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An Approach to Model Industry Ecosystems

Enabling an Ecosystem for Service Platforms

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Abstract. Service platforms require a transparent and if possible systematic overview of the industry they are placed in. Currently, no modelling method for specifying industry ecosystems is available. However, the paper describes the specifics of a developed industry ecosystem modelling method. It consists of an actor-relation layer, to illustrate the type of connectivity between the actors, a data-relation layer, to demonstrate the kind of data exchanged, and a service based data-relation layer, to demonstrate an industry ecosystem supported by service platforms. By means of the proposed modelling method, an introduction of a service platform within an industry is facilitated.
The qualitative approach for this paper includes a review of relevant secondary literature to point out the basic structure and similarities of current modelling methods and thus the gap in research.

Keywords: industry ecosystem • modelling method • service platform • digitalization

1 Introduction

In secondary literature, the term ecosystem usually describes interconnecting and interacting stakeholders, which together form a system [1, 2]. Today in the digitalization era, industry ecosystems are in a transformational digital wave, due to technologies enabling digitalization, such as mobile, social, big data or cloud. Such arising digital ecosystems – unlike traditional value chains – are characterized by the coopetition of major players [3]. Coopetition is a phenomenon of digital ecosystems where the actors not only compete with each other but also cooperate simultaneously with each other. Companies should not just serve customers, they should also collaborate with them, and they should not see their rivals only as competitors, but as partners to create new value [4]. This leads to the foundation of a digital economy.

The main benefit of a digitalized industry ecosystem is improvement in collaborative processes between the different actors of an ecosystem by means of shared services along their workflows. Service platforms simplify such intercompany workflows since different companies are linked to each other through the platform and are using the same services provided by the platform. This makes information exchange and collaboration between different actors easier. Furthermore, with the next wave of technology-

enabled platform-driven ecosystems, service platforms throughout industries are arising. This facilitates scalable, adaptable, and interconnected ecosystem-based digital economies, which are based on integrated services.

Today, the main challenges for ecosystems are the transformation towards a digitalized industry ecosystem and the integration and maintenance of the ecosystem actors [2], [5,6]. Industry stakeholders are aware of this and know, at least for the most part, that they need to transform themselves. Yet, realizing digital transformation remains a challenge [4], [7]. Specifying the industry ecosystem is the suggested way of this research project to start with the digital transformation. By means of a generic modelling method to describe industry ecosystems, the industries will gain increase of transparency on the current situation of their ecosystem. In addition, the modeler would have a systematic approach to model an industry ecosystem on which their service platform can run. In a heterogeneous environment like the industry ecosystem, it is necessary for service platforms to know which kind of data is exchanged between companies in order to provide the platform that suits the actor's service needs best. The developed industry ecosystem modelling method should provide this information for a service platform provider.

The paper is organized as follows: in section 2, insights to the existing frameworks and models describing business ecosystems are given. Based on this literature, a modelling method, which supports specification of industry ecosystems, is created in section 3. Section 4 provides insights from the evaluation of the model method. The last section evinces the conclusion of this research paper.

2 Frameworks and Models to Describe Business Ecosystems

2.1 Business Ecosystem Dimensions Supported by Key Management Practices

A known approach is the 6C framework for describing an "Internet of Things" (IoT) - based business ecosystem. It defines six dimensions a business ecosystem must consider [8]. *Context*, which is to specify the environmental features of the ecosystem. *Cooperation*, which is to specify the mechanisms which the actors use for interaction to accomplish the common strategies. *Construct*, which is to specify the basic structure and auxiliary infrastructure of the business ecosystem. *Configuration*, which is to define the stakeholder relationships and their configuration patterns within the business ecosystem. *Capability*, which is to determine the key success features of the business ecosystem. *Change*, which is to specify the shift of system configuration pattern from one lifecycle to the other.

These dimensions' match to define the structure of a business ecosystem. Yet, some key management practices, which help to continually improve a functioning business ecosystem, are important to consider during the development phase of the industry ecosystem modelling method. Currently, most organizations are not effectively using management practices to maximize their ecosystem performance by continual improvements [9]. There is generally a chance to increase value within existing ecosystems just by refining six management practices [9]. *Loose coupling*, which is to be flexible and

scalable. *Access management*, which is to expand the ecosystem by number of actors according to the objective and scope of the ecosystem. *Behavior management*, which is to increase the potential for productive interactions among actors through behavioral norms and enforced rules. *Incentives*, which is to foster capability building and cumulative learning by intrinsic- and extrinsic-based incentives. *Action points*, which is to incorporating several action points leads to opportunities for efficient friction which forces and sharpens choices. *Interaction archive*, which is to store rich content information regarding actors' interactions to enable a long-term view of the ecosystem's opportunities.

All the key management practices could help the dimension context of the 6C framework since the practices can be seen as key missions. In addition, the practices *loose coupling*, *access management*, and *incentives* support the dimension *cooperation* since for the ecosystem it is important to be flexible in order to be able to provide access to new actors. The management practice *interaction archive* can aid the dimension *construct* by showing how past interactions have helped to form the ecosystem in the past. Moreover, the practice *behavior management* can help the 6C's dimension *configuration* since its objective is to manage the stakeholders based on their configurations. The key management practice *action points* can be of use for the dimension capability by defining milestones for shared objectives among the stakeholders, which can be used as capabilities of the ecosystem. For the dimension change the practice *interaction archive* can be of valuable use. The reason for this is that in order to show a change from one state to another state within the lifecycle, it is necessary to store the information of the old state within an archive.

2.2 Business Ecosystem Architecture Model

The business ecosystem architecture model, as shown in Fig. 1, has been created as a model for the architecture of business ecosystems based on Moore's framework from 1993 of business ecosystems [10]. According to the model, three levels of actors are involved in a business ecosystem. On the first level, the local level, there are five actors: the core unit, which is the company for which the business ecosystem is designed, the clients, the distribution channels, the suppliers, and the standardization bodies. Actors of this first level are mainly the actors which are usually part of the supply chain management of a business and thus, these actors cooperate closely between each other. The competitors, governmental agencies, and stakeholders of the actor are part of the second level, the intermediate level. On the third level, the global level, the actor's international partners and international competitors are placed.

Actors within a business ecosystem need to cooperate with each other to achieve common goals [11]. This characteristic of business ecosystems is also designed as a part of the architecture model. Actors of the intermediate level, the competitors, the governmental agencies, and the stakeholders as well as the standardization bodies of

the local level are the environmental elements which play a main role in the development of the core units' entire model. They are important to establish legal background, to develop competitiveness and diversity, and to attract new investments [11].

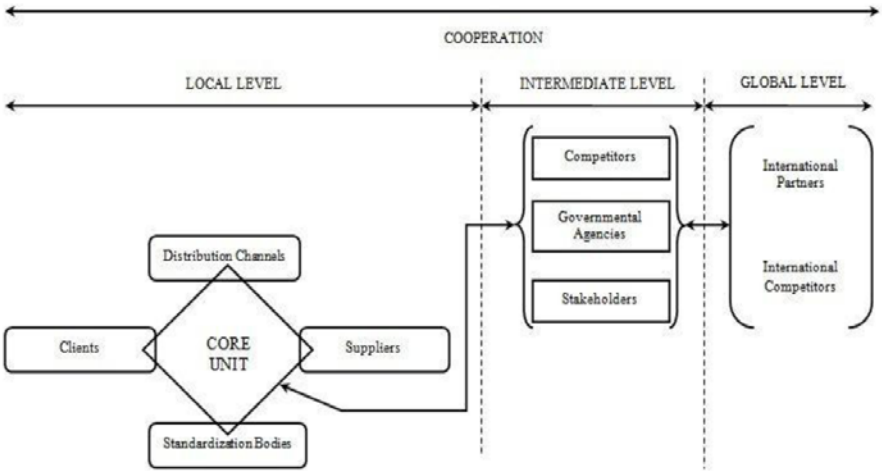

Fig. 1. Business ecosystem architecture model (Source: Social and Behavioral Sciences 124, p. 315)

3 Development of an Industry Ecosystem Modelling Method

The aim of our research and the focus of this paper is a modelling method to represent the current situation of an industry ecosystem and to help visualize the benefits of a digitalized industry by means of service platform-based data exchange.

Based on the models for business ecosystems discussed in chapter 2, we define that an industry ecosystem can consist of nine different types of actors (supplier, partner, customer, industry association, competitor, distributor, research facility, government agency, and investor). Furthermore, there are two service platforms: the information exchange platform and the collaboration platform. The industry association is the orchestrator of these two platforms. Usually, not all actors do intercompany collaborative tasks, namely government agencies and investors. Those two actors are mainly interested in an information exchange platform as they want information about compliance of the company-actors and their investments. Thus, the chances are high that all the actors will use the information exchange service platform for retrieving and/or delivering data, but only some actors the collaboration service platform.

The modelling method to illustrate the current situation of an industry ecosystem consists of an actor-relation layer, a data-relation layer, and a service-based data-relation layer. The benefit of having a three-layer industry ecosystem modelling method is mainly to have an increased visibility as well as transparency of the industry ecosystem. The layers could be designed as one layer, but then the separation of actor-relation and data-relation could not be achieved in order to get the important benefits of increased

visibility and transparency from an industry ecosystem. In addition, the resulted model could not show in an illustrative way that service-based ecosystems are beneficial.

The proposed model method for industry ecosystems is shown in Fig. 2.

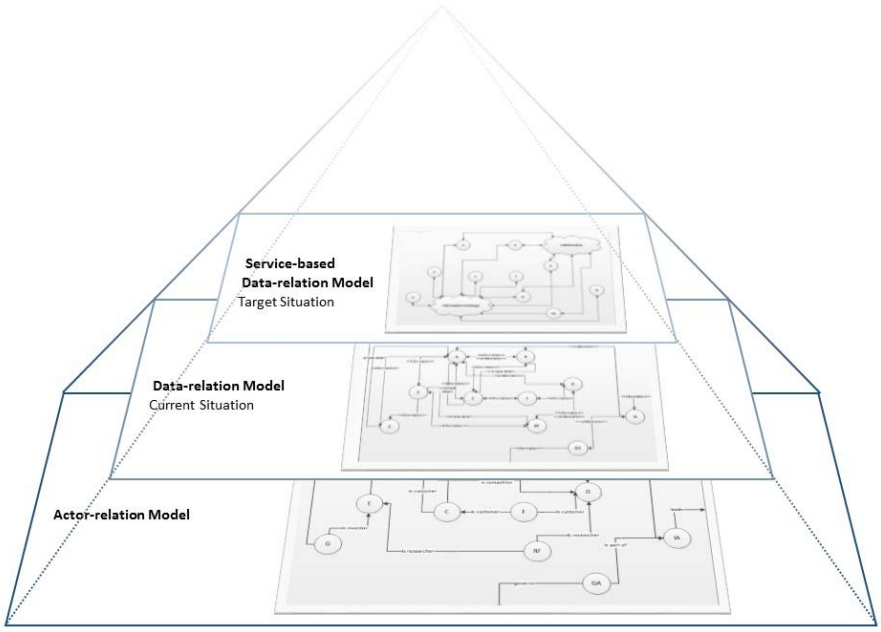

Fig. 2. Service-based industry ecosystem modelling method pyramid

Actor-relation modelling method

In order to know all the actors within an industry ecosystem, an overview of the current situation should be developed [10]. The best way to do so is by first collecting all the different actors involved in the industry ecosystem. Second, the connections between those actors need to be documented and included into the design. Those two steps combined resolve in an actor-relation modelling method.

The business ecosystem architecture model, described in chapter 2.2, only lists the different types of actors and makes clusters of how close the actors are involved to the core actor analyzed, but this does not work for this modelling approach. The reason for this is the lack of a core actor on an industry level to which all the other actors can be linked to. Instead, all the actors need to be seen as core actors. Therefore, connections between all actors need to be made. Furthermore, the modelling method designed during this research project is focused on the Swiss industries. Thus, a separation of national and global actors is not necessary.

The actor-relation modelling method supports the context and cooperation components of the 6C framework. The specified model gives insights on the environment of the industry ecosystem such as all the involved actors and the type of relation between them. Also, the developed model gives enlightenment for the context component of non-direct business partners like government agencies.

Data-relation modelling method

After knowing which actors are involved within the industry ecosystem and how their relations are, the type of data exchange between the actors needs to be specified. Those types are simple data exchange, information exchange, and collaborative data exchange. There can be none, one, two, or even three connections between the actors.

There are five levels of content: data, information, knowledge, understanding, and wisdom [12]. The levels from knowledge on are not relevant for this paper because they concern the application and evaluation of the content. Data is raw content like symbols while information is processed data that results in meaningful data [12,13]. The literature does not have collaboration data as a specific content category, but for this paper it does make sense to specify collaborative used information as collaborative data. This data is necessary for actors when they are collaborating towards a common goal.

The data-relation modelling method supports the construct and configuration components of the 6C framework. The finalized model gives insights to the kind of data which is exchanged. Also, insight is given to what kind of infrastructure the interfaces between the actors need to have. In addition, comprehension on the intercompany workflows and to which level they are configured is provided.

Service-based data-relation modelling method

If the industry decides to introduce a service platform for its ecosystem, a service-based data-relation layer for the final model is required. This layer illustrates the usually targeted future situation for an industry ecosystem, which is an industry ecosystem with a service-based platform, on which intercompany workflows can be performed.

The evaluation of the service-based industry ecosystem data-relation modelling method confirms increase of simplicity and transparency within the industry ecosystem by reduction of the number of relations. The highest amount of connections for an actor is two; one to the information exchange platform and one to the collaboration platform. Consequently, it is cost effective for each actor to have only two interfaces to manage, instead of multiples. If an actor wants to exchange information or collaborate with a new actor, no interfaces need to be set-up between them. Instead, they are already linked through the platform. Thus, it becomes more efficient to handle new intercompany workflows.

3-layer industry ecosystem modelling method

Having the three models combined into one model would be chaotic and not of great use. Instead, a pyramid modelling method, consisting of the three models, erases that issue. As Fig. 2. demonstrates, the actor-relation model is the base of the pyramid. The reason to have the actor-relation on the pyramid's bottom is the fact that industries need to start with the specification of it first. Without a clear view of the involved actors and the relations between them, it is too challenging to model the data-relations. Thus, the data-relation model is on top of the actor-relation model and should be done after the modelling of the actor-relation model. The service-platform-based data-relation model is put on top of the pyramid as the highest layer for the industry ecosystem model. The reason to not just replace the data-relation model is the fact that this model is still needed in order to have an overview of the kind of data which is exchanged between the actors. In addition, it helps to have a detailed overview of the actual data exchange

between the industry ecosystem actors. Therefore, it helps to know which actor exchanges data or collaborates. This three-layer industry ecosystem modelling method pyramid covers all the content of the 6C framework and the business ecosystem architecture model.

4 Application of the Model Method

To proof that the developed industry ecosystem model can be applied on industries as well as on businesses, the case of the hotel group Accor from the hotel industry has been analyzed. The Accor case is described in detail in secondary literature [14]. The result provides evidence that the developed industry ecosystem modelling method can be used in real life cases by starting with modelling the different business ecosystems and later merge the industry-relevant business ecosystems together into one overarching industry ecosystem model.

The mapping of the case revealed two interesting insights. The first insight is the fact, that the identified actor types might need to be classified in more depth depending on the industry. For the hotel industry it might help for example to classify the actor type partner into more detailed categories like travel blogs, review sites, online travel agency, travel agency, and more. Yet, each industry will have to define such actor classifications for themselves since the developed modelling method is used as a generic approach to illustrate industry ecosystems.

The second insight is the fact that for modelling a business ecosystem it makes sense to group different actors together. For example, it makes sense to group all customers of Accor. But for an industry ecosystem this would not work. This is the case because the actors within the customer group might consist of partners to other industry ecosystem actors. Thus, it is not possible to group actors since for example they can be customer to one actor, competitor to another actor, and partner to another actor.

Concluding, it can be said that the modelling method is a success. The modelling method proves to be generic, simple to use, delivering a transparent overview of the ecosystem, and straightforward to explain to third parties. Yet, the modeler needs to have in mind that only actors operating within the targeted ecosystem shall be part of the model's outcome. Also, some deeper classifications of actors might be necessary in order to have a precise ecosystem and thus, a higher transparency of the ecosystem.

5 Conclusion

A generic modelling method to describe an industry ecosystem needs to fulfill the six dimensions and management practices analyzed in chapter 2.1. In order to not only have a generic, systematic, and transparent approach, but also a clear overview of the industry ecosystem, the modelling method needs to have several layers. The first layer is the actor-relation layer. This layer specifies the different relation types like partner or customer. The second layer is about the data-relations between the actors. The different data-relations are simple data, information, and collaborative data. If the industry ecosystem modeler would need to include a service platform as part of the industry

ecosystem, we recommend adding a third layer to the pyramid, the service platform-based data-relation layer. By means of such a third layer, it would be visible that an industry service platform would facilitate the different actor interactions. The evaluation proofs that the industry ecosystem modelling method can be used to generate a generic representation model, which brings transparency and system to an industry ecosystem. Furthermore, it would facilitate an overview of an ecosystem on which a service platform could be built on. The pyramid brings transparency and an overview to all the types of services used during the interactions between the industry actors.

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