European Companies' Readiness and Challenges in Data Economy

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This study investigates the readiness and challenges European companies face in embracing a data-driven economy. By conducting a comprehensive survey of 1,200 European companies spanning various industries and sizes, we reveal a mixed outlook on the data economy's potential to offer a competitive advantage. We find that 20% have already leveraged data to gain competitive advantage, a majority see potential benefits, while 19% perceive no advantage. Importantly, our findings highlight the need for substantial business model transformations to capitalize on data-driven opportunities. The paper also identifies the obstacles faced by companies in adopting a data-driven approach, including legal complexity, lack of data, competence in data-driven business models and technological competence. Challenges are most pronounced among micro-sized businesses and sectors like arts, entertainment, leisure, and international NGOs. Overall, the research suggests that if the company has the skills, a data economy has the potential to drive innovation and growth. By identifying the disparities in readiness and perception across different sectors and company sizes, this study contributes to a more informed discourse on fostering a conducive environment for all companies to thrive in the data-driven economy.

Keywords: data economy, business model changes, competitive edge, challenges, companies

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1 Introduction

The data economy is described as "a global digital ecosystem in which data is collected, structured, and shared to generate economic value" (Sestino et al., 2023). Organisations are increasingly dependent on analysing, exchanging, and utilizing digital information that has been collected, cleansed, organized, and aggregated for multitude of purposes. This information is disseminated in business ecosystems and multi-sided markets for the collective advantage (Brynjolfsson et al., 2011; Jetzek et al., 2014; Heikkilä et al., 2023). The significance of data is anticipated to grow even further (European Commission, 2020), leading to a demand for the re-skilled labour force to enhance innovation within the European economic area (EC, 2023).

While literature suggests that firms can leverage their Business Models (BMs) for innovations by digitalization and big data analytics capabilities (Bouwman et al., 2019; Ciampi et al., 2021; Sorescu, 2017), the experiences and outcomes of seizing these opportunities vary. Our earlier study (Heikkilä et al, 2023) found that companies' data-driven innovation is boosted by participating to data ecosystems, which help them to establish practices for ethical sharing and using of data to innovate and sustain new business.

In this paper we elaborate further our earlier findings by studying the role of BM changes in making use of data and by analysing which industries can keep up with the data economy development, what are the hindering factors for catching up or progressing faster, and eventually we discuss the importance and priorities in potential remedies to keep up with the development.

Our analysis is based on a survey conducted among European companies, focusing on their perceptions on data economy and the changes they have made to their business models. The data are collected from 1,200 diverse companies in four European countries as part of Sitra's IHAN project (2021), which focused on building a European data economy model and rule book for good conduct of data driven business (Sitra, 2022).

This research enhances the body of knowledge on BMs, particularly those of focusing on data-driven BMs where data forms a fundamental component of a company's business model (Trabucchi & Buganza, 2019; Heikkilä et al., 2023).

The structure of this paper is laid out as follows: We begin with brief literature review elaborating on the research on data economy and business models. Next, we describe the research method and the data in more detail. Following this, we disclose our findings concerning perceptions of benefits derived from the data economy, encountered obstacles, and alterations in business models - firstly examining all companies, then categorizing them by size, and finally concentrating on companies in selected industries. The paper concludes with a discussion, limitations of this study and suggestions for future research.

2 Data-based Business models

A BM describes the logic of how a company creates, delivers, and captures value (Teece, 2010; Wirtz et al., 2016). Typically, it consists of elements describing what kind of product or service is offered, who the customers are, how the production is organised, who the partners are and how the company generates income. Companies respond to continuously evolving environments by modifying their BMs (Marolt et al., 2018; Pucihar et al., 2019). These BM changes can range from modest refinements to some BM elements to a complete overhaul of the entire BM (Saebi et al., 2017; Eriksson et al., 2022).

Data-driven innovation refers to innovation that utilizes data and information and communication technologies as its core ingredients. The scholarly work defines it as a type of business innovation that leverages data to yield positive economic and social outcomes (Jetzek et al., 2014). Firms employ data to enhance decision-making processes, optimize organizational operations, or augment value for customers (Brynjolfsson et al., 2011). For example, by collecting and analysing data from users or other sources (Trabucchi & Buganza, 2019; Jetzek et al., 2014), a firm can infuse the data (Schüritz & Satzger, 2016), and gain insights into how its customers value its products and services and how it could add even more value to the market.

Several companies have realized the potential advantages of creating new BMs that utilize data as a crucial resource (Hartmann et al., 2014). Ciampi et al. (2021) assert that a company's competence in big data analytics positively affects its ability to innovate its BM. Bouwman et al. (2019) revealed that companies that actively utilize social media, big data, and information technology can increase their performance by transforming their BMs and strengthening their capacity for innovation. This however requires that the company has access to business and technical capabilities (Eriksson & Heikkilä, 2023).

In their qualitative study Rashed & Drews (2021) noticed companies taking differing approaches to data utilization depending on the degree of understanding of their data and degree of self-incentive. Typically, external support in e.g. selecting technology, in MVP or in operating model design was provided by consultants. Surprisingly, no data ecosystems were mentioned, even though the EU sees data ecosystems as crucial for the commercialization and commodification of data services, products, and platforms, thereby stimulating economic growth and innovation (European union, 2023). The expectation is that in data economy, especially with multi-sided markets and data ecosystems running on platforms (e.g., Hagiu, 2016; Tiwana, 2015; Giessman & Legner, 2016; Helfat & Raubitschek, 2018), the skills needed for operating and being an active member of platform and data economy are on high demand (EC, 2023). Indeed, in our earlier study (Heikkilä et al, 2023) we found that companies' data-driven business model innovation is boosted by participating to data ecosystems, which help them to establish practices for ethical sharing and using of data.

Little is still known about differing companies' perceptions on the benefits they can derive from the data economy, what are the obstacles they encounter, and how much do they change their business models. These are the topics of this study.

3 Methodology

The study was executed in 2021 within four European countries: Germany, Finland, France, and the Netherlands, sponsored by Sitra, the Finnish Innovation Fund (www.sitra.fi). Sitra is distinguished by its unique role at the national level in Finland, given its accountability and direct reporting to the Finnish Parliament, with Sitra's initial capital donated by the same body for the good of the nation.

Table 1: Profile of respondents' companies

Variable	Category	%
Country	Finland	25
	France	25
	Germany	25
	The Netherlands	25
Firm size (turnover €)	Micro (under 2 million)	28.1
	Small (2 – 10 million)	26.6
	Medium (10 – 50 million)	22.1
	Large (over 50 million)	23.2
Industry sector	Professional, scientific, and technological operations	6,5
	Administrative and support services	6,4
	Information and communications	9.8
	Mining and quarrying operations	0,3
	Operations of international organisations and institutions	0,8
	Real estate operations	2,4
	Training	0,5
	Transportation and warehousing	4,3
	Farming, forestry, and fishing industries	1,8
	Hotel and catering	3,3
	Other service operations	16,0
	Finance and insurance	8,0
	Construction	5,5
	Electrical, gas, heat, and ventilation maintenance	1,2
	Arts, entertainment, and leisure	2,3
	Industry	11,3
	Health and social services	8,1
	Wholesale and retail; motor vehicle and motorcycle repairs	6,6
	Water supply, sewerage, waste management and other sanitation	0,4

The survey respondents are B2B decision-makers, encompassing key management positions in charge of data, digitalization, information systems, strategy, marketing, and business development. The respondents were engaged on a voluntary basis, having previously indicated their willingness to participate in surveys. The process involved inviting respondents based on certain background criteria until stratum quotas of size in each country was met. The respondents retained the autonomy to accept or decline participation in the survey at their discretion. They were rewarded

for their contributions and time to the survey with incentives such as gift cards or airline miles.

Table 1 outlines the final samples in all countries. They are equally distributed across the involved countries and almost equally in size categories (by company turnover in accordance with the EU size classification - large, medium, small, and micro, excluding sole proprietors). There were neither specific quotas for industry type (EU-sectoral classification), nor for relative position or role within the data economy (e.g. Hagiu, 2016). The questions, scales and the raw dataset is freely accessible through Sitra (2021), reflecting its commitment to transparency and public engagement (see also Saaristo & Heikkilä, 2022; Ulander et al. 2021).

4 Findings

We will first present the overall findings at aggregated level, generalised over company sizes and industries. Then we analyse how the results differentiate between firm sizes, and last we take a deeper look at three industry groups: Information & Communication Technology, Finance, and Insurance (ICT-FIN); Transportation and warehousing (TRANSPORT), and Arts, entertainment, leisure and international organisations such as NGOs and charity organizations (ART_NGO), which differ in their expectations, skills and obstacles in engaging to data economy.

4.1 Overall Insights from the European Company Dataset

Survey results indicate that the studied companies are willing and prepared to embrace a data-driven economy (Figure 1.): Nearly half (48%) of the total respondents stated that a data economy had created (21%) or would create (27%) a competitive edge for their company. About one in five were negative on the promise of data economy.

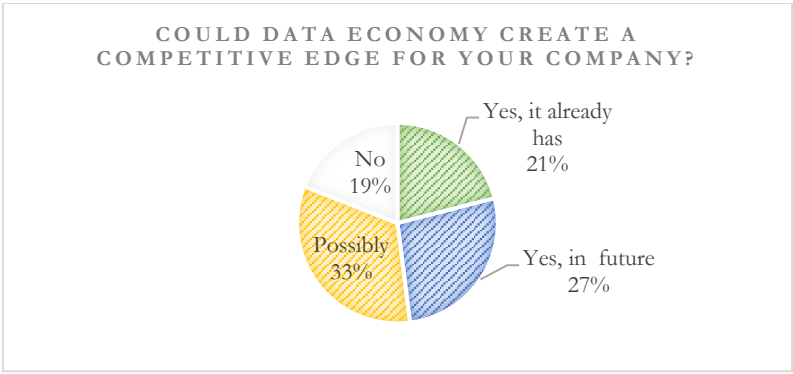

Figure 1: Could data economy create a competitive edge for your company?
Source: Own

The companies were also asked if they had made any significant changes to their business model in seven key components (customers, channels, value proposition, activities, resources, partners, revenue models) during the last two years (see Figure 2. and Table 2). Three out of four companies had made at least some changes to at least one component of their business models during the last two years, nearly half of the changes coined as radical.

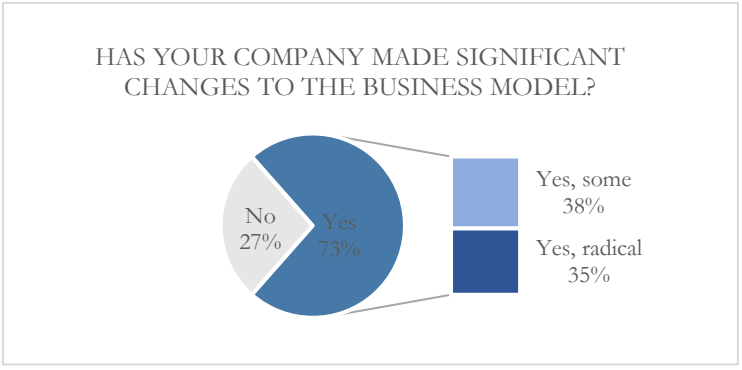

Figure 2: Has your company made significant changes to the business model during the last two years?
Source: Own

Table 2: Has your company made significant changes to the business model during the last two years?

		Frequency	%	Valid %
Valid	No	325	27.1	27.3
	Yes, some	449	37.4	37.7
	Yes, radical	418	34.8	35.1
	Total	1192	99.3	100.0
Missing		8	0.7	
Total		1200	100.0	

Table 3., in turn, shows that there is a statistically significant association (<.001) between the degree of changes to the business model and believing that a data economy creates a competitive edge now or later versus possibly, or not at all. Those who do not believe in data economy, do little BM changes on the average, or vice versa. Especially when compared with the believers the difference is striking (more than four changes vs one).

Table 3: No of BM components changed & competitive edge

		How many BM Components were changed (max 7)		
		Mean	N	Std. Deviation
Could data economy create a competitive edge for your company?	Yes, it already has	4.3571	252	2.52782
	Yes, it will in the future	4.2747	324	2.53432
	Possibly	2.5797	394	2.40148
	No	1.0954	220	1.79928
Total		3.1427	1191	2.67163

The table 4. below illustrates the big and statistically significant differences between two extreme groups of companies (those who already have created competitive edge and those who do not expect to gain competitive edge). While 54% to 66% of the first group has made changes to each BM component, in the second group the respective percentages vary between 11% and 23%.

Table 4: Changes in BM Components among two distinct groups: those who have achieved a competitive advantage through the data economy and those who perceive no competitive edge

	Could data economy create a competitive edge for your company?	
Changes in..	Yes, it already has, (N=252)	No, (N=220)
BM Customer component	54 %	14 %
BM Value proposition	65 %	16 %
BM Channels	64 %	13 %
BM activities	64 %	17 %
BM Resources	66 %	23 %
BM Partners	66 %	18 %
BM Revenue model	64 %	11 %

All the above pinpoints to the fact that data-driven business necessitates wide-scale changes in the business model of the company. As the survey did not cover the companies' intentions to make changes to their business model, further modifications may still be on the drawing board.

5.2 Analysis by Company Size Categories

We asked whether the companies possess skills to function as an active member in the data economy. Not surprisingly, the skill level is significantly correlated (<.001) with the size of the company (Figure 3.). The micro firms considered their skills significantly lower compared to other companies while large companies claimed to have the best skills.

Moreover, Figure 4 shows (<.001) that medium-sized companies hold the most optimistic expectations about gaining a competitive advantage through data utilization. On the other hand, for micro companies the outlook was less positive. This trend is hardly surprising and can largely be attributed to the disparity in resources. Micro companies, with their limited resources, face significant challenges in collecting and utilizing data effectively – and as indicated earlier are also less skilled in participating to the data economy than bigger companies. Hence, the economic standpoint becomes especially significant in this scenario, highlighting the critical role of resource availability in leveraging data for competitive gains.

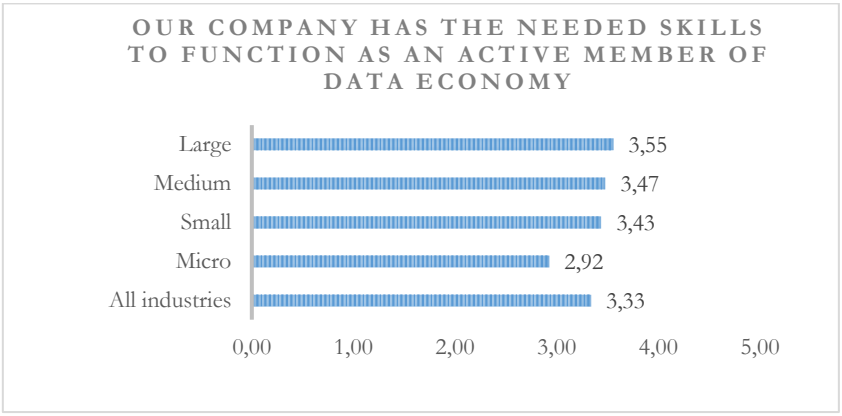

Figure 3: Data Economy Skills per company size (<.001)

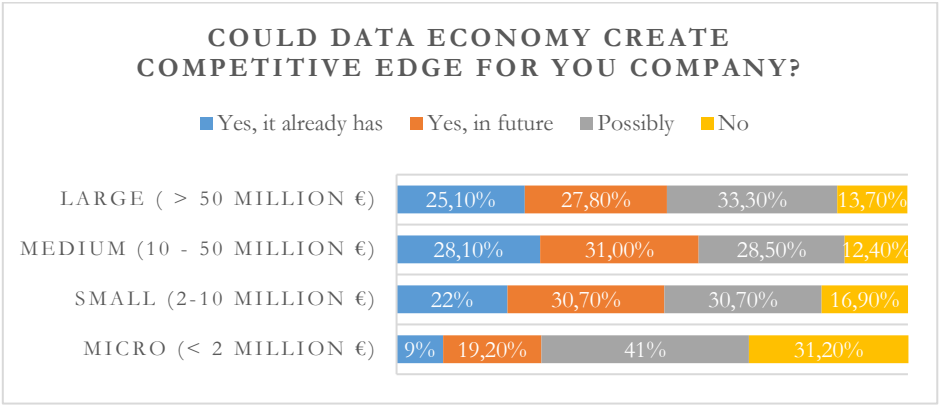

Figure 4: Company size and competitive edge (<.001).

Similar story continues with regards BM changes (Figure 5.). Micro companies have made the least changes and medium sized companies the biggest changes to their BM. To the contrary it is the medium sized firms, which are best prepared for reaping the benefits from data economy by innovating their business model.

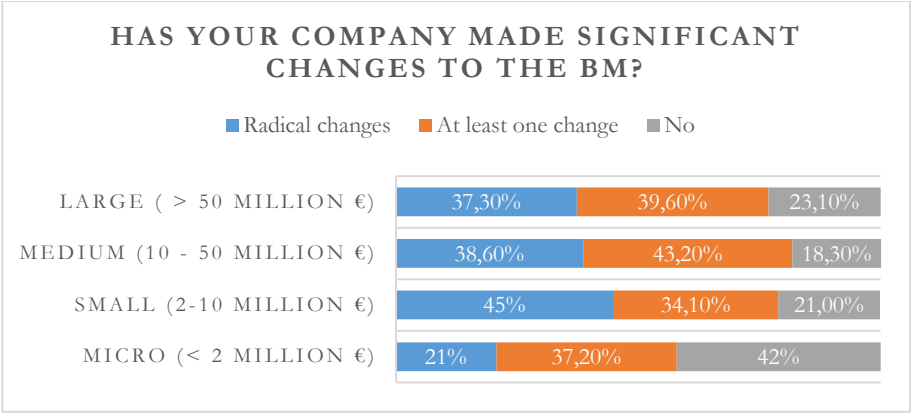

Figure 5: Company size and extent of changes to the BM. (<.001).

So, what are the main obstacles on the way taking advantage of the data driven economy. One could expect the size of the company being a determining factor for recognizing the obstacles – yet Table 5 shows, that the set of obstacles are rather similar in our sampled companies, although we can find some differences, too.

Table 5: Obstacles on the way to data economy per company size

	Micro	Small	Medium	Large
Obstacles on the way to data economy:	N=308	N=291	N=243	N=255
Complexity of the regulatory framework for businesses	26%	23%	33%	38%
Lack of competence on data economy related business models	26%	31%	23%	22%
Lack of available data	25%	33%	33%	37%
Lack of competence on data economy related technical capabilities	18%	24%	26%	24%
Customers do not recognize the potential of such new services	22%	22%	21%	24%
Lack of funding available	17%	10%	17%	13%

To our surprise, funding for data economy investments was not listed a major issue. Instead, lack of data is one of the most mentioned obstacles. The bigger the company the more challenges seem to arise from lack of data – and obviously this has something to do with the complexity of regulatory environment, as it is similarly associated with the company size. And finally, the lack of competence in data

economy business models and lack of technical capabilities are also mentioned by many.

5.3 Analysis of specific industries

For further analysis we decided to focus on three groups with different skills: *Information & Communications* and *Finance & Insurance* sectors possess top skills in terms of being active participants in the data economy, so we combined them as one group (ICT-FIN). *Transportation and Warehousing* (TRANSPORT), in turn, have average skills. Contrary to ICT-FIN, which offers immaterial services mostly, TRANSPORT is lot about moving physical, material objects. The third group consists of *Arts, Entertainment, Leisure* and *International Organisations* (ART-INT) who self-evaluate themselves as having lowest skills for data economy (Figure 6).

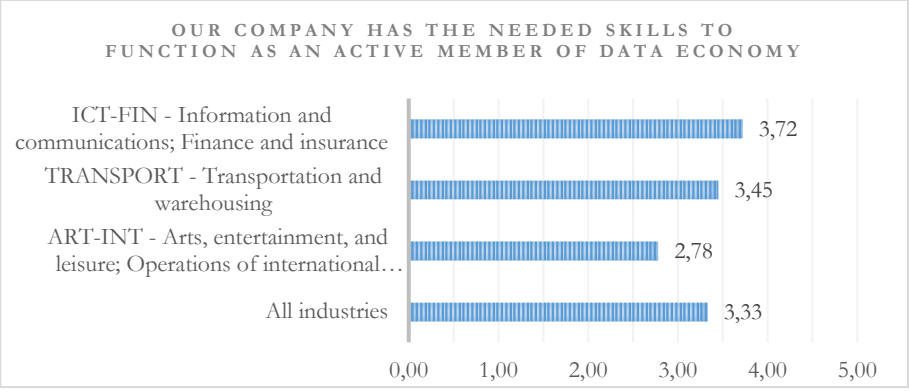

Figure 6: Industry sectors and skills (<.001).

Comparison of the groups in Figure 7. shows how ICT-FIN and TRANSPORT are rather similar in their view on getting competitive advantage from data economy. Over 30% of them report already benefiting from data. To the contrary, perceptions of ART-INT are less positive, only 13,5% of ART-INT have been able to gain competitive advantage from data.

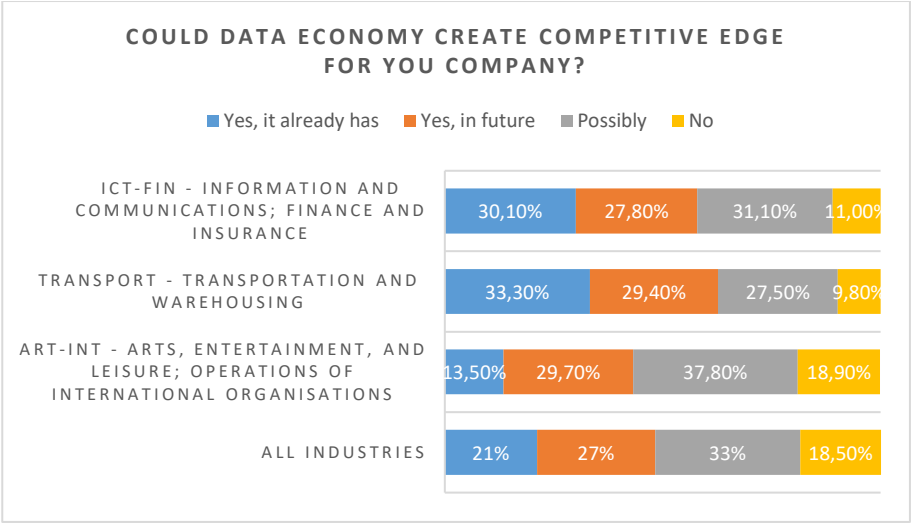

Figure 7: Competitive edge in three industries.

We dig deeper on how the companies perceive the data economy to financially benefit their business with the help of Kruskal-Wallis and Mann-Whitney tests. Results are presented in Table 7 and A1.

Table 7: Three industry groups' views on potential benefits from data

How much potential you see in data sharing to				
		Create additional revenue from current business model	Create new revenue streams from innovations	Saving costs
ICT-FIN	Mean	3.46	3.65	3.35
	N	210	210	210
	Std. Deviation	.939	.863	.983
TRANSPORT	Mean	3.53	3.63	3.67
	N	51	51	51
	Std. Deviation	1.084	1.095	1.125
ART-INT	Mean	3.00	3.00	3.24
	N	37	37	37
	Std. Deviation	1.202	1.106	1.278
All Industries	Mean	3.22	3.27	3.31
	N	1187	1183	1183
	Std. Deviation	1.145	1.152	1.144

ICT-FIN and TRANSPORT sectors perceived a significant potential to increase their revenues in two ways: by optimizing their current business model and, even more importantly by innovations. ART-INT sector is significantly less convinced on the benefits of data economy altogether. ART-INT primarily sees the potential benefits of the data economy in terms of cost savings, an expectation that is uniformly shared across all industry groups. Perhaps surprisingly, almost half of the ART-INT mention complexity of regulation to be the biggest obstacle (46%, compared to 25% in TRANSPORT and 35% in ICT-FIN), followed by lack of competence in data-driven business models (32%, vs. TRANSPORT 37% and ICT-FIN 26%). Third obstacle is lack of data (16% vs. TRANSPORT 46% and ICT-FIN 33%).

6 Discussion and Conclusions

This study finds that European companies perceive the data economy as offering a competitive advantage. Almost half of the surveyed companies stated that the data economy had provided, or would provide in future, a competitive edge for their business. 19% of the companies consider that the data economy will not benefit them. The perceived economic potential from the data economy is significantly linked to the level of BM changes implemented by the companies: those that have already benefited from the data economy have made large-scale modifications to their BMs, in contrast to those companies that are unwilling or unable to benefit from data, which have made minimal changes to their BMs.

Furthermore, the study provides evidence that micro-sized firms (with a turnover of less than two million euros) are particularly struggling to adapt to the data economy. These firms are lacking the necessary skills, and only 9% of micro companies believe they have been able to gain a competitive advantage from data. As the biggest obstacles, companies of all sizes cite a lack of data, the complexity of regulations, and a deficiency in data-driven BM and technical skills.

Further analysis of three industry groups reveals that the ICT-FIN and TRANSPORT industries significantly outperform the ART-INT sector. The former two are able to leverage the benefits of the data economy by innovating and adapting their business models. This not only allows them to increase revenues within their current business models but also to innovate new ones. We interpret this disparity

as reflecting the productivity and welfare losses in the ART-INT sector: despite anticipating some improvements in form of cost savings, it fails to engage fully in data-sharing ecosystems and thus cannot reap the full benefits. Indirect evidence also suggests that the profitability of the ART-INT sector has not improved during the data economy era, despite a Compound Annual Growth Rate of 10-12% in industry revenue in the studied countries. Therefore, despite expected market growth from 2022 to 2027 (Statista, 2023), ART-INT is not benefiting from a data economy to enhance its business, unlike the more adept ICT-FIN and even the average TRANSPORT industries.

The fact that the ART-INT industry has not caught up starts to show in the industry performance statistics (Figure 8, Eurostat, 2023). On the other hand, ICT-FIN sector is creating more value per employer. This may imply that inclination towards data economy is related with higher productivity.

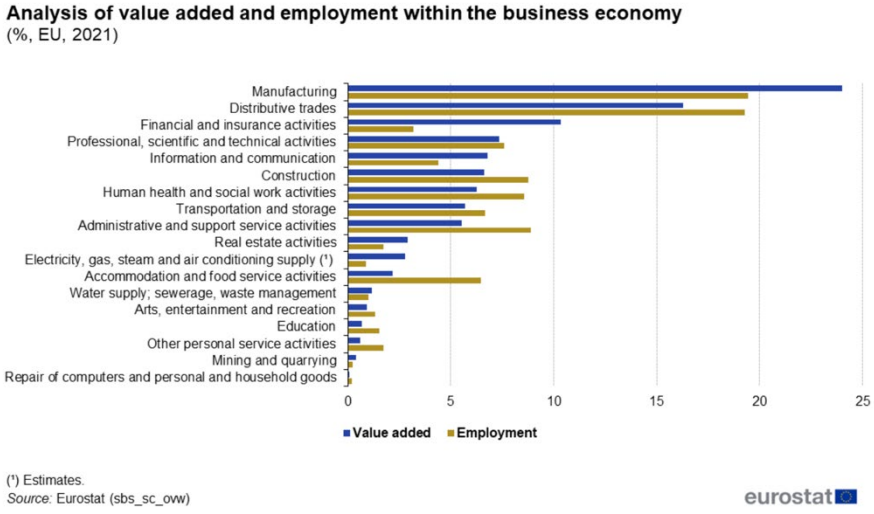

Figure 8: Percentage of value added and employment, EU 2021

Is there likely to be a significant disparity in the ability of different industries to benefit from data and engage in the data economy, potentially leading to creative destruction? This concern is particularly acute for industries such as ART-INT, which appear less capable of harnessing the advantages of data. We are less concerned on the evolution of ICT-FIN and even TRANSPORT, because the

utilization of data for changing their business keeps also profits up, the better the more involved the industry is into the data economy's innovative traits. The results also raise similar concerns about level of data-driven innovation within micro-sized companies, which see themselves as significantly less skilled with respect to the data economy.

This study has some limitations that need to be taken into consideration when interpreting the results. Firstly, the data was collected from four European countries only, and therefore, the results may not be generalizable to companies in other regions, such as the United States and China, which have different regulatory environments and attitudes towards fair and sustainable data practices. Secondly, the cross-sectional nature of the survey could introduce response bias, as firms at different stages of their innovation trajectories may hold varying views on data-driven innovation. However, the inclusion of a large sample size is expected to mitigate such variance. Moreover, our findings highlight the perceived low skills to benefit from data by the micro-sized companies. This discovery underscores an urgent need for more detailed research to understand the specific barriers and opportunities faced by these companies, which range from small retail stores to hairdressers and startups. Future studies should consider incorporating questions about company age to better distinguish between the unique challenges faced by established micro-sized businesses and those encountered by startups. Such research is crucial for developing targeted strategies and support mechanisms to elevate the data economy competencies of micro-sized companies across various sectors.

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Appendix

Table A1: Mann-Whitney test presenting pairwise differences between industries

How much potential you see in data sharing to	ICTFin – ArtInt	ICTFin - Transport	ArtInt - Transport
Create additional revenue from current business model	-2.066	-0.866	-2.142
Create new revenue streams from innovations	-3.288*	-0.125	-2.504*
Saving costs	-0.127	-2.449*	-1.676

Notes: values in the cells are z scores. * represents 2-talied significance