System Definition of the Business/Enterprise Model

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Abstract. Business and enterprise modeling has gained its momentum. Today, there are various approaches that allow describing an enterprise from different points of view. However, it is not possible to cope with the growing variety of the heterogeneous models without a clear and well-defined approach. This paper proposes the system definition of the business/enterprise models based on the systems analysis and the general system theory. This definition is verified by four examples of the existing business/enterprise models given by different authors and widely used both in academia and industry.

1 Introduction

Business modeling is considered to be a "managerial equivalent of the scientific method" [1]. A scientific method requires a sound foundation, however, there is no single definition of the business/enterprise model that is accepted by the research community and industry as a standard [2–5]. It is often the case that the business/enterprise model is defined in terms of some domain where this model emerges, and, thus, it cannot be understood by all the stakeholders of the enterprise. It is commonly agreed that the business model describes the enterprises' nature and might show a way to gain a competitive advantage [6]. The lack of such information on the managerial's table doesn't lead to a failure, but rather to an inefficient use of the existing enterprises' resources. Moreover, the business/enterprise model plays an important role in different projects executed in the enterprise, such as enterprise engineering and enterprise integration [7].

This paper shows how the business/enterprise model can be defined using the systems analysis [8] and the general system theory [9]. We propose to represent a business/enterprise model as the system of interconnected views (representations) [10]. The features selected by the stakeholders determine these views. Such multi-view implementation of the business/enterprise model is driven by a necessity to show a single enterprise-object from multiple points of view. Our definition of the business/enterprise model could be regarded as a meta-definition in the sense of meta-modeling. We show examples of the enterprise features that

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might have been chosen in the existing definitions of the business/enterprise model [2, 11–13].

This paper is structured as follows. Section 2 revisits the basics of the systems analysis and the systems theory. Section 3 presents a system theory based definition of the business/enterprise model. Section 4 provides an evaluation of the proposed definition on four examples. Section 5 gives an overview on the state of the art in the business/enterprise modeling, while Section 6 concludes the paper.

2 What Is a System and Systems Analysis?

Systems analysis [8] is an applied scientific methodology that is based on a variety of mathematical methods and procedures, and provides guidance on how to study the object under research by developing an interdisciplinary knowledge about it. The systems analysis takes into consideration conflicting goals, existing risks, and the incompleteness of the information about the object under research and its environment. The core idea of this methodology is to create a new "dimension" when doing research or solving a problem by adding the systems aspect [14]. This aspect unifies the knowledge about the properties of the object, the information about its relations with other objects within some environment, and the internal relations between the parts of the object.

The main concept in the systems analysis is the notion of a system. This paper uses the following definition [10]: *system* $S = (E, R)$ is a structure containing a set of *entities* E and a set of *relations* $R \subseteq E^n$ between these entities. The system is more than just a set of its entities, because of the *synergy* effect. This effect causes the system to have some new features that are not provided by the set of disjoint entities [15].

The system, its entities and relations have some *features* (*properties*). The feature is a pair $f = (k, v)$, where k is a definition of the feature, and v is its value for a given system, entity or relation. The values of k and v are not limited to a particular notion or domain, and depend purely on the system under consideration and the problem being solved.

Consider an enterprise represented as a system, then one of the features of its entities is a function of the entity within the enterprise $f_F = (k_F, v_F)$. So, k_F is defined as "the function of the entity within the enterprise". The value can be given in a textual form (e.g., "production", "marketing", "finance"), or in a form of a process showing how the inputs are transformed into the outputs (e.g., a business process diagram [16]). However, a good practice would be using a single modeling notion to express the values of each feature. The values of different features might be expressed in different notions. Such practice arises due to the need to compare the system's entities based on the selected features. Therefore the values should be comparable, preferably in a single notion to avoid a comparison of apples and oranges.

Based on the features of the system, we define a *view* on the system S as a transition function $P : (S, F) \to (E, R)$, where F is a set of features [10].

The system is split into entities based on the selected features, and all the entities have pairwise different values of these features. Splitting a system into smaller parts, and working with a partial system's representation (view) is one of the systems analysis foundations [8]. The views of the same system can be ordered. The ordering allows discovering a set of features defining the smallest entities of the system, i.e., the essence of the system in a classical way [9]. Moreover, the ordering also allows determining the smallest set of features required to represent the system under analysis given the setup of the problem.

Using an already described feature f_F, we can define a view $P(S, \{f_F\})$ for an enterprise S. Having chosen a textual notion for the value of the feature, we create a functional structure of the enterprise [17]. When choosing a business process description as a value of the feature, we create a process based organizational structure [18]. This example shows a need for the precise definition of the used features, and a proper selection of the notion for their values.

The features of the system and the feature-based views on the system are the fundamentals of the business/enterprise model definition presented in the next Section.

3 The Business/Enterprise Model

There is no single definition of the business/enterprise model [2–5]. However, there is a common understanding that such model should present the enterprise to its stakeholders by means of showing some particular aspects or dimensions of the enterprise. These aspects can be expressed based on the features of the enterprise and its entities.

The business model and the enterprise model can be regarded as synonyms [19] or different terms [5], and the relation between them requires a separate research that is beyond the scope of this paper. However, recently the term "business model" is more frequently used in the literature. Therefore, this paper uses the term "business model" to refer to both business and enterprise models.

The business model can be defined as a system derived from the enterprise. The entities of this system are the views on the enterprise that are defined by the selected features.

Definition 1. *Business model $BM(S)$ for the enterprise S is a system, whose entities p_i are the views on the enterprise based on the subset $F_{BM}^{(i)}$ of the enterprise's features F_S.*

$$BM(S) = \left(\left\{ p_i = P\left(S, F_{BM}^{(i)}\right) | F_{BM}^{(i)} \subseteq F_S \right\}, R_{BM} \right)$$

Definition 1 could be regarded as a meta-definition of the business model in the sense of meta-modeling. It allows defining a specific business model by choosing a set of features required for analysis of the enterprise in the specific situation. The views of the business model in Definition 1 are conceptualizations. They only define enterprise's entities and relations between them in a formal way, but

don't show their essence. Therefore, the views should be implemented using some modeling tool before they can be used in the discussion with the stakeholders (e.g., by means of mathematical, graphical, or descriptional models). For example, UML can be used as a modeling tool for implementation of the views. The result will be UML class diagrams with the organizational entities being classes, and associations being relations between them. Another possibility to implement the views is to use a kind of descriptional model (i.e., textual description containing non-standardized block diagrams). The latter is better accepted and often used by the management.

Figure 1 summarizes the previous discussion around the given definition of the business model. For the sake of simplicity, we have shown only one business model, but there might be multiple depending on the set of selected features. For each view there might be also different implementations. Note that we distinguish between two types of relations among the entities in Figure 1: dependency and realization.

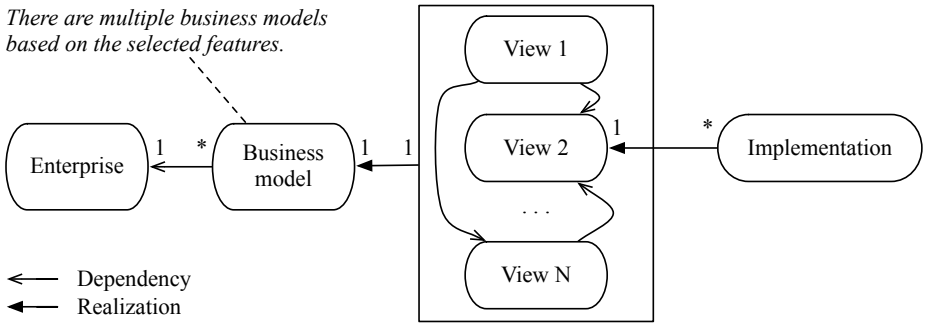

Fig. 1. Relations between the enterprise and its business model

Let's show an example of a business model for the enterprise. Every enterprise has an organizational structure [17], and we can select a structural feature $f_S = (k_S, v_S)$ to build the business model. The business model is $BM(S) = (\{p_S\}, R_{BM})$, where $p_S = P(S, \{f_S\})$. The definition k_S is "the organizational role of the entity in the enterprise". The view p_S contains the organizational entities of the enterprise and the relations between them (e.g., the values v_S for the entities will be "an institute", "a faculty", and "a chair" in a university, when a university is regarded as an enterprise).

4 Evaluation

Definition 1 allows inspecting the features that have been possibly selected to create existing definitions of the business model. We have selected four examples of the business model definitions described in the literature [2, 11–13]. The models have been chosen for the following reasons. The definition given in [2]

is popular in the scientific community, and at the moment of writing this paper has been cited more than 430 times. Schief and Buxmann [11] apply this model to the software engineering domain, and make an empirical verification of their definition. Osterwalder and Pigneur [12] have proposed another definition of the business model that has been co-created by 470 members of the Business Model Innovation Hub. And the last selected definition is a "classical" enterprise architecture work by Zachman [13]. As discussed in [5], the enterprise architecture is a business model, though it is not referred to as such.

The evaluation goes as follows. First, we describe the definition of the business model. After that, we give a possible set of features that might have been used for the definition, and show the correspondence between the definition in the business model and Definition 1.

Example 1. The unified perspective on the business model [2] consists of six "components". Each component is defined in a form of a question to an enterprise, and the answer could be given it terms of component's properties. The relations between the components are not defined, though the components describe the same enterprise. The business model has three levels (foundation, proprietary, and rules) that form a hierarchy, and drill down from an abstract to a precise description of the enterprise. We consider only the top most foundation level. A possible set of features that drove creation of this business model contains three features:

- $f_1^{(1)} = \left(k_1^{(1)}, v_1^{(1)}\right)$ with the name $k_1^{(1)}$ "*customers/outputs*"
- $f_2^{(1)} = \left(k_2^{(1)}, v_2^{(1)}\right)$ with the name $k_2^{(1)}$ "*competitors/market*"
- $f_3^{(1)} = \left(k_3^{(1)}, v_3^{(1)}\right)$ with the name $k_3^{(1)}$ "*internal processes of the enterprise*"

In terms of our approach, the "component" can be mapped to a view, and the business model is defined as $BM(S) = (\{p_i\}, R_{BM})$, where $p_i = (S, F_i)$, and $i = \overline{1,6}$. The relations between the views p_i should be captured in the set R_{BM}. So, the views-components are built using the following features:

1. Component "how do we create value?":$F_1 = \left\{f_1^{(1)}, f_3^{(1)}\right\}$
2. Component "who do we create value for?": $F_2 = \left\{f_1^{(1)}\right\}$
3. Component "what is our source of competence?": $F_3 = \left\{f_3^{(1)}\right\}$
4. Component "how do we competitively position ourselves?": $F_4 = \left\{f_2^{(1)}\right\}$
5. Component "how we make money?": $F_5 = \left\{f_1^{(1)}, f_2^{(1)}\right\}$
6. Component "what are our time, scope and size ambitions?": $F_6 = \left\{f_1^{(1)}, f_2^{(1)}\right\}$

This business model provides quite interesting insights on the enterprise by using various combinations of features when building the views.

Example 2. In [11], authors propose a software industry specific business model containing 5 groups and 20 elements. The business model is specific for the software industry, and it is based on multiple other definitions, including [2]. This business model definition is similar to Example 1 in its descriptive approach, and also doesn't specify the relations between its groups. A possible set of features to characterize the groups contains three features:

- $f_1^{(2)} = \left(k_1^{(2)}, v_1^{(2)}\right)$ with the name $k_1^{(2)}$ "*technical?*"
- $f_2^{(2)} = \left(k_2^{(2)}, v_2^{(2)}\right)$ with the name $k_2^{(2)}$ "*enterprise or software related?*"
- $f_3^{(2)} = \left(k_3^{(2)}, v_3^{(2)}\right)$ with the name $k_3^{(2)}$ "*strategical or operational?*"

The groups can be mapped to the views, and the elements are the entities of these views in terms of our approach. So, the business model is $BM(S) = \left(P\left(S, \left\{f_1^{(2)}, f_2^{(2)}, f_3^{(2)}\right\}\right), R_{BM}\right)$. Each view has been created using all the features, and they have the following values $(f_1^{(2)}; f_2^{(2)}; f_3^{(2)})$:

1. Group "strategy": non technical; enterprise and software related; strategical
2. Group "revenue": non technical; enterprise and software related; operational
3. Group "upstream': technical; software related; operational
4. Group "downstream": non technical; enterprise related; operational
5. Group "usage": non technical; software related; operational

This business model definition could be regarded as a set of views on the enterprise along three different axes identified by the selected features.

Example 3. The business model proposed by Osterwalder and Pigneur [12] gives an insight into the nature of the business model. It consists of nine building blocks that are organized on a so called canvas: customer segments (CS), value propositions (VP), channels (CH), customer relationships (CR), revenue streams (RS), key resources (KR), key activities (KA), key partnerships (KP), and cost structure (CS). These building blocks are connected in a complicated way. The relations between these blocks are implicitly defined in the business model. Such specification qualitatively improves the business model, and positively distinguishes it from Examples 1 and 2. The blocks and the structure of the business model are shown in Figure 2.

A possible set of features that inspired the creation of this business model definition is:

- $f_1^{(3)} = \left(k_1^{(3)}, v_1^{(3)}\right)$ with the name $k_1^{(3)}$ "*does the view reflect financial sides of the enterprise?*" and possible values $v_1^{(3)} \in \{yes, no\}$
- $f_2^{(3)} = \left(k_2^{(3)}, v_2^{(3)}\right)$ with the name $k_2^{(3)}$ "*what is the target of the view?*" and possible values $v_2^{(3)} \in \{company, customer, both\}$
- $f_3^{(3)} = \left(k_3^{(3)}, v_3^{(3)}\right)$ with the name $k_3^{(3)}$ "*does it belong to an enterprise (is it managed by an enterprise)?*" and possible values $v_3^{(3)} \in \{yes, no\}$

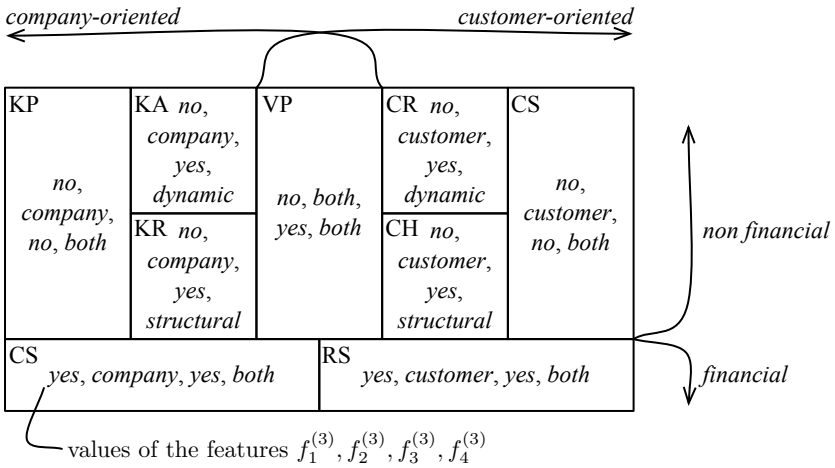

Fig. 2. The entities of the business model proposed in [12] with the values of the features $f_1^{(3)}$, $f_2^{(3)}$, $f_3^{(3)}$, and $f_4^{(3)}$

– $f_4^{(3)} = \left(k_4^{(3)}, v_4^{(3)}\right)$ with the name $k_4^{(3)}$ "*type of the view?*" and possible values $v_3^{(3)} \in \{structural, dynamic, both\}$

The building blocks of the business model can be mapped to the view in our approach, so $BM(S) = \left(P\left(S, \left\{f_1^{(3)}, f_2^{(3)}, f_3^{(3)}, f_4^{(3)}\right\}\right), R_{BM}\right)$. The values of these features for each entity are shown in Figure 2.

Example 4. Zachman [13] proposes a set of views on the enterprise in a form of a table that is called the Zachman framework. This is a 6 times 6 table formed by an intersection of communication questions (what, how, when, who, where, and why) and reification transformations (identification, definition, representation, specification, configuration, and instantiation). Lately, the reification transformations have been mapped to the audience perspectives [20].

The business model according to this framework contains six views corresponding to the audience perspective, and they can be also considered as views in our approach, so $BM(S) = (\{p_i\}, R_{BM})$, where $i = \overline{1,6}$. The feature that has been chosen to define this set of views is a "*level of detalization*" with the values ranging from *a high-level perspective* to *a very detailed* one. Each view consists of six entities that correspond to the communication questions, namely $p_i = \left(\left\{e^i_{what}, e^i_{how}, e^i_{when}, e^i_{who}, e^i_{where}, e^i_{why}\right\}, R_{p_i}\right)$. The relations between the entities inside the view differ depending on the view.

Evaluation Summary. We have selected four business models that are coming from different backgrounds. We have given examples of the features that might have been used to define these business models, and, thus, these definitions can

be formalized using Definition 1. Note that there might exist other ways to identify the features of the presented business models.

The examples have shown that it is possible to formalize the business model as a system of views or components of an enterprise. However, in practice, these views are often isolated, and the relations between them are not defined at all, though they target the same enterprise.

After the analysis of the features that might have driven to the creation of the business model, it is possible to reveal the necessity of using the ideas from UML, systems analysis [8] and the system theory of technology [21] in order to separate the identified features into groups. The examples of such groups are static, dynamic, use case, and control features. These groups allow to pre-define a set of possible features that can be used when defining a specific business model, and, thus, provide a possible guidance to the unified definition of the business/enterprise model.

5 Related Work

The definition of the business model has been widely discussed both in academia and industry [2–5]. Recent literature review [3, 4] has revealed the rise and the growing importance of the business modeling domain since early 1990s. However, there is no single definition of the business model, possibly due to the fact that this field is relatively young, and still in a rapid evolution phase.

The variety of the business models tries to cover the variety of the existing enterprises. This is typically achieved by a definition of the industry specific models, e.g., software industry [11], e-commerce [22], and utility services [23]. Such models are created as a result of the detailed analysis of the selected industry, and it is not easy to reapply them in a different context (i.e., in a different industry). Moreover, these models are empirical, and, hence, don't take into consideration the knowledge from the theory of the firm [17]. To build an adequate business model, it is required to integrate this knowledge into the business model definition. In our approach this can be done by a proper selection of the features when building the business model.

In [5], authors make first steps towards a unified definition of the business model by defining two levels: a metamodel and a model of the enterprise. The metamodel shows the elements belonging to a business model, and the model is an instance of the business model for the specific enterprise. However, the methodology for definition of such metamodel hasn't been described. We cover this gap by using the meta-modeling mechanisms and the system theory [24].

Another possible tooling for creating a concept and an instance of the business model is an ontology [25]. Ontology is a very powerful tool because it accepts the object under research as an open system, and allows defining the missing elements. However, the core of the ontology is defined empirically, as in the other works discussed previously.

There is a common tendency to define the business models using two notions [4]: a component [26] as a building block of the business model, and a point

of view [27] that represents the enterprise from different perspectives. However, these concepts haven't been formalized to form a crisp and generic business model definition. Our work extensively uses these concepts having formalized them by means of the system theory [8, 9, 21].

In [28], authors apply the general system theory to the enterprise in order to analyze the enterprise architecture. The enterprise is interpreted as a socio-technical system, and the elements of the enterprise architecture are mapped to the concepts of the socio-technical system. The authors describe the motivation of application of the systems theory to the enterprise. However, their work is limited to the enterprise architecture.

In summary, the definition of the business model has been given from different perspectives and in various contexts. The idea of separating the business model into multiple conceptual layers has been discussed. However, to the best of the authors' knowledge there is no in-depth analysis of the business model with regards to the general system theory from a scientific perspective.

6 Conclusion

This paper proposes an application of the systems analysis and the general system theory to the business modeling domain. It presents a (meta-)definition of the business model, and shows its correlation with the existing definitions of the business model. Such feature-based definition allows a system representation of the enterprise that can be plugged into various enterprise frameworks. The roles of the features are manifold: they are the levels of the enterprise's formalization process, and can be also used for model validation. The evaluation has shown the rationality of such approach and has identified missing points in some definitions. It is often the case that the business model definitions represent the business model as a set of views, but don't consider the relations between them. Our future work will focus on the deep analysis of the features that drive creation of the business model definitions. Such set of features could be a possible way to the unified definition of the business/enterprise model.

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