Developing a Taxonomy for Revenue Models of Platform Business Models

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Abstract Platform business models like Uber Ride or Airbnb Lodging enable innovative business models by operating digital platforms to connect providers and consumers of products and services in two-sided markets. A particular challenge with platform business models is designing an appropriate revenue model to capture value. This paper presents a taxonomy that classifies the different dimensions and characteristics of revenue models for platform business models. A proven taxonomy development method is used that includes a review of current literature related to platform business models. The taxonomy provides a comprehensive classification of platform revenue models and is applied to a real-life case. The results of this paper include a UML class model and a final taxonomy with 14 dimensions and 64 characteristics. The paper contributes to the design process of novel platform business models and expands the understanding of how digital platforms can generate revenues.

Keywords: platform business models, revenue model, digital platform, taxonomy, dimensions.

1 Introduction

The significance of digital platforms continues to grow, and companies such as Uber Ride, Airbnb Lodging, Spotify Music, and eBay Marketplace have established innovative platform business models. Regardless of the industry, every company must make strategic decisions about their business model to stay competitive (Parker et al., 2016). The emergence of platform business models raises the question of what competitive advantages a company can achieve with its own business model and underscores the need for design knowledge to innovate novel (platform) business models. The motivation of this paper is based on a research preview from Bartels & Gordijn (2022) and addresses the design of systematic revenue models for platform business models. We provide a taxonomy that classifies relevant dimensions and characteristics of revenue models for platform business models. The research question for this paper is as follows: *Which dimensions and characteristics can be used to describe revenue models of platform business models?*

To answer this research question, we used a taxonomy development process following Nickerson et al. (2013) and extracted relevant dimensions and characteristics from a literature review. We also present a use case of the *Smarte.Land.Regionen* (SLR) platform, a digital solution-brokering platform for German counties, where the proposed taxonomy was applied to design a possible revenue model. In follow-up research, the taxonomy will be developed into a design tool to help practitioners create platform business models more systematically. This paper is structured as follows. In section 2, we introduce key terms and relevant related work. Section 3 presents the research design of the taxonomy development process and section 4 shows the taxonomy we created. Section 5 presents the use case to which the taxonomy was applied. Finally, section 6 presents our discussion, limitations, and an outlook on future work.

2 Theoretical Background

In our understanding, a *platform business model* is characterized by four aspects adapted from the definitions of Koch & Krohmer et al. (2022), Gordijn & Wieringa (2021), and Täuscher & Laudien (2017): (1) A platform business model describes the concept of how economic value is created, distributed, and consumed in a network of parties, called a digital ecosystem. (2) It creates value through a digital platform, operated by a platform operator (i.e., asset broker),

which connects at least two market sides – asset providers and asset consumers. (3) It brokers assets such as products or services via its digital platform. (4) A digital platform can serve as the hub of a digital ecosystem consisting of companies working collaboratively and competitively to meet customer needs (Moore, 1996). The *revenue model* is part of the value capture dimension of a business model and clarifies which monetization mechanisms are used to generate revenues. Accordingly, the revenue model of a platform business model, as we understand it, explains how revenue can be generated by enabling brokering services via a digital platform connecting asset providers and asset consumers. A *taxonomy* is defined as a structure above the technical terms of a subject area (Freichel et al., 2021a). In this paper, a taxonomy is considered a form of classification of relevant dimensions and characteristics for revenue models of platform business models.

Van de Ven et al. (2021) presented a taxonomy for *business models of data marketplaces* with 17 business model dimensions and 59 business model characteristics. Springer & Petrik (2021) showed a taxonomy for *platform pricing of digital platforms* in the context of the Industrial Internet of Things (IIoT) with 13 impact factors and 38 characteristics. Staub et al. (2021) elaborated a taxonomy for *digital platforms* with 16 design dimensions and 44 characteristics. A similar taxonomy for digital platforms was elaborated by Freichel et al. (2021a) with 16 dimensions and 40 characteristics. Täuscher & Laudien (2018) presented a taxonomy for *marketplace business models* with 14 business model attributes and 43 specifications. They applied their taxonomy to a sample of 100 digital marketplaces and showed that there are recurring revenue models, meaning that about 74% of all platform business models studied use a commission model as the key revenue stream. This finding prompted us to investigate platform revenue models to gain a deeper understanding of crucial business model variations. Compared to existing taxonomies that conceptualize digital platforms and their business models holistically (see van de Ven et al. (2021), Freichel et al. (2021a), or Staub et al. (2021)), our work focuses on the dimensions and characteristics of revenue models for platform business models and aims to contribute to a better understanding of how digital platforms can generate revenues.

3 Research Design: Taxonomy Development Process

The development process of our taxonomy for revenue models of platform business models follows the guidance of Nickerson et al. (2013) as a well-

structured methodology for researchers who intend to develop taxonomies step by step. The literature review, development process, and data presented in this paper are fully documented and can be found here: Bartels et al. (2023).

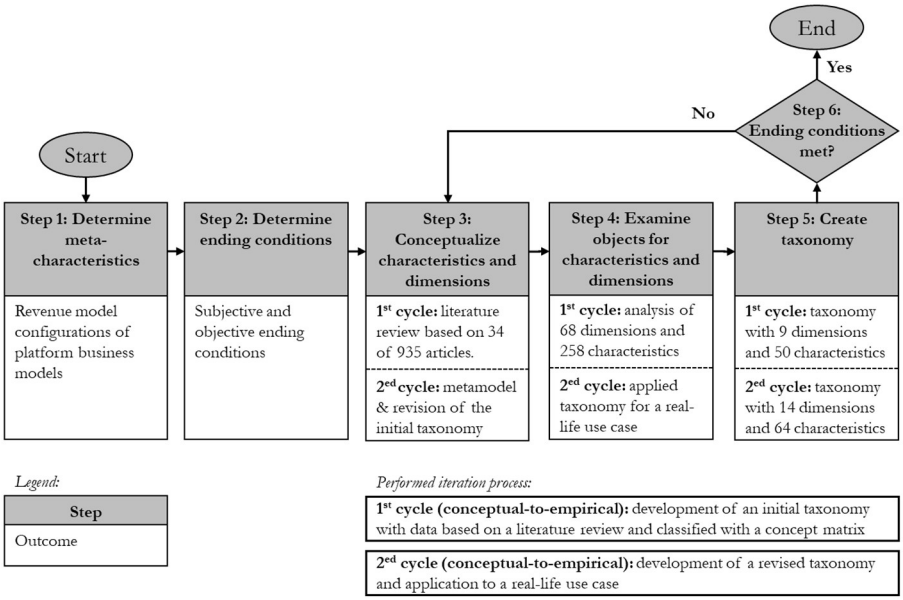

Figure 1: Taxonomy development process adapted from Nickerson et al. (2013)

As shown in Figure 1, the purpose and object of the taxonomy is defined in *Step 1*. In *Step 2*, the ending conditions are set, i.e., the criteria that the taxonomy must meet in order to be accepted. For the development of the taxonomy, *Step 3*, *Step 4,* and *Step 5* are repeated in two *conceptual-to-empirical* iteration cycles. After applying the taxonomy to a real-life case, all ending conditions in *Step 6* are met.

3.1 Determination of meta-characteristics and ending conditions

The purpose of our taxonomy follows the research preview of Bartels & Gordijn (2022), and revenue models of platform business models such as the revenue models of eBay Marketplace, Airbnb Lodging, or Uber Ride form our *object of interest*. The configuration aspects of these revenue models (e.g., $0.35 insertion fee per listing on eBay) are determined as the relevant *meta-characteristics* of our taxonomy. Following Nickerson et al. (2013), we consider *objective and subjective ending conditions* that must be met for the taxonomy to be accepted: (1) The taxonomy must comprise the *main dimensions and characteristics* of a revenue model for platform business models, and (2) *no new* dimensions or characteristics should be added in the last iteration. Subjectively, the taxonomy must be (3) *meaningful*

without being unwieldy or overwhelming and (4) *extensible* in order to add new dimensions or characteristics. Finally, (5) each dimension and characteristic must provide useful explanations about the object (*explanatory*).

3.2 First cycle: Literature research and classification

To get a data basis for the creation of the taxonomy, we conducted a literature review on revenue models of platform business models. The databases of Scopus, Web of Science, IEEE Xplore, ACM Digital Library, Google Scholar, and Dimensions were searched using the following string: *(ecosystem OR platform) AND (business model OR value capture OR revenue model OR profit model)*. This resulted in a total of 930 papers. The screening process of titles, abstracts, and full text was guided by the definition of inclusion and exclusion criteria. Of the total of 930 papers, 29 papers were included based on the following inclusion criterion: *The paper focuses on relevant dimensions or characteristics of revenue models for platform business models* (IC). In addition, five more papers were added to the included results, as we consider them relevant: Derave et al. (2022), Freichel et al. (2021a), Springer & Petrik (2021), Van de Ven et al. (2021), and Weking et al. (2020). A total of 34 papers were thus used for developing the taxonomy. The remaining 901 papers were excluded based on the following exclusion criteria: 204 papers were *duplicates* of another paper (EC1), 30 papers were *not in English* (EC2), six papers were *less than three pages* (EC3), 13 papers were *not research papers* (EC4), 41 papers were *not accessible* even after contacting the authors (EC5), and 607 papers *did not meet the inclusion criteria* (EC6). The full-text review of the 34 included papers resulted in a total of 68 dimensions and 258 characteristics for revenue models of platform business models. The review process of the literature search with each criterion is documented here: Bartels et al. (2023). To synthesize the data, a classification was created as a *concept matrix* according to Webster and Watson (2002). First, all dimensions were sorted alphabetically by title, studied based on the descriptions, and coded using our own classifications. Of the 68 dimensions examined from the literature, nine dimensions could not be classified – the remaining 59 dimensions were grouped into nine self-coded dimensions. Figure 2 gives an overview of the selected revenue model dimensions derived from the literature. The concept matrix summarizes the comprehensive classifications for revenue models of platform business models on the left side (A) while showing relevant dimensions for revenue models on the right side (B). Figure 2 shows that nine dimensions could be extracted based on 27 papers.

Here, "revenue model", "revenue stream", "revenue source", and "pricing model" are frequently used as relevant dimensions.

(A) Meta-descriptions of the analyzed papers						(B) Own derived and classified revenue model dimensions							
N°	Authors	Provides a **classifictaion** (e.g. taxonomy)?	Number of business model-related **dimensions**	Number of value capture-related **dimensions**	Number of value capture-related **characteristics**	**Revenue model**	**Revenue stream**	**Revenue source**	**Payment frequency**	**Pricing model**	**Price mechanism**	**Price discovery**	**Price discrimination**
1	Curtis et al. (2020)	Yes	16	5	28		x	x			x		x
2	Derave et al. (2022)	Yes	12	5	24		x	x	x			x	x
3	El Sawy & Pereira (2013)	Yes	19	4	0	x				x			
4	Enders et al. (2008)	No				x							
5	Freichel et al. (2021a)	Yes	7	3	0		x	x					
6	Freichel et al. (2021b)	Yes	16	2	4	x	x	x			x		
7	Ghezzi (2010)	No											
8	Giessmann et al. (2014)	Yes	5	1	5		x						
9	Helfat & Raubitschek (2018)	No											
10	Hoyer et al. (2009)	No											
11	Hyrynsalmi et al. (2012)	No				x							
12	Immonen et al. (2014)	No								x			
13	Janssen & Zuiderwijk (2014)	No				x							
14	Kim (2016)	No						x					
15	Kohler (2015)	No					x						
16	Kübel & Zarnekow (2014)	Yes	19	2	4			x	x				
17	Laczko et al. (2019)	No				x							
18	Lin et al. (2020)	No				x							
19	Mancha & Gordon (2022)	No								x			
20	Park et al. (2020)	No								x			
21	Rohn et al. (2021)	Yes	5	2	7		x	x		x	x		
22	Ruggieri e al. (2018)	No					x						
23	Schreieck et al. (2017)	No											
24	Springer & Petrik (2021)	Yes	13	3	10			x	x				
25	Staub et al. (2021)	Yes	16	3	10		x					x	x
26	Still et al. (2017)	Yes	10	2	0	x							
27	Täuscher & Laudien (2017)	Yes	14	4	15		x	x			x	x	x
28	Täuscher & Laudien (2018)	Yes	14	4	15		x	x			x	x	x
29	Teece & Linden (2017)	No											
30	Teece (2018)	No											
31	Ven et al. (2022)	Yes	17	5	17	x				x		x	
32	Verstegen & Doorneweert (2017)	No											
33	Weking et al. (2018)	No					x			x			
34	Weking et al. (2020)	Yes	19	3	11	x		x	x	x			
		Average	**13**	**3**	**10**	∑ **10**	**12**	**11**	**4**	**8**	**5**	**5**	**5**
		Deviation	**5**	**1**	**8**								

Figure 2: Concept matrix of search results

However, the initial taxonomy derived from the concept matrix did not meet the ending conditions, as the "pricing model" dimension had a strong overlap with "price mechanism", "price discovery", and "price discrimination". Therefore, in the second iteration cycle, the dimension was deleted to avoid redundancy.

3.3 Second cycle: Meta-model and taxonomy revision

In the second iteration of taxonomy development, we created a UML class model to express the relationships of the revenue model dimensions for platform business models within the taxonomy in a transparent way. We consider this step to be useful for designing a taxonomy holistically and ensuring its meaningfulness. The metamodel in Figure 3 illustrates the relationships between eight classes depicting the dimensions of the taxonomy.

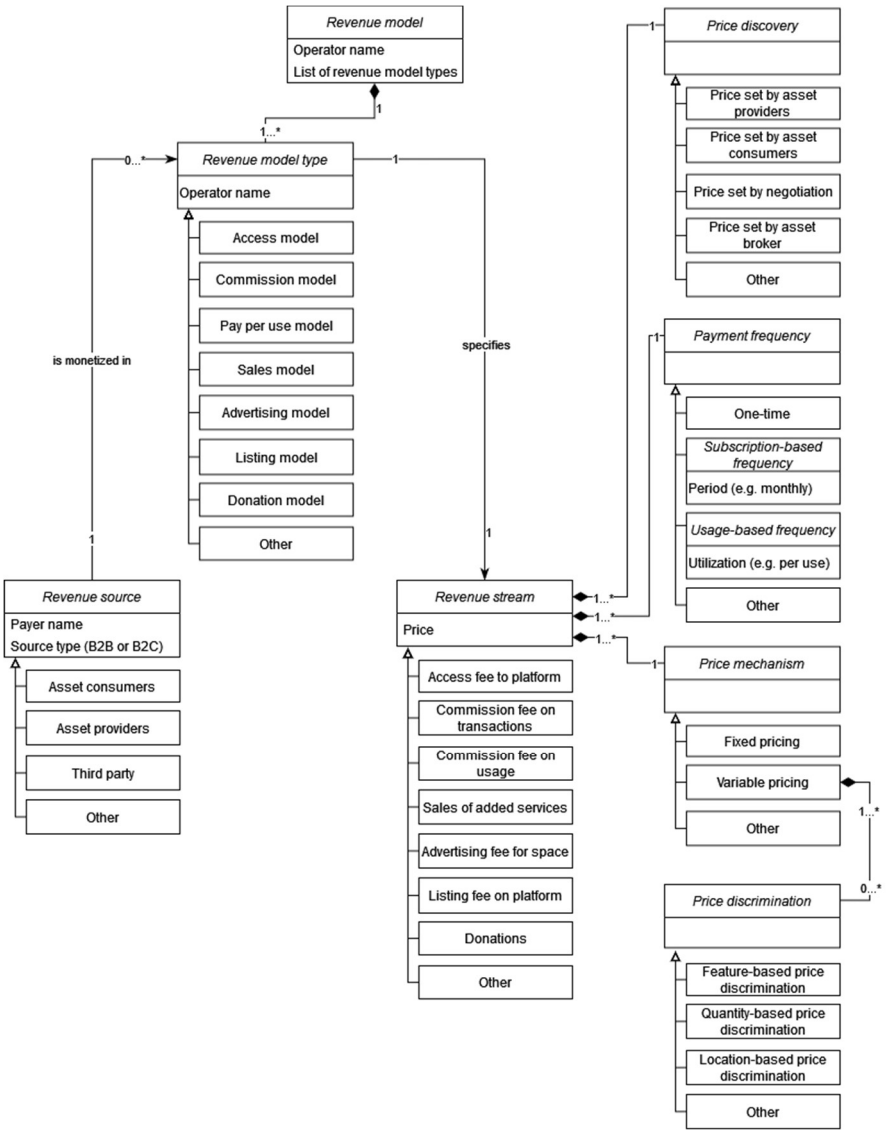

Figure 3: UML metamodel of the proposed taxonomy

An asset broker and operator of a revenue model (e.g., the platform provider of the eBay marketplace) may have multiple "revenue model types", each having a "revenue source" (*who* is monetized?) and a "revenue stream" (*how* to monetize?). This triangular relationship is crucial in our opinion and is also confirmed by the literature, as demonstrated in Figure 2. The pricing components, including "price discovery", "payment frequency", "pricing mechanism", and "price discrimination", always refer to an individual "revenue stream". The pricing model as a dimension is not explicitly included in the metamodel, as it is either redundant to the existing dimensions or can be considered as a combination. The classes shown in Figure 3 were adopted as dimensions in the second iteration.

4 Taxonomy

An asset provider (e.g., Airbnb host) aims to generate revenues through a business model of its own (e.g., renting one's own apartment to travelers), which should be viewed as a separate but relevant component for describing the overall platform business model of an asset broker (e.g., the operator of the Airbnb Lodging platform). For this, the use of a digital platform by asset providers depends on their ability to generate revenues. We concluded that a revenue model for a (two-sided) platform business model can only be described holistically if both the asset broker's revenue model and the asset provider's revenue model are represented. Consequently, the final taxonomy includes 14 dimensions, with seven dimensions covering the asset broker's perspective and the other seven dimensions covering the asset provider's perspective. The taxonomy shown in Figure 4 satisfies all relevant ending conditions.

A *revenue model type of the asset broker* (DB1) covers the revenue source and revenue stream through which the asset broker generates revenues. A *revenue stream of the asset broker* (DB2) describes how the asset broker generates revenues, i.e., the strategy the asset broker uses to monetize the revenue source through the platform. Access fees, commission fees, sale of platform services, advertising fees, listing fees, or donations may be used to generate revenue. The *revenue source of the asset broker* (DB3) describes who is monetized by the asset broker, i.e., the actor through whom the asset broker generates the revenue stream. Asset consumers, asset providers, or third parties can be monetized by the asset broker. The *payment frequency of the platform price* (DB4) describes how often payments recur for the asset broker, i.e., the frequency with which the revenue source is charged by the asset broker. Payments can appear as one-time, multiple-time, or usage-

based. The *price discovery of the platform price* (DB5) describes who sets the platform price, i.e., whether the platform price is set by the asset broker, by asset providers, asset consumers, or by negotiations. The *price mechanism of the platform price* (DB6) describes the influence of supply and demand on the platform price, i.e., whether the platform price is fixed or variable. A platform price can be fixed and static or variable and dependent on further factors. If the platform price is variable, it can be subject to price discrimination. The *price discrimination of the platform price* (DB7) describes different platform prices, i.e., whether discriminatory factors influence the platform price to be paid. Platform price discrimination can take the form of location-based, quantity-based, or feature-based price differences.

Revenue model dimensions of a platform business model			**Revenue model characteristics of a platform business model**							
Revenue model of the asset broker	DB1	Revenue model type of the asset broker	Access model	Commis-sion model	Pay per use model	Sales model	Adver-tising model	Listing model	Donation model	Other
	DB2	Revenue stream of the asset broker	Access fees to platform	Commis-sion fees on platform transactions	Commis-sion fees on usage	Sales model of platform services	Adver-tising fees for space	Listing fees on platform	Donations	Other
	DB3	Revenue source of the asset broker	Asset consumers		Asset providers			Third party		Other
	DB4	Payment frequency of the platform price	One-time		Subscription-based frequency			Usage-based frequency		Other
	DB5	Price discovery of the platform price	Platform price set by asset providers		Platform price set by asset consumers		Platform price set by negotiation		Platform price set by asset broker	Other
	DB6	Price mechanism of the platform price	Fixed platform pricing				Variable platform pricing			Other
	DB7	Price discrimination of the platform price	Feature-based price discrimination		Quantity-based price discrimination			Location-based price discrimination		Other
Revenue model of the asset provider	DP1	Revenue model type of the asset provider	Sales model		Rental model			Pay per use model		Other
	DP2	Revenue stream of the asset provider	Sales of assets		Rental fees for assets			Usage fees for assets		Other
	DP3	Revenue source of the asset provider	Asset consumers		Asset broker			Third party		Other
	DP4	Payment frequency of the asset price	One-time		Subscription-based frequency			Usage-based frequency		Other
	DP5	Price discovery of the asset price	Asset price set by asset providers		Asset price set by asset consumers		Asset price set by negotiation		Asset price set by asset broker	Other
	DP6	Price mechanism of the asset price	Fixed asset pricing				Variable asset pricing			Other
	DP7	Price discrimination of the asset price	Feature-based price discrimination		Quantity-based price discrimination			Location-based price discrimination		Other

Figure 4: Taxonomy for revenue models of platform business models

A *revenue model type of the asset provider* (DP1) covers the revenue source and revenue stream by which the asset providers generate revenues. The *revenue stream of the asset provider* (DP2) describes how the asset providers generate revenues, i.e., the strategy the asset providers use to monetize the revenue source through the platform. The asset provider can generate revenue through the platform by selling, renting, or charging a usage-based fee for the asset. The *revenue source of the asset provider* (DP3) describes who is monetized by the asset providers, i.e., the actor through which asset providers generate their revenue stream. Asset consumers, the asset broker, or third parties can generate revenue for the asset provider. The *payment frequency of the asset price* (DP4) describes how often payments recur for asset providers, i.e., the frequency with which the revenue source is charged by the asset providers. Payments for an asset can appear as one-time, multiple times, or usage-based. The *price discovery of the asset price* (DP5) describes who sets asset prices on the platform, i.e., whether asset prices are set by the asset broker, by asset providers, or by asset consumers. The *price mechanism of the asset price* (DP6) describes the influence of supply and demand on asset prices, i.e., whether asset prices on the platform are fixed or variable. The price of an asset may be fixed or variable and depend on other factors. If the price of an asset is variable, it can be subject to price discrimination. *The price discrimination of the asset price* (DP7) describes different asset prices, i.e., whether discriminatory factors influence asset prices on the platform. Asset price discrimination can take the form of location-based, quantity-based, or feature-based price differences.

5 Taxonomy applied to the SLR Platform

To ensure that our taxonomy will be applicable, we used a revenue model of a digital platform in a research project as a real-life case. This research project, called *Smarte.Land.Regionen* (SLR), aims to improve public services in rural areas through digital solutions. For this purpose, a digital ecosystem is being created that includes a digital platform at its core, called the *SLR platform*. The SLR platform follows the logic that the SLR platform operator (the asset broker) brokers digital solutions, e.g., mobility services (assets) provided by software companies (asset providers) to counties (asset consumers) and their citizens on its digital platform. The SLR platform was studied in an earlier work by Bartels & Schmitt (2022) as a use case for designing network effects for a platform business model. In this work, the SLR platform is used as a real-life object to test whether the taxonomy is suitable for representing a platform revenue model. As shown in Table 1, the SLR platform's revenue model defines that software

providers who want to offer their digital solutions on the SLR platform have to pay a fixed access fee to the SLR platform operator on a monthly basis.

Table 1: Taxonomy applied to the SLR platform

Description of the SLR platform revenue model	
DB1	The SLR platform operator generates revenue through an **access model** and monetizes the providing software companies.
DB2	Revenues are generated through an **access fee** to the SLR platform.
DB3	**Software companies** that provide solutions are monetized.
DB4	Access fees accrue **monthly**.
DB5	Access fees are set by the **SLR platform operator**.
DB6	Access fees are **fixed** at 500€ and are not changeable.
DB7	There is **no price discrimination**.
DP1	The software companies generate revenue through the SLR platform by offering digital solutions based on a **pay-per-use model** and monetizing the **counties**.
DP2	Revenues are generated through a **usage fee** for the digital solutions.
DP3	**Counties that request** solutions from the SLR platform are monetized.
DP4	Usage fees are incurred each time a **digital solution is operated for a county**.
DP5	Usage fees are set by the **providing software company**.
DP6	Usage fees are **variable**.
DP7	Usage fees **depend on the functionality** of the digital solution and vary.

In our view, the combination of "access fee" (in DB2) and "monthly" frequency (in DB4) is a *subscription model*, but we can express this more precisely through the taxonomy and consider it not as a standalone revenue model, but as a variant of the "access model" (in DB1). In this way, the digital solution listed on the SLR platform can be found by counties and booked for their citizens. Software companies generate revenue by offering counties their digital solutions through the SLR platform and customizing them to meet the needs of counties and citizens.

6 Discussion, Limitations, and Future Work

The main contribution of this work is the creation of a meaningful taxonomy and metamodel in order to get a better understanding the revenue models used by platform business models. The research question of how to classify revenue models of platform business models is answered with a taxonomy of 14

dimensions and 68 characteristics. In their work, Täuscher & Laudien (2018) showed that 74% of platform business models use commission models as their core revenue model. Although this number is significant, it also indicates that much of the variation in revenue models is not fully understood yet. In our view, there are variants such as commission per transaction (e.g., a fee per eBay product sold) or commission per unit of usage (e.g., a fee per Uber mile driven). Our taxonomy is a first step towards gaining a more nuanced understanding of revenue models of platform business models. The proposed taxonomy offers a more precise way of describing different revenue models compared to other taxonomies that use a single characteristic, such as 'subscription' (as seen in Täuscher & Laudien, 2018). As shown in our real-life case, we achieve this level of detail by combining multiple dimensions: "revenue stream" (DB2) with "access model" and "payment frequency" (DB4) with "monthly" frequency.

Limitations. Our taxonomy focuses on revenue models as part of the value capture and does not address the value proposition and the value creation of a business model. Second, it focuses solely on platform business models with two-sided markets involving the asset broker and asset providers as actors with monetization intentions, and therefore cannot be used for one-sided or multi-sided platforms. Despite our transparent taxonomy development process (the research data can be found here: Bartels et al. (2023), there may still be important aspects that have gone unnoticed. An example can be seen in the *payment frequency* dimension, which is weakly backed in the existing literature and occurred only four times in our data (see concept matrix in Figure 2). However, recent work, such as the platform ontology of Derave et al. (2022), emphasizes the importance of frequency and shows that research on digital platforms and their business models is still evolving. Consequently, we may have overlooked other aspects in our taxonomy that need to be further elaborated in the future.

Future work on the proposed taxonomy should include the study of different "objects", i.e., platform revenue models, to refine or extend the existing dimensions and characteristics, as suggested by Nickerson (2013) as *an empirical-to-conceptual* process. Our initial contribution of applying the taxonomy to the SLR platform is a first step. Now, the taxonomy needs to be tested on more real-life objects. The overall goal of this research is to provide this taxonomy as a design tool for practitioners to systematically design revenue models, as proposed by Bartels & Gordijn (2022), who called this a "business model construction kit".

Acknowledgments

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