

The Sustainable Business Model Database: 92 Patterns That Enable Sustainability in Business Model Innovation

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Abstract: Humanity's consumption of resources is many times greater than nature's capacity for regeneration. Companies need to innovate their own business models to incorporate sustainability in all dimensions, as they are the main producers of greenhouse gases and environmental damage. However, obstacles such as dominant logics hinder the necessary processes. One way of overcoming these problems is to use sustainable business model patterns as an exemplary description of the business activities of existing and successful companies. The aim of this publication is to provide a holistic collection of relevant business model patterns for sustainability. The basis for this is the rich body of research in this area, which is, however, hampered by small-scale representations, overlaps, and problems of understanding. This will be addressed by conducting a comprehensive literature review, standardising, clustering, and eliminating duplication. The resulting database will enable sustainable business model innovation.

Keywords: business model pattern; business model innovation; sustainability; innovation management



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1. Introduction

Humanity consumes many times the resources that nature can regenerate. If continued, this overexploitation could cause lasting damage to the livelihoods of future generations, so a more sustainable economy must be sought. The goals to be achieved in this regard are described, for example, in the framework of the United Nations' Sustainable Development Goals. However, achieving these goals requires a fundamental transformation of the economy, to which not only technological innovations, but also business models must contribute [1].

This contrasts with the fact that the business model of many companies was determined at a time when the importance of sustainability was significantly lower than it is today, and this has remained the same since then. It is, therefore, not suitable to meet the need of a sustainable business practice. Reasons for resistance to change include the "dominant logic" as the collective mindset of a company, which has emerged in the course of past successes and now makes a company blind to necessary changes [2]. The business model as a representation of the fundamental corporate logic is disproportionately affected by the inhibiting effect of the dominant logic [3–5].

The importance of the work is thus twofold. On the one hand, it is about enabling companies to meet the demands of their customers and, thus, to maintain their own competitiveness [6]. The business model, for example, is, together with product, service, and process innovations, the main field of innovation activity [7–9], but in contrast to product innovations, business model innovations offer longer-lasting competitive advantages [10–12] and, therefore, generate higher returns [13]. On the other hand, it is about contributing to environmental protection by adopting sustainable business practices.

Cumulatively, there is thus a need to integrate sustainability into the business model of companies [14]. Therefore, the following will focus on how this can be achieved, with the focus on a practical implementation.

The combination of business models and sustainability is called sustainable business models. These enable companies to achieve their sustainability goals [15] and, therefore, to meet the expectations of the public for more sustainable business models [16]. The results of this are, for example, greener products and packaging or new business models [17], which are created by including sustainable practices in the value proposition, value creation, and value capture activities of companies [18]. Nosratabadi, Mosavi, Shamshirband, Kazimieras Zavadskas, Rakotonirainy, Chau [19] see no comprehensive picture of how companies in different industries can implement sustainability in their business models. Geissdoerfer, Vladimirova, Evans [20] see a “a three-fold problem in sustainable business model innovation: (1) many business model innovation meetings and workshops are conducted, but the ideas are not followed up, (2) even promising sustainable business model concepts are not implemented, and (3) most implemented business models, especially in the start-up context, fail in the market”. Therefore, it is highly relevant for the field of business model innovation to provide tools for entrepreneurial practice that enable innovation [21–23]. As practitioners often rely on trial-and-error experimentation to innovate their business model and, therefore, have a high chance of failure [6,15,24] see methods and tools of business modelling as core challenge for creating sustainable business models.

The most relevant approach to overcome this is pattern-based innovation [2,25], which has proven its value in practice and enables business model innovations by adapting parts or the entirety [26]. The underlying mechanism refers to the recipe function and communication function of the business model. An example of this is the razor-blade business model pattern, which originated in the consumer goods industry, namely, men’s razors, and has spread to other industries, e.g., printers. Basically, the business model of one company can be used as an instrument to guide the design of a business activity envisaged for the future in another company [27,28]. The quality of a pattern-based business model innovation can be increased by a broad basic selection of possible patterns, as this allows different strategic objectives to be met in the best possible way, as well as the varying conditions in the companies. Therefore, it is important to know all accessible patterns, but a broad selection has the downfall that patterns face constraints based on a high diversity and overlaps among patterns [29]. Therefore, the research question is: **Which business model patterns exist to create sustainable business models?**

The aim here is to create a database as structured collections of different patterns which, thanks to their largely unambiguous presentation, enable the patterns to be used directly for innovation or to be further adapted to entrepreneurial requirements through measures such as the business model pattern combination matrix.

The challenges and, thus, weaknesses of the current research are that the patterns are heterogeneous. Some descriptions only consist of a few elements, while others describe holistic business models, and the underlying description frameworks also differ [29]. Therefore, a holistic representation of all known patterns is needed. To reach this, the patterns are structured based on a rigorous taxonomy-building approach.

Based on the relevance of the topic, there are already publications that pursue a similar goal. A distinction must be made between literature reviews and primary surveys. Representatives of the first kind are Comin, Aguiar, Sehnem, Yusliza, Cazella, Julkovski [30]; Ritala, Huotari, Bocken, Albareda, Puumalainen [31]; and Boons, Lüdeke-Freund [18] as the largest collection.

Primary surveys, on the other hand, are Clinton, Whisnant [32] or Zufall, Norris, Schaltegger, Revellio, Hansen [33]. The practically oriented approach, together with a broad literature selection, solves the problem that the literature reviews do not contain all the patterns found in the primary surveys. The primary surveys, on the other hand, lag behind the reviews in terms of the extent and number of patterns described. Furthermore, primary surveys usually have a sectoral focus, which stands in the way of general usability due to the resulting low total number of patterns described. An extended list analysis is, therefore, advisable.

The contribution of this publication is to provide this list by creating the largest coherent database on business model patterns in the context of sustainability currently available. This means that all potentially relevant patterns can be found in one place, and these have also been classified according to the most likely outcomes, allowing direct application relative to the company's goals. Not relevant are sustainability strategies such as the 10 common circular economy strategies (i.e., recover, recycling, repurpose, remanufacture, refurbish, repair, reuse, reduce, rethink, refuse) [34]. Although these include aspects of the business model patterns, as these also reflect generally valid constructs of action, they are above in scope.

2. Definition of Core Constructs

Before the scientific approach is presented, the underlying constructs must be defined so that they can be made clear.

2.1. Business Model

Every company, regardless of its industry, business activity, or even the intention to make a profit, has a business model [35,36], which is superior in achieving a competitive advantage for product or service innovations [13].

The origin of the term is heterogeneous. The concept itself was first introduced in 1954 by the publication *The Practice of Management* by Peter Drucker [11,37,38]. Other early representatives are Bellman, Clark, Malcolm, Craft, Ricciardi [39], which also does not represent the modern understanding of a business model. The topic only gained significant scientific relevance around the year 2000 [40].

There is no generally accepted definition in science of what a business model is, but a large number of different definitions [41] are used in parallel in scientific discourse. In this context, Gassmann, Frankenberger, Sauer [42] list seven schools of thought for understanding the business model. This publication is based on the recombination school because it describes business model innovation best. The business model, as a combination of constant basic dimensions, is therefore a kind of blueprint for corporate activity [42]. The following definitions of the construct are considered under this premise, so that the working definition can be determined by comparing similarities and differences (Table 1).

Table 1. Definition of the construct business model.

Definition	Source
"(. . .) an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues."	[43]
"(. . .) how a firm will make money"	[44]
"A business model depicts the content, structure and governance of transactions designed so as to create value through the exploitation of business opportunities."	[45]
"(. . .) a system of interdependent activities that transcends the focal firm and spans its boundaries."	[46]
"A business model is (. . .) a reflection of the firm's realized strategy"	[37]
"A business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value."	[47]
"(. . .) a description of an organization and how that organization functions in achieving its goals (e.g., profitability, growth, social impact, (. . .)"	[48]

The overall view of the sources shows that the business model is primarily based on the following dimensions. Firstly, there is the value proposition. This includes all dimensions that create a benefit for the customer of the company [49] and, as such, is the portfolio of products and services provided by the company that creates value for the customer or solves problems [36]. Secondly, there is the value capturing dimension, which is the totality

of costs and revenues. Thirdly, the customer segments must be taken into account. The question here is: “Who is the customer?” [50]. It is, therefore, a question of which target groups are addressed by the service offered [36]. Finally, it is relevant that not only the individual elements, but also their interaction, has a defining effect. There is, thus, a kind of system in which the elements influence each other, which is scientifically described by the terms “interlocking” [51] or “interrelation” [52]. The systematic structure is described, for example, by Magretta [50] or by Afuah, Tucci [53], who wrote that a business model is a “system that is made up of components, linkages between the components, and dynamics”.

Cumulatively, the business model is understood in this paper as the sum of the components value proposition, value capturing dimension, customer segment, and revenue mechanism, as well as their interactions with each other.

2.2. Business Model Innovations

Business model innovations are decisive for the absolute success of a company, just as they are for the competitive position [54–56]. These are superior in the sustainability of the achieved competitive advantage to process innovations, as well as product innovations, which is based on the fact that the imitation of a whole system of activities is significantly more complex to copy than it is to imitate individual products or processes [10]. The construct of business model innovation does not have a clear monochrome line of descent and, thus, definition. In order to enable an understanding of the term, it is put into relation to the respective current paradigms, referring to the work of Ghaziani, Ventresca [40], which illustrated the meaning of the term business model innovation in the scientific discourse between 1975 and 2000 (Table 2).

Table 2. Core dimensions of business model innovation based on Ghaziani, Ventresca [40], Lambert, Davidson [57] and Amit, Zott [45].

Period	Meaning
1975–1994	computer/systems modelling (technology model)
1995–2000	value creation (unit model)
2001–today	revenue model als Summe von value creation und value capture (Komponentenmodell)

Even under this paradigm, there is no uniformly accepted definition of the term [2,58]. In order to obtain a working definition, a construction is made based on the existing understanding of the business model and the available definitions. For this purpose, relevant definitions of the construct business model innovation are considered first (Table 3).

Table 3. Definitions of the construct business model innovation.

Definition	Source
“Business Model-Innovation is (. . .) how a firm will make money”	[44]
“Businessmodel innovation is the discovery of a fundamentally different business model in an existing business.”	[59]
“Business model innovation is the convergence of both a new profit model and a new customer value proposition, unified to create an entirely new type of market player.”	[60]
“Business Model-Innovation is (. . .) unit of analysis, [to] identify novelty, lock-in complementarities and efficiency.”	[61]
“Business Model Innovation (. . .) represents an (. . .) source of future value for businesses—a way of creating new or enhanced revenues and profits at relatively low cost”	[62]
“Business model innovation is about generating new sources of profit by finding novel value proposition/value constellation combinations.”	[63]
“Business model innovation refers to a business model configuration that specifies new ways to create and capture value for the focal organization, its customers, and other stakeholders.”	[64]

Focusing on the recombination school as a formative dimension of understanding, the following working definition emerges. The basic idea here is that two or more components of the business model must be affected in order to be called a business model innovation. Thus, if only one component of the business model is changed and the others remain

unchanged, one can assume that it is a process or product innovation [65,66]. If, for example, only the benefit promise is innovated, but not the basic value creation logic, a product or service innovation exists [2].

A business model innovation is, thus, the deliberate innovation of two or more components of the business model, whereby these are primarily the value proposition, the value creation activities, the customer segment, and the revenue mechanism, but may also be any other business model component as a secondary consideration.

2.3. Sustainable Business Model Innovation

Sustainable business model innovation links the field of business model innovation with sustainability through the implementation of sustainable dimensions and concepts in the design and application of business models [67]. This merger is increasingly seen as the basis for competitive advantage [68]. The effectiveness of business model innovations is, thus, confirmed in the field of sustainability. However, the positive effects are not limited to the executing company itself, but also affect the surrounding environment, including global benefits. For example, a business model that puts sustainable consumption at the centre can contribute to combating climate change or improve the living conditions of local communities [69]. The intended social or natural outcome thus distinguishes the post-sustainable business model innovation from the traditional business model innovation. To shed more light on this and to create a working definition, several definitions are considered below, based on Geissdoerfer, Vladimirova, Evans [20] (Table 4).

Table 4. Definition of the construct sustainable business model innovation.

Definition	Source
“Sustainable business model innovation is understood as the adaption of the business model to overcome barriers within the company and its environment to market sustainable process, product, or service innovations.”	[18]
“(. . .) searching for ways to deal with unpredictable (. . .) wider societal changes and sustainability issues.”	[70]
“Business model innovations for sustainability are defined as: Innovations that create significant positive and/or significantly reduced negative impacts for the environment and/or society, through changes in the way the organization and its value-network create, deliver value and capture value (i.e., create economic value) or change their value propositions.”	[71]
“Sustainable business innovation processes specifically aim at incorporating sustainable value and a pro-active management of a broad range of stakeholders into the business model.”	[72]
“(. . .) processes through which (. . .) new business models are developed by businesses and their managers (. . .) how companies revise and transform their business model in order to contribute to sustainable development.”	[73]
“(. . .) modified and completely new business models [that] can help develop integrative and competitive solutions by either radically reducing negative and/or creating positive external effects for the natural environment and society.”	[74]

Building on the existing understanding of business model innovation, the following working definition thus emerges.

A sustainable business model innovation is the redesign of an existing business model, with the aim of achieving a sustainable output besides or as a substitute of a commercial intention. For this, at least two dimensions of the business model are subjected to innovation.

2.4. Business Model Patterns and Sustainable Business Model Patterns

The concept of business model patterns appears under different names, such as business model configurations [75] or business model archetypes [71].

The recombination of existing business models or their simple adaptation account for 90 percent of all business model innovations [76]. Business models are mostly independent of industries and, therefore, enable knowledge transfer and learning from best practices [77].

An example of this is the razor–razorblade pattern, which was developed by King Camp Gillette for razors during the First World War, but is now used in a wide range of industries, such as printers or vacuum cleaners. Business model patterns have a double nature, as they are descriptive constructs, which have a reality-describing effect through

the representation of existing business models, and performative constructs, since business model innovations can arise through these (application in the company) [2]. A pattern is, therefore, the embodiment of a problem solution, which has been proven in practice [78] (Table 5).

Table 5. Definitions of the construct business model pattern.

Definition	Sources
“Generalizations of specific business models”	[43]
“The essence of a different way to conduct business”	[79]
“Business models with similar characteristics, similar arrangements of business model Building Blocks, or similar behaviors”	[36]
“The relationship between a certain context or environment, a recurring problem and the core of its solution”	[26]
“A specific configuration of the (. . .) business model dimensions (...) that has proven to be successful”	[76]
“Reusing solutions that are documented generally and abstractly in order to make them accessible and applicable to others.”	[80]
“We define a business model pattern as a combination of configuration options, which repeatedly occurs in successful business models.”	[81]

Cumulated, a pattern in this paper is understood to be a fixed design of a business model, which is at the same time kept abstract and can be used to generate business model innovations. This is an explicit use of the recombination school. Sustainable business model patterns are based on the definition of sustainable business model innovation, patterns that aim to increase the sustainability of the relevant sub-framework.

According to Nemeth [82] and Weltgen [83], the following business model characteristics are central to the impact of business model patterns (Table 6).

Table 6. Special characteristics of a business model.

Function	Implication
Recipe function	This is understood to mean that a company’s current business model can be used to guide business model innovations in other companies [64]. The function is not about copying the model completely, but rather about using it as a stimulus-based creativity technique.
Structuring function	Representation of the key similarities and differences between two or more business models [27].
Identification function	The internal identification function shows whereby a company feels it belongs to a group of companies with the same business model based on the structure of the business model. The external dimension [84] has the goal of realising social acceptance, scientifically speaking, the “license to operate” or other positive attributions through identification.
Communication function	The business model is a narrative representation [85] of the company’s activities and, above all, of the value generation [83] vis-à-vis third parties (stakeholders), whereby, according to Doganova, Eyquem-Renault [28], these are a heterogeneous target group.
Analysis function	The object here is the description and classification of the business model of companies [83]. The analysis can relate both to the status quo and to the future, whereby, in this case, the business model approach, like a rapid prototyping tool [86], makes it possible to check business model innovations for their probability of success.

The presentation of business model patterns is commonly done in the form of databases. Databases exist as both sector-specific and general. In the context of this publication, this can be illustrated using databases in the context of sustainability patterns. Relevant representatives are Curtis [87] (sharing economy) and Zufall, Norris, Schaltegger, Revellio, Hansen [33] (smartphone), which each have lists with a clear focus on one sector. On the

other hand, there are also lists without a sector reference, such as Clinton, Whisnant [32] or even databases like Remane, Hanelt, Tesch, Kolbe [88], which see sustainability only as a field of a listing without preceding restrictions. Lüdeke-Freund, Carroux, Joyce, Massa, Breuer [89] represents the largest listing of models in the context of sustainability, and these were compiled within the context of a literature review and, therefore, are not subject to the database.

3. Materials and Methods

This requires a meta-perspective, which is achieved through three steps. The first step is to collect all available business model samples based on a literature review. The second step is to create a taxonomy. The last step is to assign the patterns to outcome dimensions and exclude duplicates and irrelevant patterns. Results can be seen in (Table 7).

Table 7. Research design overview.

Research Steps	Goals	Procedure	Results
Phase 1: Exploring the research literature on the topic of sustainable business model innovations	Indexing of all relevant sources	Search relevant sources (e.g., EconBiz or Business Source Complete) based on criteria; Development of relevant search terms; Discovery of further relevant publications through source analysis of the data material that has been indexed so far; Opening up the sources and sorting out unsuitable hits.	List of relevant sources
Phase 2: Creation of a taxonomy for the classification of patterns	Creation of a taxonomy	Exclusion of duplicates and patterns with no relevance for sustainability development of a taxonomy to capture the patterns.	Taxonomy that can be used to classify patterns
Phase 3: Creation of the database through classification of the patterns	Generating a database that unlocks unique patterns based on the output and thus enables innovation.	Transfer of all patterns into the matrix (taxonomy) based on similarities in title, description, case study companies; Use taxonomy until all patterns have been assigned.	Database of unique sustainable business model patterns

3.1. Literature Review on the Topic of Sustainable Business Model Patterns

The review was based on the recommendations of Easterby-Smith, Thorpe, Jackson [90]. The databases EconBiz, Business Source Complete, ABI INFORM Complete, and Google Scholar form the basis of the data. In these, only English-language articles from scientific publications were searched for, and a further subdivision according to quality characteristics, such as the source-normalised impact per paper, CiteScore, SCImago journal rank (SJR), or h-index, was not carried out in order to also include practical results.

The second step was the selection of keywords. Central to this was the idea that the wording could differ between different authors, which has already become apparent in the context of the definition of the core structures. The search terms were selected here based on a similarity approach. This means that relevant sources were identified in an iterative process based on the initial search terms: sustainability and business model innovation. The keywords used in these sources were then used for further searches based on a relevance assessment. The focus was on human judgement as the gold standard in the evaluation of unsupervised methods [91]. The final search terms were composed of all possible combinations of verbalisations of the underlying constructs: business model, pattern, and sustainability (Table 8).

Table 8. Search terms.

Search Terms Part 1	Search Terms Part 2	Search Terms Part 3
	pattern sequence	sustainability sustainable development sustainable innovation
business modelling business model business model analogies [92] atomic business models [79] operating business models [93]		

The search terms used for “article title, abstract, keywords and if possible for the research body” were, on the one hand, the field of business model patterns and, on the other hand, the sector of sustainability, which together formed the search entries.

The next step was the discovery of further relevant publications through source analysis of the data material that was indexed so far. However, no further hits resulted from this, so it can be assumed that the patterns presented here largely reflect the current state of research.

All searches were conducted between 6 January 2022 and 10 October 2022, and 17 relevant publications were found. In total, 125 patterns could be extracted, and a focus on case studies emerged, which was due to the underlying research literature.

3.2. Creation of a Taxonomy

The goal of the second phase was the creation of a taxonomy for the classification of patterns and, consequently, integrating them in the database. Taxonomies enable the user to classify objects according to similarities and differences, so that the user can describe, understand, and analyse the patterns easier [94]. In addition, taxonomies can also be used as a foundation for sense-making [95] and to simulate innovation [96]. The focus here is on pattern classification, so that all design decisions are aligned with this paradigm.

The taxonomy development process according to Möller, Stachon, Azkan, Schoormann, Otto [97] was used, as it relates specifically to the subject of business model innovation. This makes it more suitable than comparable approaches that have a broad focus. In addition, the form of presentation as a morphological analysis allows easy application to different application scenarios and, thus, flexibility with regard to the object of research. The form of presentation here is a simple table, with forms as described by Khan [98] and Khan [99] or AlMobark [100].

- Object of Analysis: All company types are valid.
- Data Collection: Systematic Literature Review
- Data Sampling: Selective/Comprehensive
- Development: The approach of Nickerson, Varshney, Muntermann [94] was used as it enables deep insights into the topic and also provides a practical results.
- Industry Scope: Generic
- Technology Scope: Generic but focus on sustainability
- Depth of Analysis: Wide
- Representation: Exclusivity
- Visualisation: Table
- Further Application: (Arche-)Types
- Clustering Tool: Outcome proximity

In order to build the taxonomy dimensions, an adapted version of the approach according to Nickerson, Varshney, Muntermann [94] was used, as it is the most used scheme in this regard (Figure 1).

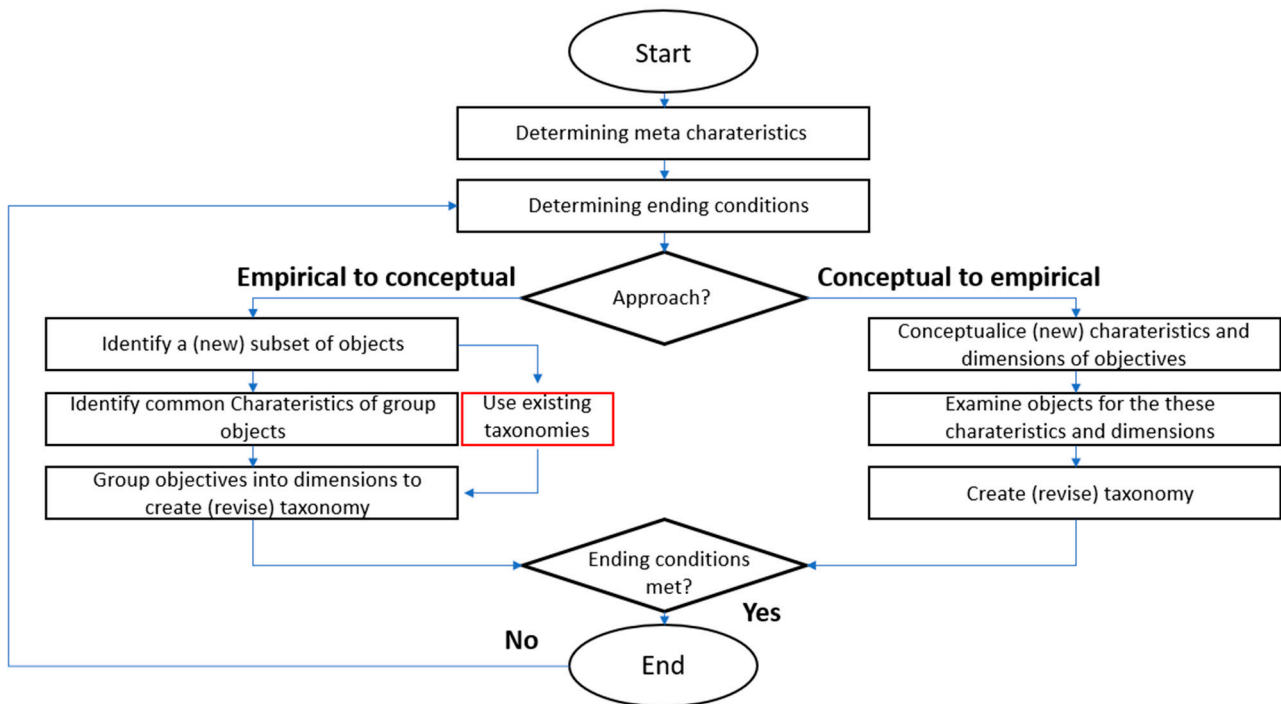


Figure 1. Process of taxonomy dimension determination based on Nickerson, Varshney, Muntermann [94].

The first step is about determining meta characteristics. The choice is based on the purpose of the taxonomy [94]. Thus, after designing a business model, it is necessary to measure the performance in regard to sustainability, but above all, to understand the central elements that are responsible [101]. A pattern must, therefore, provide information about the possible outcome in terms of sustainability and the key elements addressed in the business model.

In the second step, we defined ending conditions. Here, the conditions according to Nickerson, Varshney, Muntermann [94] must be considered first, which are mutually exclusive and collectively exhaustive characteristics of the taxonomy dimensions and the fact that neither new dimensions or characteristics were added, merged, or split in the last iteration.

The empirical-to-conceptual approach was taken in the first iteration, with 125 patterns considered enough to meet the demands for an empirical approach, so that an initial structure could be created [94]. In the first step, the identification of a new subset of objectives will be combined with the identification of common characteristics. The outcome is replaced by the business model canvas according to Osterwalder, Pigneur, Clark [36]. This approach was chosen because potential outcomes could not match the canvas, as it is recognised in science and the practice framework [48] and offers applicability in a wide range of scenarios. El Sawy, Pereira [102] shows 26 business model approaches, with the triangle of Gassmann, Frankenberger, Csik [76], the framework of Abdelkafi, Makhotin, Posselt [26], and the STOF model [103] as the most common examples. These would have been alternatives, but are either not recognised enough or are too shallow in depth to make a reasoned decision when the patterns are substantially similar. An example of the latter is the model of Gassmann, Frankenberger, Csik [76], which has significantly fewer fields compared to the canvas. In order to identify common characteristics of the patterns, they were coded in relation to the business model canvas dimensions. Grouping the dimensions into the taxonomy was not totally bypassed, as the dimensions of the business model canvas were used. The results of the analysis were formulated to provide a basis for acting as an axis in the diagram.

The conceptual-to-empirical approach was used in the second approach in order to create outcome dimensions. The first step was the exclusion of duplicates and patterns with no relevance for sustainability, as well as obviously unsuitable hits, which were characterised by the fact that the topic of the patterns was not dealt with or no new patterns were developed. The basis for this is the resource-based view, as the patterns are used to achieve a sustainable competitive advantage based on an innovation of the business model. Therefore, the subsets of objectives were established. The identification of common characteristics was performed once again, and the focus was on a qualitative approach to the subject matter, as this was easy to access due to the uniform structure of the patterns. The search for outcome dimensions was started with the inclusion of the existing categories of Lüdeke-Freund, Froese, Schaltegger [104]. These dimensions were further developed, and the patterns that could not be assigned were again searched for commonalities. The procedure here is based on the first iteration, in which deviations in the individual patterns in the existing clusters were coded regarding the results to be expected in the company after implementation.

The new dimensions here are auxiliary, new target group, and information. In order to determine if the clusters are finished, i.e., distinguishable from each other, semi-structured interviews with four people out of the target group of professionals with relevant work experience employed in relevant positions were conducted. The process of taxonomy building ended with meeting the ending criteria. Results of the process can be seen in (Table 9).

Table 9. Taxonomy Y axis dimensions.

Class Description	Outcome	Outcome Dimension
Increase of the contribution margin through sustainability in processes and the value proposition	Rise in contribution margin	Pricing & Revenue
Access to a service is enabled, not its possession	More accessibility through reduced capital commitment	Access Provision
Minimisation of waste through recycling and reuse of products	Services whose components can be better reused	Closing the Loop
Services that are more sustainable than comparable competitor products	Unique selling proposition on the market	Service & Performance
Products are optimised for sustainability during their development process	Increasing sustainability in manufacturing	Ecodesign
Creation of a community from producers to make production sustainable through the optimised use of resources	Building a community	Cooperative
Provision of innovative financing services	Increase the target group	Financing
Alignment and selection of production steps and suppliers in the supply chain based on sustainability criteria	Increasing sustainability in manufacturing	Supply Chain
Creation of a community of users, to whom services are iteratively offered for purchase	Building a community	Community Platform
The economic activity results in social added value or is fully oriented towards it	Sustainability outside the direct product reference	Social Mission
Addressing new customer segments	Increase the target group	New Target Group
Those in need get access to services	Increase the target group	Giving
Enabling the user to make a well-informed decision based on facts regarding sustainability	Increase the target group	Information
Business model innovation that supports sustainability indirectly	Sustainability outside the direct product reference	Auxiliary

The result of this is a taxonomy with two axes. On the X-axis, the dimensions of the business model canvas are plotted according to Osterwalder, Pigneur, Clark [36], and these visualise the focal points of the business model. These are not described individually here, but reference is made to the underlying work. The Y-axis, on the other hand, shows the outcome dimensions.

After the taxonomy was created, all patterns were transferred into it. In addition, the following dimensions were added: Name of the pattern, Description, and Case study company. The description was used to summarise the content of the individual pattern in the context of one sentence, so that it is clear what the core understanding of the pattern is. The use of the same dataset for method and results enhances the results by increasing the coherence between patterns and the framework. Central to this is the idea of circularity, as set out in grounded theory, as an iterative development for the holistic development of the field of events.

3.3. Creation of the Database through Classification of the Patterns

The starting point is again semi-standardised interviews with the four experts, in which they give subjective input as to whether the patterns overlap. For those patterns that have a possibility of proximity, we used a qualitative approach, with the focus on description and case study companies.

The second step is using a taxonomy to finally cluster all the patterns in order to generate a usable database. The following matrix defines which dimensions of the business model are addressed by which cluster and, thus, together with the definitions of the outcome dimensions (Figure 2).

	Key Activity	Key Partner	Key Ressources	Value Proposition	Customer Relationship	Channels	Customers	Cost Structure	Revenue Stream
Pricing & Revenue	★			★				★	★
Access Provision							★	★	★
Closing the Loop	★		★						
Service & Performance				★					
Ecodesign	★			★				★	
Cooperative	★	★							
Financing				★				★	★
Supply Chain	★		★						
Community Platform			★			★	★		
Social Mission				★	★				
New target group							★		
Giving							★	★	★
Auxiliary				★		★			
Information					★				

Figure 2. Focus points of the business model per outcome cluster.

Here, black stars represent the focus of a single business model patterns; however, this does not mean that the other dimensions are not addressed, but rather that a focus is defined for the purpose of demarcation.

4. Results

In total, 17 relevant publications were found, from which 125 usable samples could be extracted to include in the merger process (Table 10). These are, on the one hand, broad lists without a direct reference to the industry. On the other hand, with an almost balanced ratio of publications, there are sector-specific databases. The largest listing of 45 entries by Boons, Lüdeke-Freund [18] was not included here, as this is a literature review. Table A1 on the

appendix shows the relevant sources in detail. Not all authors provided information on the survey method, but it can be said that case studies are the most important source of patterns, followed by theoretical considerations that result from the existing research literature.

Table 10. Original sources of sustainable business model patterns.

Source	Number of Relevant Patterns	Focus Area of Publication
[88]	5	None, broad focus
[105]	6	Circular Economy Business Model Patterns
[106]	9	None, broad focus
[107]	7	None, broad focus
[32]	20	None, broad focus
[108]	3	E-learning
[26]	11	E-mobility
[31]	9	S&P 500 firms
[33]	6	Smartphone life cycle
[87]	8	Sharing economy
[109]	3	Circular economy
[110]	4	Social Value
[111]	7	Social Value
[20]	13	None, broad focus
[112]	3	Circular business models for the fast-moving consumer goods industry
[113]	6	Fast-moving consumer goods
[114]	5	Fast-moving consumer goods

From these publications, it was possible to collect patterns of 92 sustainable business models, with the results can be seen in Table 11. Therefore, the total number of patterns described in a publication could be more than doubled. This shows the rapid development of the field of sustainability. One can see that the fields of application of the patterns are widely spread, so that patterns are directly available for a large number of fields of application.

Table 11. Sustainable business model patterns.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Trash-to-cash	Pricing & Revenue	Selling of used products to extract the resources contained therein and use them as a basis for new products.	Duales System Deutschland and cmr	[88]
Reuse and Redistribution	Pricing & Revenue	Selling of second-hand goods, whereby at most, a slight upgrading has taken place through the removal of signs of use.	Rebuy and Godsinslösen	[89,109]
Refurbishing and repair gap-exploiter	Pricing & Revenue	Selling of used products that have previously been significantly repaired or overhauled.	Back Market and kaputt.de	[33,105]
Refurbishing and WEEE service provider	Pricing & Revenue	At the end of the life cycle of an electrical appliance, it is taken back from the user within the framework of a contract concluded in advance and subjected to further recycling.	AfB Group	[33]
Energy Saving Companies	Pricing & Revenue	A company enables energy savings for its customer and is paid on the basis of and in relation to them.	Danfoss Solutions	[107]

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Chemical Management Services	Pricing & Revenue	In the context of chemicals, the benefit achieved by the customer through the application of these is remunerated.	SAFECHEM	[107]
Freemium	Pricing & Revenue	Splitting the scope of a product into a basic functionality, which is provided free of charge, and additional services for an additional fee.	FreedomPop and TextNow	[32]
Pay for Success	Pricing & Revenue	The producer is paid only when his performance is successful.	Johnson & Johnson Social Finance/ Collective Health	[32]
Robin Hood	Pricing & Revenue	Charge wealthy customers more than poorer customers for the same product or service, so that the first rich subsidize the poor.	Museums, Aravind, Eye Care	[88]
Differential Pricing	Pricing & Revenue	Linking the price of services to fixed criteria that use the target group's ability to pay as a differentiating factor.	Narayana Health and Novo Nordisk	[32]
Reverse auction	Pricing & Revenue	Allocation of orders to the lowest bidding participant under fulfilment of given conditions.	Bundesnetzagentur	[26]
Negative operating cycle	Pricing & Revenue	A purchase price payment that is due upon conclusion of the contract, whereas the performance due is postponed.	traveller's cheque	[26]
Product-service systems	Pricing & Revenue	Business models that integrate products and services into customer offerings that provide a product, a functionality, or a result.	apple	[20]
Summary: The basic concept of sustainable business models, which links sustainability directly to financial outcomes, meaning that an increase in sustainability has a direct financial impact. Sustainability thus becomes a driver of growth and return. Being a default category, the patterns have the broadest application focus and can be used in any product related to sustainability.				
Subscription Model	Access Pro-vision	The customer pays an ongoing fee to gain ongoing access to a product or service.	Better Place and Blissmobox	[32]
Rent instead of buy (lease instead of sell, leasing, lease)	Access Provision	Temporarily lend a product to the customer and charge a rent instead of selling it for permanent use.	Xerox, fashionette and United Rentals	[88]
Shared infrastructure	Access Provision	Share a common infrastructure among several competitors.	ABACUS	[88]
Shared Resource	Access Provision	Access to a product in a community of users is sold instead of actual ownership, with a focus on the group behaviour.	AirBnB and Fon	[32]
Fractionalization	Access Provision	Splitting the power of disposal of a product that is too expensive for the target group on the basis of duration of use.	Marriott International	[26]

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Deliver functionality rather than ownership	Access Provision	Satisfying the user's need without owning the product that delivers the service.	Hilti and Rolls Royce plc	[20,32,108]
Summary: The sale of a product is replaced by granting use for a fee. The sustainable impact is centred around the minimisation of produced goods through increasing the efficiency of use. The core idea is about sharing, so that the focus of applications is on expensive, but rarely used, products because transaction costs have a minor impact on them.				
Recycling	Closing the Loop	Recycling of resources from used or no longer functional products as raw material for new services.	Duales System	[20,105, 106]
Cascading and Repurposing	Closing the Loop	Multiple use of the inherent energy of a natural energy source, such as wood.	Veolia	[105]
Organic Feedstock Business Models	Closing the Loop	Use of waste from food production and preparation as an energy source for processes with an exogenous energy demand.	KLM	[105]
Take back management	Closing the Loop	The value proposition of a product is extended to include a take-back guarantee, so that the customer has no problems when disposing of it.	Desso	[107]
Cradle to cradle	Closing the Loop	Products are not understood by the manufacturer as a one-time transaction, but are viewed in a holistic framework of use and recycling.	Gabriel	[107]
Closed-Loop Production	Closing the Loop	The waste that is generated during the production is continually recycled through capturing, reusing, or biodegrading and composting waste.	Novelis or Interface	[32]
Repair	Closing the Loop	Extending product life through repair and maintenance.	Agito Medica	[109]
WEEE service provider	Closing the Loop	Recycling and waste disposal of electrical equipment with the aim of transferring the highest possible proportion into new products and protecting the general public.	binee, take-e-way, and Closing the Loop	[33]
Summary: The category stands for the idea that waste should be seen as a valuable resource and, therefore, integrated in the production process rather than being disposed of. This pattern is particularly suitable for manufacturing companies.				
Functional sales and management services	Service & Performance	Integration of sustainability aspects into functional sales and management services, so that they influence the decision-making process.	Fairphone	[106]
Efficiency optimisation by ICT	Service & Performance	The efficiency of processes is increased through the integration of ICT technologies.	Bosch	[106]
Sustainable mobility systems	Service & Performance	Mobility services are provided in a way that reduces the negative impact on the environment and the community.	ubitricity	[106]

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Physical to Virtual	Service & Performance	Physical sales infrastructure is replaced by digital sales channels, so that resource consumption is significantly reduced.	Sungevity, FreshDirect	[32]
Maximise material and energy efficiency	Service & Performance	Replacing physical products with digital counterparts, saving the resources of physical deployment.	Pearson	[108]
Unique partnerships	Service & Performance	Selling an attitude to life associated with a bundle of services to fill them.	LMVH	[26]
Maximise material and energy efficiency	Service & Performance	Generation of the maximum output with a given number of resources through more efficient processes.	Aurubis	[20]
Substitute with renewables and natural processes	Service & Performance	Replacing non-renewable resources with renewable ones and artificial processes with ones that mimic or use processes in nature.	Thyssenkrupp	[20]
Summary: Sustainability is considered an integral part of the value proposition of a product. To justify this, the business model is geared towards consuming fewer resources relative to a conventional counterpart. The implementation here is non-specific, as potentially all starting points in the business model can be addressed. Consequently, the field of application is hardly limited, although services are more difficult to market.				
Repair & maintenance	Ecodesign	Extending the life cycle of a product through the easy reparability, which is a design trait.	SHIFT	[105]
Greener product/process	Ecodesign	Sustainable design of the production process.	Dassault Systèmes	[106]
Design, Build, Finance, Operate	Ecodesign	Combining the financing, creation, and operation of a product into a bundle of services designed for a multi-year basis.	Allfarveg	[107]
Produce on Demand	Ecodesign	A service is created only if there is a dedicated purchase contract for it.	LEGO CUUSOO, Threadless	[32]
Rematerialization	Ecodesign	New products are created so that waste can be a relevant resource pool.	Waste Management Lehigh Technologies	[32]
Usage-extending distributor	Ecodesign	Production and distribution of particularly long-lasting products.	Vireo, Deutsche Telekom, and Swisscom	[33]
Product Design	Ecodesign	Offering products that combine one or all of the following dimensions: responsible supply chain, long life expectancy, increase users' ecoefficiency, and are reusable, repairable, and/or recyclable.	Xella Denmark	[109]
Summary: The patterns describe a design and production process philosophy that is centred around the idea of resource consumption from a lifetime perspective. The overarching goal is to minimise resource consumption; therefore, it is particularly suitable for durable investment goods.				

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Industrial symbiosis	Cooperative	Linking of different stages of the value chain or of companies with similar needs for the resource-efficient implementation of production processes.	Cleantech Östergötland	[106]
Industrial Symbiosis Industry	Cooperative	In industry, unused or underutilised resources are made available to multiple consumers, so that the efficiency of resource utilisation is increased.	Kalundborg	[107]
Summary: Patterns under the label “cooperative” focus on linking different companies at the same and different stages of the value chain, so that networks are created that minimise waste and time losses by optimising resource usage. The patterns are, therefore, mainly relevant for companies with expensive resource inputs.				
Buy One, Give One	Giving	Every service sold is priced in such a way that an equivalent service can be given away to those in need.	2 Degrees TOMS Shoes	[32]
Summary: With “Giving”, the purchase of a product is combined with an obligatory donation for sustainable causes. Therefore, a trade-off between price and social value takes place, which determines a target group with high purchasing power. Relevant product categories have an initial low purchasing price, so that the surplus can be neglected.				
Innovative Product Financing	Financing	Implementation of innovative financing solutions for the payment of the purchase price or user fee of a service.	Simpa Networks Sungevity	[32,106]
Microfinance	Financing	The provision of small loans to low-income borrowers who do not have access to a traditional bank account.	WaterCredit Jamii Bora Bank	[32]
Crowdfunding	Financing	Financing through many comparatively small amounts raised from end consumers.	Kickstarter Fundly	[32]
Summary: “Financing” as a pattern deals with the question of how to raise money for companies and purposes that have no or underdeveloped access to financing. In this regard, non-traditional sources that value purpose as a part of the return are favoured. This pattern is relevant for companies and projects with no stable financing and cashflow, such as start-ups, as well as for purposes that do not generate risk-adequate returns.				
Alternative energy-based systems	Supply Chain	The exogenous process energy is obtained as sustainably as possible.	BASF	[106]
Green Supply Chain Management	Supply Chain	Sustainability is integrated into the supply chain, so that preliminary products are created in a socially and environmentally compatible manner.	IKEA IWAY	[33,107]
Inclusive Sourcing	Supply Chain	Only suppliers that meet the highest standards of sustainability and human rights are used.	Walmart Sylva Foods	[32]
Summary: The “Supply Chain” pattern is based on optimising the supply chain based on all three dimensions (economy, ecology, and social) of sustainability. This takes place along all upstream stages of the value chain and manifests itself, for example, through sourcing input factors with a lower carbon footprint. Yet, it is just as important to process the transactions in the value chain in a sustainable manner. The pattern is particularly suitable for large companies, as they have the same obligations imposed by the legislator and, at the same time, have the resources to ensure compliance.				

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Cooperative Ownership	Community Platform	Association of consumers who jointly own, manage, and use production factors or consumer goods.	Ocean Spray The Co-operative Group	[32]
Collaborative community platforms	Community Platform	Platforms that implement social or environmental topics based on the joint achievements of the members.	not far from the tree	[87]
Niche peer-to-peer platforms	Community Platform	Intermediation of goods and services with a niche character between commercial and non-commercial suppliers and consumers, following soft or no rules.	SmartCommute, BKS Y and WarmShowers	[87]
Niche corporate platforms	Community Platform	Intermediation of goods and services with a niche character between commercial and non-commercial suppliers and consumers, following strict rules.	FreshRents, Privateshare and Seats2Meet	[87]
Commercial peer-to-peer platforms	Community Platform	Intermediation of goods and services between commercial and non-commercial suppliers and consumers, following strict rules.	Poparide, reheart and Swimply	[87]
Peer-to-peer space sharing platforms	Community Platform	Informal mediation of areas for work and residential purposes between all possible target groups.	Airbnb, FlipKey and RoverPark	[87]
Peer-to-peer mobility sharing platforms	Community Platform	Brokerage of mobility services by private providers to the end consumer.	Turo, Uber and BlaBlaCar	[87]
Business-to-consumer mobility sharing platform	Community Platform	Brokerage of mobility services by commercial providers to the end consumer.	ZipCar, ShareNow and DropBike	[87]
Coworking space platforms	Community Platform	Rental of workstations in coworking spaces.	WeWork, Spaces and Impact Hub	[87]
Summary: "Community Platform" is a two-sided model. On the one hand, it creates value through the efficient allocation of goods and services, so that resources are used efficiently. On the other hand, companies could enter the platform economy and, consequently, could generate a monopoly earning through it. The pattern is particularly useful in markets where suppliers and consumers have little information about each other or where there is uncertainty about the quality of the service.				
Green neighbourhoods and cities	Social Mission	Increasing the sustainability of human settlements by incorporating sustainable technologies and increasing the proportion of plants in the built environment.	Grüne Nachbarschaft	[106]
Sufficiency-advocating network provider	Social Mission	Combination of a main service with a secondary social purpose that has no direct relation to the design of the main service.	good	[33]
Two-Sided Social Mission	Social Mission	Linking companies that want to be socially active with target groups in need.	Was hab' ich?	[110]

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
One-Sided Social Mission	Social Mission	Providing access to services that the vulnerable target group would otherwise not be able to afford.	Arbeiterkind	[110]
Commercially Utilised Social Mission	Social Mission	Offering a product or service for free to a social target group while earning revenue from monetising the information generated by the social target group.	co2online	[110]
Market-Oriented Social Mission	Social Mission	Enable labour market access for target groups with multiple employment barriers.	Fifteen	[110]
Micro Distribution and Retail	Social Mission	Establishment of a livelihood-securing source of income through trade for disadvantaged target groups.	Project Shakti of Hindustan Uni Lever	[111]
Experience-Based Customer Credit	Social Mission	Lending by non-financial market companies based on experience with the respective customer from existing business relationships.	MYbank	[111]
Last-Mile Grid Utilities	Social Mission	Covering the gap between households and bigger supply lines through access to financing and customer service.	Last Mile Solutions	[111]
Value-for-Money Housing	Social Mission	Housing that offers a combination of high value for money and facilitated access to mortgage financing for people with low income.	Housing Plus Group	[111]
Smallholder Procurement	Social Mission	Linking many inherently geographically remote locations into one network, so that synergies in transport, packaging, and capacity result in an attractive target group.	National Food Reserve Agency in Tanzania	[111]
e-Transaction Platforms	Social Mission	Reducing transaction costs by incorporating digitization, so that lower-income groups can also gain access to scarce goods.	PayPall	[111]
Value-for-Money Degrees	Social Mission	Enabling access to university education for low-income groups.	The Open University	[111]
Social enterprises	Social Mission	Businesses that have in addition or solely the goal of creating a social impact.	Aravind Eye Care	[20]
Repurpose for society or the environment	Social Mission	Utilising organisational resources and capabilities to create societal or environmental benefits.	Bosch Stiftung	[20]
Inclusive value creation	Social Mission	Delivering value to formerly unattended stakeholders or including them in the value creation process.	Unilever and Symrise	[20]

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Summary: In the “Social Mission” pattern, a strong stakeholder orientation in the corporate goals and, consequently, in the corporate strategy is the core idea. Therefore, profit is not the first goal of companies, but rather creating a positive impact. The application focus is, therefore, broad, as almost every business model could be rearranged in a way to improve the social value.				
Micro-Franchise	New target group	Adaption of the traditional franchising concept to the poor in order to own and manage their own businesses.	Fan Milk Limited Hapinoy	[32]
Alternative Marketplace	New target group	Tapping previously untapped potential by using a new transaction mechanism between customer and manufacturer.	ITC e-Choupal OneMorePallet	[32]
Own the undesirable	New target group	Pursuing a business in seemingly unprofitable market segments.	Ryanair	[26]
Dial down features	New target group	Addressing target groups with comparatively low needs with appropriate services.	Dacia	[26]
Licensors or franchisor	New target group	Licensing of a business model for sustainable purposes.	Messe Nürnberg	[26]
Bottom of the pyramid solutions	New target group	Producing goods and services for customers at the bottom of the income pyramid.	Xiaomi	[20]
Summary: “New target group” refers to the development of new customer groups that would not have been reached without the business model. Here, the focus is on a social mission that tries to reach disadvantaged groups as customers. The pattern is, therefore, broadly applicable.				
Behaviour Change	Information	The business model is aligned to incentivize and reward customers for sustainable behaviour.	Opower Recyclebank	[32]
Adopt a stewardship role	Information	Protecting natural systems by introducing a gatekeeper who controls access or incentivizes and, therefore, moderates certain behaviours.	National Park Service (USA)	[20]
Encourage sufficiency	Information	Providing information and incentives that encourage less consumption.	RESET—Digital for Good	[20]
Summary: The patterns of the “Information” group aim to enable customers to make an informed decision regarding consumption, so that a nagging approach towards behaviour change can be implemented. The application horizon is broad, with a focus on a market where several products are substitutes relative to each other.				
Develop scale-up solutions	auxiliary	Breaking up the traditional relationship between customer and producer through the use of digital tools.	Amazon	[108]
Reverse razors/blades	auxiliary	Consumables are exchanged between different main products.	Canon Printer or Apple Music	[26]
Develop sustainable scale up solutions	auxiliary	Scaling up sustainable solutions and technologies.	Impact Hub Ruhr	[20]
Multi-sided platform	auxiliary	A platform that brings suppliers and buyers together and thus facilitates transactions.	eBay	[26]

Table 11. Cont.

Name of the Pattern	Outcome Dimension	Description	Case Study Company	Source
Unbundling the business model	auxiliary	A provider focuses on one value step or need.	Blau.de	[26]
Bundling	auxiliary	Bundling of several different services from one or more providers into a single service block, so that the consumer can choose the fitting option and, therefore, consume less.	Google	[26]

Summary: With regards to “auxiliary”, patterns are to be applied broadly, as they do not aim directly at increasing sustainability. Rather, they provide support and a competitive advantage for sustainable business models, so that the negative effects of more sustainability, such as higher costs, can be compensated for, and the service becomes marketable.

There are two basic types of application for business model patterns. Firstly, they can be used unchanged as a basis for business model innovations. Secondly, they can be adapted, for which Abdelkafi, Makhotin, Posselt [26] is an example in the scientific field. By adapting business model patterns for the application purpose of electromobility, the possibility of a transfer becomes apparent. Tools to be used in practical work in the company are, for example, the “pattern combination matrix” according to Echterfeld, Amshoff, Gausemeier [81], or by applying an adapted form of “morphological analysis” as described by Seidenstricker, Linder [115] or Lüdeke-Freund, Gold, Bocken [105]. Further development of the patterns can take place, for example, through creativity techniques, such as “association” or “confrontation” [81] or the “6-3-5 method” [116]. In general, a variety of creativity techniques offer starting points for pattern innovation.

The starting point in any case is a collection of patterns, as the presented research demonstrates.

5. Discussion & Limitations

The taxonomy presented here is not the first attempt to organise the field of sustainable business model innovations. The field was covered by both initial surveys (e.g., [32]) and literature reviews (e.g., [89]).

First of all, it must be stated whether the aim of the work is to collect a holistic collection of relevant business model patterns for sustainability to be realised. Compared to Boons, Lüdeke-Freund [18], as the most extensive collection of patterns to date, the number of patterns has more than doubled. By including both sector-related publications and those with a broad focus, it was also possible to take a holistic view. Against this background, it can be assumed that the present publication is the most comprehensive collection of samples to date.

This is also supported by the fact that the patterns reflect the three-pillar model of sustainable development. Thus, ecological patterns and outcomes are pursued, as well as economic and social ones. Thus, the representation of the underlying construct is given, whereby it should be critically noted that there is a focus on the topic of ecology. However, this corresponds to the public discussion and the requirements induced by external legislation, such as the circular economy or waste avoidance.

In the following, it must also be clarified whether the underlying goal of using the collection to realise business model innovations in order to achieve more sustainability can be achieved. The basic research direction is scientifically validated, as the cited publications on the topic of sustainable business model innovation show the fundamental fit of the idea. Csik [2] showed, for example, that the use of business model patterns can increase creativity in the business model innovation process so that it delivers better results. In the case of sustainable business model innovation, Linder, Williander [117] proposed additional problem areas, such as the likelihood and impact of product obsolescence. The communicative function of patterns can counteract this by increasing the level of understanding of all involved.

However, a well-founded evaluation and quantification of the positive influence is still pending. The determination of the positive correlation is subject to many problem areas, starting with the design of a functioning and effective business model [118]. Challenges can still arise because patterns, as publicly available information, do not create a comparative competitive advantage, as theoretically everyone has access to them. In this regard, the fact that 90 percent of all business model innovations are the recombination of already existing patterns is relevant [76]. Therefore, the pattern itself is not the relevant outcome, but the database itself is the core element, as it provides different patterns in a structured way that yields combinations, for example, through tools such as the pattern combination matrix" according to Echterfeld, Amshoff, Gausemeier [81], or by applying an adapted form of "morphological analysis", as described by Seidenstricker, Linder [115] or Lüdeke-Freund, Gold, Bocken [105]. In addition, the underlying publications of the samples show that a strong practical orientation prevails. It can, therefore, be assumed that they are close to application. Thus, the present publication can stimulate sustainable business model innovations; nonetheless, how well this works is still the subject of future research.

Finally, the aim of the survey was to strike a balance between sound methodology and easy accessibility for practitioners in the companies. The dedicated focus on the needs of the target group is reflected in the differentiation of the application fields of the pattern. The output dimension of the taxonomy is, with 14 dimensions, much more fine-grained than comparable publications, such as Lüdeke-Freund, Gold, Bocken [105]. Yet, they use a more differentiated involvement of external parties. The decision to entrust only one person is made against the background of the greater consistency of the results, but at the same time, this also represents a limitation. The evaluation shows that a level of target group orientation comparable to other publications has been achieved.

Moreover, the used taxonomy is a model, and as such, it represents reality in a condensed way. The business model itself is also a simplified representation of the entrepreneurial activity. Cumulatively, therefore, success factors may have been distorted or forgotten during the iterative simplification, either because they were not considered relevant or because their relevance only emerges from the interaction with the other factors. This cannot be ruled out, but in the context of the application of the designs, a combination of these is sought, so that this is of secondary importance.

Further, the contributions to the patterns are not evenly distributed, but a few authors like Clinton, Whisnant [32], with 20 patterns, have a disproportionate share. This is mitigated by the fact that the patterns are merged, and the accumulations are broadly based collections without a specific sectoral reference.

One factor that has a limiting effect is that the existing literature is evaluated. Relevant patterns can, therefore, not be part of the enumeration, as these have not yet been described scientifically, although they already exist in practice. In addition, patterns may be missing because publications like Xia-Bauer, Vondung, Thomas, Moser [119], based on the focus on patterns in the context of companies, were not included. Further, only formulated patterns were transposed in order to enable a sound comparison, which excludes publications such as Reuter [120]. Cumulatively, this is a minor problem due to the small number of excluded patterns, but it can be seen as the first point of future research fields. New patterns are continuously emerging due to the pressure on companies to adapt [16]. Together with the general fact that business model patterns are in danger of disregarding important and new patterns [121], there is a need to repeat the survey in the future.

Finally, the coding was only performed by one person, so bias may have resulted. The orientation towards existing categories should counteract this, but that can only partially compensate for the disadvantage.

6. Direction for Future Studies & Implications

Further research is needed on how to increase the effectiveness of pattern-based innovation. Here, for example, the process-oriented approach according to

Gausemeier et al. (2017) [25], which is strongly oriented towards the manufacturing industry, could be a starting point.

In addition, there are publications that show that circular business models gain greater acceptance through digital technologies [122]. Whether this effect can also be observed in the context of sustainable pattern-based business model innovations needs to be explored. If the focus is placed more on the sustainability aspect, the publication of Reim, Sjödin, Parida [123] with the “Circular business model decision tree” is a relevant starting point.

This also shows the scientific contribution, which, in addition to new research directions, consists in the presentation of all known patterns, which enables other researchers to easily find out the current state of research. Thus, both the application-related research environment, such as Abdelkafi, Makhotin, Posselt [26], benefit, as well as basic research. More generally, a contribution is made to the establishment of sustainable business models in the context of scientific discourse. Practical contributions include outlining the scope of possible sustainable business models and, therefore, acting like a stimulus-based business model innovation technique, as Csik [2] showed that evaluating existing business models can increase creativity in the business model innovation process so that it delivers better results. Finally, by referring to relevant role models and, thus, activating the analyse and communication function of the business model, this publication enables innovations to be implemented more quickly and more likely.

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Appendix A

Table A1. Sources of the business model patterns.

Source	Source	Name of the Publication
[88]	International Journal of Innovation Management	The Business Model Pattern Database—A Tool For Systematic Business Model Innovation
[105]	Journal of Industrial Ecology	A Review and Typology of Circular Economy Business Model Patterns
[106]	OECD Publishing	Why New Business Models Matter for Green Growth
[107]	Nordic Innovation	Green Business Model Innovation
[32]	SustainAbility Inc	20 Business Model Innovations for Sustainability
[108]	Journal of Cleaner Production	Analysis of the growth of the e-learning industry through sustainable business model archetypes: A case study
[26]	International Journal of Innovation Management	Business model innovations for electric mobility what can be learned from existing business
[31]	Journal of Cleaner Production	Sustainable business model adoption among S&P 500 firms: A longitudinal content analysis study
[33]	Journal of Cleaner Production	Business model patterns of sustainability pioneers—Analyzing cases across the smartphone life cycle
[87]	Journal of Cleaner Production	Business model patterns in the sharing economy
[109]	Nordic Council of Ministers	Moving towards a circular economy
[110]	Entrepreneurship Research Journal	Monetizing Social Value Creation—A Business Model Approach
[111]	International Finance Corporation	Accelerating Inclusive Business Opportunities: Business Models that Make a Difference
[20]	Journal of Cleaner Production	Sustainable business model innovation: A review
[112]	Sustainable Production and Consumption	Circular business models for the fastmoving consumer goods industry: Desirability, feasibility, and viability
[113]	Sustainability	Characterisation and Environmental Value Proposition of Reuse Models for Fast-Moving Consumer Goods: Reusable Packaging and Products
[114]	IS4CE 2020 Conference of the International Society for the Circular Economy	The Evolution of Reuse and Recycling Behaviours

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