ATARCA

Project Deliverable 2.2 (D2.2)

Report on anti-rival business model patterns (archetypes)

30.09.2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964678.

ATARCA

Grant agreement number: 964678

Project acronym: ATARCA

Project full title: Accounting Technologies for Anti-Rival Coordination and Allocation

Deliverable number	D2.2
Revision history	Final document submitted 30 September 2022
Deliverable responsible	Aalto University
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Dissemination Level	Public document

Abstract

The ATARCA project investigates how to organize around “anti-rival resources”– that is, resources that do not deplete when shared (e.g., knowledge and digital goods). This ATARCA deliverable (D2.2) reports research to identify business model patterns compatible with anti-rivalry. Such patterns can be used to enhance business model innovation for anti-rival systems. An integrative literature review and an empirical study were used as data.

Introduction

About ATARCA project and the position of this deliverable

The ATARCA project[1] investigates how economic actors can be incentivized to share resources that do not deplete when shared (e.g., knowledge, and digital goods), and how the actors can capture positive externalities arising from such sharing. Following Weber (2004), we call such non-depletable (or "negatively subtractable") resources *anti-rival* – highlighting the key difference from *rival* and *nonrival* resources already analyzed in the extant economics literature (e.g., Ostrom, 2005).

This document reports the part of ATARCA that has studied how sharing anti-rival resources and the positive externalities could be organized in *business models*. For the concept of business model, we use the definition of "formal conceptual representations of how a business function" adopted by Massa et al. (2017, p.21) in their literature review. Following such a holistic perspective, we focus on analyzing how value is created and captured (and shared) in business models, both on the level of firms and their activity systems, and the level of large-scale stakeholder networks.

1 ATARCA stands for "Accounting Technologies for Anti-Rival Coordination and Allocation". The EU H2020 funded ATARCA project strives for an evidence-based foundation for anti-rival compensation and governance solutions. The project utilizes participatory design, prototyping, intervention-based action research, and qualitative and quantitative data analysis to design and implement new anti-rival systems, and to analyze their impacts. This document is one of the public deliverables of ATARCA. More information: atarca.eu.

About this study

As an analytical approach to business model innovation, we have used *business model patterns* (also referred as *"archetypes"*; the terms are used interchangeably in the scholarly discourse, but in this study we use the term "*pattern"*) which can be perceived as building blocks that you one can combine and configure to answer a recurring problem (Alexander et al., 1977). The business model literature acknowledges that new business models are often combinations of several already existing models (Osterwalder and Pigneur, 2010). Initiated in large scale by Gassmann et al. (2013), empirical research has recognized hundreds of different patterns, in different contexts.

In this study, we first *integratively reviewed the business model pattern (and archetype) literature)*, with a specific emphasis on contexts that are potentially aligned with anti-rival thinking – that is, the context connects to resources which are negatively subtractable. Thus, we studied, in particular, data, information, and knowledge business, but also the contexts of sustainable business models (as they have a focus on resource regenerability) and the sharing economy (as the key action in such contexts is, indeed, resource sharing). Then, driven by the ATARCA project's specific interest in distributed ledger technology (such as blockchain) -based projects (so called web3 companies) we conducted a *qualitative empirical study on web3 startups and scaleups that operate with data resources.* These cases were particularly interesting due to their ability to create community-driven customized accounting systems and because such firms had not been thus far studied from the business model pattern perspective. Here, we focused on data resource related projects as they potentially connect to interesting anti-rival contexts of data, information and knowledge – in contrast to the expansive amount of web3 projects working with payment and investment instruments linked to the inherently rivalrous (exchange-based) market economy applications.

As a result of the literature and empirical work, we *recognized a subset of business model patterns that are compatible with anti-rival thinking* – that is, they do not build their value creation and capture logic on depletable resources or creating artificial scarcity for originally non-depletable ones. We also recognized business model patterns that can act as *enablers for anti-rival business models* – meaning that they can convert a business model to align with anti-rival thinking.

The structure of this document

The rest of the document is structured as follows. First, in "*Conceptual background of business model related terminology*", we present the key business model concepts used in this study. Then, in "*Synthesis of the existing literature*", we review the extant literature on business model patterns with a specific emphasis on anti-rival perspectives and identify a comprehensive list of business model patterns that potentially support anti-rivalry. After that, in "*Empirical study on data-related web3 business model patterns*" we present the method used and the results of our empirical work augmenting the existing business model pattern literature with a data-related web3 startup and scaleup perspective. Finally, in "*Identifying and summarizing anti-rival business model patterns*", we present the patterns that are 1) aligned with anti-rival thinking, and which can 2) enable anti-rivalry utilization. The last chapter concludes.

Conceptual background of business model related terminology

Business model as a concept

Although the term Business Model (BM) is widely used, the term lacks a clear academic definition (Chesbrough, 2007; Foss & Saebi, 2017; Massa et al., 2017; Schneider & Spieth, 2013). Some scholars define BMs as stories (Magretta, 2002) and descriptions (Teece, 2010) that explain how enterprises work; here, the business model explicates the underlying economic logic with which value is delivered to customers at an appropriate cost (Magretta, 2002). Along these lines, Teece (2010) summarizes that BM describes how the business creates and delivers value to its customers and how it makes money out in the process.

Taking a slightly different stance, some scholars explain BMs through a series of activities that businesses must perform to create value (Chesbrough, 2007). Such activities vary from the procurement of raw materials to the satisfaction of the end consumer and the value must be captured from a portion of those activities. This so-called activity view emphasizes the creation of new business opportunities in the design of activity systems (Zott & Amit, 2010). Transaction content, structure, and governance activities are at the focus of analysis (Zott & Amit, 2010).

Further, there are also scholars who pose a more systemic perspective on BMs–this perspective has gained increasing traction during the last decades in particular (Zott & Amit, 2007; Zott & Amit, 2010). Along this line or reasoning, interdependent BM activities inherently exceed beyond the focal firm boundaries (Zott & Amit, 2010). Hence, the systemic perspective to BMs is needed to illustrate how the organization is linked to both the internal and external network of stakeholders and how the network members engage in economic exchange to create value for all (Zott & Amit, 2007).

To consolidate the diversity in BM thinking, there are also approaches that take an integrative perspective. In their widely popularized "Business Model Canvas", Osterwalder (2004) and Osterwalder & Pigneur (2010) explain the concept of BM to comprise of nine general building blocks: key partnerships, key activities, key resources, value proposition, relationships with the customers, customers, channels, revenue stream, and cost structures. Similarly, Gassmann et al. (2013) maintain a holistic stance by summarizing the key questions regarding BMs in three areas: customer (Who is your target customer?), value proposition (What do you offer to the customer?), value chain (How is the value proposition created?) and revenue model (How is revenue created?).

In this study, we take such a holistic approach to BMs. We adopt the definition provided by Massa et al. (2017, p.21) describing BMs as "*formal conceptual representations of how a business function*". Thus, we aim to focus on all the mentioned BM areas: value creation and capture, activity systems, and stakeholder networks. As an analytical framework, we employ Gassmann et al.'s (2013) customer-value proposition-value chain-revenue model conceptualization.

Business model innovation

In the BM context, innovation means designing new ways to create and capture (or share) value in a novel way so that a competitive advantage and longevity is created for the stakeholders involved. Business Model Innovation (BMI), in particular, refers to designing a new BM or modifying the way the company operates around existing BMs (Amit & Zott, 2010; Amit & Zott, 2012). Through BMI a company modifies or improves elements in its BM (Abdelkafi et al., 2013), resulting in additional but thus far unused sources of value generation (Amit & Zott, 2012).

BMI is important both to startups and scaleups, as well as incumbents aiming for growth (Günzel & Holm, 2013). Turbulent competitive landscapes push companies towards dynamic renewal (Wirtz et al., 2016; Chesbrough, 2007). It seems that innovations in business models are harder to replicate than the innovations related to products and processes (Amit & Zott, 2012). Therefore, BMI has been identified as crucial for firms' sustained success as BMI increases a company's resilience to competition and industry change (Magretta, 2002; Chesbrough, 2007; Gassmann et al., 2013; Weking et al., 2019).

Business model patterns

Within BMI, one particularly creative and popular way to innovate is using so called Business Model Patterns (BMPs), which are reproducible and configurable building blocks that provide a "solution" to a recurring "problem" (Alexander et al., 1977). While the business model literature refers to such building blocks with different terms, like "ideal-types" (Stubbs and Cocklin, 2008) and "archetypes" (Bocken et al., 2014), we use in this study the term "business model pattern" due to its wide popularity in the state-of-the art literature (Lüdeke-Freud et al., 2018). However, despite the homogeneous term use, we included the "business model archetype" literature to our analyzed literature set, due to the "archetype" term's wide use especially in the sustainability related research. Thus, we are interested in business model patterns (and archetypes), which:

> *"...[describe] a problem which occurs over and over again in our environment, and then [describe] the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" (Alexander et al., 1977, p.12). (words in brackets changed to singular form by the authors)*

Prior research has shown that 90 % of existing business models are, actually, copies of existing ones (Gassmann et al., 2013). Complete business models are often combinations of several BMPs (Osterwalder and Pigneur, 2010). Herein, BMs are combinations of *"business model dimensions [...] that [have] proven to be successful"* (Gassmann et al., 2014, p. 22). Thus, BMPs aim to describe the proven, replicable components of successful business models; and innovating with BMPs means envisioning new or improved business models by recombining those existing patterns (Amshoff et al. 2015; Gassmann et al., 2014).

During the last decade, several authors have contributed to the body of knowledge on BMPs (e.g., Gassmann, 2013; Mikusz & Csiszar, 2015; Remane et al., 2017; Weinberger et al., 2016; Facchinetti & Sulzer, 2016; Curtis & Mont, 2020; Lüdeke-Freund et al., 2018; Abdelkafi et al., 2013; Oserwalder & Pigneur, 2010; Weking et al., 2019). One of the most comprehensive works on BMP is done by Gassmann et al. (2013). They analyzed 250 business models that were applied in different industries within 25 years: 55 universal business model patterns were identified.

Most studies on BMPs build upon or contribute to developing the Gassmann et. al's 55 patterns. The original patterns have evolved, and more patterns have been identified (Remane et al., 2017; Weking et al., 2020b; Curtis, 2021). A few studies on the structured and hierarchical order of BMP have been established to reduce the complexity (Taran et al., 2016; Remane et al., 2017; Weking et al., 2020a). Yet, the literature on new BMPs remains fragmented and incomplete (Weking et al., 2020a; Curtis, 2021), while the increasingly evolving business field stresses the need for BMPs to advance.

All in all, BMPs tap into one of the key challenges of BMI: challenging the dominant logic of an industry and overcoming the barriers of promoting and managing change (Gassmann et al., 2013). BMPs are aimed to be implemented both in the same and in completely different contexts than where they were originally designed. This makes BMPs paradigm-shifting: new markets can be envisioned, obeying entirely different rules (Amshoff et al., 2015). Herein, the role of BMPs is to reduce complexity and increase efficiency in innovation processes (Amshoff et al., 2015; Cloutier & Verma, 2006).

Synthesis of the existing literature: BMP's that potentially support anti-rivalry

Method of including the literature to be synthesized, and synthesizing the results

The literature synthesis part of our study aims to compose a *comprehensive list of business model patterns that potentially support anti-rivalry*. Using Gassmann et al.'s (2013) initial yet already somewhat older work as a starting point, we review the thus far published business model pattern literature to augment the initial pattern set with new patterns that have been recognized in contexts that suit the particular characteristics of anti-rival resources.

Gathering the literature set. Our search on existing business model pattern literature was done in Sciverse Scopus, targeting articles published before 1st of April 2022. Articles with the phrase "business model patterns" or "business model archetypes" (or the same phrases in singular form) in the abstract, title or keyword were included. Articles that were not published in academic journals or were not written in English were excluded. Also, we excluded articles that were published in outlets not listed as peer reviewed publications in the interdisciplinary Finnish Publication Forum (JUFO)[2]. The search with such criteria resulted with 77 articles.

2 Finnish Publication Forum is a publication channel classification system implemented by the Finnish scientific community that supports the evaluation of the quality of research output. More information: www.julkaisufoorumi.fi/en

After using this inclusion and exclusion criteria, a screening was made based on the abstract of the article: studies were only included if they were 1) about recognizing business model patterns and 2) referring to potentially anti-rival contexts (i.e., dealing with resources that are not depletable, or about value offerings that are not organized around exchange relationships). For the latter criterion, our literature recognized that BMP research has been conducted in potential anti-rival contexts of: *1) open data* (a natural target of our inquiries), *2) industry 4.0* (industrial processes are increasingly being organized with data resources), *3) sharing economy* (not all resources of sharing economy are anti-rival, but the logic of operation is about "sharing"), *4) sustainability* (sustainability topics often include anti-rival thinking through emphasizing resource regenerability), *5) AI startups* (AI is often connected to data resources that are anti-rival), and *6) entrepreneurial universities* (sharing knowledge is anti-rival).

Based on the literature retrieval and screening process, nine articles were selected for further analysis. Each of those six articles were read through, and the identified business model patterns in the studies were listed for each paper separately. Then, the resulted lists were compared with the original 55 patterns recognized in the Gassmann et al. (2013) article: we noted patterns that were already included (or that were exactly the same) in Gassmann et al. (2013), patterns that had been further developed the original Gassmann et al. (2013) patterns, and completely new patterns. After conducting this analysis for each other the papers individually, we composed an integrated list of all patterns (illustrated in Figure 1), including the original Gassmann et al. (2013) patterns, and new and developed patterns identified in our literature search. This integrated pattern set serves as a *list of business model patterns that potentially support anti-rivalry.*

Business model patterns recognized in open data context

Zeleti et al. (2016) identified BMPs in the context of open (government) data and found five archetypical BMP with 15 sub-categories. When comparing Zeleti et al.'s results with Gassmann et al. (2013) BMPs, we recognized the following new patterns: *charging for changes, free as branded advertising, demand-oriented platform, supply-oriented platform, increase quality through participation, cost avoidance, supporting primary business* and *premium* (derived from freemium -pattern).

Zeleti et al. (2016) provide also additional information on some of Gassmann et al.'s BMPs: *white-label development*, *dual-licensing*, *infrastructural razor and blades*, and *sponsorship* (see synthesis in Table 1).

Table 1. Synthesis of open data BMPs (Zeleti et al., 2016) and Gassmann et al.'s (2013) 55 BMPs.

Name of the pattern	Description (all quotes from Zeleti et al., 2016, p.540)	Gassmann's original pattern	Builds on Gassmann's pattern	New pattern
Freemium	"Freemium offers free but limited data and high quality data at some cost and provides limited availability of useful free data to public and perceived value of data as value in return".	X		
Dual-licensing	"Dual-Licensing offers free data for non-commercial uses and high quality data for commercial use. It also provides limited availability of useful free data to public".		X	
Charging for changes	"Charging for changes offers free but limited data services and high quality data at some cost and provides limited availability of useful free data to public and perceived value of data as value in return".			X
Open source	"Open source offers free data for non-corporate use and quality data for corporate use and provides limited availability of useful free data to public and perceived value of data as value in return".	X		
Free as branded advertising	"Free as branded advertising offers useful data for public and provides perceived value of data as value in return".			X
Sponsorship	"Sponsorship offers free and useful data to the public using resources provided by sponsors".		X	
Support and Services	"Support and services offers high value adding data services and provides perceived value of data as value in return".	X		
Demand-oriented platform	"Demand-oriented platform offers high quality and reliable data at some cost and provides commoditization and democratization of data as value in return".			X
Supply-oriented platform	"Supply oriented platform offers efficient and scalable infrastructure and provides perceived value of data as value in return".			X
White-Label development	"White-label development offers useful data services and Apps and provides saving in development time and budget as value in return".		X	

Premium	"Premium offers specific customer need and provides perceived value of data as value in return".		X*
Increase quality through participation	"Increasing quality through participation offers higher quality of data and provides higher data quality as value in return".		X
Cost Avoidance	"Cost Avoidance offers sustainable publishing solution, cost avoidance, and improved meaning of data and data integration as value in return".		X
Supporting Primary Business	"Supporting primary business offers strategic support to the business objective and provides improved in business results as value in return".		X
Infrastructural Razor and Blades	"Infrastructural razor and blades model offers incomplete data at dis-count price while the complementary parts are provided at some cost. It provides perceived value of data as value in return".	X	

* Derived from Freemium

Sharing economy -related business model patterns

Curtis (2021) studied 63 Sharing Economy Business Models (SEBMs) and compared them to existing BMPs of prior research (incl. Gassmann, 2014; Mikusz & Csiszar, 2015; Remane et al., 2017; Weinberger et al., 2016; Facchinetti & Sulzer, 2016; Curtis & Mont, 2020; Lüdeke-Freund et al., 2018; Abdelkafi et al., 2013; Oserwalder & Pigneur, 2010; Weking et al., 2019). Several unique SEBMs were recognized. Curtis (2021) concluded that six of the new identified patterns are particularly specific only to a sharing economy: *community governance, existing community, mixed revenue source, nodes*, *review system* and *price set by user*.

We further recognized that Curtis (2021) developed the following patterns initially recognized by Gassmann et al. (2013): *fractional ownership*, *free, membership,* and *rent instead of buy*. Additionally, two of the recognized patterns by Curtis (2021) were new to Gassmann et al.'s (2013) original patterns: *differential pricing* and *unbundling*. The rest of the recognized patterns were already mentioned by Gassmann et al. (2013). Table 2 illustrates.

Table 2. Synthesis of sharing economy BMPs (Curtis, 2021) and Gassmann et al. (2013) 55 BMPs.

Name of the pattern	Description (all quotes from Curtis, 2021, p.1660)	Gassmann's original pattern	Builds on Gassmann's pattern	New pattern
Add-on (Additional services)	"Platform offers extra or additional services beyond their primary offering, typically at a higher profit margin".	X		
Barter	"Allow users to exchange non-monetary compensation for a product or service".	X		
Community governance	"Sees users involved to a greater degree in the daily operations and strategic decisions of the platform".			X
Crowdfunding	"Financing the platform by soliciting contributions from the larger community, often offering a non-monetary reward".	X		
Differential pricing	"Offering the same product to users at different prices, based on the market and user characteristics or behaviour".			X*
Existing community	"Introduce platform among a group of people possessing something in common (e.g. neighbourhood, school)".			X
Fractional ownership (Cooperative Ownership)	"Shared ownership of an asset among a group of consumers (e.g. crowd cooperative)".		X	
Franchising	"Allow franchisees to licence the business concept – including training, branding, technical infrastructure –for a recurring fee and/or revenue sharing".	X		
Free	"Allow users free access to the platform and its primary offering, using additional sources to generate revenue (e.g. donation, crowdsourcing, advertising)".		X	
Membership	"Recurring cost to users for access to the platform".		X	
Mixed revenue source	"Revenue in a multi-sided market may come from a multitude of sources".			X
Nodes	"The fragmented diffusion of sharing platforms geographically, driven by interested actors wanting to start operations in their own contexts".			X

Open source	"Offer to make available platform's intellectual property (e.g. matching algorithm, booking management, review system)".	X		
Pay per use (Transaction fee)	"One-time charge to users each time the good or service is accessed".	X		
Pay what you want	"Invite users to set the fee to access the platform (e.g. transaction fee, commission, donation)".	X		
Peer-to-peer	"Platform mediation between users having equal standing based on rank, class, age, etc.".	X		
Price set by users	"In a multi-sided market, users set the price of the exchange".			X
Rent instead of buy	"Temporarily lend a product for a fee, instead of transfer of ownership (e.g. goods sharing platforms)".	X		
Review system	"Provide feedback about the service quality or social interaction			X
Servitisation (Product-to-service)	"Offer renting options to access products instead of purchasing new products (e.g. B2C platforms)".		X	
Subscription	"Recurring cost to users for access to goods or services".	X		
Unbundling	"Focus on customer relationship management, facilitating access to shared assets (e.g. carsharing)".			X*

* Not mentioned by Gassmann (2013) but identified earlier by (Mikusz & Csiszar, 2015; Remane et al., 2017; Weinberger et al., 2016; Facchinetti & Sulzer, 2016; Curtis & Mont, 2020; Lüdeke-Freund et al., 2018; Abdelkafi et al., 2013; Oserwalder & Pigneur, 2010; Weking et al., 2019)

Sustainability-related business model patterns

Our literature set contained four studies on sustainable business models. The most comprehensive work on sustainable BMPs was done by Lüdeke-Freund et al. (2018). They created a taxonomy for sustainable business model (SBM) patterns, consisting of 45 detailed BMPs for sustainability (see table 3). Lüdeke-Freund et al.'s (2018) work is built on existing literature on SBMs and BMPs (including Gassmann et al., 2013). Thus, based on our analysis, only two of the 45 identified patterns were similar to Gassmann et al.'s (2013) original patterns (freemium and crowdfunding). Ten patterns were further developments of the original patterns (innovative product financing, subscription model, pay for success, result-oriented services, use-oriented services, cooperative ownership, two-sided social mission, remanufacturing/next life sales, physical to virtual, and shorter supply chains). The rest were new patterns.

We also found that sustainability research has often used the term "business model archetype" in their BM-related analysis. The most fundamental work on such SBM archetypes is done by Bocken et al. (2014), who developed eight main archetypes: maximize material and energy efficiency, create value from waste, substitute with renewables and natural processes, deliver functionality rather than ownership, adopt a stewardship role, encourage sufficiency, repurpose for society/environment and, develop scale up solutions. More recently, Pieroni et al. (2020) and D'Amato et al. (2020) have offered more detailed perspectives on Bocken et al.'s original framework. To consolidate the findings, we integrated the perspectives of Bocken et al. (2014), Pieroni et al. (2020), and D'Amato et al. (2020) and synthesized the outcomes with Lüdeke-Freund's (2018) work. As a result, only one new SBM pattern, demand reduction services, was found.

Table 3. Synthesis of SBM BMPs (Lüdeke-Freund et al., 2018) and Gassmann et al. (2013)

Name of the pattern	Description (all quotes from Lüdeke-Freund et al., 2018, Appendix 1)	Gassmann's original pattern	Builds on Gassmann's pattern	New pattern
Differential pricing	”Charging groups with higher payment thresholds higher prices to subsidize those groups who cannot afford to pay as much".			X
Freemium	”Provide a basic service or product free of charge to lower entry barriers for customers, while a fee is charged for additional features and functionality. This allows gaining traction through partly free offerings".	X		
Innovative Product Financing	”Offering product leasing or renting for a certain period of time instead of selling it outright. As an option, this can lead to ownership (“progressive purchase”). This allows extending breadth and depth of customer groups for new products".		X	
Subscription Model	”Charging a customer a rolling fee, typically on a monthly or annual basis for access to a product or service. The customer pays a fee, irrespective of product or service use. This allows creating consistent income stream".		X	
Pay for Success	”Employing success-based contracting, usually between providers of a new product or service and the client, in which payments depend on meeting a pre-defined success level".		X	
Product-oriented Services	”The business model is still mainly geared towards sales of products, but some extra services are added. The product is usually owned by the customer. Customers pay for the product and product-related services offered by the provider".			X
Result-oriented Services	”The client and provider in principle agree on a result, and there is no pre-determined product involved. The service provider owns the product and is responsible for its use. This creates more accountability within the broader system for product disposal, and higher likelihood of product repair, reuse and recycling. The customer pays for an outcome and not for buying or using a particular product".		X	

Use-oriented Services	”The traditional product still plays a central role, but the business model is not geared towards selling products. The product usually stays in ownership with the provider and can be shared by a number of users. Customers pay e.g. a leasing, renting or service fee for the use and performance of a particular product".		X	
Building a Marketplace	”Creating a new marketing system for otherwise neglected customer segments, by building new customer relationships, distribution channels, and revenue models. This allows offering products and services that take into account the needs of social target groups and their varying education and income levels".			X
e-Transaction Platforms	”Offering cashless accounts and payment systems to social target groups without bank access. These accounts are used in combination with e-transaction platforms that enable transactions between product and service providers and customer".			X
Experience-based customer credit	”Providing access to credit (as a non-bank) based on former experience with the customer, instead of formal bank applications. Lending is not based on a customer’s credit history, but on other transactions in the past".			X
Last-Mile Grid Utilities	”Providing basic supplies through extended grid coverage and bundling financing (e.g., tiered pricing), technology (e.g., smart metering), and customer service (e.g., maintenance) to minimize technical and commercial losses and ensure that customers are paying".			X
Value-for-Money Degrees	”Providing access to higher education to everyone, including those with low income, by making higher education affordable. E.g. through standardized and modular curricula, hiring part-time instructors, on-site and distance learning, offering flexible financing options".			X
Value-for-Money Housing	”Offering affordable home ownership by bundling high value for money homes (e.g., efficient design), facilitating access to financing (e.g., third-party financing), and customer support (e.g., customer training)".			X
Cooperative Ownership	”The cooperative model follows a multi-stakeholder approach and is therefore owned and managed by cooperative members. Members can be retail consumers, users of services, employees, suppliers, or the local community, for example".		X	
Crowdfunding	”Mobilizing a network, usually online, to tap the financial resources of a mixed group of people and to circumvent traditional financiers such as banks. Forms of crowdfunding are e.g. donation-based, loan-based and equity-based".	X		

Microfinance	”Providing small loans and financial services to people without access to conventional banks. Microfinance is often provided through group-lending systems where group members act as guarantors for each other".		X
No dividends	”Investors are entitled to get their money back. But profits are not distributed to them as these are reinvested to improve the product or service quality or to fund new social businesses. Social target groups benefit from improved product and service quality and/or lower prices".		X
Buy One, Give One	”Donating goods or services in a fixed ratio to regular sales. Costs can be covered by regular sales revenues, third-party donations or social investors. Offering a product or service for free to a social target group while earning revenues from commercial customers, e.g. based on the information generated by the social target group".		X
Commercially Utilized Social Mission	”Offering a product or service for free to a social target group while earning revenues from commercial customers, e.g. based on the information generated by the social target group".		X
Experience Broker	”Accumulating problem-specific know-how as a resource. This know-how is derived from affected persons’ experiences and is used to educate, train, and help social target groups".		X
Market-Oriented Social Mission	”Offering opportunities to excluded social target groups to engage as productive and paid workforce. They can help in generating market revenues. Training and capability development might be required".		X
One-Sided Social Mission	”Launching a dedicated project/organization aimed at satisfying the consumption need of a target group that does not have sufficient funds to pay for a product or service. The social mission is largely funded by social investors and supported by volunteers".		X
Empowerment	”Launching an enterprise owned and run by the social target group to generate market-based revenues and even make profits. The social target group benefits from income and business opportunities".		X
Two-sided Social Mission	”Offering a platform, maybe third party-funded, to match two social target groups, one on the production and one on the consumption side. The group on the production side offers free production support for the consuming social target group".	X	

Hybrid model / gap-exploiter model	”Employing a hybrid model that combines a durable product and short-lived consumables. That is, selling a long-lasting device, such as a copier, and remanufacturing its short-lived parts, such as toner cartridges, where the company obtains revenues mainly from the consumables"	X
Maximise material productivity and energy efficiency	”Seeking to improve resource efficiency, reduce waste and emissions through product and process redesign, such as lean manufacturing, eco-efficiency (Factor 4 and Natural Capitalism), and cleaner production".	X
Product design	”Offering responsible and sustainable products that last, increase users' eco-efficiency, and are reusable, repairable, and/or recyclable. Risks in production and use are reduced, e.g. toxicity. This allows replacing inefficient and harmful product designs".	X
Substitute with renewables and natural processes	”Substituting finite and non-recyclable production inputs with renewable resources and designing processes based on nature-inspired principles, e.g. closing material and energy cycles".	X
Co-Product Generation	”Using the by-products from product generation as input for additional products that can be used by the company itself or sold on the market. This allows reducing waste, optimizing material flows, and increasing revenue".	X
Industry Symbiosis	”Employing a shared or cascaded use of resources, by-products, and waste materials among different actors on a commercial basis. Establishing inter-firm exchanges and linkages driven by the need to reduce virgin inputs, waste, and costs. This allows reducing waste and optimizing material flows among multiple organizations".	X
Online Waste Exchange Platform	”Creating an electronic marketplace for waste that matches supply and demand, enabling the exchange of waste between actors and retaining the value contained in materials. Companies providing such services gain earnings from commissions on transactions".	X
Product Recycling	”Recycling used products in such a way that their base materials are recovered and most of their embodied value (energy, labor, financial capital) is retained. This allows gaining access to resources and retaining the value contained in materials".	X

Remanufacturing / Next Life Sales	”Used products flow (back) to a manufacturer who repairs or replaces product components, incl. cosmetic updates (refurbishment), or disassembles products to reuse their components in “as new” products (remanufacturing). This allows retaining the value contained in products and creating new revenue sources".	X	
Repair	”Products remain the customer’s property, but broken or used products are repaired and/or maintained by a service provider. The same products are used again and longer, and the value they contain is retained".		X
Reuse	”Used products flow (back) to a service provider and/or distributor, either directly or via an intermediary, and are then resold, maybe in slightly enhanced form. This allows retaining the value contained in products and creating new revenue sources".		X
Take Back Management	”Implementing channels and management systems to recover products or parts from customers and distributors. This allows bringing back products or parts to manufacturers".		X
Upgrading	”Replacing outdated components that are part of products in use with technologically superior or updated components. This allows using working products as long as possible".		X
Sharing Business	”Sharing, or collaborative consumption, is about matching the supplier side of a platform with the demand side of that platform. The product is shared among a number of users, whenever the individual user needs access to the product. Sharing models have in common that the consumer does not pay for buying a product but only for using it".		X
Green Supply Chain Management	”Sourcing raw inputs and components in the most eco-friendly way possible and reducing or even eliminating toxic inputs. Suppliers are urged to commit to green supply chain management. Partners and networks are crucial for green supply chains".		X
Inclusive Sourcing	”Integrating local, low-income or less skilled suppliers into the supply chains of existing for-profit companies. This can require providing financial support and training opportunities to develop local suppliers’ capabilities".		X

Micro Distribution and Retail	”Offering products and services that match customers’ cash-flows (e.g., small-sized product units) and employing specialized, independent distributors. This can require strengthening existing retail outlets and delivery channels through training and financing partners as local vendors".		X
Physical to Virtual	”Introducing virtual customer relationships and channels, and only a few or no retail outposts. Making use of third-party platforms, e.g. “shop-in-shop” models. This allows increasing resource efficiency and scalability of product distribution".	X	
Produce on Demand	”Producing a product only when consumer demand is verified, e.g. via online platforms that allow customers to place pre-orders, to vote on preferred products or even to design their own products. This allows reducing overproduction and inefficient use of resources".		X
Shorter Supply Chains	”Reducing the length and complexity of supply chains, e.g. spatially, through less and closer partner and customer relationships. Improving transparency, e.g. by reducing the number of connections or knowledge sharing with suppliers".	X	
Demand reduction services	“Value delivered by solutions that moderate the use of energy and resources by individuals and companies. Customers benefit from savings that are greater than the service fees. Value is captured through recurrent income from service contracts”. (Pieroni, 2020, p.6)		X

Business model patterns identified in the context of Industry 4.0

Weking et al. (2020b) studied BMPs for the manufacturing industry, with a particular Industry 4.0 focus, resulting with a field-specific BMP framework consisting of three BPM categories and 10 BMPs. Our synthesis of Weking et al. (2020b) and Gassmann et al. (2013) reveals that two new patterns were recognized (see elaboration in Table 4): *product-related platformization* and *process-related platformization.* Additionally, seven of the recognized patterns were building on Gassmann et al.'s (2013) original patterns: *crowdsourced innovation, production as a service, life-long partnerships, product as a service, results as a service, product-related consulting* and *process-related consulting*. Finally, mass customization was already recognized by Gassmann et al. (2013).

Table 4. Synthesis of industry 4.0 BMPs (Weking et al., 2020b) and Gassmann et al. (2013) 55 BMPs.

Name of the pattern	Description (all quotes from Weking et al., 2020b, p. 8-10)	Gassmann's original pattern	Builds on Gassmann's pattern	New pattern
Crowdsourced innovation	"A new product development and design process shapes crowdsourced innovation. A community of people design products (crowdsourcing) instead of hired experts only. The innovation platform becomes a key resource and the community a crucial partner. Firms move from a closed business toward an open one. New manufacturing techniques allow fast, on-demand production of individual goods in micro-factories (mass individualization)".		X	
Production as a service	"Transforming product ideas into physical goods is core to production as a service. Firms undertake production from design checking until shipping as a service for their customers. The value chain shifts from producing mass-produced, expert-designed goods to mass-individualized, user-designed products. The customer becomes a key partner and can choose among a wide range of different materials and production techniques (long tail)".		X	
Mass customization	"The integration of customers into the value chain characterizes mass customization. Firms shift from mass production to mass customization, which enables customers to adapt the final product to their individual taste by choosing from a range of options (long tail). However, hired experts and designers still develop and design the core product. Customization is an additional option for personalization only and not a requirement (add-on). Smart production enables profitable production of small lot sizes".	X		

Life-long partnerships	"IoT-connected products enable this pattern to evolve a firm’s service portfolio from scheduled maintenance with repairs after failure to preventing breakdowns with remote monitoring and predictive maintenance throughout the whole product life-cycle. The firm becomes a solution provider and a partner for the entire product use phase. A firm still generates significant turnover by selling tangible products. However, firms add continuous revenue streams with subscription-based, life-long service contracts".	X
Product as a service	"Renting instead of selling products and related services or offering them for a use-based fee shapes this sub- pattern. Customers do not pay for ownership or service delivery but for product usage and availability. Smaller but continuous fees replace higher proceeds of one-time product sales. This sub-pattern provides new customer value by guaranteeing the availability of the product".	X
Result as a service	"Selling the output or result of a product characterizes result as a service. Like product as a service, it turns discontinuous sales-based revenue streams into continuous ones. Firms sell full-service packages and take responsibility for safe operations and compliance".	X
Product-related consulting	"Product-related consulting complements product sales with advice and consulting based on the firm’s own experiences with the products. The type of product can range from purely physical to purely digital products. Firms provide new customer value by offering integrated product service solutions. The new consulting service extends the existing product/service line or is an add-on to it. Firms help their customers to make optimal use of the products. In contrast, servitization patterns focus on repair, maintenance, or operating services and not on consulting".	X
Process-related consulting	"Process-related consulting makes use of a firm’s experiences in internal processes. Firms offer this know-how to external parties as advice and consulting. This new service does not involve a tangible product and contains new value beyond the traditional value proposition (do more to address the job), for example, consulting about smart production and digital transformation".	X

Product-related platformization	"Product-related platformization describes how firms use their experience from manufacturing and selling asset-intensive machinery and turn it into a new digital product. The new offering primarily addresses un-solved customer problems (do more to address the job). In the case studies, the new product is a cloud-based platform for innovating or trading goods and services among user groups. Community members become key partners. Acting as an intermediary in this multi-sided market allows firms to charge different user groups, for example, com-missions from third parties".	X
Process-related platformization	"Process-related platformization makes use of a firm's experience with internal processes and smart production and transforms it into a new digital platform with related services, for example, an IoT platform. In contrast to product-related platformization, the value proposition is an integrated solution of a digital product and related IT services rather than solving other customer's problems. Firms are more focused on service and support rather than intermediating. Analyzing customers' data becomes a key activity, while a user community is less relevant".	X

Artificial intelligence (AI) -related business model patterns

Weber et al. (2022) studied 100 AI startups from the widely used startup and scaleup database Crunchbase[3] and found four archetypical BMPs: *AI-charged Product/Service Provider*, *AI-development Facilitator*, *Data Analytics Provider,* and *Deep Tech researcher*. Compared to existing BMPs, Weber's findings are conceptual, and they represent the emerging area of new types of business models for the future: see more elaboration in Table 5.

Table 5. Synthesis of AI startup BMPs (Weber at al., 2022) and Gassmann et al. (2013) 55 BMPs.

Name of the pattern	Description (all quotes from Weber, 2022, p.100).	Gassmann's original pattern	Builds on Gassmann's pattern	New pattern
AI-charged Product/Service Provider	"Provide products and services that have readily trained AI models embedded".			X*
AI Development Facilitator	"Facilitate AI development of customers with customizable solutions or technical interfaces ".			X*
Data Analytics Provider	"Provide solutions that integrate and analyze various data sources for decision support".			X
Deep Tech Researcher	"Research and develop basis AI technology for innovative niche problems".			X**

* Similar to Standardization

** Similar to Individualization

3 https://www.crunchbase.com/

Entrepreneurial university -related business model patterns

Abdelkafi et al. (2018) found three BMPs for entrepreneurial universities which are: *consulting services, combination consultancy-teaching* and, *modularisation with self-reinforcement* (see Table 6). From these patterns, the last two are not mentioned as such in the Gassmann et al.'s (2013) original BMPs, while the first one builds on Gassmann et al.'s work.

Table 6. Synthesis of entrepreneurial university BMPs (Abdelkafi at al., 2018) and Gassmann et al. (2013) 55 BMPs.

Name of the pattern	Description (all quotes from Abdelkafi et al., 2018, p.100)	Gassmann's original pattern	Builds on Gassmann's pattern	New pattern
Consulting services	"(...) entrepreneurial university offers consultancy services to vocational service providers with export goals. Because the business model does not involve teaching and presence abroad, the related risk is minimal. Other universities, however, may develop skills in market analysis and business model innovation to make similar offers. Nevertheless, the strength of the entrepreneurial university lies in its knowledge about the context – the vocational training sector. The sustainability of the business is primarily dependent on the service providers' willingness-to-pay".		X	
Combination consultancy-teaching	"It exhibits a higher level of risk than the first pattern, as the clients of the entrepreneurial university are not only the German service providers, but also companies in foreign countries, which are the potential buyers of educational services. Because the university cannot offer full programs, it has to cooperate with other vocational training service providers. Standardisation of the courses enables the university to maintain costs at a low level, whereas the individualisation of courses can increase costs and business risks".			X

Modularisation with self-reinforcement	"First, the study programs are modularised, so that a high level of individualisation can still be achieved at reasonable costs. Second, cooperation makes it possible that the university leverages local infrastructure. Third, the active involvement of departments and professors constitutes a big incentive for the academic staff. The departments can fund research with this money, thus creating positive feedback loops: more teaching leads to more revenue spent on research, thus nurturing teaching with new insights, which improves teaching and related reputation even more, and leading to more demand for teaching services. The third business model (modularisation with self-reinforcement) induces clearly the highest risk compared to the other models".	X

Literature summary

The integrated framework presented in Figure 1 highlights our synthesis of the BMP literature under our specific interest of anti-rivalry and Gassmann et al.'s (2013) original 55 patterns. In the framework, we have summarized our results on BMPs in the potentially anti-rival fields of 1) open data, 2) industry 4.0, 3) sharing economy, 4) sustainability and, 5) entrepreneurial universities, and integrated those results with the original Gassmann et al. (2013) model. After removing duplicates (1): i) 56 new BMPs were recognized, ii) updates and contributions were identified to 25 of the original patterns so that they become new patterns in our model, and iii) the original 55 patterns were added to the integrated model for completeness. Altogether, our *comprehensive list of business model patterns that potentially support anti-rivalry* totals 136 patterns.

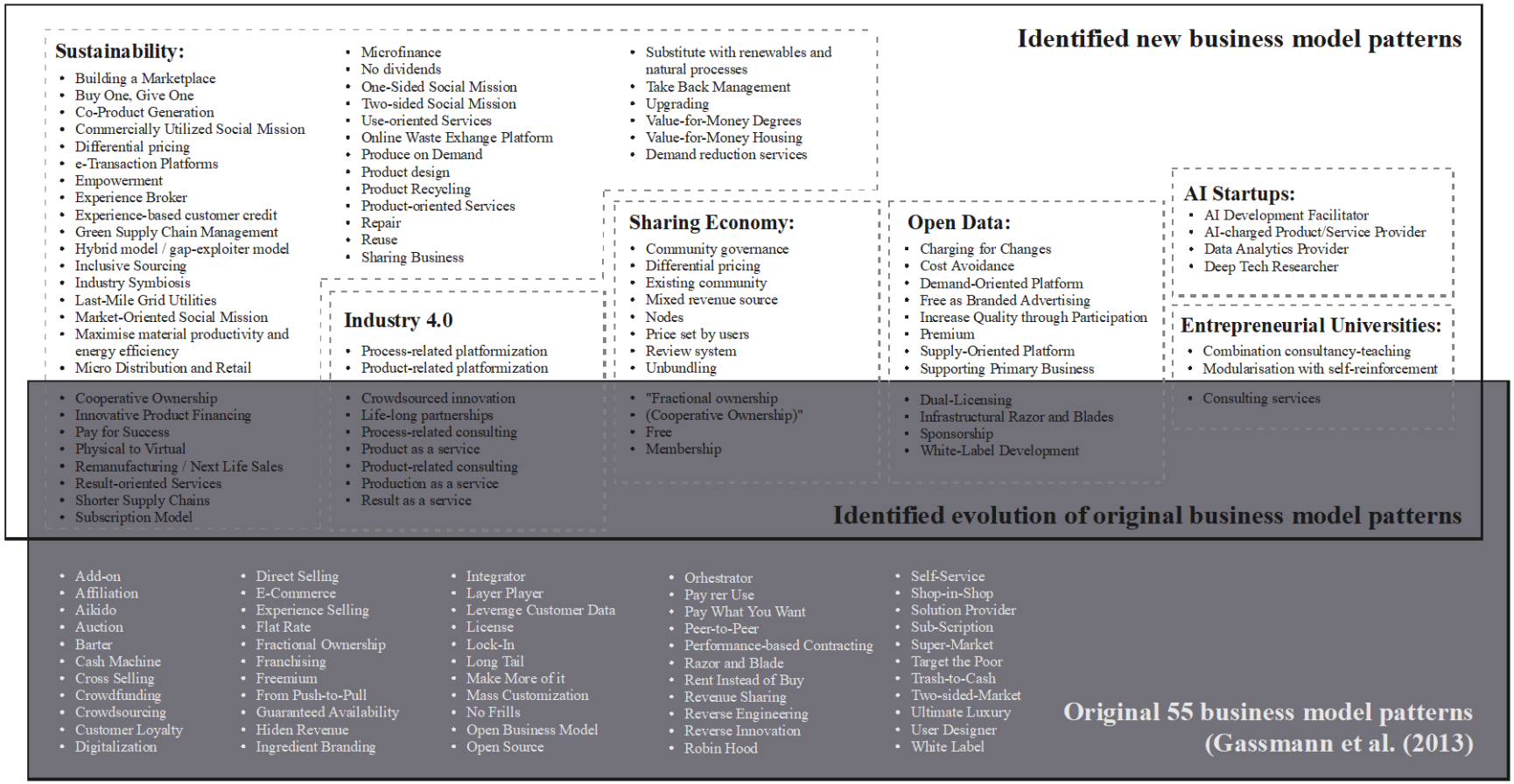

Figure 1. Synthesis of the anti-rival featured BMP literature: comprehensive list of business model patterns that potentially support anti-rivalry.

Empirical study on data-related web3 business model patterns

The aim of our empirical study was to augment the extant understanding of business model patterns in potentially anti-rival contexts, as described in the literature synthesis, by analyzing how web3 startups and scaleups operating with data resources are conducting BMI. The motivation for such an empirical study was the lack of web3 companies in the extant published BMP analysis. Web3 startups and scaleups potentially offer a particularly interesting perspective to anti-rival BMPs due to web3 technology's ability to create large-scale customized economic systems (for the specific needs of anti-rival resources and anti-rival accounting), powered by distributed ledger technologies and cryptographic tokens.

Method of the empirical study

The empirical part of this study was conducted using an approach similar to previous studies on business model patterns and taxonomies such as Gassmann et al. (2013). First, a list of organizations that could be analyzed was identified. Second, the list of organizations was narrowed down based on certain parameters. Third, a thematic analysis based on the Gioia Methodology (Gioia et al., 2013) was conducted whereby initial codes were transformed into first order concepts, second order themes, and eventually into aggregate dimensions.

Preliminary list of organizations. We began this study by utilizing a modified search feature on Crunchbase, an online startup database and platform. To scope and focus this study, we utilized the keywords and search parameters as follows. Keywords: blockchain, web3, data; other variables: ≥10 employees, ≥3 funding rounds; founded before: July 4, 2020. We exported the list of organizations on August 23, 2022, which left us with 253 organizations to begin with.

The number was downsized first, through a quick check through the organization's websites. Most organizations removed at this stage were due to 1) security issues with the website access, 2) website hosting had expired, or 3) language barriers. We only analyzed the webpages of startups who had information provided in English.

A further and final downsizing of the organizations was done by removing organizations who had no funding information available on the CrunchBase database, and by removing those organizations whose funding amount had exceeded USD150,000,000 as such companies no longer belonged to our target of startups and scaleups. Thus, we were left with a list of 149 organizations to be analyzed. The list of organizations can be seen in Appendix 1.

Analysis. We utilized the Gioia Methodology; first, we identified initial codes which were then grouped and transformed into first order concepts, second order themes, and finally, larger aggregate dimensions (Gioia et al., 2013). To conduct this study, we analyzed solely the webpages of all of the 149 organizations. Any whitepapers or mentions of the organizations elsewhere were ignored for the purposes of this study to ensure that all organizations were analyzed with the same approach and method.

To reduce any bias, the initial codes were taken as either direct quotes or snippets from the websites themselves or with minimal grammatical changes for clarity. As outlined in the literature review, to better understand the codes, we adopted the notion of a business model provided by Massa et al. (2017) and Gassmann et al. (2013), whereby business models were viewed as formal conceptual representations of how a business functions. In practice, this meant that when extracting the codes, we looked for what (value proposition), how (value chain), value (revenue model), and who (customer segment) for the organizations in this study (Gassmann et al., 2013). A total of 1367 codes were identified for the 149 organizations.

An example of an initial code is as follows, "Empowering financial institutions with critical data for research, trading, risk, analytics, reporting, and compliance, (*Organization E*)"; in this case, the code allowed us to identify the 'who' (customer segment) of the organization, following Massa et al. (2017) and Gassmann et al. (2013). Similarly, another example of an initial code is "Now you can use ONE platform to automate and simplify company HR and IT (*Organization H*)"; this code allowed us to identify the organization's value proposition.

These initial codes were then transformed into first order concepts where "informant-centric terms and codes were utilized" (Gioia et al., 2013, p.18). For example, the aforementioned code from Organization E was converted into the following first-order concept "analytics and compliance." A similar approach was undertaken for all the 149 organizations and the corresponding 1367 initial codes. At this step, some codes were repeated and reutilized if similar patterns or concepts were found.

From the first order concepts, we then moved towards second order themes where the focus shifted from informant-centric to researcher-centric concept and themes (Gioia et al., 2013). At this stage, existing business model and business model innovation literature, such as the one presented earlier within this report, was made use of to create the second order themes. So, if we were to continue with the same Organization E example, the first order concept of "analytics and compliance" was transformed into "data engineering."

In a final stage, these second order themes were consolidated into a few, key aggregate dimensions. As outlined by Gioia et al. (2013), these aggregate dimensions provide a "forced 'stepping-up' in abstractness", which lays "the foundation for balancing the deep embeddedness of the informant's view in living the phenomenon with the necessary '30,000-ft.' view often required to draw forth the theoretical insights" (p.21).

Figure 2 indicates a snippet of the Gioia Methodology approach utilized within this study.

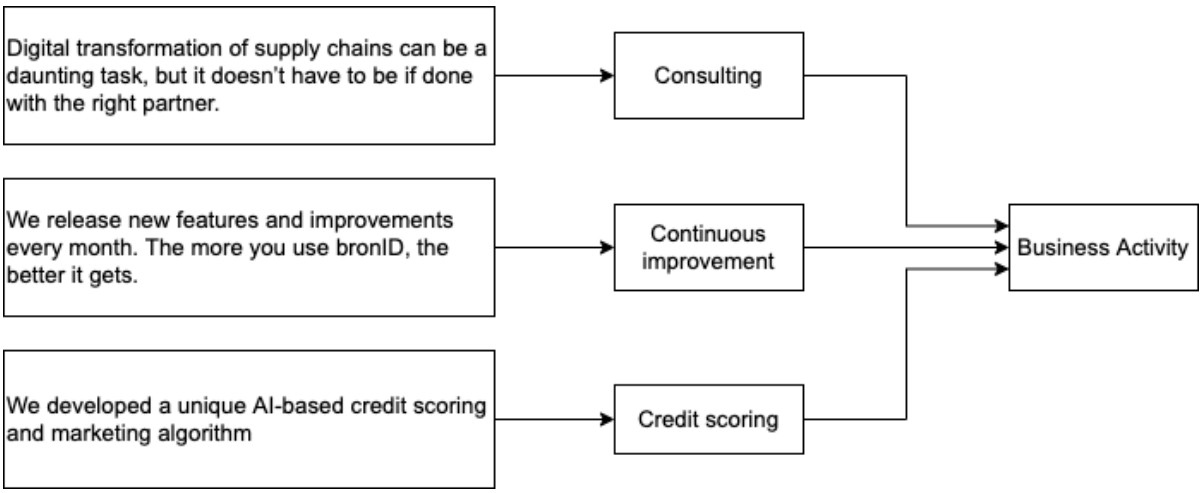

Figure 2. An example of the Gioia Methodology adopted for this study.

Findings of the empirical study

Following the methodology adopted for this study, the findings will be presented first in a holistic manner, after which the individual aggregate dimensions will be further explored in detail. As seen in Figure 3, the key aggregate dimensions identified were the following (in no particular order): Industry, Tokenization, Integrations, Solution Offering, Data Activity, Business Activity, and Infrastructure. The Product or Service Offering within the figure has been highlighted to indicate that it is not an aggregate dimension but rather that the solution offering, and integrations combined create the holistic offering provided by the businesses to their customers or users. In a similar vein, the product or service offering also connects to the business and data activity to indicate that the business and data activity combined created the product or service offering. The underlying light background is not an aggregate dimension but rather demarcates the areas or domains which are within the control of the organization and its corresponding business models.

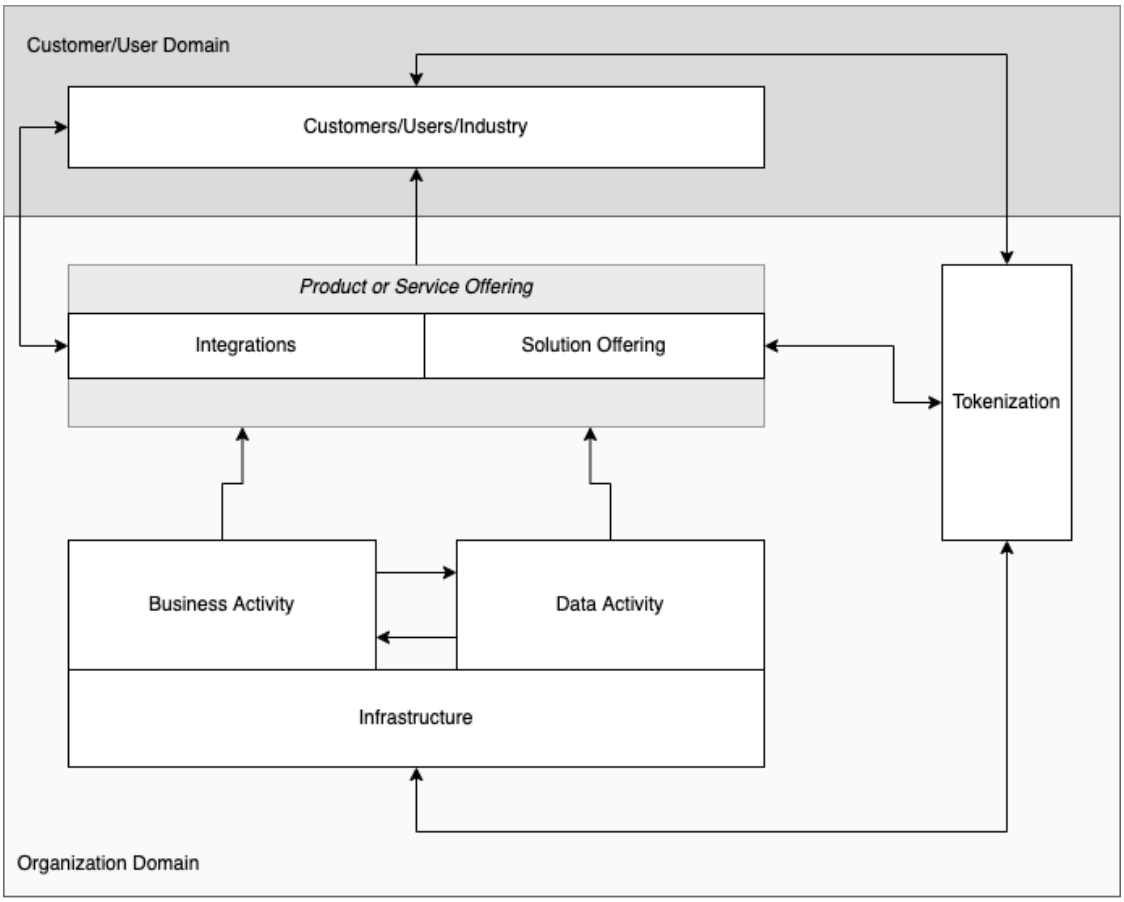

Figure 3. Overview of the key activities and functions within the BMs of the analyzed organizations.

Business activities. For this study, we classified business activities as any activities or actions identified through the initial codes or first order concepts that could be closely attributed to the value creation and value proposition notions proposed by Massa et al. (2017) and Gassmann et al. (2013). We noticed a number of business activities that were listed frequently amongst the analyzed 149 organizations. Such activities are presented, along with a short clarification, in Table 7. The clarifications provided aim to indicate whether these activities were 1) closely linked to a particular industry, 2) a direct product or service offering (for example, where cybersecurity was a business activity that was also directly offered by the organizations to their customers), or 3) process improvements, meaning that the business activity was something that enabled the organization's customers to improve their own existing business activities through increased efficiency or decreased costs.

Table 7. Key business activities of the investigated companies.

Business Activity	Explanation
Auditing	Closely linked with fin-tech organizations
Automation	Process improvements, usually industry agnostic
Compliance	Closely linked with fin-tech organizations
Consulting	Industry agnostic
Crypto intelligence	Closely linked with fin-tech organizations
Customer engagement	Closely linked with mar-tech organizations[4]
Customization	Process improvements, usually industry agnostic
Cybersecurity	Linked with the organization's product/service offering directly
Increased efficiency	Process improvements, usually industry agnostic
Increased speed	Process improvements, usually industry agnostic
Investment management	Closely linked with fin-tech organizations
Marketplace	Linked with the organization's product/service offering directly
Reducing risk	Closely linked with fin-tech organizations
Resource matching	Process improvements, usually industry agnostic
Simplify workflow	Process improvements, usually industry agnostic
Smart contracts	Linked with the organization's product/service offering directly
Supply chain visibility	Linked with the organization's product/service offering directly

[4] https://advertising.amazon.com/library/guides/what-is-martech

Data activities. To simplify and abstract the various data-oriented activities undertaken by the organizations analyzed, we classified these first order concepts into three so-called data activities: data creation, data engineering and management, and data storage. Table 8 illustrates the activity categories further.

Table 8. Data oriented activities of the analyzed companies.

Data Activity	Explanation
Data Creation	Air quality measurement
	Data collection, harvesting
Data Engineering & Management	AI models
	Computer vision
	Data anonymization
	Data encryption
	Digital credentials
	Digital ID
	Market data and insights
Data storage	Data/Crypto/Currency Wallet
	Distributed storage

As seen from the table, data creation consists of activities closely linked with the action of creating new data which can then be engineered or managed further. Examples of data creation activities identified from the organizations analyzed included industry specific measurements such as supply-chain oriented data creation (like location data) or particular data types like air quality.

Data engineering and management is where most of the data-oriented actions were classified into, and these pertained towards the use of analytics or AI methods to analyze or engineer the data, or other processes that were utilized to validate, encrypt, or authenticate various types of data. Other examples also included the comprehension of data, provided as a service by the analyzed organizations; the most prominent were in the financial technology (fintech) industry where several organizations provided visualizations, or indexes to better clarify the market positions and statuses.

Data storage within the focus of this study primarily included two types of storage related actions, 1) data wallets (including cryptocurrencies and digital tokens), and 2) decentralized, distributed storage systems primarily supported through the use of DLT or distributed data cloud systems. The former included digital wallets created by the analyzed organizations to help users store their digital assets and were primarily provided on an individual basis, while the latter included both individual users and business-to-business customers and entities. Within the data storage activity, we also included aspects that support it such as the data storage measures, or the more specific data storage standards created by the organizations themselves.

As the focus of this study is primarily on the business model implications, the data activities were abstracted to a high level without going further into the details of the types of methods utilized or constructed. Instead, we focused primarily on how the data and business activities combined provided the solution offering from these organizations to their respective customers.

Infrastructures. Infrastructure within the context of this study primarily relates to the various layers of infrastructure that support the types of business and data related activities the organizations are running or operating as part of their value propositions. More specifically, as our CrunchBase search was based on 'blockchain' as a keyword, most of the organizations analyzed had some level of infrastructure based upon blockchain. While most organizations had some blockchain implementation, there were slight differences between the levels or types of infrastructure implementations by these organizations; these could primarily be classified into 1) chain-related, 2) layer specific, or 3) trust protocols.

Chain-related implementations were primarily identified within organizations based on whether the organization's infrastructure layer was specific to a type of blockchain (e.g., Bitcoin), multi-chain (e.g., Bitcoin and Ethereum), or chain-agnostic (type of blockchain did not matter). Layer specific implementation, without going into the technical details, primarily focused upon what layer of the DLT the infrastructure implemented by the organizations may be operating or affecting. An example of this would be instances where organizations had implemented their own protocols or implementations directly on Layer 1 of the DLT to improve various privacy measures. The discussions on trust protocols related to the implementations made by the organizations on other aspects of the technological layers other than DLT specific ones. Lastly, we have also included hardware layer infrastructures as a few of the organizations analyzed had also created their own custom, specific hardware for running various business or data-oriented activities either for themselves or for their customers. Table 9 illustrates.

Table 9. Infrastructure layers and corresponding types.

	Specification	Type/Clarifications
Layer of Infrastructure	DLT	Blockchain infrastructure
		Bitcoin blockchain
		Layer 1 privacy blockchain
		Zero-trust implementation
		Multi-chain
		Middleware Layer
	Hardware	High-performance servers
	Application	Application Layer
	Protocol Level	Protocol
		Trust based
		Middleware layer

Industries. Industry in our findings refers to the types of industries served or supported by the analyzed organizations as part of their business models. Within the industries, there could also be the division of customers into business-to-business and business-to-consumer categories. Within the organizations analyzed, the various types of industries (apart from industry agnostic organizations) included aviation, fin-tech, games industry, energy markets, music industry, pharmaceutical and consumer goods, real-estate, reg-tech, education, consumer economy, sustainability-oriented industries (like plastic recycling and carbon capture), and animal husbandry or agricultural businesses. Unsurprisingly, the types of industries served by the organization also had a key link to the business and data-oriented activities of the organization.

Solution offering and integrations. Solution offering in our findings is the amalgamation of the various ways in which the analyzed organizations provided their offerings to their customers and users. These solution offerings were also closely linked to the integrations offered by the organizations. The solutions provided by the organizations could be primarily classified as being either all-in-one solutions, plug-and-play mechanisms, stand-alone solutions, feature offerings, or in some cases, even hardware solutions such as sensors, terminals, or devices.

Integrations refer to the ways in which the product and service offerings provided by the analyzed organizations could integrate with existing business processes or other products and services. Some examples of integrations include Application Programming Interfaces (APIs)[5], Software Development Kits (SDKs)[6], single-line code implementations, or integrations to existing services or platforms such as Amazon Web Services (AWS)[7], Twitch[8], or Microsoft Azure IoT[9]. Table 10 illustrates.

We found that for most of these organizations, it was through the combination of their solution offerings (e.g., all-in-one solution) and integrations (e.g., APIs) that the organizations made their product and service offerings to their customers and users. That is to say that as most of these organizations required their offerings to connect with their customer's existing business processes, subscriptions, or software solutions to truly provide the business activities we have previously identified (e.g., increased efficiency).

5 https://www.ibm.com/cloud/blog/sdk-vs-api

6 https://www.ibm.com/cloud/blog/sdk-vs-api

7 https://aws.amazon.com/

8 https://www.twitch.tv/

9 https://azure.microsoft.com/en-us/solutions/iot/

Table 10. Example of integrations and solution offerings provided by the organizations.

Type	Example	Product/Service Offering
Integration	Back-end	
Integration	SDK	
Integration	API	
Integration	Developer Tools	
Solution offering	End-to-end	
Solution offering	Plug-and-play	
Solution offering	Trading terminal	
Solution offering	Low code	

Pricing mechanisms. While some information on the pricing mechanisms utilized by the organizations was available on their webpages, it should be noted that most organizations did not include the exact details of their prices – especially if they did not belong to the first five mechanisms listed in Table 11 below. As such, the findings presented here are not necessarily representative of the overall 149 organizations but rather indicates only a few of the organizations whose pricing mechanisms could be uncovered through their webpage information.

Table 11. An overview of some of the pricing mechanisms utilized by the organizations.

Pricing Mechanisms	Commission based pricing
	Flexible pricing
	Subscription pricing
	Pay per seat
	Transactional fees
	Case-by-case basis

Commission based pricing represented the analyzed organizations receive a share percentage of the total sales or volume of sales undertaken by their customers. Flexible pricing referred to mechanisms where it was seen that customers had options for pricing usually determined by individual, small team, or enterprise level solutions. In a similar vein, subscription pricing corresponded either to the cost per subscription to the service per user, or then if the orders were large enough – to an organizational or enterprise level.

Transactional fees were particularly eminent in businesses whose activities closely resembled those of marketplaces whereby the analyzed organization would take a proportional cut out of every transaction handled by them for a customer. Case-by-case basis was by far the most common mechanism whereby potential customers were asked to request a demonstration of the product or service offering or request a quote from the organization itself for the service requested by the customer.

Tokenization. When referring to tokenization[10], the findings indicated that tokenization was utilized primarily to support, run, and govern the activities of the organization, and its surrounding community of users, customers, and suppliers (in the case of decentralized structures). For example, many DLT supported organizations created tokens as a form of 1) rewarding the decentralized nodes supporting the infrastructure upon which the organization's activities were created, 2) as a method of payment, like a currency, for customers to utilize, and 3) as a method for governance whereby users who had staked[11] tokens could receive the benefits of voting or power in terms of governing the actions of the organizations. Table 12 summarizes.

Table 12. Overview of the various forms of tokenization in place at the organizations.

Form of Tokenization	Stake Tokenization
	Tokenization as a form of currency
	Tokenization of "physical" assets
	Utilization Token
	Decentralized governance
	Rewards Program
	Confidential token
	Crypto currency
	Currency tokenization
	Governance Tokenization

10 "A token is an object that represents something else, such as another object (either physical or virtual). A token is the digital representation of an asset based on DLT. It can be transferred between two parties without the need for a central intermediary." (https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/technology/lu-token-assets-securities-tomorrow.pdf)

11 "Staking is a way of earning rewards for holding certain cryptocurrencies is the key takeaway." (https://www.coinbase.com/learn/crypto-basics/what-is-staking)

The act of tokenization as a form of rewarding was a recurring pattern amongst almost all of the organizations who utilized decentralized infrastructures either in the form of DLT or distributed databases or distributed data storage systems. Here, individuals (or organizations) that provided the infrastructure to support the systems on top of which the organizations have built their key business or data-oriented activities were rewarded with tokens. A common example was where nodes that assisted these organizations with storing their customer's data in a distributed manner would be rewarded with tokens that could be utilized within the ecosystem or converted into other forms of currencies or rewards. Another common example was with smart contract systems whereby to store the transaction details onto the DLT, a network of nodes had to mine the transactions onto the ledger, and would, as a result, receive compensation in the form of a cryptographic token.

Tokenization as a method of payment, as the name would suggest, was the process whereby these organizations had created their own hyper-local token-based currencies that customers of these organizations had to purchase or invest into to make use of the product or service offerings provided by the analyzed organizations. Oftentimes to make these payments, the customers would have to exchange their other assets (either fiat currencies[12] or digital assets like cryptocurrencies) into these aforementioned tokens.

Tokenization as a method for governance was seen in organizations where these tokens provide users or holders of these tokens with voting and other decision-making powers over the DLT system that supports the organizations. The purpose of these governance tokens is to decentralize the decision-making systems that govern the role and functions of these organizations. However, while the overall goals of these governance tokens remain the same, the manners in which these tokens operate and what governance powers they convey vary from organization to organization or from token to token as well. That means that different governance tokens may have different rules and utilization methods.

Within the organizations analyzed, there were also a couple of organizations whose primary objective was simply to create tokens as a form of currency, usually as a stable or confidential currency, to provide users with an alternative payment method.

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[12] "Fiat money, in a broad sense, all kinds of money that are made legal tender by a government decree or fiat. The term is, however, usually reserved for legal-tender paper money or coins that have face values far exceeding their commodity values and are not redeemable in gold or silver." (https://www.britannica.com/topic/fiat-money)

Some organizations also provided tokenization as a service whereby the act of tokenization referred to the act of converting a regular asset (fiat currencies, or other similar assets) into digital assets in the form of cryptocurrencies, NFTs[13], or other forms of tokens. These would then allow their customers to operate using these digital assets on web3 and DLT oriented ecosystems. One organization also provided tokenization as an internal tool for their customers whereby customers of said organization could create tokens for use within their own workforce, often with similar benefits as the other tokenization methods listed but on the intra-organizational level.

Synthesis of the empirical findings: Business model patterns in the data-oriented web3 field

Patterns that build on extant research. Our study found 21 distinct business model patterns, summarized in Table 13.

Table 13: Business model patterns of data-related web3 firms

Name of the pattern	*Description*	Builds on Gassmann et al. (2013)	Builds on other literature reviewed in our synthesis	New Pattern
Currency Tokenization	"create tokens as a form of currency, usually as a stable or confidential currency, to provide users with an alternative payment method"			x
Customization	Offering customization possibilities within the product/service offering	x		

13 ”NFTs are tokens that we can use to represent ownership of unique items. They let us tokenize things like art, collectibles, even real estate. Ownership of an asset is secured by the blockchain – no one can modify the record of ownership or copy/paste a new NFT into existence.” (https://ethereum.org/en/nft/)

Data authentication	The process of verifying the data source, asset, or identity		x
Data intelligence	Provision of additional services such as analytics for customer's data	x	
Data standardization	Standardization of the customer's data into specific formats or structures	x	
Data validation	Process of validating customer's data with additional information such as real-time location, temperature, or similar		x
Decentralized Data Creation	"Data Creation consists of activities closely linked with the action of creating new data which can then be engineered or managed further"	x	
Decentralized Data Exchange(s)	Enabling the sharing of data between two individuals (entities) through a decentralized network of nodes	x	
Decentralized Data Storage	"Decentralized, distributed storage systems primarily supported through the use of DLT or distributed nodes"	x	
Decentralized Governance	"Decentralize the decision-making systems that govern the role and functions of these organizations"		x
Digital Identity	Creation of a digital identity, either as a digital manifestation of a physical asset, or entirely new digital assets.	x	
End-to-end	Provision of an 'all-in-one' solution that takes care of the entire value chain for the customers	x	

Infrastructural multi-homing	"differences between the levels or types of infrastructure implementations that could primarily be classified into chain-related, layer specific, or trust protocols”			x
Integration	Enabling the integration of business' product/service offering with customer's existing processes and systems	x		
Marketplace	Facilitating the buying and selling of products/services between two separate groups of customers	x		
Profit sharing communities	Sharing of revenues (profits) between a distributed network of individuals or entities	x		
Reward Tokenization	"individuals (or organizations) that provided the infrastructure to support the systems key business or data-oriented activities are rewarded with tokens"			x
Subscription	"subscription pricing corresponded either to the cost per subscription to the service per user"	x		
Utility Tokenization	Process whereby these organizations created their own tokens that customers purchase or invest into to make use of the business' offerings			x
Zero trust	Business model is based on a zero-trust policy between all players resulting in a high level of encryption and data security			x

The patterns identified through our findings connected on various levels to the different business model patterns by various scholars like Gassmann et al. (2013), Weber et al. (2022), and Curtis (2021). The business model patterns in our findings pertaining to *data authentication* and *data validation* connected closely to the patterns labeled as *"Data Analytics Provider"* by Weber et al. (2022, p.100). Data analytics providers were defined as providing "solutions that integrate and analyze various data sources for decision support" (Weber, 2022, p.100); our business model patterns of data authentication and validation also revolved around the process of working with data to create additional value for customers. In our case, data authentication focused primarily on the process of 1) verifying the data sources, which was primarily related to supply chain visibility issues and 2) verification of digital identities like digital ID and other digital credential formats.

Then, our identified business pattern *decentralized governance* has strong overlaps with Curtis' (2021) pattern *"Community governance"* which itself related to the stronger and larger "*user involvement in the daily operations and strategic decisions of the platform*" (p.1660). In a similar vein, our pattern of decentralized governance looked at how these web3 and blockchain oriented organizations had found ways to decentralize the decision-making powers within these organization to an individual level. The differentiating factor between these two patterns perhaps is the role that DLT and tokenization plays in our case to enable the decentralization.

The largest number of connections for our identified patterns were seen with the work of Gassmann et al. (2013) where our patterns were seen to closely link with the following: *mass-customization, subscription, revenue sharing, peer-to-peer, leveraging customer data, crowd sourcing, two-sided marketplace, integrator, and digitalization* (Gassmann et al., 2013).

The idea of revenue sharing closely links to our findings on *profit sharing communities*, albeit the slight difference between the two patterns may be the role of DLT and tokenization in facilitating these activities in the web3 domain. In both cases, the main principles behind revenue sharing were extending the value creation and creating "symbiotic effects" within the value chains (Gassmann et al., 2013, p.10). In addition, within the web3 domain, profit sharing is also intended to incentivize node operators and individuals to support the infrastructure, like the distributed data storage, that enables the key business activities of these organizations.

The Gassmann et al. (2013) patterns of mass-customization, two-sided marketplace, and integrator link to our findings presented in *integration* and *solution offering,* in the sense that customization and marketplaces were seen as common methods for product and service offering in the web3 domain, and integration within our context focused on the idea of the organization ability to enable integration of its offerings with the customers' existing processes, functions, or systems.

Decentralized data creation matched with the Gassmann et al. (2013) pattern of crowdsourcing. While Gassmann et al. viewed crowdsourcing as "The solution of a task or problem is adopted by an anonymous crowd, typically via the Internet" (2013, p.6), decentralized data creation focuses on the idea of potential individuals and nodes serving as the creators or extractors of data, for example through running various IoT sensors or sharing location data via their smartphones.

Subscription, one of the patterns identified within our findings, refers to one of the various pricing mechanisms utilized by the organizations; our definition fully aligns with Gassmann et al.'s interpretation of subscription as the "the customer pays a regular fee, typically on a monthly or an annual basis, in order to gain access to a product or service" (2013, p.11). Deriving from this definition, our findings identified that subscription pricing mechanisms for these web3 organizations typically corresponded to the cost per subscription on a user level, but also scale all the way up to an organizational or enterprise level subscription.

Gassmann et al.'s (2013) business model pattern digitalization, perhaps unsurprisingly, associates with our patterns of *digital identity, data intelligence, and standardization*. Defined as the "the ability to turn existing products or services into digital variants" (Gassmann et al., 2013, p.6), digitalization in our context relates to the creation digital identities, either as a representation of existing assets or the creation of entirely new ones, and to the provision of additional services that derive from various forms of data or digital assets.

New patterns. We also identified the emergence of new business model patterns prevalent in the web3 blockchain economies. These business model patterns include *1) Zero trust, 2) Utility tokenization, 3) Infrastructure multi-homing, 4) Reward tokenization, and 5) Currency tokenization*.

Zero-trust business model patterns focus on the creation of systems where none of the actors within the value chain trust each other as a default. To facilitate this, these businesses often incorporate a high level of privacy and security, often with additional encryption infrastructural layers.

Utility tokenization focuses on the creation of tokens that enable customers to utilize the business' offerings. An example of this would be an organization creating tokens that their customers can spend to make use of the blockchain services offered by the organization.

The business model pattern, infrastructural multi-homing, refers to the business making changes at, or in between, different layers of the infrastructure. An example of this within the web3 economy would be the business incorporating its own additional protocols and infrastructural developments directly on top of an existing blockchain. Moreover, this can also refer to the business creating its offerings in a manner that allows it to operate in a single-chain, multi-chain, or chain agnostic manner entirely as well.

Reward tokenization involves the business creating rewards in the form of tokens for users, individuals, or entities that support the infrastructure that in turn supports the business' key offerings. Within the web3 economy, this was particularly prevalent with businesses creating tokens, often in the form of cryptocurrencies, and offering these tokens as a reward for the various nodes that support the blockchain infrastructure, or in other cases support a decentralized data storage system.

The business model pattern on currency tokenization involves the business creating tokens, usually in the form of cryptocurrencies, with the sole purpose of having these tokens serve as tools that serve accounting and trading purposes. These tokens are then often exchanged on decentralized exchanges where users can trade for or with these tokens for other cryptocurrencies, digital assets, or even fiat currencies in certain cases.

Identifying and summarizing anti-rival business model patterns

Assessing the pattern compatibility with anti-rivalry

The final stage in our study involved identifying–among the business model patterns identified in both the literature synthesis (Figure 1) and the empirical study (Table 13)–the patterns which are aligned with anti-rival thinking. Herein, we composed a complete list of all identified patterns and categorized them into four groups according to the following criteria.

First, we recognized patterns that are anti-rival compatible, meaning that they i) do not enforce resource scarcity, ii) do not follow exchange logic (vs. sharing logic), and iii) try to maximize resource usage (in relation to the objective of the usage context) through sharing. Second, we identified patters that had an enabling role; such patterns were seen to play a significant role in transforming a business model to have anti-rival characteristics if certain conditions were met, such as: i) no artificial scarcity was created, ii) reward schemes among contributors were designed to maximize sharing and resource usage, iii) costs of sharing and resource usage could be kept minimal, and iv) system's regenerative characteristics (resource renewal) were kept net positive.

Then, we listed such patterns that could possibly be used in anti-rival systems but required special attention in their use to prevent the resulting business model from diverting to rival logic. This means that the patterns indeed had some anti-rival potential, but their traditional use has hitherto been popular in only rival and exchange-based systems. Therefore, special considerations are needed with such patterns' application, namely in regard to: value creation models, revenue models, resource usage, solution delivery, technology availability, connection to physical assets, resource access terms, and the interplay with other business model patterns.

Finally, we identified patterns that could not be used in anti-rival systems due to their inherent connection to asset scarcity and exchange-based relationships. Here we maintain that our perception of a pattern being not compatible with anti-rivalry is not a value-aspired statement (how things should be), but rather a specific characteristic important with regards to purpose of this study.

The results of our analysis are discussed in the following section with illustrative tables 14 and 15, and visualized in figures 4 and 5. The titles and descriptions in the visualized patterns have been stylized to increase generalizability.

Business model patterns aligned with anti-rivalry

Among all the identified business model patterns – both those reported in the literature and those recognized by our empirical work – we found 11 patterns that have anti-rival thinking directly embedded into them. These patterns originated unsurprisingly predominantly from the open data (Zeleti, 2016) and sustainability contexts (Lüdeke-Freund et al., 2018), and from the initial Gassmann et al. (2013) patterns. It was noteworthy none of the patterns were from sharing business contexts (Curtis, 2021). Table 14 summarizes the results.

The pattern of *cost avoidance* minimizes the costs of producing or delivering the goods. It supports anti-rivalry if the generated value of sharing the anti-rival goods offset the minimized costs. In *flat rate* businesses*,* a single fixed fee is charged for good without connection to its usage, allowing limitless sharing of the good as one fixed price covers all use.

In contrast, *sponsorship* and *free as branded advertising* patterns build on offering free goods to users while costs are covered by sponsors who receive benefits in return for increased good use. In a similar fashion, *hidden revenue* also abandons the logic that the user is responsible for the business's income: revenue comes from a third party, covering the goods' production and delivery costs.

In the pattern *increased quality through participation*, the quality of the goods increases with increased participation, and therefore, the use of the good is perceived as net positive to the extent that the vendor does not want to limit the usage. On a more general level, the patterns of *open business model* and *open source* refer to business models with extensive collaboration among the ecosystem partners. The patterns do not limit the number of value creators or value appropriators (although there might be some restrictions based on the used licensing scheme). Increased value is perceived as an asset through intensified contribution to and use of the good.

Somewhat connected to the previous, in the *experience broker* pattern, context-specific know-how is accumulated and used as a resource for social purposes. The allocative efficiency of knowledge goods is enhanced through sharing them with the ones who need them.

In *make-more-of-it*, in turn, an actor produces resources not just for one's own use but offers them to other actors. Thus, slack resources potentially gain new affordances. Here, increased generativity evades zero-sum logic if pattern usage does not employ artificial scarcity.

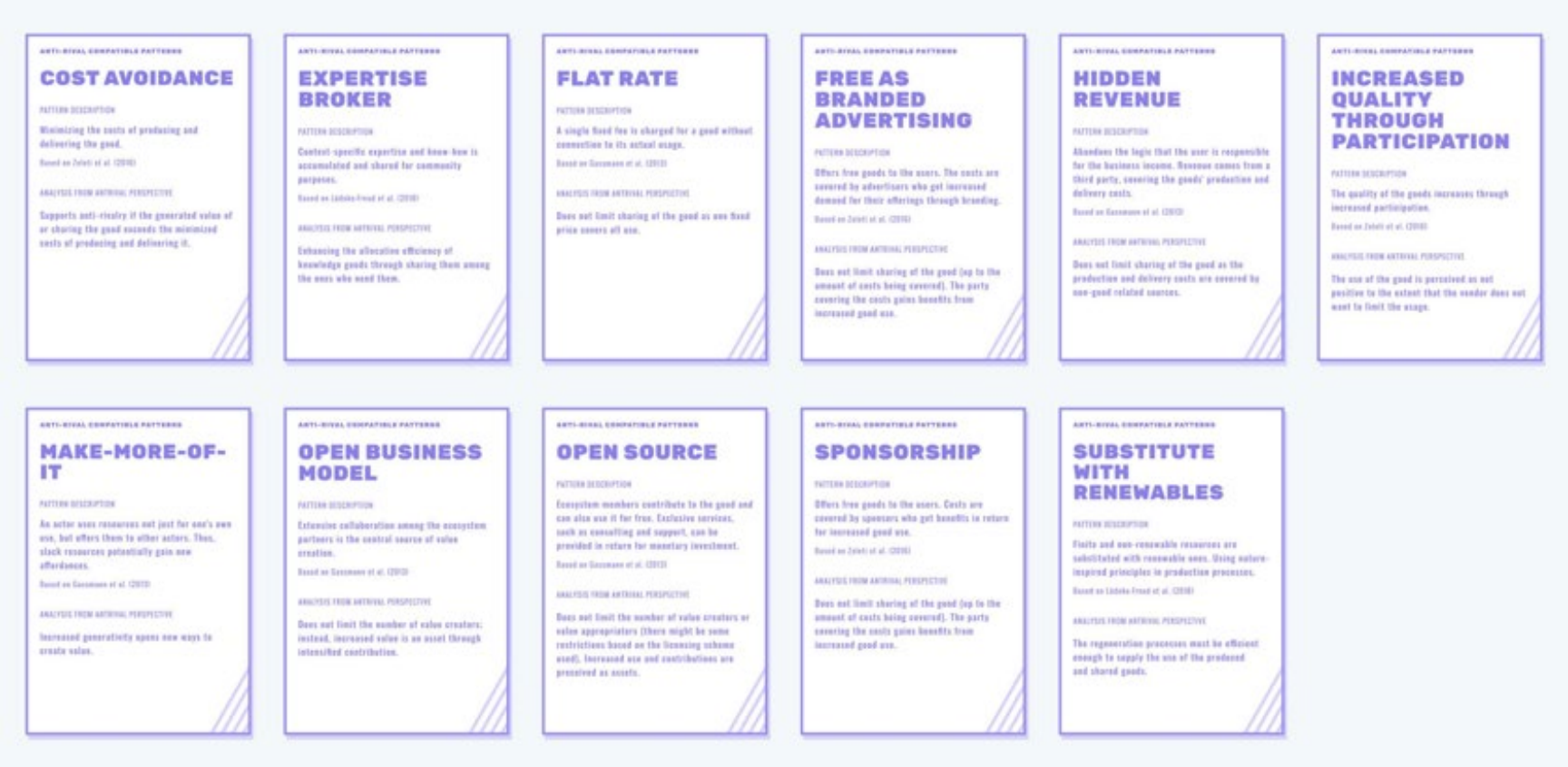
Finally, the pattern *substitute with renewables and natural processes* involves substituting finite and non-renewable resources with renewable ones and using nature-inspired (regenerative) principles in production processes. Here, one must ensure that the regeneration processes are efficient enough to supply the usage of the produced and shared goods.

Table 14: Anti-rival compatible patterns

Pattern name	Description	Analysis from anti-rival perspective
Cost avoidance	Minimizing the costs of producing and delivering the good (Zeleti et al., 2016).	Supports anti-rivalry if the generated value of or sharing the good exceeds the minimized costs of producing and delivering it.
Flat rate	A single fixed fee is charged for good without connection to its usage (Gassmann et al., 2013).	Does not limit sharing of the good as one fixed price covers all use.
Sponsorship	Offers free goods to the users. Costs are covered by sponsors who get benefits in return for increased good use (Zeleti et al., 2016).	Does not limit sharing of the good (up to the amount of costs being covered). The party covering the costs gains benefits from increased good use.
Free as branded advertising	Offers free goods to the users. Costs are covered by advertisers who get increased demand for their offerings through branding (Zeleti et al., 2016).	Does not limit sharing of the good (up to the amount of costs being covered). The party covering the costs gains benefits from increased good use.
Hidden revenue	Abandons the logic that the user is responsible for the business income. Revenue comes from a third party, covering the goods' production and delivery costs (Gassmann et al., 2013).	Does not limit sharing of the good as the production and delivery costs are covered by non-good related sources.
Increased quality through participation	The quality of the goods increases through increased participation (Zeleti et al., 2016).	The use of the good is perceived as net positive to the extent that the vendor does not want to limit the usage.
Open business model	Extensive collaboration among the ecosystem partners is the central source of value creation (Gassmann et al., 2013).	Does not limit the number of value creators; instead, increased value is an asset through intensified contribution.
Open source	Ecosystem members contribute to the good and can also use it for free. Exclusive services, such as consulting and support, can be provided in return for monetary investment (Gassmann et al., 2013).	Does not limit the number of value creators or value appropriators (there might be some restrictions based on the licensing scheme used). Increased use and contributions are preceived as assets.

Experience broker	Context-specific know-how is accumulated and used as a resource for social purposes (Lüdeke-Freund et al., 2018).	Enhancing the allocative efficiency of knowledge goods through sharing them with the ones who need them.
Make-more-of-it	An actor uses resources not just for one's own use but offers them to other actors. Thus, slack resources potentially gain new affordances (Gassmann et al., 2013).	Increased generativity evades zero-sum logic if pattern usage does not employ artificial scarcity.
Substitute with renewables and natural processes	Finite and non-renewable resources are substituted with renewable ones. Using nature-inspired principles in production processes. (Lüdeke-Freund et al., 2018).	The regeneration processes must be efficient enough to supply the use of the produced and shared goods.

Figure 4: Anti-rival compatible patterns visualized



Business model patterns enabling anti-rivalry

We also identified nine patterns that do not directly enforce, but merely enable anti-rival business models (summarized in Table 15). With *digitalization,* existing goods are turned into digital variants, offering benefits (e.g., efficiency, duplicability) that do not reduce the perceived customer value. By offering the potential for zero-marginal costs, digitalization enables anti-rivalry if no artificial scarcity is created in the process.

Leveraging digitalized infrastructures, *crowdsourcing* enables the usage of ecosystem members on a large scale to perform a task or solve a problem. Distributing the efforts to a large community has the potential to keep the marginal costs minimal and thereby support anti-rivalry. In a similar vein, in *peer-to-peer,* cooperation is mediated between individuals belonging to a group that aims for the same purpose. This makes decentralized collaboration efficient, facilitating the creation of positive externalities. Continuing in the domain of communities, *community governance* involves users in daily operations and strategic decisions related to goods production and delivery. Collaborative decision-making makes it possible to customize the anti-rival system features to local needs. Furthermore, *fractional ownership* enables collective stewardship of an asset among a group of stakeholders, and in the *sharing business* pattern, a good is shared among the users based on the usage needs (the pattern supports anti-rivalry if no artificial scarcity is created in the implementation).

Our own empirical research on data-oriented web3 BMPs found two patterns that enable anti-rival thinking: *reward tokenization,* and *zero-trust*. In the former, the contributors who support the business model actions or infrastructure are rewarded with tokens. Reward tokenization has the possibility to support anti-rivalry through a system that enables better resource matching and asset sharing amongst the various nodes and individuals; however, to make such reward systems anti-rival compatible, one needs to design the tokens to be non-rival, at least. Zero-trust, in turn, enables sharing systems based on social networks (usually based on trust) to operate on a large scale, in which one cannot count on the trust based on personal relationships.

Table 15: Patterns enabling anti-rivalry

Pattern name	Description	Notes from anti-rival perspective
Digitalization	Existing goods are turned into digital variants, offering benefits (e.g., efficiency, duplicability) that do not reduce the perceived customer value (Gassmann et al., 2013).	By offering the potential for zero-marginal costs, digitalization enables anti-rivalry if no artificial scarcity is created in the process.
Crowdsourcing	Ecosystem members are used on a large scale to perform a task or solve a problem. A small reward is offered to the contributors (Gassmann et al., 2013).	Distributing the efforts to a large community with the potential to keep the marginal costs minimal. Anti-rival potential depends on the reward scheme and community size.
Peer-to-peer	Mediating cooperation between individuals belonging to a group that aims for the same purpose (Gassmann et al., 2014).	Makes decentralized collaboration efficient, facilitating the creation of positive externalities.
Review system	Feedback gathering and analysis about the quality of the goods or the related social interactions (Curtis, 2021).	The curation mechanism makes it possible to better organize community collaboration, and the capturing of positive externalities.
Community governance	Users are involved in daily operations and strategic decisions related to goods production and delivery (Curtis, 2021).	Collaborative decision-making makes it possible to customize the anti-rival system features to local needs.
Sharing Business	A good is shared among the users based on the usage needs (Lüdeke-Freund et al., 2018).	The pattern supports anti-rivalry if no artificial scarcity is created in the implementation.
Fractional ownership	Collective stewardship of an asset among a group of stakeholders.	Collective action should be used to facilitate resource sharing.
Reward tokenization	Individuals (or organizations) that provide the key contributions are rewarded with tokens. (identified in our empirical study)	Tokens must be sharable and not impose rival logic.
Zero-trust	Creation of systems where none of the actors within the value chain must trust each other as a default. (identified in our empirical study)	-

Figure 5: Anti-rival enabling patterns visualized

Conclusion

Through an integrative literature review and an empirical study, this research reported a subset of business model patterns compatible with anti-rival thinking. Such patterns refrain from building value creation and capturing logic on resource rivalry. In addition, the research recognized business model patterns that can convert a business model to better support anti-rival thinking, that is, patterns that enable anti-rival business models. The results both contribute to the theoretical discourse on business model innovation and also offer help for practitioners' business model design processes.

References

Abdelkafi, N., Makhotin, S., & Posselt, T. (2013). Business model innovations for electric mobility—what can be learned from existing business model patterns?. *International Journal of Innovation Management, 17*(01), 1340003.

Abdelkafi, N., Hilbig, R., & Laudien, S. M. (2018). Business models of entrepreneurial universities in the area of vocational education–an exploratory analysis. *International Journal of Technology Management, 77*(1-3), 86-108.

Alexander, C, S Ishikawa, M Silverstein, M Jacobson, I Fiksdahl-King and S Angel (1977). A Pattern Language. New York, NY: Oxford University Press.

Amit, R., & Zott, C. (2010). Business model innovation: Creating value in times of change.

Amit, R., & Zott, C. (2012). Creating value through business model innovation. *2012, 53*.

Amshoff, B., Dülme, C., Echterfeld, J., & Gausemeier, J. (2015). Business model patterns for disruptive technologies. *International Journal of Innovation Management, 19*(03), 1540002.

Bocken, N. M., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of cleaner production, 65*, 42-56.

Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & leadership*.

Cloutier, R., & Verma, D. (2006). Applying pattern concepts to systems (enterprise) architecture. *Journal of Enterprise Architecture, 2*(2), 34-50.

Curtis, S. K. (2021). Business model patterns in the sharing economy. *Sustainable Production and Consumption, 27*, 1650-1671.

Curtis, S. K., & Mont, O. (2020). Sharing economy business models for sustainability. *Journal of Cleaner Production, 266*, 121519.

D'Amato, D., Veijonaho, S., & Toppinen, A. (2020). Towards sustainability? Forest-based circular bioeconomy business models in Finnish SMEs. *Forest policy and economics, 110*, 101848.

Facchinetti, E., & Sulzer, S. (2016). General business model patterns for local energy management concepts. *Frontiers in Energy Research, 4*, 7.

Foss, N. J., & Saebi, T. (2017). Fifteen years of research on business model innovation: How far have we come, and where should we go?. *Journal of management, 43*(1), 200-227.

Gassmann, O., Frankenberger, K., & Csik, M. (2013). The St. Gallen business model navigator.

Gassmann, O., Frankenberger, K., & Csik, M. (2014). *The business model navigator: 55 models that will revolutionise your business*. Pearson UK.

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods, 16*(1), 15-31.

Günzel, F., & Holm, A. B. (2013). One size does not fit all—understanding the front-end and back-end of business model innovation. *International journal of innovation management, 17*(01), 1340002.

Lüdeke-Freund, F., Carroux, S., Joyce, A., Massa, L., & Breuer, H. (2018). The sustainable business model pattern taxonomy—45 patterns to support sustainability-oriented business model innovation. *Sustainable Production and Consumption, 15*, 145-162.

Magretta, J. (2002). Why business models matter.

Massa, L., Tucci, C. L., & Afuah, A. (2017). A critical assessment of business model research. *Academy of Management Annals, 11*(1), 73-104.

Mikusz, M., & Csiszar, A. (2015). CPS Platform Approach to Industrial Robots: State of the Practice, Potentials, Future Research Directions.

Osterwalder, A. (2004). *The business model ontology a proposition in a design science approach* (Doctoral dissertation, Université de Lausanne, Faculté des hautes études commerciales).

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers* (Vol. 1). John Wiley & Sons.

Ostrom, E. (2005). *Understanding Institutional Diversity*. Princeton University Press

Pieroni, M. P., McAloone, T. C., & Pigosso, D. C. (2020). From theory to practice: systematising and testing business model archetypes for circular economy. *Resources, conservation and recycling, 162*, 105029.

Remane, G., Hanelt, A., Tesch, J. F., & Kolbe, L. M. (2017). The business model pattern database—a tool for systematic business model innovation. *International Journal of Innovation Management, 21*(01), 1750004.

Schneider, S., & Spieth, P. (2013). Business model innovation: Towards an integrated future research agenda. *International Journal of Innovation Management, 17*(01), 1340001.

Stubbs, W., & Cocklin, C. (2008). Conceptualizing a "sustainability business model". *Organization & environment, 21*(2), 103-127.

Taran, Y., Nielsen, C., Montemari, M., Thomsen, P., & Paolone, F. (2016). Business model configurations: a five-V framework to map out potential innovation routes. *European Journal of Innovation Management*.

Teece, D. J. (2010). Business models, business strategy and innovation. *Long range planning, 43*(2-3), 172-194.

Weber, S. (2004). *The success of Open Source*. Harvard University Press.

Weber, M., Beutter, M., Weking, J., Böhm, M., & Krcmar, H. (2022). AI Startup Business Models. *Business & Information Systems Engineering, 64*(1), 91-109.

Weinberger, M., Bilgeri, D., & Fleisch, E. (2016). IoT business models in an industrial context. *at-Automatisierungstechnik, 64*(9), 699-706.

Weking, J., Böttcher, T., Hermes, S., & Hein, A. (2019). Does business model matter for startup success? A quantitative analysis. In *27th European Conference on Information Systems*.

Weking, J., Hein, A., Böhm, M., & Krcmar, H. (2020a). A hierarchical taxonomy of business model patterns. *Electronic Markets, 30*(3), 447-468.

Weking, J., Stöcker, M., Kowalkiewicz, M., Böhm, M., & Krcmar, H. (2020b). Leveraging industry 4.0–A business model pattern framework. *International Journal of Production Economics, 225*, 107588.

Wirtz, B. W., Pistoia, A., Ullrich, S., & Göttel, V. (2016). Business models: Origin, development and future research perspectives. *Long range planning, 49*(1), 36-54.

Zeleti, F. A., Ojo, A., & Curry, E. (2016). Exploring the economic value of open government data. *Government Information Quarterly, 33*(3), 535-551.

Zott, C., & Amit, R. (2007). Business model design and the performance of entrepreneurial firms. *Organization science, 18*(2), 181-199.

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long range planning, 43*(2-3), 216-226.

Appendix 1

Table A1. Companies analyzed in the empirical study

Name of Organization	Organization's Website
4-Soft	https://4-soft.com
Acronis	http://www.acronis.com/
AdHash	https://adhash.com
AID:Tech	https://aid.technology/
Amberdata	http://www.amberdata.io
AnChain.ai	https://www.AnChain.ai
Applied Blockchain	https://appliedblockchain.com/
AppsCo	http://www.appsco.com
Arweave	https://www.arweave.org/
Augmate	http://www.augmate.io
Axoni	https://axoni.com
Band Protocol	https://bandprotocol.com/
BCdiploma	https://www.bcdiploma.com
BEAM	https://beam.mw
Billon Group	http://www.billongroup.com
Binance	https://www.binance.com
Bitfold	https://www.bitfold.com
Bitfury Group	http://www.bitfury.com
Bitmark	https://bitmark.com
Blinking	https://blinking.id/
Block Aero Technologies Holdings Limited	http://www.block.aero
Blockchain Foundry Inc.	https://blockchainfoundry.com
Blockfolio	http://www.blockfolio.com/
Blocknative	https://www.blocknative.com
Blocksize Capital	https://www.blocksize-capital.com
BloXroute Labs	https://bloxroute.com
Bluzelle	http://bluzelle.com/
BRICKBRO	https://www.brickbro.com/
bron.tech	https://bron.tech
Cambridge Blockchain	http://www.cambridge-blockchain.com/
Candex	https://www.candex.com

Cardano Foundation	https://cardanofoundation.org
Carnes Validadas	https://carnesvalidadas.com
CERE Network	https://www.cere.network
ChekkitApp	https://chekkitapp.com/
CipherTrace	https://ciphertrace.com/
CloudCover	https://cloudcover.cc
Coin Metrics	https://coinmetrics.io
Coinfirm	http://www.coinfirm.com
Concordium	https://www.concordium.com
Core State Holdings Corp	https://corestateholdings.com/
Covalent	https://www.covalenthq.com/
Credmark	http://credmark.com/
CrowdForce	https://crowdforce.io/
Crypto Asset Rating Inc	https://www.cryptoassetrating.com/
DappRadar	https://dappradar.com/
Data Gumbo	https://www.datagumbo.com
DefenseArk	https://www.defenseark.com
Device Authority	https://www.deviceauthority.com
Devvio	https://devv.io/
Dock	https://dock.io
DOVU	https://dovu.earth
Dune Analytics	https://www.duneanalytics.com/
Dusk Network	https://dusk.network/
Ecotrace	http://ecotrace.info/
Edge	https://edge.app/
Electron	http://www.electron.net
Empower	https://www.empower.eco/
Encrypgen	https://www.encrypgen.com/
Enjin	https://enjin.io
Ethereum Foundation	https://www.ethereum.org/
Everipedia	https://everipedia.org/
Everledger	http://everledger.io
Evernym	http://evernym.com/
Fanprime	https://fanprime.io
Fetch.AI	https://fetch.ai/
Finboot	http://finboot.com
Flare Network	https://flare.xyz/

Flipside Crypto	https://flipsidecrypto.com/
Fluree	http://flur.ee
Gem	http://gem.co
GeoDB	https://geodb.com/
GlobaliD	https://www.global.id
Gospel Technology	http://gospel.tech
Hanhaa	https://www.hanhaa.com/
Harena Data	http://harenadata.net/
HashCash Consultants	https://www.hashcashconsultants.com
Home Lending Pal	https://www.homelendingpal.com
HOPR	https://hoprnet.org
Hoptroff	https://www.hoptroff.com/
iComply Investor Services Inc.	http://www.icomplyis.com
INHUBBER	https://inhubber.com/
Intalio	https://www.intalio.com/
Internxt	https://internxt.com/
Junar	http://www.junar.com
Kaiko	http://www.kaiko.com
Keep	https://keep.network/
KeyChain Pay	https://www.keychainpay.com
Linius Technologies	http://www.linius.com
Liven	https://www.liven.love/
Lucata Corporation	http://www.Lucata.com/
LuxTag	https://luxtag.io/
MakerDAO	https://makerdao.com/
Meeco	https://meeco.me/
Messari	https://messari.io
modum	https://www.modum.io
Moeco	https://moeco.io
MVL Chain	https://mvlchain.io/
N-Frnds (nFrnds)	http://www.nfrnds.com/
N3TWORK	http://www.n3twork.com
Nansen	https://nansen.ai
NATIX	https://natix.io/en
NetObjex	http://www.netobjex.com
Numbers Protocol	https://numbersprotocol.io
NXM LABS INC.	https://www.nxmlabs.com

Nym Technologies	https://nymtech.net/
Oasis Labs	https://www.oasislabs.com
ObEN	https://oben.me/
Ocean Protocol	https://oceanprotocol.com
OpenRisk Technologies Inc.	https://openrisk.io
OS City	https://os.city/
Particular Audience	https://www.particularaudience.com
peaq	https://www.peaq.io
PeerNova	http://peernova.com/
Pinata	https://pinata.cloud
PlanetWatch	https://www.planetwatch.io
Pocket Network	https://pokt.network/
Privacy Tools	https://privacytools.com.br/
QEDIT	https://qed-it.com
Quadrant.io	https://www.quadrant.io
Reengen	http://www.reengen.com/
Revelator	http://revelator.com/
Sensefinity	https://www.sensefinity.com
Sentient.io	https://sentient.io/
Sepior	https://sepior.com/
SettleMint	https://settlemint.com/
ShapeShift	https://shapeshift.com
Shyft	https://www.shyft.network/
SingularityNET	https://singularitynet.io/
Solidus Labs	http://www.soliduslabs.com
Stacks	https://www.stacks.co/
StandardC	https://www.standardc.io/
Storj	http://storj.io
StreamNative	https://streamnative.io
Tassat Group	https://www.tassatpay.com
The Block	https://www.theblockcrypto.com/
The Graph	https://thegraph.com/
TradeWindow	https://www.tradewindow.io/
TRM Labs	https://trmlabs.com
ULedger	https://www.uledger.io
UrbanChain	http://urbanchain.co.uk
VegaX Holdings	https://vegaxholdings.com/

VeriSmart	http://www.verismart.ai/
VIA	http://www.solvewithvia.com
Volvero	http://www.volvero.com
WorkAxle	http://workaxle.com
Zama	https://zama.ai
Zamna	https://zamna.com
Zilliqa	https://www.zilliqa.com

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964678.