized as two primary points. First, to our knowledge, we are the first study to examine the relationship between DI and CSR. Our study investigates how DI should be harnessed as a collective effort to achieve superior social benefits (i.e., CSR). Existing literature in the DI and business ethics domains suggests that the organizational drive toward technology and innovation is a significant catalyst for changes in social norms and practices [9]. We enrich the research stream of the digital domain and CSR domain by employing metaorganization theory and proposing mechanisms that link the DI to CSR. Second, our paper contributes to the dialogue on the boundary conditions required for promoting social benefits in a digital environment [13] by analyzing the interactions between DI and metaorganizations [14,17]. Conventional theory argues that organizations, stakeholders, and the external environment significantly impact the utilization of digital technology, leading to certain moral and ethical changes [18,19]. This assertion has been confirmed in our results; these factors significantly moderate the relationship between DI and CSR. Given the paucity of empirical studies on how boundary conditions facilitate CSR in a digital environment, our research offers valuable insights for firms aiming to assess the role of boundary conditions in influencing social welfare derived from DI.

The remainder of this paper is organized as follows. Section 2 provides the theoretical background and hypothesis. The methodology is described in Section 3. In Section 4, the results are presented. Finally, Section 5 offers a discussion and our conclusions.

2. Theoretical Background

2.1. Sustainability through Digital Technology and Metaorganizations

An added benefit of DI is that it has the capability to address social challenges with uncertainty [20]. These digital technologies improve traceability and transparency through proof of provenance, data immutability, and real-time data exchange, which in turn enhances the production and operational activities of organizations. The terms "digitalization" and "DI" are often used interchangeably to describe firms' responses to digital technology [21–23]. Moreover, DI has been conceptualized as innovative digital solutions that enable digital transformation of businesses [24,25]. Some studies have posited DI as a crucial driver for organizational strategies in the emerging digital world [1,2]. It has been found that DI builds an open architecture that integrates resources from multiple sources, facilitating participation from various parties and aligning a large number of previously diverse and uncoordinated audiences to generate sustainable shared value [7,20,26]. At the organizational level, scholars have proposed that DI transcends simple applications of digital technology [27,28]. As DI impacts not just the company but also a broader range of stakeholders, it extends beyond merely achieving business improvements and efficiency gains [29]. Firms can leverage DI to reshape their social interactions and integrate professional knowledge from various stakeholders purposefully into their innovations. Researchers are, therefore, increasingly focusing on the strategic initiatives of DI processes, which drive innovation that delivers economic, social, and environmental benefits [6,21]. Notably, digital technologies such as the Internet of Things, Industrial Internet, and Cloud Platforms enhance innovation's efficiency and effectiveness, strengthen stakeholder relationships, and magnify impacts on broader society [6,30,31].

As stated above, we propose that firms adopting DI need to set social responsibility as a goal to maintain stakeholder relationships. Yet, encouraging all stakeholders to align with the collective value proposition under the guidelines of digital products or services is not an easy task for firms [2]. In other words, DI demands firms to orchestrate interactions and collective actions toward system-level objectives, allowing them to gradually establish and implement value propositions, thereby forming shared social values [6]. In most cases, specific resources such as knowledge and capabilities are not readily accessible within the network. However, actors possessing such capabilities may be drawn into the network by the appeal of CSR activities [32]. This viewpoint is corroborated by recent theorizations on metaorganizations. These theories suggest that prosocial activities of mutual complementarity and common development can bolster the commitment of actors to stakeholders in situations where business relationships among member digital actors are driven by collaboration and co-creation [32,33].

Therefore, we adopt a metaorganizational perspective to explore the social implications of DI. On the one hand, given the typical characteristics of the DI process, it is useful to perceive DI as an "organization of organizations"—that is, a metaorganizational form. DI as metaorganizations connects multiple digital actors, activities, and interfaces, underpinned by interrelated social or economic value propositions [14]. In line with the socio-technical viewpoint in literature streams, the effectiveness of DI depends on cooperation and coordination across diverse organizational units and actors [34]. On the other hand, a metaorganization is a universal and effective network in which member organizations maintain legal autonomy and are not connected through legally binding business relationships in the digital environment [13,32]. In DI, for instance, application developers on a mobile application platform agree to the terms and pay platform fees and commissions in exchange for access to the user base, development tools, and opportunities to receive revenue and feedback from the ecosystem [14]. Therefore, just as in metaorganizations, actors in DI can freely interact while retaining self-will and autonomy. However, the exist-

ing viewpoint is not comprehensive. While scholars have shown the relationship between digitalization and the social aspects of sustainability [17,21,23], there is no consensus on why DI leads firms to pay more attention to altruistic behavior [9,28]. Thus, to respond to Etter et al.'s (2019) call for studies on whether and how digitalization affects business ethics [9], as well as to enhance the effectiveness of shared value in the digital environment, this study seeks to provide insights into the social responsibility mechanism of DI. Importantly, we introduce metaorganizations theory to explain this issue and to clarify the boundary conditions under which DI affects CSR.

2.2. Digital Innovation and Corporate Social Responsibility

Digital literature streams refer to DI as a sociotechnical phenomenon and describe it as a process as well as using digital technology to jointly allocate resources with dynamic actors [35]. For instance, the innovation process, new products and services, and other outcomes are continually redefined by heterogeneous actors who might be affiliated with different organizations, integrated only temporarily [36]. Hence, researchers also perceive DI as a "metaorganization or evolving organization," which entails (1) all actors in the metaorganization uniting and coordinating innovation content; and (2) generating economic benefits through the creation and utilization of shared value. In this context, DI facilitates and constrains the behavior, interaction, and scope of actors, progressively altering its relevant organizational logic. We propose that each actor in DI has its inherent social responsibility embedded in the respective value-creating activities. In this study, we theorize that DI enhances CSR activities.

On the one hand, DI can shape organizational logic around the principles of openness, co-creation, and sharing, thereby fostering CSR activities. Within the metaorganization formed by digital technology, a multilateral interdependence emerges within or between heterogeneous groups of actors. In this construct, the utility of each actor hinges on the sustainable behaviors exhibited within the DI process [5,37]. Throughout the DI process, firms can generate high levels of social synergies and positive externalities by harnessing co-specialized resources and capabilities from diverse actors. This contributes to the formation of shared value [32,38]. This dynamic process enables firms to implement strategic decisions that foster positive relationships with stakeholders and actively participate in, and build, digital communities centered on co-value propositions [39,40]. This metaorganization underscores social benefits predicated on collectivism, fostering the promotion of CSR. Therefore, DI can fortify collective cognition and promote strategic preferences for long-term sustainability, such as social responsibility activities.

On the other hand, DI necessitates that firms pursue stable network externalities, thereby improving CSR performance. As the potential of DI leads to an increasing number of interconnected actors, the shared value derived from the DI process necessitates that each actor maintain legitimacy in the face of social expectations from external stakeholders. Digital platforms serve as an example [5,35]. Actors that manipulate platform rules for self-interest may generate significant negative externalities and, consequently, face legal pressures from external users. Such negative externalities could tarnish the reputation of the metaorganizations and severely hamper the effectiveness of their DI. For instance, some third-party apps on Apple's platform collected user data without permission, potentially causing social friction and damaging the financial performance of Apple stores [26]. Therefore, firms engaged in DI might need to address unique social issues arising from their interactions with other parties and respond to concerns about legitimacy from both internal and external stakeholders [2]. These requirements may incentivize firms to engage in prosocial actions, triggering a synergistic effect across all interacting parties that ultimately strengthens stable network externality. In this context, DI can enhance the efficiency of communication and interactions with stakeholders, improve the level of information disclosure, and thus positively impact CSR activities. In summary, we propose the following hypothesis.

Hypothesis 1. *DI positively affects CSR.*

2.3. Moderating Effect of Metaorganizations Factors

The impact of DI on CSR, as discussed above, essentially revolves around shared value and sustainability in the DI process to cater to internal and external stakeholders. Although DI generally contributes to improved social benefits, some firms provide greater prosocial motivation during the DI process than others. Hund et al. (2021) argued that a firm's prosocial motivation must concentrate on the dynamics between organizations, the environment, and DI [35]. Moreover, based on metaorganization theory, Hund et al. (2021) pointed out that organizational and environmental factors play a critical role in enhancing the prosocial motivation of DI on CSR. In this context, self-organization, interorganization, and the external environment—elements embedded within the metaorganizations perspective—determine the prosocial motivation of actors to make decisions [15]. This suggests that the impact of DI on CSR may be contingent on these factors. As metaorganization factors evolve, some firms in the DI process may devote greater attention to their CSR performance.

2.3.1. Moderating Effect of Values Appropriation

A fundamental characteristic of digital innovation (DI) is its inherent "self-organization" nature, signifying that the effectiveness of innovation in the digital environment arises primarily from the independent action of each actor [1,32]. Consequently, actors are predominantly autonomous, not governed by any formal authority. Activities are not coordinated by bureaucracy but by emergence, and strategic initiatives are not propelled by hierarchy but by independent coordination and collective interaction [5]. Thus, when envisioning the organizational form constructed by DI as a metaorganization, wherein actors form a coordinated network, it becomes feasible to incorporate the influence of self-organizing and interorganizing factors.

Value appropriation is a crucial self-organizing factor as the crafting and orchestration of available resources significantly impact the implementation of sustainable strategies by actors [41]. Value appropriation refers to the ability of firms to create and capture value from innovation [2,42]. In the DI process, we contend that value appropriation will further promote CSR activities. To an extent, value appropriation suggests that enterprises within metaorganizations have a more advantageous niche, implying that these core firms need to maintain a reasonable balance between value capture and sharing amid the complex and intertwined DI landscape [43]. This necessity arises because DI has reshaped the original technical infrastructures and associated value chain systems within and between firms. Although digitally enabled interactions have enhanced connectivity and diversity, the tight coupling with stakeholders can expose significant mutual dependencies and hinder further integration of the value chain [15]. Therefore, as the focal actor, the enterprise needs to leverage more altruistic behaviors to evade such confusion and risks, enabling the reconfiguration and transformation of available resources. Based on this, we propose the following hypothesis:

Hypothesis 2. *Values appropriation enhances the positive impact of DI on CSR.*

2.3.2. Moderating Effect of Partner Concentration

Continuing from the above, from the perspective of metaorganization, the relationship between firms is also crucial to the evaluation of CSR activities [44]. For example, CSR scholars concur and assert that the long-term potential of metaorganizations hinges on cooperation and mutual trust among different participants [45]. To legitimize their activities, actors will increase their engagement in CSR, providing a degree of leverage for their collective actions [44,46]. We posit that the drive for CSR induced by DI is moderated by the extent to which actor groups have stable relationships (meaning that they may have similar operations, customers, organizational goals, or knowledge bases).

Partner concentration signifies the mutual dependencies between firms and their partners. Generally, the greater the dependency on partners, the more attention a firm will give to its partnerships, and the more responsive it will be to partners' strategic decisions, business innovations, and other changes. During the DI process, a higher degree of partner concentration can effectively mitigate the uncertainties faced by firms, thus promoting CSR activities [32]. This is because high partner concentration indicates that actors have a high degree of embeddedness in the value chain [47,48]. High embeddedness provides firms with more opportunities to obtain core knowledge and details about partners' innovations across organizational boundaries. It also facilitates firms' absorption and digestion of latent knowledge in the DI process, positioning partner concentration as advantageous in dealing with partners and reducing power and information asymmetry. Given that DI is a process relying on collaboration with partners to create value, actors may pay more attention to collective behavior and social benefits [49]. In this sense, we contend that firms adopting DI are more motivated to engage in CSR activities. For instance, research has demonstrated that firms actively engage in CSR activities to foster a good reputation and cultivate trust among partners [46]. Therefore, we consider partner concentration an important catalyst for CSR in DI. The higher the concentration of partners, the more motivated firms are to participate in social responsibility during the DI process [50]. Based on this, we propose the following hypothesis:

Hypothesis 3. *Partner concentration enhances the positive impact of DI on CSR.*

2.3.3. Moderating Effect of Environmental Uncertainty

Environmental uncertainty reflects the degree of change of a firm's environment [51]. As Tortora et al. (2021) posited [52], a firm's strategy, in which digital technology plays a central role, can potentially be shaped by the environment. The Uber example illustrates that DI occurs in highly dynamic and uncertain contexts, in which values and interests diverge between actors, and control and decision-making are broadly dispersed [38,53]. While digitalization might appear to inhibit value creation as the environment deteriorates in many cases, it can also lead to some firms constructing durable strategic initiatives.

The digital economy assumes that firms adopting DI make long-term and/or very bold decisions, and their risk tolerance significantly varies from traditional firms. Following this logic, in scenarios of high environmental uncertainty, firms are more inclined to pursue strategic change and embark on risky innovation activities such as DI. However, Garud et al. (2013) have indicated that a significant challenge of innovation activity at this time is that it may be perceived as illegitimate by stakeholders [54]. Scholars have argued that such legitimacy depends on how firms and their stakeholders understand and respond to the uncertainty in the digital environment [55]. In this context, firms need to lean more toward active cognitive processing and sense-making, forming more sustainable goals and strategies by mobilizing more stakeholders to interpret and construct meaning. CSR activity is a strategic initiative to actively align with the value demands of stakeholders. Therefore, environmental uncertainty can increase a firm's willingness to engage in CSR activities. Based on this, we propose the following hypothesis:

Hypothesis 4. *Environmental uncertainty enhances the positive impact of DI on CSR.*

The research framework used in this study is illustrated in Figure 1.

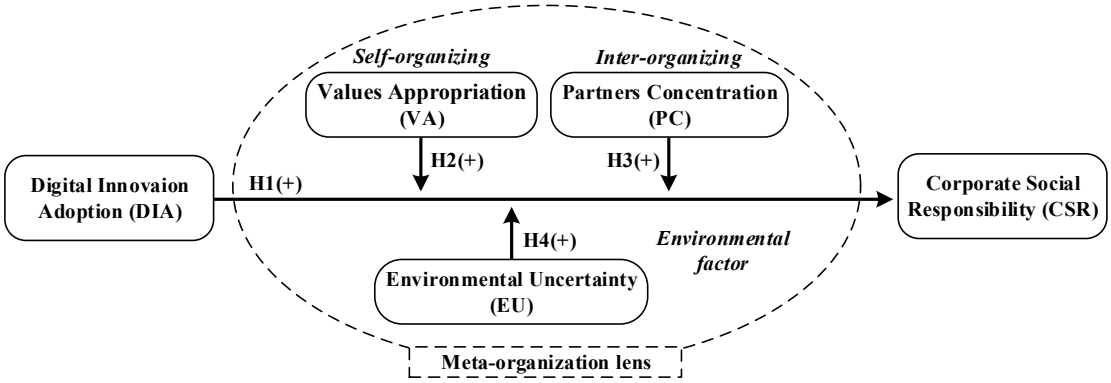

Figure 1. Theoretical Model.

3. Methodology

3.1. Sample

Our dataset incorporates publicly listed A-share firms on the Shanghai and Shenzhen Stock Exchanges. Predominantly, we used datasets from the China Stock Market Accounting Research (CSMAR, https://www.gtarsc.com, accessed on 15 December 2022) and Chinese Research Data Services (CNRDS, http://www.cnrds.com, accessed on 20 December 2022), esteemed for their reliability [1]. Data not specifically mentioned are extracted from the CSMAR database. Our research spans from 2010 to 2020, a timeframe deliberately selected to circumvent the significant influence the 2008 financial crisis likely exerted on both DI and CSR. The absence of data post-2020 is attributable to the fact that CSR data has only been disclosed up to 2020.

Upon collating data from CSMAR, CNRDS, and the HeXun Index (https://www.hexun.com, accessed on 10 November 2022), we initially compiled a sample of 80,337. By eliminating pre-2010 and post-2020 data, we reduced the sample size to 55,848. Certain Chinese listed companies exhibit financial irregularities or an abnormal status, as indicated by ST or PT labels, leading to a significant amount of missing data primarily due to suspension. By excluding entries with ST or PT labels (966 observations) and those with missing variable values (47,553 observations, which include 11,791 observations of VA, 9532 observations of PC, 7701 observations of CSR and others), we finally amassed a database of 7329 firms, yielding 2002 firm-year observations for analysis.

3.2. Measurement of Variables

3.2.1. Dependent Variable

Corporate Social Responsibility (CSR). Similar to previous studies in a digital context [20,56], we focus on social responsibility behavior in the process of external social practice of firms. Typically, previous research has relied on the Rankins and HeXun Index databases to measure the CSR activity of Chinese firms. However, the Rankins database altered their scoring system to a different rating form in 2020, disrupting data continuity. Therefore, we opted to use the natural logarithm of HeXun Index scores to measure the degree of CSR activity. The HeXun Index encompasses five aspects: the environment, shareholder relations, social initiatives, supplier interactions and customer and consumer rights, and employee relations, with a total possible score of 100.

3.2.2. Independent Variable

Digital Innovation (DI). Similar to previous studies [57], we conceptualize DI in this paper as innovative digital solutions that integrate emerging digital technologies to support digitalization [25,35]. Theoretical and empirical studies generally posit that the essential purpose of DI is to produce effective innovation output and application in the market, and its effectiveness hinges on the deployment and development of key digital technologies [24,58]. Additionally, a vital aspect of DI is the establishment and acceptance of

standards. Previous researchers have defined these as standard-setting digital technologies that enable, constrain, and coordinate the actions and interactions of numerous actors in metaorganizations [38]. In this regard, digital researchers have compiled a feature lexicon with digital technology as the key core by counting and summing research papers, industry reports, and policy documents [28,59,60]. The degree of DI disclosed in annual reports can reflect the emphasis on DI activities and, to a certain extent, the changes in organizational logic during its interactions with stakeholders [43]. In this vein, the measurement method of the feature lexicon aligns with the application of metaorganization theory in this article. Therefore, drawing from the feature terms of Wu et al. (2022) and Zhong and Ren (2023), we quantify the degree of DI based on the word frequency statistics in the annual reports of listed companies [28,60]. Given the right bias characteristics of the annual report data, we apply a logarithmic transformation to ensure the reliability of the results.

3.2.3. Moderator

Values Appropriation (VA). VA is defined as an ability that allows companies to extract a larger percentage of the value generated from resources. This enables the companies to invest or allocate more resources in value creation [2,43]. Following Chin et al. (2022) [2], we regard the sales growth ratio as an indicator of firms' VA. Thus, we use this ratio to measure VA. Accordingly, we employ the growth ratio as the indicator of VA.

Partner Concentration (PC). Researchers have developed various measures of partner concentration, many of which are based on the percentage of a firm's sales to its major suppliers and customers (those accounting for over 10% of sales) [50,61]. Therefore, we use the average proportion of sales to the top five customers and suppliers as a measure of partner concentration.

Environmental Uncertainty (EU). Environmental uncertainty stems from the external environment, and changes in the external environment can induce fluctuations, ultimately leading to variability in a firm's sales revenue [62]. Consequently, environmental uncertainty can be measured by the coefficient of variation in sales [51,63]. Following Ghosh and Olsen's (2009) methodology [51], we first compute the environmental uncertainty without industry adjustment by dividing the standard deviation of abnormal sales revenue over the past five years by the average sales revenue during the same period. We then adjust this value by the industry environmental uncertainty (i.e., the median of unadjusted environmental uncertainties for all companies in the same industry in the same year) to measure the environmental uncertainty.

3.2.4. Control Variables

Several variables that might influence CSR were controlled for in this analysis. This is important as the characteristics of firms may lead to variations in their sustainable behavior [1,64]. We measured *firm size (Size)* as the logarithm of the total assets, and the number of *listing years (ListAge)* as the logarithm of the years since a firm's listing. We also considered *Tobin's Q*, as it represents the future long-term value of firms [28].

Given the significant influence of management characteristics and attitudes on decision-making [65], we controlled for executive-related variables. The *management shareholding ratio (Mshare)* was measured as the proportion of management shareholding to total share capital, and the *board size (Board)* was measured as the logarithm of the total number of directors on the corporate board.

We also controlled for certain strategic initiatives such as *returns on total assets (ROA)*, measured as the ratio of net profit to total average assets, and the *cash flow ratio (Cashflow)*, measured as the proportion of net cash flow to total assets. These factors were viewed as the driving force of innovation and significantly influenced the resource allocation of firms' long-term strategic behavior [66].

Furthermore, we considered the influence of the supply chain. A firm can gain digital experience and learn how to conduct CSR from its supply chain partners [46]. Hence, we calculated the ratio of the *top customer to total sales (TopCustomer)* and the *top purchase to*

total purchases (TopPurchase) using data from CNRDS for our research. Additionally, we have further employed China's marketization index to account for the potential influence of regional economic systems on robustness checks. This approach is pertinent given the prominence of such regional variances as key environmental factors within the Chinese context [28,56].

4. Results

4.1. Result Analysis

4.1.1. Descriptive Statistics and Correlation Analysis

Table 1 presents the descriptive statistics of the key variables. The dataset reveals notable variation in both *CSR* and *DI* across firms. The mean value of *CSR* stands at 3.145, coupled with a standard deviation of 0.485, reflecting a substantial disparity in prosocial behavior among firms. Similarly, the mean value of *DI* is 1.417, accompanied by a larger standard deviation of 1.449, pointing to a wide gap in the level of digital innovation among firms, an observation aligning with the current Chinese context. The means and standard deviations of *VA*, *PC*, and *EU* within the dataset exhibit similar characteristics, suggesting that our sample broadly encapsulates firms across various situations.

Table 1. Descriptive statistics and correlation analysis.

Variable	N	SD	Min	Max	Mean
CSR	7329	0.485	−1.661	4.520	3.145
DI	7329	1.449	0	6.252	1.417
VA	7329	0.141	0.00200	1.194	0.178
PC	7329	6.317	0.0110	86.88	4.657
EU	7329	1.126	0.142	6.932	1.293
Size	7329	1.152	19.16	27.46	22.19
ROA	7329	0.050	−0.566	0.669	0.054
Cashflow	7329	0.066	−0.447	0.533	0.051
ListAge	7329	0.702	0	3.367	2.062
TobinQ	7329	1.376	0.684	31.40	2.118
Board	7329	0.191	1.099	2.890	2.116
Mshare	7329	0.210	0	3.002	0.168
TopCustomer	7329	0.133	0	1	0.132
TopPurchase	7329	0.119	0	1	0.137

The average Variance Inflation Factor (VIF) is 2.51, and all VIF values are below the generally accepted threshold of 10, indicating that multicollinearity is not a significant concern. Both fixed-effect and random-effect models were compared, and the results of the Wu–Hausman tests ($Chi^2 = 101.68$, $p < 0.05$) suggest that the fixed-effect models are more suitable for our research. Considering the impact of unobservable factors over time on *DI* and *CSR*, we further incorporate industry and year dummy variables into our model.

4.1.2. Regression Results

We employ a hierarchical regression method to test the hypotheses. Table 2 presents the regression results, exploring the influence of *DI* on *CSR*. Model 1, which includes only control variables, serves as a baseline regression model to provide a comparative benchmark for the analysis. Model 2 is used to test the relationship between *DI* and *CSR*. Model 2 reveals that *DI* is positively related to *CSR*, and the effect is statistically significant (beta = 0.010, $p < 0.05$). Therefore, Hypothesis 1 is supported.

Table 2. The regression results of *DI* affecting *CSR*.

Variables	*CSR*					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
DI		0.010 **	0.009 **	0.013 ***	0.010 **	0.008 *
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
DI × *VA*			0.058 **			0.067 ***
			(0.024)			(0.024)
DI × *PC*				0.002 **		0.002**
				(0.001)		(0.001)
DI × *EU*					0.006 *	0.005 *
					(0.003)	(0.003)
VA	−0.211 ***	−0.211 ***	−0.240 ***	−0.209 ***	−0.208 ***	−0.270 ***
	(0.046)	(0.046)	(0.050)	(0.046)	(0.046)	(0.052)
PC	−0.005	−0.005	−0.005	−0.004	−0.005	−0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EU	−0.030 ***	−0.030 ***	−0.030 ***	−0.030 ***	−0.034 ***	−0.033 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Size	0.105 ***	0.103 ***	0.104 ***	0.103 ***	0.103 ***	0.109 ***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ROA	4.173 ***	4.158 ***	4.153 ***	4.154 ***	4.149 ***	4.106 ***
	(0.224)	(0.223)	(0.223)	(0.223)	(0.223)	(0.223)
Cashflow	0.084	0.099	0.096	0.097	0.095	0.142
	(0.100)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)
ListAge	−0.008	−0.008	−0.008	−0.007	−0.008	−0.011
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
TobinQ	−0.012 ***	−0.013 ***	−0.012 ***	−0.013 ***	−0.013 ***	−0.015 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Board	−0.003	−0.003	−0.004	−0.004	−0.003	0.004
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Mshare	0.004	0.001	0.002	0.000	−0.002	0.004
	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)
TopCustomer	0.099	0.100	0.100	0.072	0.097	0.066
	(0.093)	(0.093)	(0.092)	(0.092)	(0.092)	(0.092)
TopPurchase	0.023	0.021	0.027	−0.021	0.018	0.041
	(0.103)	(0.103)	(0.102)	(0.098)	(0.102)	(0.099)
Year/Industry	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.727 ***	0.740 ***	0.737 ***	0.753 ***	0.745 ***	0.641 ***
	(0.137)	(0.138)	(0.138)	(0.137)	(0.138)	(0.144)
Observations	7329	7329	7329	7329	7329	7329
F	99.108	91.791	86.180	86.223	86.463	78.634
Adj-R^2	0.325	0.326	0.326	0.326	0.326	0.338

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

Models 3, 4, and 5 are used to test the moderating effects of *Value Appropriation (VA)*, *Partner Concentration (PC)*, and *Environmental Uncertainty (EU)* respectively, on the relationship between *DI* and *CSR*. Model 3 shows that the regression coefficient for the interaction between *DI* and *VA* is significantly positive (beta = 0.058, $p < 0.05$), indicating that *VA* enhances the positive relationship between *DI* and *CSR*. Similarly, Models 4 and 5 test the moderating effects of *PC* and *EU* on the relationship between *DI* and *CSR*. The results show that the regression coefficients for the interaction between *DI* and *PC* (beta = 0.002, $p < 0.05$) or *EU* (beta = 0.006, $p < 0.01$) both enhance the positive impact of *DI* on *CSR*. Thus, Hypotheses 2, 3, and 4 are all supported.

Finally, Model 6 regresses *CSR* with all variables to form a comprehensive model to test the robustness of the result. The results indicate that the regression coefficients for these variables remain positive and significant, thereby further strengthening these hypotheses.

4.2. Robustness Checks

4.2.1. Alternative Measures: Digital Innovation

First, we refined the measurement of *DI* by calculating the proportion of feature terms' frequency to the total number of words in the annual report. This method, as validated by Eklund and Mannor (2021) [65], provides a more precise representation of the degree of DI within a firm's strategic focus. As depicted in Table 3, using the hierarchical regression method, Model 8 was used to test the relationship between *DI* and *CSR*. Model 8 shows that *DI* is positively related to *CSR*, with the effect being statistically significant (beta = 0.917, $p < 0.05$).

Table 3. Alternative test of *DI*.

Variables	*CSR*					
	Model 7	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
DI		0.917 **	0.872 *	1.195 **	0.929 **	1.162 **
		(0.465)	(0.449)	(0.494)	(0.467)	(0.479)
DI × *VA*			0.058 **			0.058 **
			(0.024)			(0.024)
DI × *PC*				0.001 *		0.001 *
				(0.001)		(0.001)
DI × *EU*					0.006 *	0.005
					(0.003)	(0.003)
VA	−0.211 ***	−0.211 ***	−0.240 ***	−0.209 ***	−0.208 ***	−0.236 ***
	(0.046)	(0.046)	(0.050)	(0.046)	(0.046)	(0.050)
PC	−0.005	−0.005	−0.005	−0.005	−0.005	−0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EU	−0.030 ***	−0.030 ***	−0.030 ***	−0.030 ***	−0.034 ***	−0.032 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Size	0.105 ***	0.104 ***	0.104 ***	0.104 ***	0.104 ***	0.104 ***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ROA	4.173 ***	4.166 ***	4.160 ***	4.165 ***	4.157 ***	4.152 ***
	(0.224)	(0.224)	(0.223)	(0.224)	(0.224)	(0.223)
Cashflow	0.084	0.093	0.090	0.090	0.089	0.083
	(0.100)	(0.100)	(0.099)	(0.100)	(0.100)	(0.100)
ListAge	−0.008	−0.008	−0.008	−0.008	−0.008	−0.008
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
TobinQ	−0.012 ***	−0.012 ***	−0.012 ***	−0.012 ***	−0.012 ***	−0.011 **
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Board	−0.003	−0.003	−0.003	−0.004	−0.003	−0.005
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Mshare	0.004	0.003	0.004	0.003	0.000	0.003
	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)
TopCustomer	0.099	0.101	0.101	0.078	0.098	0.076
	(0.093)	(0.093)	(0.092)	(0.092)	(0.092)	(0.091)
TopPurchase	0.023	0.022	0.027	−0.013	0.018	−0.011
	(0.103)	(0.103)	(0.103)	(0.099)	(0.102)	(0.098)
Year/Industry	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.727 ***	0.735 ***	0.732 ***	0.744 ***	0.740 ***	0.744 ***
	(0.137)	(0.138)	(0.138)	(0.137)	(0.137)	(0.137)
Observations	7329	7329	7329	7329	7329	7329
F	99.108	91.672	86.082	85.954	86.307	76.859
Adj-R^2	0.325	0.326	0.326	0.326	0.326	0.327

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

Models 9, 10, and 11 were used, respectively, to test the moderating effects on the relationship between *DI* and *CSR*. The results indicate that the regression coefficients for the interaction between *DI* and *VA* (beta = 0.058, $p < 0.05$) or *PC* (beta = 0.001, $p < 0.1$) were significant. Similarly, Model 11 reveals that the regression coefficient for the interaction

between *DI* and *EU* is positively significant (beta = 0.006, $p < 0.1$) in relation to *CSR*, suggesting that *EU* enhances the positive relationship between *DI* and *CSR*. Consequently, all hypotheses were corroborated.

4.2.2. Endogeneity Analyses: Instrument Variable Estimation

To avoid potential endogenous bias due to reciprocal causation and peer effects, we also used instrument variable estimation for endogenous treatment. Following the approach of Lewbel (1997) and Bentolila et al. (2010) [67,68], we used the degree of digital innovation classified by provinces as the instrument variables (referred to as *Bentolila IV*). As demonstrated in Model 13 (Table 4), *DI* is significantly affected by the participation of other firms in the region (beta = 0.657, $p < 0.01$), and the *F* statistic exceeds 10, suggesting the selected instrument variable does not suffer from a weak instrument variable problem. Thus, the results from Models 14–17 continue to support our hypotheses. In Model 18, the signs of the four main effects are consistent, with some slight differences in regression coefficients' significance. This validates the previous hypotheses and leaves the conclusions of the prior study unaltered [39].

Table 4. Instrument variable estimation.

Variables	*DI*	*CSR*				
	Model 13	**Model 14**	**Model 15**	**Model 16**	**Model 17**	**Model 18**
Bentolila IV	0.657 ***					
	(0.044)					
DI		0.079 ***	0.040	0.042	0.024	0.008
		(0.023)	(0.026)	(0.032)	(0.028)	(0.038)
DI × *VA*			0.008 ***			0.008 ***
			(0.002)			(0.002)
DI × *PC*				0.030 *		−0.005
				(0.017)		(0.016)
DI×*EU*					0.289 **	0.206 **
					(0.117)	(0.105)
VA	0.066	−0.208 ***	−0.213 ***	−0.211 ***	−0.614 ***	−0.519 ***
	(0.119)	(0.046)	(0.045)	(0.046)	(0.179)	(0.171)
PC	−0.007	−0.004	−0.011 **	−0.004	−0.004	−0.011 ***
	(0.006)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
EU	0.018	−0.031 ***	−0.031 ***	−0.071 ***	−0.031 ***	−0.023
	(0.013)	(0.005)	(0.005)	(0.025)	(0.005)	(0.025)
Size	0.112 ***	0.095 ***	0.095 ***	0.095 ***	0.096 ***	0.095 ***
	(0.015)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ROA	1.466 ***	4.049 ***	4.020 ***	4.037 ***	4.064 ***	4.032 ***
	(0.339)	(0.226)	(0.223)	(0.225)	(0.225)	(0.219)
Cashflow	−1.488 ***	0.207 *	0.229 **	0.219 **	0.193 *	0.220 **
	(0.243)	(0.106)	(0.105)	(0.105)	(0.106)	(0.105)
ListAge	0.022	−0.007	−0.005	−0.006	−0.006	−0.005
	(0.023)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
TobinQ	0.096 ***	−0.020 ***	−0.021 ***	−0.020 ***	−0.018 ***	−0.019 ***
	(0.015)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Board	0.092	−0.002	0.000	−0.003	−0.000	0.002
	(0.073)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Mshare	0.225 ***	−0.022	−0.019	−0.024	−0.020	−0.018
	(0.074)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
TopCustomer	−0.167	0.108	0.044	0.101	0.103	0.044
	(0.230)	(0.093)	(0.089)	(0.090)	(0.092)	(0.088)
TopPurchase	0.024	0.011	−0.114	0.006	0.002	−0.122
	(0.222)	(0.103)	(0.096)	(0.101)	(0.102)	(0.096)
Year/Industry	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−2.417 ***	0.839 ***	0.906 ***	0.882 ***	0.895 ***	0.943 ***
	(0.362)	(0.143)	(0.142)	(0.140)	(0.147)	(0.146)
Observations	7329	7329	7329	7329	7329	7329
F	34.099	92.961	88.146	87.233	87.180	81.848
Adj-R^2	0.398	0.327	0.329	0.327	0.327	0.329

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

4.2.3. Endogeneity Analyses: Heckman Model

Given that firms in China are only required to disclose information about their top five partners, sample selection bias could occur. Thus, we employed Heckman's two-stage procedure for testing. In the first-stage equation, "whether to disclose partners" was taken as the explained variable (coded as "1" when firms disclosed their partners, named *IfPartners*). We also controlled a range of variables in the regression, due to the potential influence of company characteristics, strategic initiatives, executive characteristics, and regional systems on *DI*. The *Inverse Mills Ratio*, estimated in the first stage, was then included in the second-stage model for regression. The results, as presented in Table 5, align with the benchmark regression results.

Table 5. Heckman Robust Test.

Variables	*IfPartners*	*CSR*				
	Model 19	**Model 20**	**Model 21**	**Model 22**	**Model 23**	**Model 24**
DI	0.014 ***	0.011 ***	0.011 ***	0.014 ***	0.011 ***	0.014 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
DI × *VA*			0.059 **			0.058 **
			(0.024)			(0.024)
DI × *PC*				0.002 **		0.002 **
				(0.001)		(0.001)
DI × *EU*					0.007 **	0.006 *
					(0.003)	(0.003)
VA	−0.002	−0.208 ***	−0.239 ***	−0.206 ***	−0.206 ***	−0.234 ***
	(0.034)	(0.045)	(0.050)	(0.045)	(0.045)	(0.050)
PC		−0.005	−0.005	−0.004	−0.005	−0.004
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
EU	0.013 ***	−0.028 ***	−0.027 ***	−0.028 ***	−0.032 ***	−0.030 ***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Size	−0.052 ***	0.098 ***	0.098 ***	0.098 ***	0.098 ***	0.098 ***
	(0.004)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ROA	−0.181 *	4.115 ***	4.108 ***	4.111 ***	4.105 ***	4.096 ***
	(0.095)	(0.225)	(0.225)	(0.225)	(0.225)	(0.224)
Cashflow	0.065	0.107	0.104	0.105	0.102	0.098
	(0.069)	(0.100)	(0.100)	(0.100)	(0.100)	(0.100)
ListAge	−0.000	−0.007	−0.007	−0.007	−0.007	−0.007
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
TobinQ	−0.003	−0.013 ***	−0.013 ***	−0.014 ***	−0.013 ***	−0.013 ***
	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Board	−0.029	−0.005	−0.006	−0.006	−0.006	−0.008
	(0.021)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Mshare	0.178 ***	0.018	0.022	0.018	0.017	0.020
	(0.024)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
TopCustomer		0.098	0.098	0.071	0.094	0.067
		(0.092)	(0.092)	(0.091)	(0.091)	(0.090)
TopPurchase		0.021	0.026	−0.020	0.017	−0.018
		(0.102)	(0.102)	(0.098)	(0.101)	(0.097)
Market	−0.001	0.010 ***	0.010 ***	0.010 ***	0.010 **	0.009 **
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Inverse Mills ratio		0.259 **	0.275 **	0.257 **	0.267 **	0.279 **
		(0.126)	(0.126)	(0.126)	(0.126)	(0.126)
IfPartners ratio	0.967 ***					
	(0.044)					
Year/Industry	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.333 ***	0.647 ***	0.648 ***	0.661 ***	0.657 ***	0.671 ***
	(0.103)	(0.146)	(0.146)	(0.146)	(0.146)	(0.146)
Observations	12291	7329	7329	7329	7329	7329
F	88.593	81.016	76.794	76.840	76.795	69.574
Adj-R^2	0.203	0.327	0.327	0.327	0.327	0.328

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

5. Conclusion and Discussion

5.1. Discussion

5.1.1. Research Findings

In this paper, we propose that DI has a positive impact on CSR from a metaorganizational perspective. To some extent, CSR is derived from the social effects of digital innovations and is influenced by the values and norms governing interactions within metaorganizations in a digital context. Recent studies by Chin et al. (2022) and Battisti et al. (2022) have suggested that digitalization has fostered more organic organizational forms, which in turn stimulate the sustainable behavior of firms [2,6]. Furthermore, we observe that the effect of DI on CSR is amplified when firms operate with heightened organizational and environmental factors such as values appropriation, partner concentration, and environmental uncertainty. As active participants in digital innovation, firms' engagement in CSR is facilitated when they possess robust resource allocation capabilities, strong partnerships, or operate within high-risk environments. The propensity of these firms to exhibit more pronounced prosocial preferences can be attributed to the tendency of DI as a metaorganization to pursue a shared and consistent value proposition, and for firms to maintain more stable value relationships to safeguard their own innovation. In summary, we propose hypotheses based on the aforementioned arguments. These hypotheses are elaborated and validated in Table 6.

Table 6. Hypothesis results.

Hypotheses	Description	Results	Robustness Checks
Hypothesis 1	DI positively affects CSR	Verified	Verified
Hypothesis 2	VA enhances the positive impact of DI on CSR	Verified	Verified
Hypothesis 3	PC enhances the positive impact of DI on CSR	Verified	Verified
Hypothesis 4	EU enhances the positive impact of DI on CSR	Verified	Verified

5.1.2. Research Context

Our conclusions, although drawn from the institutional setting in China, offer several valuable insights. As a relatively late adopter of digital innovation on a global scale, China's digital environment diverges markedly from those in developed countries. While the metaorganizational characteristics of DI may be similar, the motivations for prosocial behavior can vary significantly among firms in different institutional environments. In developed countries, research has indicated that as digital value relationships stabilize, firms seek more than just shared niches; they aim to extract as much value as possible from shared revenues [69,70]. For example, Amazon, often criticized for infringing on the interests of third-party complementors, currently demonstrates low prosocial motivation in its multilateral relationships. Interestingly, the company exhibited the opposite behavior during its early development years [71]. In contrast, in the Chinese context, Confucian culture and relationships based on mutual aid may incentivize firms to sustain long-term prosocial motivation in DI. The cost of unethical behavior can be significantly high for firms [28,56]. Contrary to the previous literature, which posits that values appropriation, partner concentration, and environmental uncertainty can diminish a firm's prosocial motives, our China-based study arrives at a different conclusion. The mechanisms that drive CSR in a digital context are different from those in developed country settings. Thus, certain traits of Chinese firms, which might induce negative behavior in developed countries, inspire prosocial tendencies in DI instead. This aligns with our perspective that firms engaged in digital innovation are more inclined to adopt costly CSR measures to maintain stable value relationships, rather than for purely profit-driven reasons.

5.2. Theoretical Implications

Our findings offer two critical theoretical implications. First, we contribute to the burgeoning literature on corporate strategy under digital innovation by systematically investigating how digital innovation influences CSR. While recent literature has explored

sustainability issues in the digital era, emphasizing aspects such as organizational performance [1], innovation output [72], and business models [4], there remains a scarcity of research addressing how firms embracing digital innovation engage in CSR activities. Using the metaorganizational theory lens, we argue that CSR is a strategic action that actors in digital innovation deploy to placate salient stakeholders. This study thereby enriches the literature by empirically probing the social value of digital innovations.

Second, our findings also contribute to the discourse on how digital innovation transforms organizational logic. It is posited that the digital age has given rise to an organizational logic markedly different from the industrial era it supplanted. In a digitally connected world, actors often become complementors, their digital innovations indirectly enhancing the value of another firm's offerings [5]. Consequently, CSR activities, within the metaorganizational context, evolve from a nebulous act of altruism into a strategic investment in collaboration and co-creation [73]. Value appropriation, for instance, denotes not only higher value capture within the digital value chain [2] but also a heightened sense of responsibility. Partner concentration, while signifying tight network coupling and increased mutual dependencies [15], also stimulates the prosocial motivation of participants. Likewise, environmental uncertainty, although signaling business volatility [74], spurs and amplifies the pursuit of social benefits. While creating and capturing value remain fundamental aspects of organizational logic, one significant shift we observe with digitalization is a changed emphasis on social benefits. Thus, our empirical analysis validates and aligns with Nambisan et al.'s (2017, p. 224) assertion that "the time for new theorising about digital innovation is, therefore, now" [25].

5.3. Managerial Implications

Based on the comprehensive analysis provided, several key management insights and recommendations arise. These could be pivotal for firms navigating the complexities of DI and its effects on CSR in today's rapidly evolving digital landscape. Firms must recognize CSR not as a peripheral activity, but as a core strategic action within their digital innovation efforts. Our findings suggest that the adoption of digital innovation significantly enhances a firm's CSR activities. Therefore, it is critical for managers to align their digital innovation strategies with their CSR objectives, creating a cohesive approach that delivers both business and societal value. This research also underscores the importance of considering organizational and environmental factors in the DI–CSR relationship. Firms operating with higher values appropriation, partner concentration, and environmental uncertainty appear to be more proactive in their CSR efforts in the context of digital innovation. Therefore, firms should not see these factors as challenges but as catalysts that can enhance their social responsibilities. Value creation and capture are no longer the sole pursuits; an increased emphasis on social benefits is also emerging. This insight implies that managers should recalibrate their strategies to accommodate this new focus, potentially leading to more sustainable and socially responsible business models in the digital era.

5.4. Conclusions

This paper concludes with valuable insights into the intricate nexus of digital innovation (DI) and corporate social responsibility (CSR) from a metaorganizational perspective.

First, the research underscores the profound influence DI exerts on CSR initiatives, thereby reshaping conventional business strategies and paradigms. By aligning DI and CSR strategies, firms can create a comprehensive approach that delivers both business and societal value.

Second, the findings shed light on the enhancing role of value appropriation, partner concentration, and environmental uncertainty on firms' CSR efforts within the DI context. These factors, once perceived as challenges, can act as catalysts, inspiring firms to intensify their commitment to social responsibilities.

Third, related to the point above, the study witnesses a significant shift in organizational logic instigated by digitalization. The focus is no longer restricted to value creation and capture but has expanded to emphasize social benefits. This shift necessitates a strategic recalibration by firms to embed a stronger focus on sustainability and social responsibility within their business models in the digital era.

Fourth, our discussion, although primarily derived from the Chinese institutional context, may provide valuable insights on a global scale. The study suggests that while the metaorganizational characteristics of DI are convergent, the motivations for prosocial behavior can vary significantly across different institutional environments. Hence, managers worldwide should recognize the potential of DI in creating more sustainable and socially responsible businesses.

The limitations of this study also offer new avenues for future research. We will underscore the need for further research in understanding how the balance between DI and CSR can be optimized across different institutional settings and industries. Additionally, the role of stakeholders in shaping firms' DI and CSR strategies presents a promising avenue for future exploration. As digital technologies continue to evolve, so too must our understanding of their impacts on firms' social responsibilities. In terms of the research method, while we tried our best to select high-quality literature support to feature terms, the data still inevitably have a certain degree of measurement bias in this approach from a specific theoretical perspective. At the same time, following the established practice found in leading journals [56,75], we have adopted proxies to measure core variables, such as digital innovation adopting and values appropriation. Future research should develop better methods to accurately express core variables to correct the bias and further enhance the credibility of the findings.

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