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Unpacking the Concept of Data Economy

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Abstract: Data economy, emerging from digital transformation and platformisation, positions data as a significant economic resource, often compared to "new oil". Despite increasing attention, the concept remains blurred and evolving, lacking a clear definition. This paper aims to provide a clearer understanding of the concept of data economy and proposes a new definition: Data economy is an area of the economy, where ecosystem partners and actors share data and make it accessible and usable for others in order to create new business opportunities in data economy ecosystems. Addressing an identified research gap, the paper critically synthesises existing definitions through a literature review and conceptual analysis. The analysis demonstrates that the core elements of the data economy lie in data, ecosystem, and business opportunities. The paper concludes by outlining directions for further defining the concept to support future theoretical and managerial applications.

Keywords: Data economy, data ecosystem, data economy ecosystem

1 Introduction

The concept of data economy is frequently cited within academic and policy literature, yet it remains ambiguous and contested. The various definitions of data economy are usually based on the European Commission's definition which was coined in 2017 (European Commission, 2017). Since then, the concept of data economy has been defined in various ways and the definition has evolved, broadening and narrowing, growing and slenderizing, and shifting emphasis, reflecting its multifaceted nature. The meaning of data economy appears to be blurred and evolving and a common understanding and a clear universal definition on the concept of data economy does not exist (Koskinen, Knaapi-Junnila & Rantanen, 2019; Azkan, Spiekermann & Goecke, 2019). This uncertainty makes it a challenging and complex task to fully understand the size and impact of the data economy in society (Koski et al., 2024).

Prior literature uses the concept of data economy in various ways, but its theoretical foundation and definitional boundaries have remained unclear (e.g. European Commission, 2017; Azkan et al., 2019; Koskinen et al., 2023). This creates a research gap, as the lack of conceptual clarity makes it difficult to develop theoretical frameworks, consistent research and empirical analysis in the field. This article addresses the research gap by providing a critical synthesis of existing definitions, resulting in a clearer and more comprehensive understanding of the concept of data economy and proposing a new definition. The main contribution of this study lies in clarifying and structuring the concept by unpacking its key elements, thereby supporting further theoretical analysis as well as practical applications in the management and measurement of the data economy.

Our overarching questions are: What are the elements in the concept of data economy based on the earlier research? What are the possible issues in the current definitions and how can the conceptualization be developed further? Previous definitions have not been able to describe the key elements of the data economy and link it to previously known and concrete concepts. Definitions that are too narrow can become overly abstract and difficult to apply in practice. So far, no comprehensive and systematic analysis has been conducted on how the concept of data economy has been defined and how it has evolved over the years. When conceptualizing and defining a new phenomenon like data economy, it is helpful to use previously known and more concrete concepts, which aid in creating structure and understanding for the concept of data economy. Like van Gigch (1991) has noted, we have to understand the abstraction level of observation whilst creating models from reality. (Koskinen, Knaapi-Junnila & Rantanen, 2019)

In this paper, we explore the origins and contents of the definition “data economy” to enhance our understanding of how the concept has been defined and how it has evolved over the years. We unpack different framings of the data economy to find similarities that underpin the concept. The level of abstraction is at the macro level, because the concept must be sufficiently general and comprehensive to describe the phenomenon broadly without excessive detail. The aim of this paper is to provide a clearer and more comprehensive understanding of the concept of data economy and propose a new definition of this concept. Understanding the elements of the data economy in a clearer manner allows us to find further ways to support the management of the data economy and measurement of its impact more profoundly.

We begin by presenting findings of a broad literature review. Our aim is to trace the origins and use of the concept “data economy” in academic literature over time (from its first use until the end of 2024). This allows for the analysis of different definitions, as well as examining how the definitions of data economy have evolved. This gives us an understanding of the concept's origins and development, as well as revealing differences in its definition and use. Then we deconstruct the concept of data economy, examining the key elements that underpin the concept. This opens the opportunity to explore and clarify a complex and abstract concept. In reflection on our empirical data, we focus on the concept of data economy, examining how it is formed by different elements on data, ecosystem, as well as business and value creation that underpin the concept. By opening up the concept, we suggest that it is defined as a comprehensive concept that includes data, ecosystem, and business opportunities. Finally, a new definition around the key elements is proposed.

2 Methodology

Our literature review focused on the published material which has included a definition of data economy. The primary material covered peer-reviewed journal articles, some books and book chapters, but due to the policy related nature of the concept, we also complemented the material with selected "grey literature" such as conference proceedings, working papers, research reports, and governmental and non-governmental reports. The quality of the sources included in the literature review was assessed by considering their scientific rigor, publication channel, and relevance to the concept of data economy. Both peer-reviewed articles and grey literature were included to ensure comprehensive coverage of the topic.

Our search was first conducted using two databases: Web of Science and Scopus. We defined suitable keywords to align with our research objectives and research questions, using the keyword "data economy" as a mandatory search criterion that had to appear in the title, abstract or keywords of each publication. Before the selection process and removal of duplicates, the total number of records retrieved from Web of Science and Scopus was 804. Between 1994 and 2024, Web of Science contained 264 and Scopus 540 English-language publications. The year 2017 marked a significant turning point in the use of the term compared to previous years, as illustrated in Fig. 1. Since then, the number of publications explicitly referencing the term in titles or abstracts has steadily increased.

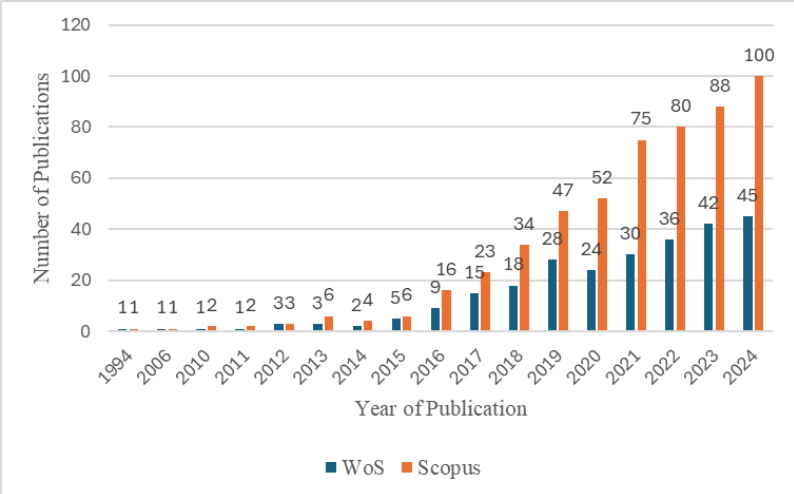

Figure. 1. Total number of publications by year using the term data economy.

Table 1. Data gathering procedure demonstrating the search strings and output from databases.

Database	Search strings	Year range	Output
WoS	"data economy" (Title) OR "data economy" (Abstract) AND "data economy" (Author Keyword)	2017-2024	72
Scopus	(TITLE ("data economy") OR ABS ("data economy") AND KEY ("data economy") AND (LIMIT-TO (LANGUAGE, "English"))	2017-2024	76

In the next phase, the dataset was refined by limiting the publication years to 2017–2024 and by including only publications in which the term “data economy” appeared in the author-provided keywords and in either the title or the abstract, ensuring a focused analysis of explicitly self-identified data economy literature. Before the selection process and removal of duplicates, this resulted in 72 articles from Web of Science and 76 articles from Scopus (Table 1). The purpose of the research was to reveal different definitions of data economy and how these have evolved over the years. All 148 articles were first screened by title and abstract, identifying those where the term “data economy” was present, and the most relevant ones were selected for further analysis.

Full texts were then assessed for eligibility. The process of selecting the articles was based on the following inclusion criteria: (1) the definition was explicitly stated in the source (not just mentioned in passing), (2) the source was relevant to the data economy concept (the main focus was on data economy, not on unrelated fields such as medicine or biology), and (3) the publication was from the period 2017–2024. The selection criteria were the quotation of a given definition used as a reference by an author. Articles were excluded if the definition was ambiguous, not clearly articulated, or not directly relevant to the research questions. Duplicate and ambiguous cases were resolved through careful review.

When examining a new phenomenon with limited prior research, grey literature can help reduce publication bias by including relevant studies and reports that may not be published in peer-reviewed journals, for example because they are preliminary, practice-oriented, or do not report clear or positive results. It can also increase the comprehensiveness and timeliness of the review and provide a more balanced picture of the available evidence. (Paez, 2017) The literature review was carried out, and documents were selected using the "snowballing" method, where previously identified studies helped in finding additional relevant studies addressing the definition of data economy (Wohlin, 2014).

The final set of nine definitions was selected through thematic coding and includes mostly peer-reviewed academic sources, along with a small number of policy and institutional sources (such as Sitra) that illustrate how the concept of data economy is used in practice. In this process, each definition was analysed to identify its key elements, such as data, ecosystem, and business and value creation. These definitions have been collected into Table 2, organized by year of publication, author, and definition. Our study is limited in such a way that definitions of measurement of data economy have not been included in the table. A few key elements were extracted from each definition to organize, compare, and

identify commonalities. In the next section, we present the main findings from our literature review, followed by a deeper exploration of the concept and its framing.

Table 2. Definitions of data economy.

Year of publication	Definitions of data economy		
	Author	*Definition of data economy*	*Key elements*
2017	European Commission [1]	The "data economy" is characterised by an ecosystem of different types of market players – such as manufacturers, researchers and infrastructure providers – collaborating to ensure that data is accessible and usable. This enables the market players to extract value from this data, by creating a variety of applications with a great potential to improve daily life (e.g. traffic management, optimisation of harvests or remote health care).	Ecosystem, Market players, Accessible, Usable, Value, Data
2018	German Association for the Digital Economy (BVDW) [11]	data economy deals with the monetization of information based on acquired data, which is transformed into valuable information using an algorithm, and then made accessible on the basis of business management functions. A data economy can be operated as its own business model or it can support, modify, or replace existing value creation models by increasing digitalization.	Monetization, Data, Valuable, Value creation
2019	Azkan, Spiekermann & Goecke [3]	defines "data economy" as an umbrella term, which includes digital business models independent of a particular industry, for example, data products and services, digital technologies, data value chains, and their technical implications for data creation, processing, provision, and use to gain benefits for an organization.	Business models, Data, Value
2019	Lammi & Pantzar [12]	By the term data economy, we refer to the development of a digital economy where massive scale data is collected by everyone, also ordinary citizens, and where data circulates faster than ever.	Collected, Data, Circulates
2019	Cuno, Bruns, Tcholtchev, Lämmel & Schieferdeck [30]	The "data economy" in that sense comprises an ecosystem of different stakeholders and market participants, such as companies, infrastructure managers, public administration, research and civil society, whose cooperation ensures that data can be made accessible and usable. In this context, the market participants/stakeholders can extract and derive value from this data by implementing and operating a variety of ICT applications/services, opening a tremendous potential for improving our everyday lives, including vital aspects such as traffic management, traffic flow optimization or remote e-health services.	Ecosystem, Accessible, Usable, Value, Data
2019	Koskinen, Knaapi-Junnila & Rantanen [2]	Data economy is an area, where a few major players are dominating markets creating their own data economy ecosystems.	Major players, Dominating, Data economy ecosystems
2021	Sitra [29]	An area of the economy where the collection and use of data are a key part of activities.	Collection, Use, Data
2022	Knaapi-Junnila, Rantanen & Koskinen [14]	the data economy is an area of systemic powers in society as it is controlled mainly by corporations, organisations and state-level policies. However, the data economy intersects and affects both systemic (organisations) and the lifeworld (shared, individual ives) as it is an integral part of both in the current digital society.	Controlled by, Digital society
2023	Koskinen, Knaapi-Junnila, Helin, Rantanen & Hyrynsalmi [15]	Data economy is an area where a few major players are dominating markets by creating their own data economy ecosystems.	Major players, Dominating, Data economy ecosystems

3 Definition of Data Economy: Key Findings from Literature

Our analysis revealed that the concept of data economy is defined in multiple ways. Although the term has been used from 1990's (Widlocher, 1994; Murtagh et al., 2012), it

has only gained wider attention since 2017, when the European Commission's report "Building a European Data Economy" laid the basis for definitions. Since then, the definition has evolved, reflecting its multifaceted nature (BVDW, 2018). However, a clear universal definition of the concept does not exist. As a highly abstract term, previous definitions have not been able to describe the key elements of data economy and link it to previously known and concrete concepts. Azkan et al. (2019) did not rely on previous definitions but sought to define "data economy" as an umbrella term, which includes digital business models independent of a particular industry, for example, data products and services, digital technologies, data value chains, and their technical implications for data creation, processing, provision, and use to gain benefits for an organization.

In one of the earliest definitions, Lammi and Pantzar (2019) describe data economy as the development of a digital economy where massive scale data is collected by everyone, also ordinary citizens, and where data circulates faster than ever. The term is based on Bolin's terms (2012) that data economy integrates two types of logic and conceptualizations of 'audience' which were quite separate in the pre-digital era. Koskinen et al. (2019) introduced a definition of data economy, which they have refined and elaborated over the years (Knaapi-Junnila, Rantanen & Koskinen, 2022; Koskinen et al., 2023). Their evolving definitions, articulated with varying nuances, reflect a continuous effort to clarify and develop their conceptualization of data economy. While the concept of data economy has been addressed in several scientific publications, only a few authors, namely Koskinen et al. (2019) and Koskinen et al. (2023), explicitly conceptualize data economy as connected to a data economy ecosystem. One reason for the variation in definitions was that the data economy ecosystem would refer to one specific part of data economy being thus more definable. The difference between data economy and data economy ecosystem is that the first one refers to the whole phenomenon, and the latter to an exclusive segment of it. (Koskinen, Knaapi-Junnila & Rantanen, 2019)

Originating from the terms "data" and "economy," the concept of data economy encompasses much more than the mere amalgamation of these two elements. It can be stated that data economy is a part of the economy, built on the use of data to create services and data-driven products for economic purposes (Koskinen, Knaapi-Junnila & Rantanen, 2019). Our analysis revealed that data plays a leading role in every definition, underscoring its centrality to the concept of data economy. One characteristic of data economy is the vast amount of data that is available (Azkan, Spiekermann & Goecke, 2019). Data has become a main source or instance for business, and its utilization increasingly takes place within broader collaborative networks (Koskinen et al., 2023). The data economy comprises an ecosystem of organizations that use data as the main object or source of their business (Opher et al., 2016). Data ecosystems can emerge through various configurations and enable the creation of value that individual actors would be unable to achieve on their own (Ding et al., 2011).

Four definitions emphasize the importance of ecosystems, highlighting the interconnectedness and ability to collaborate between different partners. These suggest that data economy thrives on the collaboration between various partners. The concept of ecosystems has been widely used from field to field, and one of the central unifying elements is value (Koskinen et al., 2023). As a result, the usage of data is currently a highly significant topic, especially in the context of data business (Koskinen, Knaapi-Junnila &

Rantanen, 2019). Koskinen et al.'s (2023) definition of data economy ecosystem takes into account that different actors use data as a main source or instance for business. Five definitions focus on the significance of business and value creation. These definitions emphasize the economic potential of data and how data can drive new business opportunities. This perspective aligns with the view that data is a vital resource in the modern economy, capable of generating substantial value. In the next section, we present a deeper exploration of the concept of data economy and its framing based on data, ecosystem, as well as business and value creation that underpin it.

4 Elements of Data Economy

4.1 Data Economy and Data

The role of data has undergone a significant transformation over recent decades. Over time data has evolved from brittle paper records to complex databases and algorithms, like blockchain, evolving from information into a new asset. (Shukla et al., 2023) However, data economy is not only about companies' activities involving data and digital technologies; it also includes the direct, indirect, and induced effects of the data market on the overall economy (Ilves & Osimo, 2019). Data has become a crucial resource in the new data economy, often referred to as the "new oil" due to its increasing economic relevance (Banterle, 2018; Rantanen, Hyrynsalmi & Hyrynsalmi, 2019). Unlike oil, data is bought and sold in different ways and data could be used to generate new sources of revenue (Shukla et al., 2023). Today, data is no longer just bits and forgotten background information; it is recognized as a strategic asset, enables the development of new products and services and provides companies with a competitive advantage. Companies have awakened to the "data network effect", which requires efficient data exchange among stakeholder (Shukla et al., 2023).

4.2 Data Economy and Ecosystem

Beyond just emphasizing data, a definition of data economy must place importance on ecosystems. The data network effect is realized within an ecosystem, and the concept of data economy is fundamentally based on the sharing of data across these ecosystems (Shukla et al., 2023). The phenomena, such as big data, artificial intelligence and Internet of Things, have steered local, national and worldwide attention increasingly towards ecosystems around data and data usage (Curry & Sheth, 2018). To ensure that data is available and usable, an ecosystem of different market players is needed to collaborate (European Commission, 2017).

Increasingly, companies require data ecosystems that enable them to exchange and trade data, such as with their supply-chain partners (Oliveira, Barros Lima & Farias Lóscio, 2019). Rantanen et al. (2019) discusses the significance of "data ecosystems", noting that the significance of data ecosystems has grown, particularly due to their ability to enrich, use, and reuse large datasets. Data ecosystems consist of sociotechnical networks that facilitate collaboration among actors in discovering, publishing, archiving, consuming or reusing data (Oliveira, Barros Lima & Farias Lóscio, 2019). These networks create value,

foster innovation, and support the emergence of new businesses. In essence, a data ecosystem is a group of actors working together with data and other shared resources (Oliveira & Loscio, 2018).

There are two types of ecosystems related to data. A data-utilizing ecosystem uses data as part of its broader operations, but data is not the center of its operations. The data is used to make the ecosystem work more efficiently, to find new business opportunities or to improve customer experience. In the second identified alternative, i.e. the data ecosystem, data plays a central role. In this case, the entire ecosystem is built around the sharing, analysis and utilization of data, and it creates the basis for the data-based solutions that the ecosystem aims for. (Aura et al., 2024) It is not enough to have the word "data ecosystem" alone in the definition, as it only addresses the core business of data usage, excluding data that is used as part of business operations. The interpretation of "data economy ecosystem" take both types of ecosystems into account and brings the interpretation towards less abstract and more understandable level (Koskinen, Knaapi-Junnila & Rantanen, 2019).

The data economy ecosystem can be understood as a hybrid that contains features of knowledge, innovation and business ecosystems (Valkokari, 2015; Granstrand & Holgersson, 2020). In an ecosystem, concrete actors such as companies, users, technology providers, and regulatory authorities can be identified, and it is possible to understand how different actors create value from data in their own business operations (Adner, 2017; Jacobides et al., 2018; Koskinen et al., 2019). A narrowly defined data ecosystem may facilitate the identification of specific actors and delineation of value chains, yet it risks neglecting the broader systemic interdependencies and feedback mechanisms (Aarikka-Stenroos & Ritala, 2017). In contrast, a more expansive conceptualization enables the capture of complex, multi-level interactions, but may compromise analytical precision and clarity (Aarikka-Stenroos & Ritala, 2017; Granstrand & Holgersson, 2020).

4.3 Data Economy, and Business and Value Creation

Data usage currently holds a pivotal role, especially in the context of the data business. The area of business in question is commonly known as data economy (Koskinen, Knaapi-Junnila & Rantanen, 2019). Data differs from other company resources because the value of data can be multiplied by sharing it with others (Seppälä et al., 2019). Value creation must be considered from both the broader ecosystem perspective and the viewpoint of individual actors.

At the ecosystem level, economic value intersects with values such as transparency and sustainability. Companies should focus on creating shared value within ecosystems, as collaborative data sharing can drive innovation, optimize processes, and lead to the creation of new business opportunities. (De Reuver et al., 2024) In this context, value is not only created for individual companies, but also distributed across the entire ecosystem, amplifying the overall impact. Data plays a pivotal role in fueling innovation within the economy and creating services and data-based products for economic manners (Koskinen, Knaapi-Junnila & Rantanen, 2019). In addition to driving innovation and economic growth, data sharing, particularly of non-personal data, enables organizations to unlock the full potential of their data assets, highlighting ecosystem participation as a strategic

advantage (Bonti et al., 2021). Thus, value creation in the data economy is fundamentally based on collaboration, openness, and the ability to leverage data across organizational boundaries.

The definition of data economy must place importance on emerging business opportunities instead of focusing on existing business structures and traditional value creation. This emphasizes the economic potential of data and how data can drive new business opportunities, highlighting the need for a forward-looking definition of data economy—one that focuses on possibilities rather than preservation, growth rather than maintenance, and innovation rather than tradition. However, understanding and leveraging the economic value of data is crucial for businesses and economies, as data has the potential to drive innovation and create services and data-based products for economic purposes. The core elements of data economy—data, ecosystem, and business opportunities—are closely interconnected and form the foundation. A causal relationship can be identified between these three areas of research, forming the basis of the conceptual framework applied in this study.

Figure 2 presents a conceptual framework illustrating their relationship and mutual dependence in data economy. Data differs from other company resources because the value of data can be multiplied by sharing it with others (Seppälä et al., 2019). Companies should focus on creating shared value within ecosystems (De Reuver, 2024). The purpose of ecosystems is to promote multidimensional and interactive collaboration, through which it is possible to generate more from the same input than individual actors could alone (Valkokari et al., 2020).

Data has evolved into a strategic asset and a crucial resource, enabling the development of new products, services, and competitive advantages. However, the true potential of data is realized within ecosystems, where collaboration among diverse actors allows for the efficient sharing, enrichment, and utilization of data. These data ecosystems foster innovation and support the emergence of new business opportunities, as companies can collaborate to drive innovation, optimize processes, and create value that would not be possible individually. Ultimately, the dynamic interplay between data, ecosystem, and business opportunities creates a positive cycle that fuels the growth and transformation of the data economy.

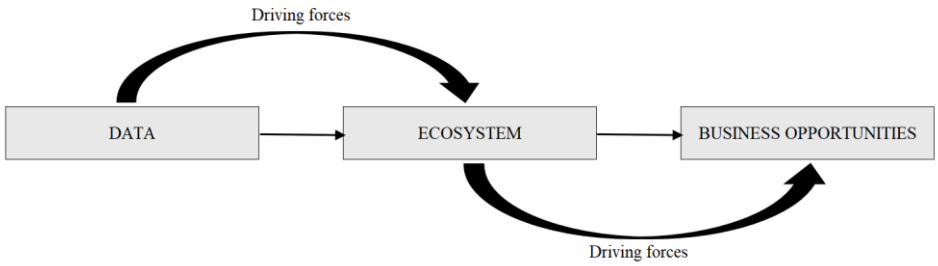

Figure. 2. Conceptual framework illustrating the relationship between data, ecosystem, and business opportunities in data economy.

5 Discussion and Conclusion

We can interpret the statement *"Data economy is an area of the economy"* through the findings of this study as referring to a form of value creation that is embedded in everyday economic activity and realized through data sharing and collaboration between multiple actors. Rather than constituting a separate or clearly bounded domain, the data economy emerges from interactions that cut across sectors and organizational boundaries, where data functions as a key resource for value creation. In this context, data can be understood as an intangible asset when it is created once, subsequently reused, and generates economic benefits over a period exceeding one year (Goodridge, Haskel & Edquist, 2021). Data differs from traditional factors of production in that it is a non-depleting and versatile resource, whose value derives from its collection, combination, and utilization (Koski et al., 2024). Like the circular economy, the data economy challenges the traditional logic of ownership and builds an economy where value is created through collaboration and the sharing of benefits among ecosystem actors. This shift from an ownership-based logic to a logic of shared value can be a decisive step in economic renewal and enabling growth.

Ecosystem actors have been acknowledged in some definitions, although the terminology varies, such as market players or major players. We prefer to use ecosystem partners and actors, each playing a crucial role in its functioning and development. The term "partner" often implies a formal and long-term relationship, suggesting that data and data sharing should be thought of as a collaboration and partnership among the partners. In contrast, "actors" are a more neutral term that includes all participants in the ecosystem, such as individuals, companies, and institutions, regardless of the formality of their relationship. The interpretation of *"ecosystem partners and actors share data"* is a less abstract concept than major players and market players, as it refers concrete actors, concrete actions around data and interactions within a specific phenomenon, making it easier to comprehend (European Commission, 2017; Koskinen, Knaapi-Junnila & Rantanen, 2019; Koskinen et al., 2023).

Data plays a pivotal role in every definition. In order to maximize the benefits of the data, it must be ensured that data is accessible and usable (European Commission, 2017; Cuno et al., 2019). The interpretation of *"make it accessible and usable for others"* take into account that data is available to the partners of the ecosystem, not just within the company. The definition of data economy must place importance on emerging business opportunities instead of focusing on existing business structures and traditional value creation. The interpretation of "*in order to create new business opportunities in data economy ecosystems*" take two types of ecosystems into account. It distinguishes that there can be two types of ecosystems; A data-utilizing ecosystem and data ecosystem, where ecosystem partners can collaborate by sharing data and creating new business opportunities.

Taking all these interpretations into account, the core of this concept lies in data, ecosystem, and business opportunities. The definition is centered around these key elements and based on the European Commission's 2017 definition, which takes into account ecosystem actors, data accessibility and usability, and the value creation from data. Based on the findings, the proposed definition of data economy is as follows:

Data economy is an area of the economy, where ecosystem partners and actors share data and make it accessible and usable for others in order to create new business opportunities in data economy ecosystems.

There were only nine definitions available, which constrained the broader exploration of the concept of data economy, as the review years spanned from 2017 to 2024. This limitation weakened the ability to conduct a fully comprehensive and systematic analysis, as a limited number of definitions may not reflect all possible interpretations. The answers to the first research question determine which key elements form the core of the concept and how the data economy is defined, which in turn affects the content and scope of the definition. Despite these, we have succeeded in making an abstract and multifaceted concept more concrete and understandable by conceptualizing and defining it through previously known and more concrete concepts.

Future studies should place stronger emphasis on both the measurement and the attribution of value in the context of data economy. While the concept of data economy has been widely discussed, no comprehensive and systematic analysis exists on how data-related value is measured, operationalized, and empirically validated across different contexts and actors. As a conceptual contribution, this study identifies key elements relevant for such assessment and thereby provides a foundation for future empirical research. Building on these conceptual elements, future studies could develop concrete measurement frameworks and indicators, as well as empirically examine how value creation, capture, and distribution are realized in practice. Empirical research designs, such as case studies, comparative analyses, and quantitative investigations are needed to test, refine, and contextualize the conceptual foundations of the data economy. Such research would not only strengthen the theoretical understanding of the data economy but also provide actionable insights for organizations and policymakers seeking to assess and leverage data-driven value.

References

Aarikka-Stenroos, L., and P. Ritala. 2017. “Network Management in the Era of Ecosystems: Systematic Review and Management Framework.” *Industrial Marketing Management* 67: 23–36.

Adner, R. 2017. “Ecosystem as Structure: An Actionable Construct for Strategy.” *Journal of Management* 43, no. 1: 39–58.

Aura, H., N. Wuori, L. Paavilainen, and M. Ruokonen. 2024. *Data-driven Competitiveness: A Handbook for Ecosystems to Utilise Data*. Helsinki: Sitra Studies 244. https://www.sitra.fi/wp-content/uploads/2024/09/sitra-data-driven-competitiveness-2.pdf, accessed 13 September 2024.

Azkan, C., M. Spiekermann, and H. Goecke. 2019. “Uncovering Research Streams in the Data Economy Using Text Mining Algorithms.” *Technology Innovation Management Review* 9, no. 11: 62–74.

Banterle, F. 2018. “Data Ownership in the Data Economy: A European Dilemma.” In *EU Internet Law in the Digital Era*, 199–225. Springer.

Bolin, G. 2012. “The Labour of Media Use: The Two Active Audiences.” *Information, Communication & Society* 15, no. 6: 796–814.

Bonti, A., A. Saini, T. Pham, M. Abdelrazek, and L. Pinto. 2021. “DSURVEY: A Blockchain-Enhanced Survey Platform for the Data Economy.” *Computer Science & Information Technology* (CS & IT) 11. http://aircconline.com/csit/papers/vol11/csit110112.pdf, accessed 25 September 2024.

Cuno, S., L. Bruns, N. Tcholtchev, and P. Lämmel. 2019. “Data Governance and Sovereignty in Urban Data Spaces Based on Standardized ICT Reference Architectures.” *Data* 4, no. 1: 16.

Curry, E., and A. Sheth. 2018. “Next-Generation Smart Environments: From System of Systems to Data Ecosystems.” *IEEE Intelligent Systems* 33, no. 3: 69–76.

De Reuver, M., H. A. Ofe, M. Gasco-Hernandez, B. Rukanova, and J. R. Gil-Garcia. 2024. “Data Economy in a Globalized World: Opportunities and Challenges for Public and Private Organizations.” *Electronic Markets* 34, no. 1: 53.

Ding, L., T. Lebo, J. S. Erickson, D. DiFranzo, G. T. Williams, X. Li, J. Michaelis, A. Graves, J. G. Zheng, Z. Shangguan, J. Flores, D. L. McGuinness, and J. A. Hendler. 2011. “TWC LOGD: A Portal for Linked Open Government Data Ecosystems.” *Journal of Web Semantics* 9, no. 3: 325–333.

European Commission. 2017. *Building a European Data Economy.* COM (2017) 9 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017DC0009, accessed 29 August 2024.

German Association for the Digital Economy (BVDW*). 2018. Data Economy: Datenwertschöpfung und Qualität von Daten.* Berlin. https://www.bvdw.org/fileadmin/bvdw/upload/publikationen/data_economy/BVDW_Datenwertschoepfung_2018.pdf, accessed 5 October 2024.

Goodridge, P., J. Haskel, and H. Edquist. 2021. “We See Data Everywhere Except in the Productivity Statistics.” *Review of Income and Wealth* 68: 862-894.

Gomes, L., A. Facin, M. Salerno, and R. Ikenami. 2018. “Unpacking the Innovation Ecosystem Construct: Evolution, Gaps and Trends.” *Technological Forecasting and Social Change* 136: 30–48.

Granstrand, O., and M. Holgersson. 2020. “Innovation Ecosystems: A Conceptual Review and a New Definition.” *Technovation* 90–91: 102098.

Ilves, L. K., and D. Osimo. 2019. *A Roadmap for a Fair Data Economy*. Sitra and The Lisbon Council. https://www.sitra.fi/en/publications/a-roadmap-for-a-fair-data-economy/, accessed 18 August 2024.

Jacobides, M. G., C. Cennamo, and A. Gawer. 2018. “Towards a Theory of Ecosystems.” *Strategic Management Journal* 39, no. 8: 2255–76.

Knaapila-Junnila, S., M. M. Rantanen, and J. Koskinen. 2022. “Are You Talking to Me? – Calling Laypersons in the Sphere of Data Economy Ecosystems.” *Information Technology & People* 35, no. 8: 292–310.

Koski, H., J. Anttila, A. Björk, V. Djakonoff, O. Kässi, H. Niemi-Hugaerts, M. Pajarinen, and J. Parkkari. 2024. *Datatalouden mittaaminen ja vaikuttavuuden arviointi.* Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 2024:44. https://julkaisut.valtioneuvosto.fi/handle/10024/165XXX, accessed 20 January 2025.

Koskinen, J., S. Knaapi-Junnila, and M. M. Rantanen. 2019. “What If We Had Fair, People-Centred Data Economy Ecosystems?” In *IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*, Leicester, UK, 329–334.

Koskinen, J., S. Knaapi-Junnila, A. Helin, M. M. Rantanen, and S. Hyrynsalmi. 2023. “Ethical Governance Model for the Data Economy Ecosystems.” *Digital Policy, Regulation and Governance* 25, no. 3: 221–235.

Lammi, M., and M. Pantzar. 2019. “The Data Economy: How Technological Change Has Altered the Role of the Citizen-Consumer.” *Technology in Society* 59: 101–109.

Murtagh, M. J., I. Demir, K. N. Jenkings, S. E. Wallace, B. Murtagh, M. Boniol, M. Bota, P. Laflamme, P. Boffetta, V. Ferretti, and P. R. Burton. 2012. “Securing the Data Economy: Translating Privacy and Enacting Security in the Development of DataSHIELD.” *Public Health Genomics* 15, no. 5: 243–253.

Oliveira, M. I. S., and B. F. Lóscio. 2018. “What Is a Data Ecosystem?” In *Proceedings of the 19th Annual International Conference on Digital Government Research (dg.o ’18)*, Association for Computing Machinery, New York, NY, USA, 1–9.

Oliveira, M. I. S., G. F. Barros Lima, and B. F. Farias Lóscio. 2019. “Investigations into Data Ecosystems: A Systematic Mapping Study.” *Knowledge and Information Systems* 61, no. 5: 589–630.

Opher, A., A. Chou, A. Onda, and K. Sounderrajan. 2016. *The Rise of the Data Economy: Driving Value through Internet of Things Data Monetization: A Perspective for Chief Digital Officers and Chief Technology Officers.* IBM Corporation. https://www.ibm.com/downloads/cas/4JROLDQ7, accessed 5 August 2024.

Paez, A. 2017. “Grey Literature: An Important Resource in Systematic Reviews.” *Journal of Evidence-Based Medicine* 10, no. 3: 233–240.

Rantanen, M. M., S. Hyrynsalmi, and S. M. Hyrynsalmi. 2019. "Towards Ethical Data Ecosystems: A Literature Study." In *IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, Valbonne Sophia-Antipolis, France, 1–9.

Seppälä, T., E. Hakanen, I. Lähteenmäki, J. Mattila, and R. Niemi. 2019. *The Resource Dependency of Data: A Prospective on Data Sharing in Supply Chains.* ETLA. http://dx.doi.org/10.2139/ssrn.3493650, accessed 9 January 2025.

Shukla, S., D. Elsheba, G. Chopra, and K. Bisht. 2024. "Data Economy: Data and Money." In *Data Science and Security*, edited by S. Shukla, H. Sayama, J. V. Kureethara, and D. K. Mishra, Lecture Notes in Networks and Systems, vol. 922. Singapore: Springer.

Sitra. 2021. "Dictionary: Data Economy." https://www.sitra.fi/en/articles/dictionary-data-economy/, accessed 17 August 2024.

Valkokari, K. 2015. "Business, Innovation, and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them." *Technology Innovation Management Review* 5, no. 8: 17–24.

Valkokari, K., K. Hyytinen, P. Kutinlahti, and M. Hjelt. 2020. *Yhdessä kestävää kasvua – ekosysteemiopas.* VTT Technical Research Centre of Finland. https://publications.vtt.fi/julkaisut/muut/2020/Yhdessa_kestavaa_kasvua_17022021.pdf, accessed 16 October 2024.

Van Gigch, J. P. 1991. *System Design Modeling and Metamodeling*. New York: Plenum Press.

Widlocher, D. D. 1994. "A Case Is Not a Fact." *The International Journal of Psychoanalysis* 75, no. 5–6: 1233–1244.

Wohlin, C. 2014. "Guidelines for Snowballing in Systematic Literature Studies and a Replication in Software Engineering." In *Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering (EASE '14)*, 1–10.