SciPap
scientific papers

Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration 2022, 30(3), 1619.

DOI: 10.46585/sp30031619
editorial.upce.cz/SciPap

Data Value Chain in Platform Business Models

Markéta Mlčúchová

Mendel University in Brno, Faculty of Business and Economics, Department of Finance

Abstract

Building on a unified definition and the main attributes that have been identified for platform business models, this paper aims to devise a unified data value chain and shed a new light on the value creation process within platform business models. To meet the main aim of the paper, the following research question is addressed: "How do platform business models create, deliver and capture value through their business model configurations?". Through an integrative literature review, this paper confirmed that data is the major asset in value creation through platform business models. Furthermore, this paper has devised a unified data value chain that encompasses sequential forms of digital data such as raw data, pre-processed data, processed data, patterns, and smart data, gaining value via numerous processes throughout the data value chain. It was highlighted that interlinked processes throughout the data value chain transformed raw data into the most valuable form of data, knowledge.

Keywords

Platform Business Model, Value Creation, Digital Data, Data Value Chain, Digitalisation

JEL Classification

F23, M21

Introduction

It is widely considered that one of the main features of the digital economy is the spread of new business models, in particular platform-based business models[1] (referred to as PBMs in this paper). Even though PBMs only employ a tiny fraction of the traditional assets used for value-creation, they have a significantly disruptive effect and dominate traditional industries (e.g., Ivanov, Dolgui and Sokolov, 2022; Kolade, Adepoju and Adegbile, 2022; Kenney, Bearson and Zysman, 2021; Kenney and Zysman, 2020; Schenker, 2019; Parker, Alstyne and Choudary, 2016). Moreover, they embody the leading edge of emerging business models and increasingly set the terms of the markets they enter (e.g., Kenney, Bearson and Zysman, 2021; Rahman and Thelen, 2019; Brynjolfsson and McAfee, 2017; Parker and Alstyne, 2008).

Despite their indisputable dominance and increasing economic importance, the specifics of PBMs have not yet been fully reflected, notably within the international tax framework (Mello and Ter-Minassian, 2020; Olbert and Spengel, 2019; Auerbach, Devereux, Keen and Vella, 2017; Devereux and Vella, 2017; Jacobs, 2017). One of the key tasks is to define the notion of value creation as performed by PBMs. Until now, despite being highly relevant, to the best of our knowledge, this has been poorly understood and addressed by academia. The current literature that addresses value creation, specifically value chains in PBMs, is highly heterogenous and inadequate.

Building on the previously unified definition and main attributes that have been identified for PBMs (Mlčúchová, 2022), the main aim of this paper is to devise a unified data value chain and shed new light on the value creation process in PBMs. To fulfil the aim of the paper, the following research question is addressed: RQ: 'How do PBMs create, deliver, and capture value through their business model configurations?'.

Synthesizing existing knowledge, along with the consolidation of concepts from various research efforts that have attempted to describe the value configurations of PBMs, this paper provides an exhaustive summary of the relevant literature and aims to stimulate further research in the field. Specifically, the contribution of the paper to related debates is in the identification and description of the main sequential stages of the data value chain in PBMs and the provision of a systematic overview of the relevant literature.

[1] As elaborated further, in this paper we follow the unified definition by Mlčúchová (2022), defying PBMs as technology-driven business model based on platforms that create value and provide an institutional and regulatory framework enabling interactions between previously unmatched demand-side and supply-side participants.

Corresponding author:
Markéta Mlčúchová, Mendel University in Brno, Faculty of business and Economics, Zemědělská 1, 613 00 Brno
Email: marketamlcuchova@seznam.cz

This paper is structured as follows. Section 2: a description of the methodology applied; Section 3: anchors the applied definition and main attributes of PBMs and focuses on value creation in PBMs; Section 4: a discussion of the results along with a list of the contributions and practical implications; Section 5: a presentation of the conclusions.

Methods

This paper represents an integrative literature review that summarizes, examines, and synthesizes the existing research that has already been done on value creation in PBMs, such that a unified data value chain is devised, and new light is shed on value creation by PBMs. In this paper we followed an inductive approach along with a qualitative content analysis method that is often used in international business research, as used for instance by: Nguyen and Kim, 2020; Jormanainen and Koveshnikov, 2012; Duriau, Reger and Pfarrer, 2007. The first methodological step was the definition of the databases and journals for the subsequent analysis. To identify the highest possible number of studies focused on value creation in PBMs, we used the major scholarly electronic databases, such as the Web of Science, Oxford Journals, JSTOR, Scopus, Science Direct, EBSCO, SpringerLink and Google Scholar.

The search terms within the search strategy included (digital) data value chain, (digital) data value configuration in PBMs, value creation in PBMs, value driver in PBMs, monetisation of digital data, cloud supply chain, digital supply chain and combinations thereof. To enable the identification of all relevant studies, PBMs were searched for using the following terms: platform business models, platforms, platform-based business models, business models based on platforms, two-sided markets, multi-sided markets, platform operators, network of contracts model and demand-side economies of scale. All of these terms tend to be used interchangeably although they are not synonymous.

To search and find relevant articles for our literature review, we further consulted the reference sections of all the review articles identified. Contrary to Nguyen and Kim (2020) we included working paper databases[2] and conference papers to ensure that we accessed the most recent studies and developments. The review was supplemented by the relevant studies, that were cited in the collected literature. With regards to the required degree of scrutiny and the purpose and topic of the review, all of the selected literature was reviewed by reading the whole of the work. The period coverage ranges from the publication of Katz and Shapiro (1985), focused on network externalities, to research papers published in 2022.

Results

A growing body of literature has classified digitalisation as a global trend and growth factor within a modern economy that belongs among the most important engines of innovation, competitiveness, and economic growth in the world (e.g., Klingenberg, Antunes and Müller-Seitz, 2022; Periyasami and Periyasamy, 2022; Kolade, Adepoju and Adegbile, 2022; Miao, 2021; Afonasova, Panfilova, Galichkina and Ślusarczyk, 2019; Olbert and Spengel, 2019 and 2017; Kenney and Zysman, 2016). One of the key features of the digital economy is the spread of new business models, in particular PBMs which have an increasing economic importance and proportion of the overall market capitalization. As highlighted, for instance, by Klingenberg, Antunes and Müller-Seitz (2022)[3], value creation increasingly takes place through platforms, thus concerns have been raised regarding the value creation and capture performed by PBMs. However, up to now, the specifics of value creation by PBMs has remained unclear and under-researched. Therefore, this paper aims to shed new light on the value creation configurations of PBMs and devises a unified data value chain for PBMs. Firstly, we briefly summarize the body of literature that defines PBMs and identifies their main characteristics. Subsequently, we shed a light on the, still poorly understood, value-creation configurations of PBMs. Finally, applying a data-oriented approach, we devise a unified data value chain employed by PBMs.

A large number of definitions have been suggested for PBMs[4], however, in this paper we follow the unified definition coined by Mlčúchová (2022), that defines a PBM as *a technology-driven business model based on platforms that create value and provide an institutional and regulatory framework enabling interactions between previously unmatched demand-side and supply-side participants*. Given the diversity and the sheer volume of PBMs, a growing body of literature[5] has investigated the main characteristics of PBMs. Mlčúchová (2022) unified the vast quantity of literature in this regard and highlighted that the main attributes of PBMs are linked to their capacity to

[2] Such as the U.S. National Bureau of Economic Research, the Census Bureau Library, Harvard Business School Working Paper Series or OECD Development Centre Working Papers.
[3] Klingenberg, Antunes and Müller-Seitz (2022) specifically focused on the impacts of digitalization on value creation and capture in the agricultural value chain.
[4] For instance, by Koskinen, Bonina and Eaton (2018); Brynjolfsson and McAfee (2017); Devereux and Vella (2017); Parker, Alstyne and Choudary (2016); Evans and Gawer (2016); Gawer (2014); Parker and Alstyne (2014); Basole and Karla (2011); Armstrong (2006); Rochet and Tirole (2006); and Mesenbourg (2001).
[5] In particular, for example, Ivanov, Dolgui and Sokolov, 2022; Eisape, 2020; Liu, Brynjolfsson and Dowlatabadi, 2018; Täuscher and Laudien, 2018; Parker, Alstyne and Choudary, 2016; Amit and Zott, 2001.

collect, analyse, and monetize digital data. Considering the utmost dynamic and vast literature in this field, Table 1 provides an overview of the main literature resources, sorted according to the research focus.

Table 1. Overview of the main literature resources.

Research focus	Authors
Definition of PBMs	Koskinen, Bonina and Eaton, 2018; Brynjolfsson and McAfee, 2017; Devereux and Vella, 2017; Parker, Alstyne and Choudary, 2016; Evans and Gawer, 2016; Gawer, 2014; Parker and Alstyne, 2014; Basole and Karla, 2011); Armstrong, 2006; Rochet and Tirole, 2006; Mesenbourg, 2001.
Main characteristics of PBMs	Ivanov, Dolgui and Sokolov, 2022; Periyasami and Periyasamy, 2022; Eisape, 2020; Liu, Brynjolfsson and Dowlatabadi, 2018; Täuscher and Laudien, 2018; Parker, Alstyne and Choudary, 2016; Amit and Zott, 2001.
Network effects	Gregory, Henfridsson, Kaganer and Kyriakou, 2021; Iansiti, 2021; Papadopoulos, 2019; Koskinen, Bonina and Eaton, 2018; Chu and Manchanda, 2016; Parker, Alstyne and Choudary, 2016; Rochet and Tirole, 2006; Eisenmann, Parker and Alstyne, 2006; Park, 2004; Shankar and Bayus, 2003; Ohashi, 2003; Katz and Shapiro, 1994 and 1985.
Impact of digitalization on the supply chain	Mashalah, Hassini, Gunasekaran and Bhatt, 2022; Ivanov, Dolgui and Sokolov, 2022; Valka, Strobelb, Winkelmanna, Hunkerc and Tomczyka, 2022; Farajpour, Hassanzadeh, Elahi and Ghazanfari, 2022; Wan, Yang and Teng, 2022; Büyüközkan and Göçer, 2018.
Data value chain	Schreibera and Metternicha, 2022; Mashalah, Hassini, Gunasekaran and Bhatt, 2022; Ivanov, Dolgui and Sokolov, 2022; Valka, Strobelb, Winkelmanna, Hunkerc and Tomczyka, 2022; Farajpour, Hassanzadeh, Elahi and Ghazanfari, 2022; Wan, Yang and Teng; 2022; Faroukhi, Alaoui, Gahi and Amine, 2020; Wiren, Mantymaki and Najmul, 2019; Olbert and Spengel, 2019; Kaiser, Festl, Pucher, Fellmann and Stocker, 2019; UNCTAD, 2019; Hadzhieva, 2019; Yu and Foster, 2017; Curry, 2016; Yi, Liu, Liu and Jin, 2014; Dijck, 2014; Miller and Mork, 2013; Kasim, Hung and Li, 2012.

In the next section, building on the stated unified definition and the main characteristics identified, we focus on how PBMs create, deliver, and capture value through their business model configurations. The objective of the following section is to summarize the preceding findings in regards to the value creation in PBMs. The research question addressed is “How do PBMs create, deliver, and capture value through their business model configuration?”.

Value Creation in Platform Business Models

According to the resource-based theory, a company is understood to be a bundle of valuable resources (Barney, 1991). Bowman and Ambrosini (2000) further developed the resource-based perspective, differentiating between value creation and value capture. The authors distinguished between perceived use value[6] and exchange value[7] (ibid.) According to Amit and Zott (2001) the source of value creation, a value driver, refers to any factor that enhances the total value created by a company. Traditionally economic value was strongly associated with the production of goods and services.[8]

From the perspective of accounting and taxation, value added, as a measure of the economic performance of an economic entity, is commonly used in financial accounting as well as national and managerial accounting. As part of the financial evaluation of the company, two main alternatives are generally employed, i.e., Economic Value Added (EVA) and Market Value Added. Additionally, the economic theory recognises Gross Value Added and Cash Value Added. Even though that EVA, primarily, is sometimes claimed to be the only true indicator of economic performance of an economic entity, yet Keys, Azamhuzjaev and Mackey (2001) demonstrated inconsistencies in definitions and various general limitations of referred indicator.

In general, value added could be understood as an enhancement made by a business to a product, service, process, or an entire business model. From the tax perspective, one of the major tasks is to define the notion of value creation, deliver and capture; the value driver. Due to changes caused by digitalisation in recent years, there has been a growing interest in theoretical perspectives that review the sources and processes of value creation, as the traditional concepts may not be fully applicable to a digitalised context. The traditional theoretical views of value creation have received much attention and various approaches have been proposed. The applicability of several theories and concepts, for instance Barney, Wright and Ketchen (2001), Dyer and Singh (1998), Porter (1985) and

[6] Use value is understood by Bowman and Ambrosini (2000) as a subjective assessment by the customer who uses consumer surplus as their criterion when making purchase decisions.
[7] The Exchange value, according to Bowman and Ambrosini (2022), is the price paid for the use value created, which is realized when the sale takes place.
[8] Thus, in traditional business models the value is transferred along a linear pipeline with producers at one end and consumers at the other (Papadopoulos, 2019).

Williamson (1981) were discussed in the context of the digital economy by Amit and Zott (2001). The authors believed that value creation, in the digital economy, goes beyond the concepts of traditional theories, as the source of value is not identical (ibid.). Similarly, Parker and Alstyne (2014) highlighted that digitalisation changes how companies do business and thus how value is created. Moreover, DeCovny (2018) claimed that a valuation of the strategic assets of companies in the digital economy involves a higher level of uncertainty due to greater limitations such as access to data, inconsistency, heterogeneity across companies, and a lack of benchmarks. Moreover, according to Vaughan and Daverio (2016) the models for revenue-generation also differ from company to company, even within the same economic sector[9]. Besides this, according to the authors, many digitally enabled economic activities do not readily appear as outputs. These economic activities may be intermediate services between businesses or consumers, hence it may be difficult to price the inputs, thus it is hard to calculate added value; as they are often also virtual, they are hard to track (ibid.). Parker and Alstyne (2014) high-lighted that value creation in PBMs does not stem from products or services, as the PBM does not produce or trade goods or services. Moreover, PBMs fully exploit the power of digital technologies which are, according to the authors, the foundation for value creation in the digital economy (ibid.).

To illustrate these new forms of value creation and highlight the differences between the traditional and digital economy, here are some simple examples of PBMs. For example, the largest taxi company in the world, Uber, does not own any cars. The most popular publisher of media, Facebook, does not create any content. The largest provider of accommodation, Airbnb, does not own any property. These examples call into question the tradition-al concepts and theories that explain the source and processes of value creation. Kenney and Zysman (2016) emphasized that whether it is Uber monetizing our cars, Facebook monetizing our social networks, Airbnb monetizing our houses, Google monetizing our searches or LinkedIn monetizing our professional networks; they all depend on the digitalisation of value-creating human activities, amplified by network effects[10].

Many authors have attempted to define and explain value creation in PBMs (e.g., Ivanov, Dolgui and Sokolov, 2022; Farajpour, Hassanzadeh, Elahi, Ghazanfari, 2022; Gregory, Henfridsson, Kaganer and Kyriakou, 2021; Miao, 2021; Iansiti, 2021; Kenney and Zysman, 2020; Hagiu and Wright, 2020; Wiren, Mantymaki and Najmul, 2019; Lee and Kim, 2019; Rahman and Thelen, 2019; Papadopoulos, 2019; Yu and Foster, 2017; Turck, 2016; Schrage, 2016; Parker and Alstyne, 2014; Amit and Zott, 2001). Until now, these explanations have been heterogenous, unsatisfactory, and we consider the concept of value creation to be inadequately and poorly understood. Considering the increasing economic importance of PBMs we further summarize recent developments and findings in this regard, with the intent of shedding new light on the value creation of PBMs.

Considering the role of information technology in the value chain, the discussion so far has mainly focused on the impact of technology on value and its delivery[11]. Lee and Kim (2019) applied psychological exchange theories such as resource exchange theory and social exchange theory allowing an exploration of the distinct components of value co-creation. The authors further explored the value-creating components in the cognitive-behavioural model of PBMs and established that there were five value-creating components[12] that played a crucial role in the enhancement of levels of trust and belief in a cognitive-behavioural process (ibid.).

PBMs often have users of one type whose utilities depend on the presence of users of a different type. Parker and Alstyne (2014) highlighted the network of relationships that add value among users over and above the physical value of the platform components. Similarly, Papadopoulos (2019) claimed that value creation in PBMs arises from the interconnected relationships between consumers, producers, and the platform itself. Network effects[13] turn users into assets and value is then created via the networking activities between those users. According to Schrage (2016), the enablement of network effects empowers users to create value both directly and indirectly. This was supported by a systematic study carried out by Amit and Zott (2001) exploring value creation in PBMs. The authors observed that in PBMs, new value can be created by the ways in which transactions are enabled. New ways of creating value are opened up by new forms of connections between buyers and sellers in existing markets (ibid.).

[9] For instance, within a digital sector as such.

[10] Network effects, although highly relevant, are outside the scope of this paper. Despite that, we briefly summarize the core concept related. Network effects refer to any situation in which the value of a product, service or platform, in general, depends on the number of users who leverage it (Mlčúchová, 2022). The greater the number of external participants on a platform, the greater the network effect, the greater the value created, the more valuable it becomes to each user and, finally, the more attractive the framework becomes to potential new users, hence the greater the number of external participants in the platform. Net-work effects amplify the co-creation interactions between the users of PBMs and represent a new genre of productivity (ibid.).

[11] Regardless, according to Teece (2010), technology can also have a significant transformative effect on the cost side of the business model. For instance, PBMs remove the need for small companies to invest in expensive servers; instead, they can buy server capacity in small slices, with respect to their needs. This kind of innovation transforms business models into entirely variable cost models, greatly improving efficiency and reducing early-stage capital requirements (ibid.). As stated, it is closely linked with the emergence of micro MNCs, exploiting the existence of PBMs expanding to foreign markets.

[12] In particular, the authors identified platform quality, convenience, compatibility, market opportunity, and fairness as the main features that amplify positive (feedback) network effects.

[13] The network size is based on the number of users and subsequently the data collected from the network's users.

Until now the main focus, in regards to value creation by PBMs, has been directed at value-creating human activities and the interconnected relationships between users which is then amplified by network effects. However, we argue that this approach is incomplete as PBMs largely rely on hard-to-value intangible assets, digital data in particular. In the same vein, Hadzhieva (2019) and Yu and Foster (2017) noted that value creation performed by PBMs not only takes into account user participation and networking activities, but they highlighted the role of data. Deeper insights into data network effects were gained by Gregory, Henfridsson, Kaganer and Kyriakou (2021), Iansiti (2021) and Turck (2016).

Most policy discussions around digital data tend to focus on privacy issues[14] and, increasingly, on data as an economic resource. Previously, the value of digital data was sometimes compared to the value of natural resources; however, recent research has claimed that digital data is only a source of value when it is tied to a particular problematic domain and solves problems for customers and businesses (e.g., Kenney and Zysman, 2020; Hagiu and Wright, 2020; Wiren, Mantymaki and Najmul, 2019; UNCTAD, 2019). Rahman and Thelen (2019), when comparing today's PBMs to the monopolists of yesteryear, stated that, in many ways, PBMs exercise deeper control due to digital data and algorithms. Through their capacity to extract and harness immense amounts of data, PBMs operate as critical intermediaries and market makers (ibid.). As mentioned by Yu and Foster (2017), PBMs rely on the capture and processing (in a systematic way) of digital data from their external and internal environments. Correspondingly, according to Olbert and Spengel (2019), digital data is progressively becoming more important in the value creation process and all PBMs rely on its collection and use. In the same vein, Kemmerling and Trampusch (2022) argued that digital data, together with digital technologies and digital infrastructures, create novel digital power resources for companies throughout many sectors. Similarly, Yu and Foster (2017) described data as an emerging key asset of value to businesses. DeCovny (2018) claimed that strategic assets are unique in nature and are often particular to a specific company in terms of how it can extract value from them. Moreover, the author pointed out that during the last few decades, the ratio of intangible to tangible asset values in public and private companies has grown significantly, a trend which is likely to continue (ibid.). Based on the most recent findings from Olbert and Spengel (2019) regarding value creation in PBMs, data is progressively becoming more important in the value creation process and all digital business models rely on its collection and use. Correspondingly Schreiber and Metternich (2022) claim that the growing availability of data along the value chain creates new opportunities for business models.

In general, digital data can be understood as machine-readable information (unfiltered symbols or signals) generated from the digital footprints of various personal, social and business activities that take place on digital platforms (UNCTAD, 2019). Additionally, digital data is part of a hierarchy, linked to information and knowledge (ibid.). It can be classified according to its type, format, acquisition and sensitivity. Stated is shown in the Table 2.

Table 2. Classification of digital data.

Classification	
Type	Personal, non-personal, corporate, technical, merchant data
Format	Non-structured[15], semi-structured[16], structured[17]
Acquisition	Volunteered, observed, inferred
Sensitivity	Sensitive, non-sensitive

In addition to the previously mentioned characteristics, digital data is non-rival[18] in nature; thus, it can be used globally and simultaneously, it can be replicated and reused multiple times without exhaustion. In addition, according to Visconti, Larocca and Marconi (2017), digital data are usually characterised by their volume, velocity, variety, veracity and value. These characteristics have significant implications in terms of value creation as, together with network effects (previously referred to as the data network effects), it can lead to economies of scale and scope. In the next section we will attempt to devise a unified data value chain of PBMs.

[14] The digital economy has imposed new regulatory challenges, such as the protection of security and privacy of data. The is reflected, for example, in Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and the free movement of such data, the repeal of Directive 95/46/EC (General Data Protection Regulation) and the current Proposal for a Regulation of the European Parliament and of The Council, which lays down harmonized rules for artificial intelligence (Artificial Intelligence Act) and amends certain Union legislative acts (COM (2021) 206 final).

[15] According to Prasad and Acharya (2016), unstructured data represents approximately 80¬–90% of digital data. It is usually not human-readable or indexable. Examples of unstructured data are source code, documents, and binaries.

[16] For example, emails, XML and languages such as HTML (Prasad and Acharya, 2016).

[17] Usually human-readable digital data that can be indexed, for example, database objects, spreadsheets, SQL and OLTP systems.

[18] The use of digital data by a particular economic entity does not limit its use by other economic entities.

Data Value Chain

Value added at various intervals through a series of activities or processes that aim to create value for a business model is understood as a value chain[19] (Porter, 1985). According to the author a value chain consists of various activities that convert inputs to outputs, hence, creating and building value (ibid.).[20] Kenney and Zysman (2020), Miao (2021), Hagiu and Wright (2020), Olbert and Spengel (2019) and Visconti, Larocca and Marconi (2017) discussed the different ways that digital data contributes to value creation in PBMs and further referred to a so-called "data value chain". Further, we focus on the data value chain as described by, for instance, Faroukhi, Alaoui, Gahi and Amine (2020), Wiren, Mantymaki and Najmul (2019), Olbert and Spengel (2019), Kaiser, Festl, Pucher, Fellmann and Stocker (2019), Hadzhieva (2019), Curry (2016) and Kasim, Hung and Li (2012), taking into consideration the body of literature focused on the impact of digitalisation on the supply chain (e.g.: Masha-lah, Hassini, Gunasekaran and Bhatt, 2022; Ivanov, Dolgui and Sokolov, 2022; Valka, Strobelb, Winkelmanna, Hunkerc and Tomczyka, 2022; Farajpour, Hassanzadeh, Elahi and Ghazanfari, 2022; Wan, Yang and Teng, 2022; Büyüközkan and Göçer, 2018).

According to Valka, Strobelb, Winkelmanna, Hunkerc and Tomczyka (2022), who focused on cloud supply chains, when we integrate digital operations, the paradigm emerges of the supply chain-as-a-service[21]. The authors claim that this goes beyond the offer of local, isolated services (ibid.). Oliveira, Fleury and Fleury (2021) distinguished between fully[22], partially and non-digitalised value chains. The authors, assuming that non-digitalised value chains no longer exist, claimed that the degree of digitalisation of the value chain is based on the share of its value that is created in digital form. In particular, in fully digitalised value chains, all activities and products/services only exist virtually, in partially digitised value chains online activities are combined with non-digital products or digital products that are transferred through the physical world (ibid.). In addition, Miao (2021) focused on the value chain in digital economy in general and stated that the value chain is the flow of data elements, information and communication technology.

The composition of data value chain was addressed by number of authors (e.g., Wiren, Mantymaki and Najmul, 2019; Visconti, Larocca and Marconi, 2017; Yu and Foster, 2017; Yi, Liu, Liu, and Jin, 2014; Dijck, 2014; Kasim, Hung and Li, 2012; Miller and Mork, 2013). We list examples of various stages recognised by the literature in the following Table 3.

Table 3. Stages of data value chain recognised by literature.

Authors	Identified stages of data value chain
Kasim, Hung and Li (2012)	Collection, management, sharing, integration, harmonization, and analysis of data.[23]
Yi, Liu, Liu, and Jin (2014), Dijck (2014)	Sourcing, warehousing, and analysis of data.
Visconti, Larocca and Marconi (2017)	Creation (data capture), storage (warehousing), processing (data mining), consumption (sharing), and monetization.
Wiren, Mantymaki and Najmul (2019),	Each stage recognised by Yi, Liu, Liu, and Jin (2014) and Dijck (2014) is further divided into datafication, digitisation, connectivity, storage, categorisation, patterning, cross-analysis, and personalisation.
Yu and Foster (2017)	Gathering (or capture), storage, distribution, data analysis, and decision-making (use).
Miller and Mork (2013)	Discovery, integration, and exploitation of data.

Source: Own elaboration based on Wiren, Mantymaki and Najmul (2019), Visconti, Larocca and Marconi (2017), Yu and Foster (2017), Yi, Liu, Liu, and Jin (2014), Dijck (2014), Kasim, Hung and Li (2012), Miller and Mork (2013).

Based on the researched literature, we consider, as did Yu and Foster (2017), the current understanding of a data value chain to be inadequate and highly heterogenous. Unlike other researchers who attempted to devise a data value chain, we focus on digital data, as considered to be the main value creation asset of PBMs (for instance by Schreiber and Metternich, 2022; Kemmerling and Trampusch, 2022; Rahman and Thelen, 2019; Olbert and Spengel, 2019; DeCovny, 2018; Yu and Foster, 2017) and declared as the main production factor in digital economy by Miao (2021). In addition, Hanafizadeh, Barkhordari Firouzabadi and Vu (2021) argued that PBMs are continuously seeking approaches to generate more value from digital data. Through a synthesis of the highly dynamic and

[19] In a nutshell, a series of activities that create and build value.
[20] Porter (1985) classified these activities as either primary activities, such as inbound logistics, operations, outbound logistics, marketing, sales, and services; or support activities, such as procurement, human resource management, technological development and infrastructure.
[21] Deeper insights into data value chains as a service were gained by Kasim, Hung and Li (2012).
[22] Examples of a fully digitized value chain according to Oliveira, Fleury and Fleury (2021) are financial services and digitally distributed media.
[23] Visualization and simulation of additional applications for scientific or business' insights.

heterogenous literature focused on data value chain we further devised a unified data value chain with a closer look at the main sequential stages of the data value chain and a deeper understanding of the accumulating value potential throughout the data value chain. The devised data value chain is as follows.

The first form of data (as shown in Figure 1) is raw data, sometimes referred to as source data, atomic data, dark data[24] or primary data. Raw data is data that has not yet been processed. The first step, in this paper, of the newly devised data value chain, involves the acquisition of raw data. This can take the form of different processes, such as discovery, identification, creation, collection and mining of raw data. According to Hadzhieva (2019), data can be collected in various ways. For instance, the collection of data entered by tracking the users via cookies (location, address, name, email, phone, shopping habits, etc.) or through a search engine (ibid.).

According to Hadzhieva (2019) raw data does not create value and needs to be processed and analysed to be incorporated into the value creation process. Similarly, Olbert and Spengel (2019) argued that data only compounds in value if it is tied to a particular problem, hence a business has to decide which data it wishes to extract (select) from the raw data, which is relevant for the creation of future value. Hence it is hypothesised, that value creation only arises once the raw data is transformed into, as its final form, digital intelligence, which is subsequently monetised through commercial use. The sequential steps of the data value chain thus transform the original raw data, that gradually gains value along the data value chain, into the most valuable form of data, knowledge.

Following that, the raw data is (pre)processed (via processes such as validation, filtration, cleaning, reduction, aggregation and format adjustment) and transformed into a format that is suitable for subsequent analysis, the so-called processed (transformed) data. The consequent, advanced analysis consists of processes such as inspection, visualisation, or modelling the processed data into patterns.

The final stage of the data value chain, as suggested in this paper, contains the most valuable form of data, the so-called smart data (sometimes referred to as knowledge or information). The processes involved at this stage are the monetisation, exchange and exploitation of data. According to Olbert and Spengel (2019) data monetisation refers to the act of generating measurable economic benefits from processed and deeply analysed data. Data monetisation appears in various forms depending on the PBM, see examples in Table 4.

Table 4. Forms of data monetisation.

Data monetization	Examples of companies
Targeted online advertising	Google, Facebook, Baidu, Google, Gumtree, Kenshoo, OLX
E-commerce platforms[25]	Amazon, Alibaba, Uber, Airbnb, Marketplace, eBay, Jumia, Lazada, MercadoLibre, Souq, Etsy, AliExpress
Cloud services	Tencent[26], MyJohnDeere, Alibaba Cloud, Amazon Web Services, América Móvil, Microsoft Azure, Salesforce, Tencent

Data monetisation can be direct or indirect (Hanafizadeh, Barkhordari Firouzabadi and Vu, 2021; Faroukhi, Ala-oui, Gahi and Amine, 2020). Indirect data monetisation arises when the PBM uses, and leverages insights gained from data to improve (or develop new) products, services, or the business model itself. An example of indirect monetisation is Netflix, based on internal data collected from its users, it improves and develops its service portfolio. Deeper insights were gained by Hagiu and Wright (2020) who focused on companies that improved their products by learning from customer data and the extent of their data accumulation (directly monetising the digital data). Direct data monetisation involves selling direct access to data to third parties.

The current literature assumes (e.g., Wiren, Mantymaki and Najmul, 2019; Hadzhieva, 2019; Olbert and Spengel, 2019) that value creation only arises once digital data is collected, stored, analysed and transformed into digital intelligence, later monetised through commercial use. In other words, that value is only created when the data reaches its final, smart, form within the devised data value chain. We agree that the data accumulates value as it passes through the stages of a value chain, as highlighted by Wiren, Mantymaki and Najmul (2019) and Visconti, Larocca and Marconi (2017). However, we acknowledge that data can be sold in different forms, as raw data, processed data or as the final analysis (smart data), thus we suggest, that even raw data has the potential to create value, for instance when directly monetised. As an example of the direct monetisation of raw data, the Thomson Reuters Corporation engages in the acquisition of raw data and subsequently sells it to third parties[27]. Moreover, Olbert and Spengel (2019) highlighted that many of Alphabet/Google's products directly rely on a data mining process. This process does not necessarily exclusively involve the use of personal user data but involves every form of digital data that is generated through the use of Alphabet/Google's products and services. In other words,

[24] Hadzhieva (2019).
[25] A literature review and conceptual framework on the impact of digital transformation on supply chains through e-commerce was devised by Mashalah, Hassini, Gunasekaran and Bhatt (2022).
[26] Technology companies that market services and products, including entertainment, artificial intelligence, and other technology. It is one of the main global video game publishers.
[27] Further analysis of these to extract value.

we are of the opinion that the revenue stream is not only based on selling data in a form that has already been transformed to a certain level within the data value chain, but also in its raw form.

Partial Summary

To partly conclude, we argue that raw data gradually gains in value along the data value chain and that the value accumulation potential differs within the sequential stages of the data value chain. Moreover, we acknowledge that PBMs are usually involved in different stages of the data value chain[28] and use different forms of data (raw, pre-processed, processed, patterns or smart data) to generate revenue. Different categories of data value chains overlap, and individual stages of the data value chain are inter-linked processes, rather than independent stages. Yet it is rare for a single PBM to encompass the entire data value chain. As indicated earlier in the text, value added could be understood as the additional features or economic value that a company adds to its product, ser-vice, process, or the entire business model. Hence, considering the described characteristics of the data value chain, we are of the opinion that from the perspective of accounting and taxation, digital data, as the key asset of the value of PBMs, should be accounted for at each stage of the depicted value chain. The devised data value chain is depicted in Figure 1. In addition, Figure 2 illustrates the gradual gains in value along the sequential stages of depicted data value chain.

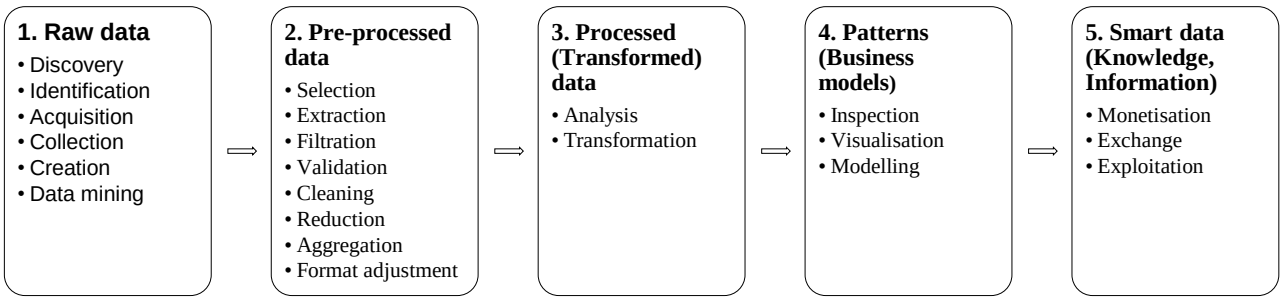

Fig. 1. Data value chain.
Source: Own elaboration based on Schreibera and Metternicha, 2022; Mashalah, Hassini, Gunasekaran and Bhatt, 2022; Ivanov, Dolgui and Sokolov, 2022; Valka, Strobelb, Winkelmanna, Hunkerc and Tomczyka, 2022; Farajpour, Hassanzadeh, Elahi and Ghazanfari, 2022; Wan, Yang and Teng; 2022; Faroukhi, Alaoui, Gahi and Amine, 2020; Wiren, Mantymaki and Najmul, 2019; Olbert and Spengel, 2019; Kaiser, Festl, Pucher, Fellmann and Stocker, 2019; UNCTAD, 2019; Hadzhieva, 2019; Yu and Foster, 2017; Visconti, Larocca and Marconi, 2017; Curry, 2016; Yi, Liu, Liu and Jin, 2014; Dijck, 2014; Miller and Mork, 2013; Kasim, Hung and Li, 2012.

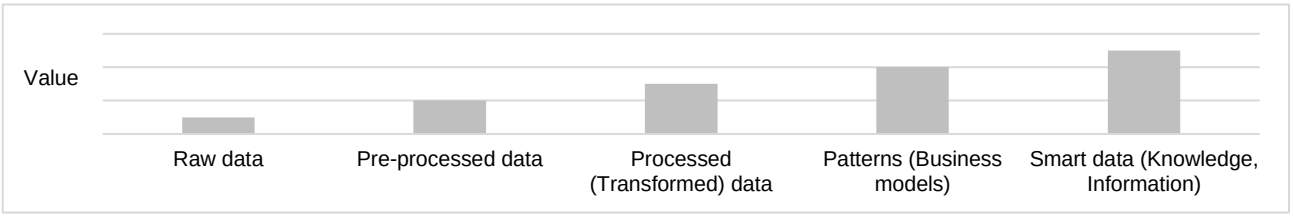

Fig. 2. Sequential value accumulation along the data value chain.

Discussion

Notwithstanding the results presented in this paper, we acknowledge, as pointed out by Schreiber and Metternich (2022), that data value chains of PBMs differ widely in terms of their suggested steps, functions, and purposes, mainly due to the different approaches taken by researchers. For instance, Farajpour, Hassanzadeh, Elahi and Ghazanfari (2022), and Büyüközkan and Göçer (2018), conversely to the approach presented in this paper, recognized a conceptual model with a focus on digital technologies and infrastructure. The authors focused on digital supply chains and devised digital supply chain framework layers as part of a traditional value chain employed by the PBMs (ibid.). The construct of the subsequent stages of the data value chain also greatly differs among researchers and the current literature is highly heterogenous and dynamic. Distinct from the data value chain described in this paper, Wiren, Mantymaki and Najmul (2019), proposed a data value chain that would consist of eight stages, subsequently amalgamated into three main phases, sourcing, warehousing and analysis. The authors focused on the identification of the challenges that are particularly difficult to overcome and mitigated them through technological developments (ibid.). Furthermore, Yu and Foster (2017), Miller and Mork (2013) and Kasim, Hung and Li (2012) referred to the structure of the data value chain, they did not mention how the capture and gathering

[28] For instance, Robert Bosch GmbH, Google or Visa, cover the entire data value chain as it collects and interprets the acquired data and, based on the gained knowledge, offers a wide range of products and services.

of data is converted and generates value. In this paper we applied a data-oriented approach and focused on how altering the forms of data gradually allow it to gain in value throughout the data value chain employed by PBMs.

Within a highly digitalised economy there are new, unorthodox notions, sources of value and nexus between generated profits and tax jurisdictions which do not conform to the current international taxation system (e.g., Mello and Ter-Minassian, 2020; Olbert and Spengel, 2019; Auerbach, Devereux, Keen and Vella, 2017; Devereux and Vella, 2017; Jacobs, 2017). Digitalisation has brought new regulatory challenges to the field of corporate taxation such as the growing phenomenon of profit shifting, large differences in the effective rates of corporate taxes (ETRs), dependence on intangible assets, the difficulty of qualifying assets and activities, the complex nature of transactions, high compliance costs for companies, the risk of double taxation and finally, yet importantly, new business models based on platforms, PBMs as referred to in this text (ibid.). This glitch is reflected in increasing academic, public, and political concern and has been discussed at both the EU level[29] as well as globally[30]. We believe that the usefulness of our paper lies in the tax perspective, particularly in the context of the Proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB)[31] proposed by the European Commission in 2011, later relaunched in 2016[32], and amended by the European Parliament in 2018. The core idea of the proposed CCCTB is a single set of rules for the calculation of an MNCs' taxable profits in the EU. The CCCTB, as proposed by the European Commission, falls under the consultation procedure[33]. The Euro-pean Parliament, besides other amendments to the proposed CCCTB proposal, took into consideration challenges brought by digitalisation to the international tax framework. The original proposal of the CCCTB introduced formulary apportionment (FA) made up of three, equally weighted factors, labour, assets, and sales by destination. The European Parliament has amended the FA and added a fourth factor, based on the collection and use of personal data by online platforms and services users (referred to as the 'data factor'). As such, this amendment suggested by the European Parliament is a clear attempt to reflect the ubiquitous features of the digital economy and the specifics of value creation in business models enabled by digitalisation. The data factor of the FA within the CCCTB is described as the collection and exploitation, for commercial purposes, of personal data from online platforms and service users in one or more Member State. According to this amendment, made by the European Parliament, the volume of personal data collected, pursuant to the data factor, should be measured at the end of the tax year in each Member State[34]. Even though we greatly welcome the endeavour to reflect the specifics of PBMs by adding the data factor to the FA of the CCCTB, the simplistic composition of the data factor, uniformly applied to all PBMs, neglects the fact that PBMs are usually involved in different stages of the data value chain and use different forms of data, is in our opinion inadequate. In this paper we argue that data gradually gains value throughout the consequential, interlinked stages of the data value chain and that different stages are distinguished by different value accumulation potentials. Even though the final form of the data in a data value chain, the smart data, is the most valuable form of data, exclusively limiting the concordium to data exploitation and collection might be considered to be short-sighted, as it omits the important notion of value. Despite that, we consider the implementation of a data factor in the FA of the CCCTB as the first critical step in addressing the specificities of the new value nexus. Finally, besides the above stated contribution to the current academic, public and political discussion, the contribution of the paper lies in an exhaustive review of literature in the field of value creation, delivery and capture of PBMs.

Conclusion

Through research into the body of literature[35] that explains value creation in PMBs the paper confirmed that digital

[29] For instance, a Proposal for a Council Directive that lays down the rules relating to the corporate taxation of a significant digital presence, a Proposal for a Council Directive on the common system for a digital services tax on revenues resulting from the provision of certain digital services.

[30] Inclusive Framework on Base Erosion and Profit Shifting Project.

[31] The core idea of the proposed CCCTB is a single set of rules to calculate the taxable profits of MNCs in the EU. It is further proposed that the consolidated taxable profits are to be shared between the EU Member States in which the MNC performs its economic activity, using Formulary Apportionment (FA). According to the CCCTB proposal, each EU Member State will then tax its share of the profits at its own national tax rate.

[32] The proposal for the CCCTB is currently included in the Package for fair and simple taxation and the Action Plan for Business Taxation for the 21st century, and to the best of our knowledge, has not yet been approved by the Council of the EU.

[33] A special legislative procedure under article 289 of the TFEU whereby the European Parliament is asked for its opinion on a proposed legislative act before it is adopted by the Council of the EU.

[34] The definition of the collection and exploitation, for commercial purposes, of personal data in the context of the data factor shall be determined in accordance with Regulation (EU) 2016/679 of the European Parliament and Council of 27th April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and the repeal of Directive 95/46/EC (General Data Protection Regulation).

[35] E.g., Schreiber and Metternich, 2022; Mashalah, Hassini, Gunasekaran and Bhatt, 2022; Ivanov, Dolgui and Sokolov, 2022; Valka, Strobelb, Winkelmanna, Hunkerc and Tomczyka, 2022; Farajpour, Hassanzadeh, Elahi and Ghazanfari, 2022; Wan, Yang and Teng; 2022; Faroukhi, Alaoui, Gahi and Amine, 2020; Hagiu and Wright, 2020; Wiren, Mantymaki and Najmul, 2019; Kaiser, Festl, Pucher, Fellmann and Stocker, 2019; Hadzhieva, 2019; Rahman and Thelen, 2019; Olbert and Spengel, 2019; Papadopoulos, 2019; Lee and Kim, 2019; UNCTAD, 2019; DeCovny, 2018; Yu and Foster, 2017; Vaughan and Daverio, 2016; Curry, 2016; Parker and Alstyne, 2014; Yi, Liu, Liu and Jin, 2014; Dijck, 2014; Miller and Mork, 2013; Kasim, Hung and Li, 2012).

data can undoubtedly be considered as the strategic asset for value creation in PBMs. Applying a data-approach, the data value chain devised encompasses sequential forms of digital data, such as raw, pre-processed, processed, patterns and smart data, that gains value through the numerous processes throughout the data value chain. The paper confirmed, that interlinked processes transform the raw data into the most valuable form of data, knowledge. Further, it was highlighted that the accumulation potential differs within the sequential stages and that PBMs are usually involved in different stages of the data value chain and use different forms of digital data. The paper concluded with a suggestion that digital data, as the key asset of the value of PBMs, should be accounted for at each stage of the depicted data value chain.

The paper has certain limitations that we must acknowledge, primarily the topic is highly dynamic and has experienced rapid growth in the available literature. PBMs are a rapidly increasing proportion of the overall total market capitalization, present across various industry sectors. They take different forms and are usually involved in various stages of the data value chain. The continuously evolving and increasing heterogeneity of PBMs entails the risk that they might shift to different business configurations than those outlined in this paper, resulting in a need to customize the general construct of a data value chain according to the specifics of various subgroups of PBMs. Secondly, we acknowledge the potential that the list of keywords applied within the search strategy may not have been sufficiently comprehensive leading to the possibility of undetected relevant literature. The application of advanced text mining tools[36] may result in a dissimilar list of keywords, consequently a distinctly different set of literature sources. Finally, this paper is a literature review that synthesises and evaluates the current literature pertaining to PBMs, thus empirical evidence, mainly in the context of the statistical significance of digital data as a value creating asset, has been omitted.

To take this research further, the future focus will be on the implications of the described value creation processes of the PBMs on the international tax framework. The focus, primarily, will be on the previously mentioned method where the FA replaces separate accounting (SA) and the arm's length principle. Building on an enhanced understanding of the value creation processes and the main attributes identified for PBMs, the main objective will be to identify the implications of the specifics of PBMs for the proposed FA within the CCCTB and in particular the composition of the data factor.

Acknowledgement

This contribution was supported by the Internal Grant Agency at Faculty of Business and Economics, Mendel University in Brno within a Doctoral project [PEF_DP_2021007].

References

Afonasova, M. A., Panfilova E. E., Galichkina M. A., & Ślusarczyk, B. (2019). Digitalization in economy and innovation: The effect on social and economic processes. *Polish journal of management studies*, 19(2), 22-32. https://pjms.zim.pcz.pl/resources/html/article/details?id=190160

Amit, R., & Zott, C. (2001). Value creation in e-business. *Strategic Management Journal*, 22, 493–520. https://doi.org/10.1002/smj.187

Armstrong, M. (2006). Competition in Two-Sided Markets. *The RAND Journal of Economics*, 37(3), 668-691. https://www.jstor.org/stable/25046266

Auerbach, A. J., Devereux, M. P., Keen M., & Vella, J. (2017). International Tax Planning under the Destination-Based Cash Flow Tax. *National Tax Journal*, 70(4), 783–802. https://doi.org/10.17310/ntj.2017.4.04

Barney, J. B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99–120. https://doi.org/10.1177/014920639101700108

Barney, J., Wright, M., & Ketchen, D. J. (2001). The Resource-Based View of the Firm: Ten Years after 1991. *Journal of Management*, 27, 625-641. https://doi.org/10.1177/014920630102700601

Basole, R. C., & Karla, J. (2011). On the Evolution of Mobile Platform Ecosystem Structure and Strategy. *Business & Information Systems Engineering*, 5(11). https://doi.org/10.1007/s12599-011-0174-4

Bowman, C., & Ambrosini, V., (2000). Value creation versus value capture: towards a coherent definition of value in strategy. *British Journal of Management,* 11, 1–15. https://doi.org/10.1111/1467-8551.00147

Brynjolfsson, E., & McAfee, A. (2017). Machine, Platform, Crowd: Harnessing Our Digital Future. New York: W.W. Norton & Company. ISBN: 9780393254303

Büyüközkan, G., & Göçer, F. (2018). Digital supply chain: literature review and a proposed framework for future research. *Computers in Industry*, 97, 157–177. https://doi.org/10.1016/j.compind.2018.02.010

Chu, J., & Manchanda, P. (2016). Quantifying Cross and Direct Network Effects in Online Consumer to Consumer Platforms. *Marketing Science*, 35(6). https://doi.org/10.1287/mksc.2016.0976

Curry, E. (2016). The Big Data Value Chain: Definitions, Concepts, and Theoretical Approaches. In: Cavanillas, J., Curry, E., Wahlster, W. (eds) New Horizons for a Data-Driven Economy. Springer, Cham. 29-37. https://doi.org/10.1007/978-3-319-21569-3_3

DeCovny, S. (2018). Assessing Value in the Digital Economy. CFA Institute. https://blogs.cfainstitute.org/investor/2018/04/18/assessing-value-in-the-digital-economy/

Devereux, M. P., & Vella, J. (2017). Implications of Digitalization for International Corporate Tax Reform. Oxford University

[36] Such as analytical techniques and deep learning algorithms.

Centre for Business Taxation. https://oxfordtax.web.ox.ac.uk/files/wp17-07pdf

Duriau, V. J., Reger, R., & Pfarrer, M. D. (2007). A content analysis of the content analysis literature in organization studies: Research themes, data sources, and methodological refinements. *Organizational Research Methods*, 10(1), 5-34. https://doi.org/10.1177/1094428106289252

Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Com-petitive Advantage*. Academy of Management Review*, 23, 660-679. https://doi.org/10.2307/259056

Eisape, D. (2020). Comparing Platform Business Models: A Balanced Scorecard Approach based on the Platform Business Model Canvas. *Nordic Journal of Media Management*, 1(3), 401–432. https://doi.org/10.5278/njmm.2597-0445.5842

Eisenmann, T. R., Parker, G., & Alstyne, V. M. (2006). Strategies for TwoSided Markets. *Harvard Business Review*, 84(10), 92–101

Evans, P. C., & Gawer, A. (2016). The Rise of the Platform Enterprise: A Global Survey. The Emerging Platform Economy Series No. 1. The Center for Global Enterprise. https://www.thecge.net/wp-content/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf

Farajpour, F., Hassanzadeh, A., Elahi, S., & Ghazanfari, M. (2022). Digital supply chain blueprint via a systematic literature review. *Technological Forecasting & Social Change*, 184, 121976. https://doi.org/10.1016/j.techfore.2022.121976

Faroukhi, A. Z., Alaoui, I. E., Gahi, Y., & Amine, A. (2020). An Adaptable Big Data Value Chain Framework for End-to-End Big Data Monetization. *Big Data Cognitive Computing*, 4(34). http://dx.doi.org/10.3390/bdcc4040034

Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy*, 43(7), 1239-1249. ISSN 0048-7333. https://doi.org/10.1016/j.respol.2014.03.006

Gregory, R. W., Henfridsson, O., Kaganer, E., & Kyriakou, S. H. (2021). The Role of Artificial Intelligence and Data Network Effects for Creating User Value. *Academy of Management Review*, 46(3). https://doi.org/10.5465/amr.2019.0178

Hadzhieva, E. (2019). Impact of Digitalisation on International Tax Matters: Challenges and Remedies, Policy Department, European Parliament. http://www.europarl.europa.eu/supporting-analyses

Hagiu, A., & Wright, J. (2020). Data-enabled learning, network effects and competitive advantage. Questrom School of Business. Working paper. https://app.scholarsite.io/andrei-hagiu/articles

Hanafizadeh, P., Barkhordari Firouzabadi, M., & Vu, K. M. (2021). Insight monetization intermediary platform using recommender systems. *Electron Markets*, 31, 269–293 (2021). https://doi.org/10.1007/s12525-020-00449-w

Iansiti, M. (2021). The Value of Data and Its Impact on Competition. Harvard Business School NOM Unit Working Paper, 22-002. https://doi.org/10.2139/ssrn.3890387

Ivanov, D., Dolgui, A., & Sokolov, B. (2022). Cloud supply chain: Integrating Industry 4.0 and digital platforms in the "Supply Chain-as-a-Service". *Transportation Research Part E*, 160 (2022) 102676. https://doi.org/10.1016/j.tre.2022.102676

Jacobs, B. (2017), "Digitalisation and Taxation", in S. Gupta, M. Keen, A. Shah and G. Verdier (eds), Digital Rev-olutions in Public Finance, International Monetary Fund, Washington, D.C.

Jormanainen, I., & Koveshnikov, A. (2012). International activities of emerging market firms: A critical assessment of research in top international management journals. *Management International Review*, 52 (5), 691-725

Kaiser, C., Festl, A., Pucher, G., Fellmann, M., & Stocker, A. (2019). The Vehicle Data Value Chain as a Lightweight Model to Describe Digital Vehicle Services. In Proceedings of the 15th International Conference on Web In-formation Systems and Technologies - WEBIST, 68-79. https://doi.org/10.5220/0008113200680079

Kasim, H., Hung, T., & Li, X. (2012). Data Value Chain as a Service Framework: for Enabling Data Handling, Data Security and Data Analysis in the Cloud. IEEE 18th International Conference on Parallel and Distributed Systems (ICPADS), 804-809. https://doi.org/10.1109/ICPADS.2012.131

Katz, M. L., & Shapiro, C. (1985). Network Externalities, Competition, and Compatibility. *The American Economic Review*, 75(3), 424- 440. https://www.jstor.org/stable/1814809

Katz, M. L., & Shapiro, C. (1994). Systems Competition and Network Effects. *Journal of Economic Perspectives*, 8(2), 93–115. https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.8.2.93

Kemmerling, M., & Trampusch, Ch. (2022). Digital power resources (DPR): the political economy of structural and infrastructural business power in digital(ized) capitalism Get access Arrow. *Socio-Economic Review*. https://doi.org/10.1093/ser/mwac059

Kenney, M., Bearson, D., & Zysman, J. (2021). The platform economy matures: Measuring pervasiveness and exploring power. *Socio-Economic Review*, 19(4), 1451–1483, https://doi.org/10.1093/ser/mwab014

Kenney, M., & Zysman, J. (2016). The Rise of the Platform Economy. *Science and Technology*, 32(3). https://issues.org/rise-platform-economy-big-data-work/

Keys, D. E., Azamhuzjaev, M., & Mackey, J. (2001). Economic Value Added: A critical analysis. *The Journal of Corporate Accounting and Finance*, 12(2), 1-93. https://doi.org/10.1002/1097-0053(200101/02)12:2<65::AID-JCAF10>3.0.CO;2-B

Klingenberg, C.O., Antunes, J. A., Jr., V, & Müller-Seitz, G. (2022). Impacts of digitalization on value creation and capture: Evidence from the agricultural value chain, *Agricultural Systems*, 201, 103468. https://doi.org/10.1016/j.agsy.2022.103468.

Kolade, O., Adepoju, D., & Adegbile, A. (2022). Blockchains and the disruption of the sharing economy value chains. *Strategic Change-Briefings in Entrepreneurial Finance*, 31(1),137-145. 10.1002/jsc.2483

Koskinen, K., Bonina, C., & Eaton, B. (2018). Digital Platforms in the Global South: Foundations and Research Agenda. Development Implications of Digital Economies. Centre for Development Informatics. https://diode.network/publications/

Lee, K., & Kim, D. (2019). A peer-to-peer (P2P) platform business model: the case of Airbnb. *Service Bussiness*, 13, 647–669. https://doi.org/10.1007/s11628-019-00399-0

Liu, M., Brynjolfsson, E., & Dowlatabadi, J. (2018). Do Digital Platforms Reduce Moral Hazard? The Case of Uber and Taxis. No. 25015, NBER Working Papers, National Bureau of Economic Research, Inc. http://www.nber.org/papers/w25015

Mashalah, H. A., Hassini, E, Gunasekaran, A., & Bhatt, D. (2022). The impact of digital transformation on supply chains through e-commerce: Literature review and a conceptual framework. *Transportation Research Part E*, 165, 102837.

https://doi.org/10.1016/j.tre.2022.102837
Mello, L. R., & Ter-Minassian, T. (2020). Digitalisation challenges and opportunities for subnational governments. OECD Working Papers on Fiscal Federalism. http://dx.doi.org/10.1787/9582594a-en
Mesenbourg, T. L. (2001). Measuring the Digital Economy. US Bureau of the Census, Suitland, MD. https://www.census.gov/content/dam/Census/library/workingpapers/2001/econ/umdigital.pdf
Miao, Z. (2021). Digital economy value chain: concept, model structure, and mechanism. *Applied Economics*, 53(37), 4342-4357. https://doi.org/10.1080/00036846.2021.1899121
Miller. H. G., & Mork, P. (2013). From Data to Decisions: A Value Chain for Big Data. *IT Professional*, 15(1), 57-59. https://doi.org/10.1109/MITP.2013.11
Mlčúchová, M. (2022). A Review of Platform Business Models. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration*, 30(1), 1454. https://dx.doi.org/10.46585/sp30011454 ed-itorial.upce.cz/SciPap
Nguyen, Q. T. K., & Kim, S. (2020), "The multinationality and performance relationship: revisiting the literature and exploring the implications". *International Business Review,* 29(2), 101670. https://doi.org/10.1016/j.ibusrev.2020.101670.
Ohashi, H. (2003). The Role of Network Effects in the US VCR Market, 1978–1986. *Journal of Economics & Management Strategy*, 12(4), 447-494. https://doi.org/10.1111/j.1430-9134.2003.00447.x
Olbert, M., & Spengel, C. (2017). International taxation in the digital economy: challenge accepted. *World tax journal*, 9(1), 3-46.
Olbert, M., & Spengel, C. (2019). Taxation in the Digital Economy – Recent Policy Developments and the Question of Value Creation. ZEW - Centre for European Economic Research Discussion Paper No. 19-010, http://dx.doi.org/10.2139/ssrn.3368092
Oliveira, L., Fleury, A., & Fleury, M. T. (2021). Digital power: Value chain upgrading in an age of digitization. *International Business Review*, 30, 101850. https://doi.org/10.1016/j.ibusrev.2021.101850
Papadopoulos, A. (2019). The power of platform businesses: How to enable value creation. Integrated Management Systems. https://www.imanagesystems.com/digital-marketing/power-platforms-enable-value-creation/
Park, S. (2004). Quantitative Analysis of Network Externalities in Competing Technologies: The VCR Case. *The Review of Economics and Statistics*, 86(4), 937–945. https://doi.org/10.1162/0034653043125275
Parker, G. G., Alstyne, W. M. V., & Choudary, S. P. (2016). Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You. W. W. Norton & Company, New York, NY.
Parker, G., & Alstyne, M. V. (2008). Managing Platform Ecosystems. ICIS 2008 Proceedings - Twenty Ninth International Conference on Information Systems, 53. http://aisel.aisnet.org/icis2008/53
Parker, G., & Alstyne, W. V. M. (2014). Platform Strategy. The Palgrave Encyclopedia of Strategic Management. http://dx.doi.org/10.2139/ssrn.2439323
Periyasami, S., & Periyasamy, A. P. (2022). Metaverse as Future Promising Platform Business Model: Case Study on Fashion Value Chain. *Businesses*, 2, 527-545. https://doi.org/10.3390/businesses2040033
Porter, M. E. (1985). Competitive advantage: Creating and sustaining superior performance. New York: Free Press.
Prasad, R., & Acharya, S. (2016). Fundamentals of Business Analytics. Wiley India Pvt. Ltd.
Rahman, K. S., & Thelen, K. (2019). The Rise of the Platform Business Model and the Transformation of Twenty-First-Century Capitalism. *Politics & Society*, 47(2), 177-204. http://dx.doi.org/10.1177/0032329219838932
Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC (General Data Protection Regulation).
Rochet, J., & Tirole, J. (2006). Two-sided markets: a progress report. *The RAND Journal of Economics,* 37(3), 645-667. https://www.jstor.org/stable/25046265
Schrage, M. (2016). Rethinking the Value of Customers in a Digital Economy. MIT Sloan Management Review, 11(4).
Schreiber, M., & Metternich, J. (2022). Data Value Chains in Manufacturing: Data-based Process Transparency through Traceability and Process Mining. 55th CIRP Conference on Manufacturing Systems, 107(2022), 629-634. https://doi.org/10.1016/j.procir.2022.05.037
Shankar, V., & Bayus, B. L. (2003). Network effects and competition: an empirical analysis of the home video game industry. *Strategic Management Journal*, 24(4), 375-384. https://doi.org/10.1002/smj.296
Täuscher, K., & Laudien, S. M. (2018). Understanding Platform Business Models: A Mixed Methods Study of Marketplaces. *European Management Journal*, 36(3), 319-329. https://doi.org/10.1016/j.emj.2017.06.005
Teece, D. J. (2010). Business Models, Business Strategy and Innovation. *Long Range Planning*, 43(2–3), 172-194. https://doi.org/10.1016/j.lrp.2009.07.003
Turck, M. (2016). The Power of Data Network Effects. https://mattturck.com/the-power-of-data-network-effects/
UNCTAD. (2019). Digital economy report. Value creation and capture: Implications for developing countries. United Nations Publication.
van der Valka, H., Strobelb, G., Winkelmanna, S., Hunkerc, J., & Tomczyka, M. (2022). Supply Chains in the Era of Digital Twins – A Review. International Conference on Industry Sciences and Computer Sciences Innovation. *Procedia Computer Science*, 204, 156–163. https://doi.org./10.1016/j.procs.2022.08.019
van Dijck, J. (2014). Datafication, dataism and dataveillance: Big Data between scientific paradigm and ideology. *Surveillance & Society*, 12(2), 197-208. https://doi.org/10.24908/ss.v12i2.4776
Vaughan, R., & Daverio, R. (2016), Assessing the size and presence of the collaborative economy in Europe, PWC, London, UK.
Visconti, R. M., Larocca, A., & Marconi, M. (2017). Big data-Driven Value Chains and Digital Platforms: from Value Co-Creation to Monetization. *Big Data Analytics: Tools and Technology for Effective Planning*, 355-371. http://dx.doi.org/10.2139/ssrn.2903799
Wan, X., Yang, D, & Teng, Z. (2022). Blockchain digital technology empowers E-commerce supply chain sustainable value co-creation decision and coordination considering online consumer reviews. *Applied Soft Computing*, 130, 109662. https://doi.org/10.1016/j.asoc.2022.109662

Williamson, O. E. (1981) The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87, 548-577. https://doi.org/10.1086/227496

Wiren, M., Mantymaki, M., & Najmul, A. K. M. I. (2019). Big Data Value Chain: Making Sense of the Challenges. *Digital Transformation for a Sustainable Society in the 21st Century,* 11701, 125-137. https://doi.org/10.1007/978-3-030-29374-1_11

Wisetsri, W., Donthu, S., Mehbodniya, A., Vyas, S., Quiñonez-Choquecota, J., & Neware, R. (2022). An Investiga-tion on the Impact of Digital Revolution and Machine Learning in Supply Chain Management. Materials To-day: *Proceedings*, 56 (2022), 3207-3210. https://doi.org/10.1016/j.matpr.2021.09.367

Yi, X., Liu, F., Liu, J., & Jin, H. (2014). Building a network highway for big data: architecture and challenges. *IEEE Network*, 28, 5-13. https://doi.org/10.1109/MNET.2014.6863125

Yu, H. F. M., & Foster, J. (2017). Towards Information Governance of Data Value Chains: Balancing the Value and Risks of Data Within a Financial Services Company. In L., Uden, L., Wei, I-H., Ting (Eds.). Communications in Computer and Information Science book series, 731, 336-346. https://doi.org/10.1007/978-3-319-62698-7_28