

# The Need of a Framework for the Digital Transformation of Industry Ecosystems

## Handling Intercompany Collaborative Workflows

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**Abstract**—This research paper, describes the specifics of an industry ecosystem and its definition, as well as the challenges occurring while transforming the ecosystem. The goal is to demonstrate the need for further research towards creating a systematic approach to solve these challenges. A framework of an industry ecosystem and its transformation towards digitalization would solve this.

**Keywords**—industry ecosystem; digitalization; collaboration; framework.

### I. INTRODUCTION

The term ecosystem is usually considered in the literature as interconnecting and interacting stakeholders who together form a system [2][4]. Industry ecosystems are today in the digitalization era in a transformational digital wave, which has been put in motion by the technologies enabling digitalization like mobile, big data or cloud. As defined in [2], digital transformation is “the seamless, end-to-end connectivity of all areas of the economy, and as the way in which the various players adapt to the new conditions that prevail in the digital economy.”

The strive for automated processes and new ways to collaborate is omnipresent with the best example of internet of everything, where communication of things is omnidirectional and autonomous [7]. New technologies like cloud allow for example the central data and document storage and enable new ways of collaboration supporting the execution of intercompany collaborative workflows, i.e., of workflows, which span over several organizations. The main benefit out of a digitalized industry ecosystem is the improvement in collaborative processes between the different actors of the ecosystem.

Main challenges for ecosystems today are the transformation of the industry ecosystem towards a digitalized industry ecosystem and the integration and maintenance of the ecosystem actors. In [2], we propose three levels of transformation at the enterprise IT level (e.g., with new roles or governance models) at process level and the ecosystem level (e.g., with new business models).

The literature still has a gap for systematically describing the industry ecosystem and its transformation towards digitalization and the need for a framework to do so. The goal of this research paper is to demonstrate the need for a systematic framework to master the challenges during the transformation of the industry ecosystem.

The paper is organized as follows: in Section II, the authors’ definition for an industry ecosystem is stated and the challenges of ecosystems are elaborated. Section III discusses two representative frameworks and a model, which describe relevant parts of a business ecosystem. In Section IV, the literature gap is pointed out. The last section, Section V, evinces the conclusion of this research paper.

### II. INDUSTRY ECOSYSTEM

This section includes a definition for industry ecosystem created by the authors and the challenges which industry ecosystem usually face, both based on literature findings.

#### A. Definition

The literature does not have analyzed the term industry ecosystem thoroughly; still there are some definitions to it. Industry ecosystems are complex systems as they consist of a large number of actors, which interconnect in a complicated way [1]. The term ecosystem can be defined as interconnecting and interacting stakeholders who together form a system [2]. It is a value adding system to which all relevant actors are connected with. An industry ecosystem consists of companies and their partners [3]. Such ecosystems come along with network-effects: the bigger the network gets through adoption of new users, the more valuable the ecosystem becomes.

From these definitions, in combination with the definitions of business ecosystem, which are highly related, the following main elements, which define an industry ecosystem, have been derived:

*The goal for an industry ecosystem is...*

- to support/allow/enable the exchange of information between actors by means of an uniform platform through overcoming the company boundaries
- to support/allow/enable the collaboration between actors through the management of collaborative intercompany workflows

*An industry ecosystem is...*

- a highly complex integrated system to exchange information
- a platform to increase industry innovation
- a system where competition as well as collaboration is nurtured
- a network of actors, which have a link to the industry
- optimally led by the industry association

*The actors within the industry ecosystem are...*

- highly integrated to the point where they become an integral part of the ecosystem
- highly diverse from any size
- collaborative industry stakeholders
- partners, suppliers, distributors, customers, competitors, investors, government agencies, research facilities, industry associations

## B. Challenges

Industry ecosystems have to face challenges, which need to be overcome, in order to provide a sustainable ecosystem to its involved actors. Fig. 1 illustrates our understanding of all relevant dimensions along with the challenges of how building and managing ecosystems can be classified.

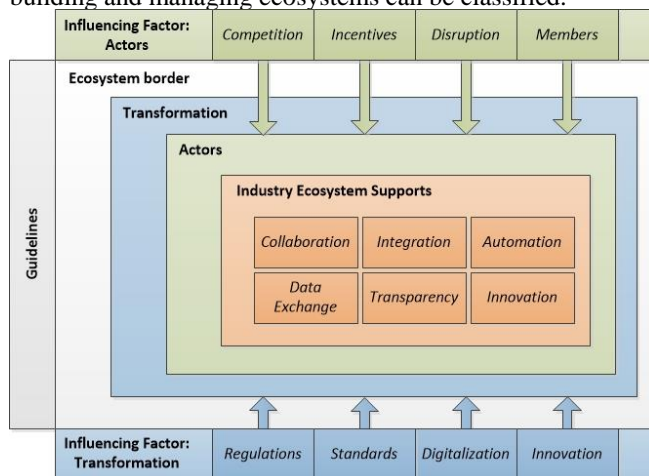


Figure 1. Challenges in Industry Ecosystems.

In the following sub-sections the challenges are explained in more detail.

### 1) Challenges Regarding Transformation of Ecosystems

There are four main factors which are challenging regarding transformation of ecosystems.

#### a) Regulations

Legal regulations differ from country to country, which makes it very challenging for an industry ecosystem to have actors involved from different countries [7]. Legal regulations as well as policies of the individual actors are challenging to handle for the industry ecosystem [10]. Therefore, it is important that the industry ecosystem covers the industry regulations and policies. For industry ecosystems it becomes difficult to handle the regulations, since different industries blur into each other [12][9].

#### b) Standards

Technology standardizations especially for data transfer are considered an important conditional factor for a successful ecosystem [10]. The electronic data interchange needs standardization across all actors [7]. An industry ecosystem is challenged by defining standards for naming or for industry specific items, such as standards for container sizes in the logistics industry [7].

#### c) Digitalization

The megatrends and enabling technologies cloud, mobile, big data, and social are the pillars for a digitalized industry

[17]. The four technologies are not only deployed by the business leaders to gain efficiency or to cut costs. Instead, companies use those technologies to create new business models and to craft new revenue streams [17]. The future customers are going to be fully digitalized and thus, industries and its actors need to be digitalized in order to not get disrupted.

#### d) Innovation

It is challenging for an industry ecosystem to define its direction of innovation, since it has several different actors involved. The innovation directions need to be kept close to the regulations, otherwise the outcome might bring trouble to the involved actors [9]. It is difficult to define innovative directions by taking the incentives for the involved industry actors into account [4]. Therefore, it is important to define a strategic landscape of which the innovation is an essential part. Businesses need innovative business models, which nowadays need industry members to be innovative and sustainable [11].

### 2) Challenges Regarding Actors

There are four main factors which are challenging regarding actors.

#### a) Competition

When industry ecosystems emerge, the power balance in the industry might change [4]. Thus, it is an important task for the industry association to maintain a certain level of competition between the actors, since competition nurtures innovation after all, but at the same time keeping the relation between the actors in good will [4].

#### b) Incentives

The association of the industry ecosystem has to find incentives for the actors to join the ecosystem as well as integrate their businesses into the ecosystem.

#### c) Disruption

New players, mostly entrepreneurs, will disrupt the ecosystem of the different industries of today; if the industries do not transform their ecosystem into a digitalized world through for example cloud computing [5]. The best way to avoid disruption of businesses is to predict the future [5]. This can be achieved by exchanging information in the industry as well as to collaborate for more efficient and economical results.

#### d) Members

It is necessary to define a leader over the industry ecosystem, who defines the components of the industry ecosystem. A company or a small group of companies need to be defined to act as the leader [4]. It might be more useful to create an industry association, to which not only one or a small group is part of, but a greater number of actors can be part of it. In addition, it is important to have an overview of all involved actors in the industry ecosystem. To do so, first the actors, which need to be considered for the industry ecosystem, need to be identified [9].

### 3) Challenges Regarding Industry Ecosystem Support Activities

There are four main factors which are challenging regarding industry ecosystem support activities.

### a) Collaboration and Automation

A transformation requires the intercompany workflows, especially the collaborative workflows, to be automated by support of cloud services [2]. Furthermore, automation of intercompany workflows needs a platform on which not only the exchange of information can be done but as well the process conducted. Only an industry ecosystem could bring all the actors together and provide the required platform to perform automated workflows and collaboration workflows.

### b) Integration

An industry ecosystem has a huge number of actors involved. To integrate them is a big effort [7]. The challenge is to integrate such heterogeneous actors, which have to compete as well as to collaborate with each other within the industry ecosystem [4].

### c) Data exchange

Information needs to be timely exchanged between actors. Thus, an efficient data exchange needs to be established within the ecosystem and provided to its actors. Data exchange is furthermore needed as a base for digitalized collaboration activities within the industry.

### d) Transparency

Not only the processes of the industry stakeholders are heterogeneous, the actors themselves are very heterogeneous as well as some of their goals [7]. So it is important for the ecosystem to keep it transparent for all the parties. The actors within the ecosystem are unlike one from another, which leads to a very diverse ecosystem [9].

### e) Innovation

Innovation through technology is essential for not only businesses but the whole industry, in order to stay competitive within the market. Current processes need to be revolutionized by innovation and technology to automate processes and to stay competitive [7]. A difficult challenge for industry ecosystems is to handle an ongoing industry innovation [4].

## III. INDUSTRY ECOSYSTEM FRAMEWORKS

Our literature review about frameworks for describing industry ecosystems revealed two frameworks, the 6C and the performance framework as well as one model, the business ecosystem architecture model, which describe relevant parts of business ecosystems.

### A. 6C Framework

The framework 6C is for describing an Internet of Things (IoT) -based business ecosystem [13]. According to the 6C framework, the following six dimensions are considered a must for a business ecosystem:

TABLE I. COMPONENTS OF THE 6C FRAMEWORK [13]

Dimension	Objective
Context	To specify the environmental features of the ecosystem.
Cooperation	To specify the mechanisms, which the actors use for interaction to accomplish the common strategies.
Construct	To specify the basic structure and auxiliary infrastructure of the business ecosystem.

Dimension	Objective
Configuration	To specify the stakeholder relationships and their configuration patterns in the business ecosystem.
Capability	To specify the key success features of the business ecosystem.
Change	To specify the shift of system configuration pattern from one lifecycle to the other.

Table I lists the objective and the description for each of the six dimensions.

### B. Performance Framework

The performance framework is to help organizations during the selection process of finding the best matching ecosystem [14]. For this goal, the framework has the following three key steps:

1. Assessing the existing ecosystems and current capabilities
2. Assessing the ecosystem options
3. Continually improve the ecosystem through key management practices

Relevant to mention in detail is the key step three. The reason for this step is the fact that most organizations are not effectively using the management practices to maximize their ecosystem performance [14].

TABLE II. KEY MANAGEMENT PRACTICES OF ORGANIZATIONS [14]

Management practice	Explanation
Loose Coupling	To be flexible and scalable.
Access Management	Expand the ecosystem by number of actors according to the objective and scope of the ecosystem.
Behavior Management	Increase the potential for productive interactions among actors through behavioral norms and enforced rules.
Incentives	Foster capability building and cumulative learning through the use of intrinsic- and extrinsic-based incentives.
Action Points	Incorporating several action points leads to opportunities for efficient friction, which forces and sharpens choices. This can be achieved through embedded integration or decision milestones where shared outcomes are achieved.
Interaction Archive	Store rich content information regarding actors' interactions to enable a long-term view of the ecosystem's opportunities.

There is generally a chance to increase value within existing ecosystems just by refining management practices, which are shown in Table II.

### C. Business Ecosystem Architecture Model

The business ecosystem architecture model defines that there are three levels of actors involved in a business ecosystem [15]. 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 the first level are mainly the actors, which are usually part of the supply chain of a business and thus, these actors cooperate closely between each other. The competitors, governmental agencies, and stakeholders 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 [15].

The 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 [16]. They are important for establishing legal background, for developing competitiveness and diversity, and for attracting new investments [16]. The actors within a business ecosystem collaborate with each other to achieve common goals.

#### IV. GAP IN THE LITERATURE

Although there have been some approaches for the description of industry ecosystems, there is no systematic way. A systematic approach entails an illustrative system for industry players usually in form of a framework. A common case is the need of intercompany collaborative workflows. For such a case it is important to have all relevant factors, like all involved actors, within the framework. Otherwise, it becomes very complicated to understand the behavior and the constellation of the ecosystem. Under such conditions, an introduction of an intercompany collaborative workflow might be too complex. Furthermore, a systematic approach provides transparency for the industry and its actors and thus, it is essential and beneficial for the transformation and the evolution of the ecosystems.

Challenges regarding industry ecosystems and their transformation towards digitalization are well defined. But the literature gives almost no input on how to approach these challenges in order to master them. The industry could make sure with the help of a framework that the awareness of the challenges is given and therefore, no challenge is overlooked. Furthermore, a framework could provide an approach on how to solve the challenges to have a successful and sustainable industry ecosystem.

#### V. CONCLUSION

This research paper, analyzed the current definitions on industry ecosystem. Due to the fact that there is no all including definition for it, the following definition has been created. An industry ecosystem is a complex system of diverse integrated actors, which all interact, exchange information and/or collaborate through collaborative intercompany workflows to common goals, to have an overview of all involved actors within an industry. An industry ecosystem is led by an association of several industry actors, which together define standards and boundaries of the industry ecosystem and push the industry innovation forward.

Researchers have mentioned several challenges for ecosystems transforming into digitalization. This paper, collects these challenges and created a framework for illustrating the challenges of industry ecosystems. Intercompany collaborative workflows are a main benefit and therefore a main driver for industries to handle the challenges of such transformations.

Two frameworks and a model for describing industry ecosystems are explained within this paper. These

frameworks are required for gaining insights to build a framework for tackling the challenges described in this paper and thus to help industries in their transformation processes.

The identified gap in the literature leads to the current state of the research team. The current work evolves around the design and development of such a framework. In order to do so, the relevant dimensions of the framework with focus on integration, collaboration, and actor management need to be identified and brought together in a systematic way. Such a methodical framework would close the literature gap and would bring new knowledge into this research topic.

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