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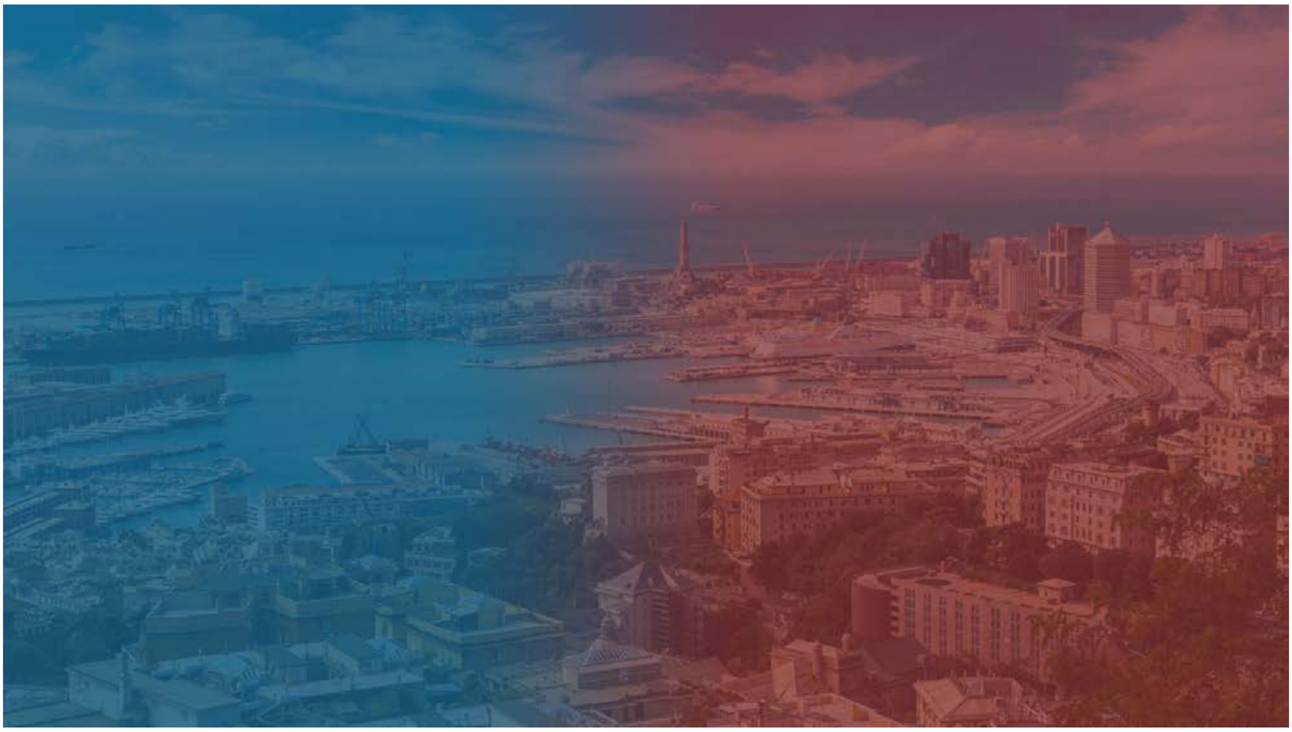

Tertiarization & sustainability new challenges for management in the digital era

Conference Proceedings

Short Papers

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12-13 June 2025

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edited by

Arabella Mocciaro Li Destri, Marta Ugolini and Lara Penco

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To the reader,

this volume contains the short papers of the Sinergie-SIMA 2025 Management Conference, hosted by the University of Genova on June 12th and 13th 2025.

Tertiarization is one of the most salient profiles of the structural change and economic development that have characterized the recent decades (Jorgenson & Timmer, 2011). The growth of the service industry affects multiple sectors, e.g. wholesaling/retailing, tourism/hospitality, transport and logistics, health services, public administration, education, communication, banking and financial services, and B2B services (Baines *et al.*, 2017; Barrett *et al.*, 2015).
This growing relevance of services in the economy and the society has stimulated a broader interdisciplinary debate, e.g., the impact of tertiarization on the performance of the entire economic system, the innovation and digitalization of services, and the applicability of service management issues for the transformation of product-based business models.
Based on these premises, the 2025 Sinergie-SIMA Conference aims to explore the role of services as part of the evolution of society in terms of relevance, growth, competitiveness, innovation, but also sustainability and well-being. The lens of analysis used to explore this phenomenon will be digitalization, as it is shaping service innovation in more traditional sectors (e.g., social and sanitary services, tourism, retailing, etc.) and it is boosting knowledge-intensive business services (KIBS). Thus, digitalization is a key driver of the business model transformation, facilitating the transition of manufacturing firms towards digital servitization, enabling a new automation frontier (Frank *et al.*, 2019; Kastalli & Van Looy, 2013; Liu *et al.*, 2024), and paving the way for new opportunities for value creation within the global economy (Ostrom *et al.*, 2015).
The application of digital technologies to services (e.g., Artificial Intelligence, Big Data Analytics, Internet of Things, Machine Learning, Additive Manufacturing, Virtual Reality, Augmented Reality, Metaverse) also facilitates the pursuit of relevant environmental and social issues, for example contributing significantly to the achievement of greater systemic efficiency that help attain the Sustainable Development Goals (SDGs) and circular economy (Xing & Liu, 2023). Leveraging advanced technologies enables the extraction of valuable insights from vast amounts of information, facilitating informed decision-making, personalized service offerings, optimizing service delivery processes, and enhanced customer experiences (Chauhan *et al.*, 2022). Big data plays a strategic role in developing novel solutions that address evolving societal challenges, while driving sustainable growth and innovativeness in the digital era (Cappa *et al.*, 2022; Ciampi *et al.*, 2021; Mikalef *et al.*, 2019). Therefore, the real challenge today is to harness the application of digitalization to enhance the service-oriented approach and empower companies' economic, social, and environmental performances, generating and consolidating greater trust and loyalty among their employees, customers, and suppliers for a more sustainable, inclusive, and better society (Shaukat *et al.*, 2016).
AIDEA devoted a Conference to the tertiarization and new challenges for management and governance 25 years ago in Genoa, and many scholars focused on these topics from multiple perspectives and with original approaches.
The 2025 Sinergie-SIMA Genoa Conference, in continuity with the past, is an excellent opportunity to discuss our community's research efforts in the service economy and management, in order to identify new effective solutions suitable to face the current digital era. Different theories, methodological approaches, and units of analysis are required to generate scientific research impacting theories but also outlining wide-ranging strategies that can offer valuable insights to business leaders, companies, and institutions. More precisely, the Conference was a great occasion to discuss the research efforts of our research community within tracks related to the:

- Conference theme (Tertiarization & sustainability. New challenges for management in the digital era),
- SIMA thematic groups (Artificial intelligence in management, Entrepreneurship, Innovation & Technology Management, International Business, Marketing, Purpose-driven Businesses,

Retailing & Service Management, Small & Family Business, Strategic Communication, Strategy & Governance, Supply Chain Management, Logistics & Operations, Sustainability, and Tourism & Culture Management),
- Management Case Studies.

The Conference call for papers gave the opportunity to submit either short and long papers. Overall, the editorial staff received 311 submissions of which 263 short papers and 49 long papers.

For the *short and long papers*, the evaluation followed the peer review process, with a double-blind review performed by, respectively, one and two referees - university lecturers and experts about the topic - selected among SIMA and the community of Sinergie members.

In detail, the referees applied the following criteria to evaluate the submissions:
- clarity of the research aims,
- accuracy of the methodological approach,
- contribution in terms of originality/innovativeness,
- theoretical and practical contribution,
- clarity of communication,
- significance of the bibliographical basis.

The *peer review* process resulted in full acceptance or rejection of the submissions. In the case of disagreement among reviewers' evaluations, the decision was taken by the Chairs of the SIMA thematic groups or conference track. Each work was then sent back to the Authors together with the referees' reports. The suggestions received by the referees were used by the Authors during the presentation of their research works at the Conference.

The evaluation process ended with the acceptance of 293 papers (249 short papers and 44 long papers). This volume proposes the short papers whose Authors have authorized their publication.

All the short papers published in this volume were presented and discussed during the Conference and published online on the web portal of Sinergie-SIMA Management Conference (**https://www.sijmsima.it/**).

While thanking all the Authors, Chairs, and participants, we hope that this volume will contribute to advancing knowledge about tertiarization and sustainability in management.

The Conference Chairs

Lara Penco, Arabella Mocciaro Li Destri, and Marta Ugolini

SUMMARY

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Track 6 - Marketing

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Track 3
Intelligenza Artificiale nel Management

Employees' autonomy in data-driven decision-making: an empirical analysis of Italian firms

LORENA M. D'AGOSTINO[1] MARCO CORSINO[2] MIRIAM TOMASUOLO[3] SALVATORE TORRISI[4]

Abstract

Digital transformation (DT) has steadily permeated industries and markets, becoming increasingly pervasive. DT spurs a fundamental shift in corporate decision-making, moving from intuition and heuristics to an analytical, data-driven decision-making (DDD) approach. While several studies uncover a positive relationship between DDD and firm performance, a comprehensive understanding of the drivers underpinning the systematic and effective use of data in decision-making is still lacking. Earlier research pointed out the role of factors such as the adoption of new digital technologies, the implementation of structured management practices, and the investment in complementary assets like human capital. This short paper contributes to this line of inquiry by exploring how different types of work autonomy favor the effective use of DDD, especially when DDD is used to promote innovation. Our study reports the findings of an ongoing research project that investigates the adoption of DDD among firms operating in Lombardy, one of the most industrialized and innovative Italian regions. Preliminary results suggest that firms adopting an innovation-oriented DDD are more likely to grant a higher level of strategic autonomy to their workers compared with firms adopting DDD for other goals, such as increasing efficiency.

Framing of the research. *Digital Transformation (DT) refers to a profound organizational change associated with the widespread use of digital technologies (Hanelt et al. 2021). A distinguishing aspect of DT is the increased availability and effective use of data, which can reshape decision-making processes. Traditionally, managers and workers relied on intuitions and gut feeling, but DT facilitates a shift toward a data-driven decision-making (DDD) approach, where real-time data is accessed and utilized for more informed decisions (Capo et al. 2022; Brynjolfsson and McElheran, 2016a). In this context, data can be used to identify emerging market trends, craft strategies, optimize operations, monitor financial performance, and drive innovation (Davenport et al., 2021). Ultimately, the adoption of a DDD approach can lead to significant improvements in firm performance (Sleep et al., 2022; Krafft et al., 2021; Davenport et al., 2021; Brynjolfsson and McElheran, 2016a).*

Several factors affect the rate of DDD adoption (Brynjolfsson and McElheran, 2016a; Sleep et al., 2022; Bar-Gill et al., 2024). First, firm size (both in terms of employment and belonging to a group) strongly predicts DDD, consistent with economies of scale. Second, ICT adoption is significantly associated with DDD, as it provides firms with the technical infrastructure needed to store and process data. Third, higher levels of formal education favor an effective use of data (Brynjolfsson and McElheran, 2016a) and affect the probability of adopting a DDD approach. Moreover, the adoption of structured management practices (e.g., performance-based monitoring, evaluation, compensation, and incentives) also affects a DDD approach (Brynjolfsson and McElheran, 2016a). Moreover, previous studies found evidence of complementarities between ICT, investments in human capital, and structured management practices (Brynjolfsson and McElheran, 2016b).

In addition to such potential complements, Sleep et al., 2022 suggest that the business knowledge perspective (i.e. IT or marketing oriented) may influence firm's DDD, with the IT-oriented perspective having a direct and positive effect on DDD and the marketing perspective none. Moreover, they find that the DDD approach enhances innovation and financial performance, highlighting the role of DDD in innovation-oriented firms.

The literature on DT has also discussed the role of workers' autonomy and decentralization of authority within organizations (Bloom et al., 2014; Dixon et al., 2021). Digital technologies can foster employee creativity, enable workers to solve a wide range of problems, and favor the implementation of new ideas (Oldham and Da Silva, 2015). Consequently, the adoption of IT can enhance workers' autonomy, leading to a more decentralized decision-making system (Bloom et al., 2014). At the same time, technologies such as robotics may reduce the need for managers to monitor

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workers' activities closely. However, depending on the tasks, robotics may require greater centralization or greater decentralization of decision-making authorities (Dixon et al. 2021); in particular, human resource-related decisions such as training are decentralized from managers to nonmanagerial employees, while the choice of production technology is centralized from managers to business owners and corporate headquarters. The existence of contrasting effects may also influence the relationship between DDD and the level of work autonomy. For example, Brynjolfsson and McElheran (2016b) conjecture that the "use of joint decision-making between managers and frontline workers could conceivably substitute for DDD" (p. 21). Nonetheless, they do not find any empirical evidence supporting such a negative correlation.

Given these complexities, it is crucial to further investigate whether DDD is associated with lower or higher levels of autonomy. This paper contributes to this discussion by presenting empirical evidence that underscore the importance of considering work autonomy as a multidimensional construct when assessing its relationship with the adoption of a DDD approach.

Purpose of the paper. *This study empirically investigates how different types and varying levels of work autonomy covary with the adoption of DDD, along with a few organizational factors like firm size (both employment and multi-unit business), business sectors, the level of employees' education, the endowment of ICTs. Our interest in work autonomy is motivated by its recognized importance in innovative and entrepreneurial activities. Autonomy, described as "the freedom granted to individuals and teams who can exercise their creativity and champion promising ideas" (Lumpkin and Dess 1996, p. 140), is a key dimension of entrepreneurial orientation, defined as "an approach to decision making that draws on entrepreneurial skills and capabilities" (Lumpkin et al. 2009: 48).*

Consistent with previous research (Bar-Gill et al., 2024; Brynjolfsson and McElheran, 2016a; Sleep et al., 2022), we conceptualize DDD as a multidimensional construct comprising four key dimensions: i) the availability of data to support decision making within the organization; ii) the extent to which the organization leverages the available data in the decision making process; iii) the extent to which the organization collects data on key performance indicators (KPIs); iv) the extent to which the organization uses the available data to pursue innovation activities. By combining these four dimensions, we define two distinct, yet interdependent, concepts of DDD: 1) DDD that supports decision-making across various functions of the firm (e.g., operations, finance, human resources); 2) DDD tailored to innovation activities.

The literature about job design and the entrepreneurship literature both describe autonomy as a multidimensional construct and distinguish structural autonomy from strategic or goal autonomy (Lumpkin et al. 2009). The former refers to discretion in the means of problem solving (e.g., work hours, work procedures, time to complete a task) within given resource constraints (Bailyn 1985). The latter reflects "the independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion" (Lumpkin and Dess 1996, p. 140). This distinction is significant, as prior research suggests that structural autonomy is primarily linked with job satisfaction and reduces employees' incentive to leave their organization (Marvel et al. 2007), whereas a high level of strategic autonomy to be positively associated with strategic effectiveness (Haas 2010).

Building on this evidence, we explore whether the adoption of a DDD approach is associated with the granting of structural and strategic autonomy within organizations. This relationship may arise for at least two reasons. First, strategic autonomy enables individuals and teams to participate in higher-level decision-making, allowing them to explore business opportunities outside the established chain of command and current corporate strategy (Burgelman 1983). Second, firms that engage in explorative search to navigate rapid changes in their competitive environment often grant strategic autonomy to individual employees or teams (McGrath 2001). In both cases, strategic autonomy requires greater reliance on data availability and their extensive use to monitor the achievement of organization-wide objectives.

Methodology. *We conducted an original survey of firms located in the Lombardy region, Italy. The data collection was conducted between April and June 2024. The sample came from two sources. The first is based on a dataset of about 2,500 firms provided by the internship and job placement office of the University of Milano-Bicocca. The firms were contacted by the office with a link to the survey. The response rate was about 10% (about 250 responses). The second data source came from an independent poll company, which collected data through the CATI method on an initial sample of 1392 firms; 246 companies responded to the survey (with a response rate of 18%). We received complete responses from a total of 423 companies: due to missing values in some of the variables used in this analysis, the working sample comprises 324 observations. Survey data were matched with firm data from the AIDA business database. The survey covers a wide range of information regarding firm characteristics, labor force composition, data-related practices, ICT adoption, managerial and organizational practices, and economic and innovation performance. We construct two indicators of DDD. The first one (i.e., DDD-KPI) is designed following Brynjolfsson and McElheran (2016a, 2016b, 2019) and Bar-Gill et al. (2024) and builds on three components: availability of data to support decision-making, actual use of data for decision-making, and intensity of performance monitoring measured by the number of KPIs monitored.*

- *Availability of data goes from none=0 to complete availability=4. In our sample, 35% of firms reported a high or complete availability of data (responses in the top two categories).*
- *Use of data to make decisions goes from no=0 to complete=4. 32% of our sample use data heavily or entirely (responses in the top two categories).*
- *The use of key performance indicators (KPIs). Our index goes from 0 to 7. It represents the sum of the number of KPIs monitored by the firm - patents, time to market, productivity, client response time, customer satisfaction, profitability,*

and revenue growth rate. Overall, the mean value in our sample is 2.4 KPIs monitored. Only 13% of our sample firms monitor more than 5[5] KPIs.

The second indicator of DDD (i.e., DDD-innovation) is based on Sleep et al. (2022), which includes data availability and use of data, and the use of data for innovation activities:

- *Type of activity influenced by data analytics. We distinguished innovation activities (product innovation, process innovation, or organizational innovation) from operational activity (customer relationship management - CRM, and supply chain management - SCM). 61% of the sample uses data to perform innovation activities, whereas 41% use data for the CRM or the SMC. 28% of firms declare that they use data to perform both innovation and CRM/SCM activities.*

Based on the measures discussed above, we construct the two indicators of DDD, as follows. The DDD-KPI indicator is a categorical variable that ranges from 0 to 2, where 0 denotes firms which report low levels of availability of data (from 0 to 2), low levels of use of data (from 0 to 2), and those that report a number of KPI monitored below the median (i.e., 2). DDD-KPI takes the value of 2 when a firm reports a high level of data availability (top two categories), a high level of data use (top two categories), and a number of KPIs monitored greater than the median. For all the intermediate cases, DDD-KPI takes the value of 1. Overall, 22.53% of the respondents are classified in the maximum level of DDD-KPI indicator, while 26.54% falls in the lowest one. The remaining 50.93% of observations accrue to the intermediate category.

Similarly, DDD-innovation is a categorical variable that goes from 0 to 2, where 0 denotes firms which report low levels of data availability (from 0 to 2), low levels of data use (from 0 to 2), and those firms that do not use data to perform any innovation activities. DDD-innovation takes the value of 2 when a firm reports high level of data availability (top two categories), high level of use of data (top two categories), and those that use data to perform any innovation activities. For all the intermediate cases, DDD-innovation takes the value of 1. Overall, 26.23% of firms are classified in the maximum level of DDD-innovation indicator, while 19.75% falls in the lowest one. The remaining 54.01% of observations accrue to the intermediate category.

We first focus on factors related to DDD that were considered relevant in previous empirical studies, namely firm size (employment and multi-unit establishment), sector, human capital, and ICT adoption. To assess possible economies of scale in adoption, we distinguish between micro and small enterprises (less than 50 employees), medium-sized enterprises (less than 250 employees) and large firms. We also consider whether the firm is part of a group or not, as measure of size. The firms belong to 9 economic sectors (ATECO letters): manufacturing, other industries, commerce, transport, tourism, business services (ICT and scientific activities), business services (others), credit and insurance, others sectors. Since the effective use of data may depend on higher levels of formal education, we also consider the level of human capital proxied by the percentage of employees with a bachelor's degree or higher. Finally, the ICT index is the sum of the following eleven types of ICT services and applications adopted: internet use, company web site, use of social networks, multimedia sharing platforms, e-Commerce, Enterprise Resource Planning, Customer Relationship Management, Data Lake, Data analytics, Cloud Computing Services, and AI.

To inspect whether a decentralization system (higher level of workers autonomy) plays a role in DDD adoption, we distinguish structural autonomy from strategic autonomy. Based on 5 items of a survey question, employees' structural autonomy captures the degree of autonomy in planning and performing the work, whereas strategic autonomy captures the degree of autonomy in taking decisions, participating in the decision-making process, and defining job tasks. Each item ranges from 0 (never) to 4 (always), and the two variables are computed as the average values of items. The sample level of structural autonomy is 2.48, whereas that of strategic autonomy is 2.09.

Results. *Tables 1-3 shows the cross-tabulation of the two DDD indicators with size in terms of employment, whether they are single or multi-unit establishments, and sector, respectively, while tables 4-5 present the summary statistics of human capital, ICT and autonomy by each level of the DDD indicators. In terms of size (tab. 1), the rate of the highest level of DDD adoption (value equals 2) increases with firm size in both indicators, confirming previous evidence regarding the importance of economies of scale in the DDD adoption. Tab. 2 shows the distribution for single firm (single unit) and firms belong to a group (multi-unit). Coherent with size, also belonging to a larger group is correlated to higher level of DDD, in both indicators. With regard to sectors (tab. 3), the rate of the highest level of DDD adoption vary across subdivisions, with commerce, business services (ICT and scientific activities) and credit and insurance with the higher percentage of DDD firms in both indicators. In particular, firms in credit and insurance shows the highest percentage, both when we consider the DDD-KPI indicator (i.e. 46.5%) and the DDD-innovation indicator (i.e. 65.38%). This aligns with the fact that this sector has long been at the forefront of data utilization and modeling (e.g. for credit risk assessment).*

Tab. 4 (left-side) shows that firms in the highest category of the DDD indicators have a greater percentage of university-degree workers (58% for DDD-KPI and 56% for DDD-innovation), as expected. Tab. 4 (right-side) shows that the average number of ICT adopted when firms are in the highest category of the DDD indicators is more than 6, which is the highest mean among the three possible levels for both indicators.

[5] 5 KPI monitored is the threshold used by Brynjolfsson and McElheran (2016) and by Bar-Gill et al. (2024).

Tab. 1: DDD indicators by size

	DDD-KPI				DDD-innovation			
Size	0	1	2	Total	0	1	2	Total
Micro and small enterprises (<50 employees)	65 32.18	112 55.45	25 12.38	202 100.00	47 23.27	124 61.39	31 15.35	202 100.00
Medium-sized enterprises (50 to 249 employees)	18 25.35	31 43.66	22 30.99	71 100.00	13 18.31	31 43.66	27 38.03	71 100.00
Large enterprises (>249 employees)	3.00 5.88	22 43.14	26 50.98	51 100.00	4.00 7.84	20 39.22	27 52.94	51 100.00
Total	86 26.54	165 50.93	73 22.53	324 100.00	64 19.75	175 54.01	85 26.23	324 100.00

Source: our elaboration

The first row shows the frequency, the second one is the percentage

Tab. 2: DDD indicators by number of units

	DDD-KPI				DDD-innovation			
	0	1	2	Total	0	1	2	Total
Single unit	71 32.13	111 50.23	39 17.65	221 100.00	53 23.98	123 55.66	45 20.36	221 100.00
Multi-unit	15 14.56	54 52.43	34 33.01	103 100.00	11 10.68	52 50.49	40 38.83	103 100.00
Total	86 26.54	165 50.93	73 22.53	324 100.00	64 19.75	175 54.01	85 26.23	324 100.00

Source: our elaboration

The first row shows the frequency, the second one is the percentage

Tab. 3: DDD indicators by sectors

	DDD-KPI				DDD-innovation			
Sector	0	1	2	Total	0	1	2	Total
Manufacturing	27 36.99	35 47.95	11 15.07	73 100.00	17 23.29	43 58.90	13 17.81	73 100.00
Other industries	2 15.38	10.00 76.92	1 7.69	13 100.00	3 23.08	8 62.54	2 15.38	13 100.00
Commerce	9 32.14	9 32.14	10 35.71	28 100.00	8 28.57	11 39.29	9 32.14	28 100.00
Transport	7 36.84	8 42.11	4.00 21.05	19 100.00	3 15.79	13 68.42	3 15.79	19 100.00
Tourism	7.00 28.00	17 68.00	1.00 4.00	25 100.00	3 12.00	21 84.00	1 4.00	25 100.00
Business services (ICT & Scientific activities)	15 17.65	44 51.76	26 30.59	85 100.00	14 16.47	41 48.24	30 35.29	85 100.00
Business services (other)	8 30.77	12 46.15	6 23.08	26 100.00	7 26.92	12 46.15	7 26.92	26 100.00
Credit and insurance	2 7.69	12 46.15	12 46.15	26 100.00	1 3.85	8 30.77	17 65.38	26 100.00
Other sectors	9 31.03	18 62.07	2.00 6.90	29 100.00	8 27.59	18 62.07	3 10.34	29 100.00
Total	86 26.54	165 50.93	73 22.53	324 100.00	64 19.75	175 54.01	85 26.23	324 100.00

Source: our elaboration

The first row shows the frequency, the second one is the percentage

Tab. 4: DDD indicators by human capital and ICT index

		Human Capital				ICT			
DDD-KPI	Freq.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
0	86	28.48	32.55	0	100	3.03	1.72	1	7
1	163	44.95	33.84	0	100	4.80	2.44	1	11
2	70	58.40	31.39	0	100	6.70	2.25	2	11
Total	319	43.46	34.51	0	100	4.76	2.56	1	11
DDD-innovation	Freq.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
0	64	40.89	36.73	0	100	3.86	2.53	1	11
1	173	38.73	34.23	0	100	4.31	2.26	1	10
2	82	55.45	30.66	0	100	6.36	2.51	1	11
Total	319	43.46	34.51	0	100	4.76	2.56	1	11

Source: our elaboration

Tab. 5: DDD indicators by structural and strategic autonomy

		Structural autonomy				Strategic autonomy			
DDD-KPI	Freq.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
0	86	2.32	0.88	0	4	1.86	0.88	0.00	4
1	165	2.62	0.94	0	4	2.15	0.73	0.00	4
2	73	3.03	0.82	1	4	2.52	0.76	0.67	4
Total	324	2.63	0.93	0	4	2.16	0.81	0.00	4
DDD-Innovation	Freq.	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
0	64	2.55	0.90	0	4	1.85	0.87	0.00	4
1	175	2.49	0.98	0	4	2.07	0.78	0.00	4
2	85	2.98	0.77	1	4	2.55	0.68	0.67	4
Total	324	2.63	0.93	0	4	2.16	0.81	0.00	4

Source: our elaboration

Tab. 5 shows preliminary and descriptive results concerning the role of workers' autonomy regarding DDD. We distinguish between structural and strategic autonomy. On the one hand, structural autonomy allows employees to manage their work within well-defined tasks. On the other hand, strategic autonomy allows agents to enter and to participate in the corporate decision-making process. As shown in Tab. 5, the average value of both structural and strategic autonomy is the highest for level 2 of DDD, confirming that the most advanced approach to decision-making is correlated to larger workers' autonomy. In addition, we can note when moving from the lowest to the highest category of DDD, the growth rate of strategic autonomy is higher than the growth rate of structural autonomy for both indicators. Indeed, it is notable in the case of DDD-innovation, i.e. 17% for structural autonomy and 37.8% for strategic autonomy. When moving from the lowest to the highest category of the DDD-KPI, the difference in the growth rate of strategic and structural autonomy is less sharp (35.5% versus 30.5%). This suggests that strategic autonomy is particularly important to a decision-making process oriented to innovation.

Research limitations. *We identify some potential limitations of the study. First, since the investigation is on going, the current study provides only a very preliminary and descriptive analysis, which prevents from establishing multiple influencing factors and quantifying relations. In addition, the analysis considers few factors related to DDD, but other important elements could be relevant, such as manager/employee trust, work satisfaction, and employee motivation that could affect innovation and performance in a DDD firm. Second, the research is based on cross-sectional data, making difficult to identify possible lagged relations or dynamics. The preliminary analysis indicates that using DDD to manage innovation activities is associated to a greater growth rate of strategic autonomy compared with the growth rate of structural autonomy. This result suggests a correlation between DDD used to innovation activities and a decentralization of the decision-making. To determine the direction of this association is difficult to establish with the current setting. It can be the case that digital technologies used to promote innovation can stimulate the adoption of more autonomy-oriented managerial practices, or can be the case that in a more decentralised system the costs to implement a DDD approach is lower, since the workforce reports higher level of competences and abilities in comparison to system characterized by a more hierarchical structure of decision-making. Further investigation is needed to inspect causality. Third, the data concerns firms located in Lombardy, which limits the generality of our results. Future studies could collect data from firms located in Italy or even in other countries to identify relevant differences affecting the findings.*

Managerial implication. *This study benefits managers in several ways. First, we find evidence of the difference in the rate of DDD adoption between large and small firms, and across economic sectors. This result indicates a possible long-term implication for the capacity of small firms and certain sector to adapt to the DT. Managers of these firms have to be aware of the importance of co-factors of DDD in order to promote the development of a data-driven approach. Second, our results indicate that organizations using a DDD approach to promote innovative activities may invest in a more decentralization decision-making. This implies modifying managerial practices leading to higher workers strategic autonomy. Indeed, the mere access to data is not enough to extract economic value. Managerial and organizational capabilities and changes are needed to translate information into innovative business strategies (Ciampi et al., 2021). Our study wants to enrich the existing knowledge on managerial and organizational changes needed to proper manage DDD.*

Originality of the paper. *The current study contributes to the existing evidence in several ways. First, we collect new and original data. Therefore, we can confirm the existing evidence on DDD phenomenon by using a primary data from firms located in Lombardy, region of Italy. The data collected cover a wide range of information, allowing us to control for a great number of features. Our findings suggest the importance of firm- and industries-specific factors that contributes to better understanding the adoption of DDD.*

Second, previous researches have examined the relationships between DDD and structured managerial practices (Capo et al. 2022; Brynjolfsson and McElheran, 2016a), others have proved the positive effect of DDD on innovation and firm's performance (Krafft et al., 2021; Davenport et al., 2021; Brynjolfsson and McElheran, 2016a); the most have indicated potential co-factors related to DDD (Capo et al. 2022; Brynjolfsson and McElheran, 2016a). However, they have not specially examined all these relationships considering different business knowledge perspective, nor they have addressed the role of workers' autonomy. To address this gap, our study investigates the role of workers' autonomy

considering separately DDD innovation-oriented from more general DDD. As expected, the role of workers' strategic autonomy seems to be central in predict DDD approach under innovation perspective.

Key words: *Digital Transformation; Data-Driven Decision-Making; Strategic Autonomy; Information and Communication Technologies*

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