Risk management in a business ecosystem

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**ABSTRACT**

**Purpose** - The purpose of this thesis is to advance the understanding of risk exposure and management for different roles in business ecosystems. The following research questions have been derived to fulfill this purpose: 

RQ1: Which risks are different business ecosystem roles exposed to, and in what way?

RQ2: How can business ecosystem actors mitigate risks?

**Method** – A single case study has been conducted on a business ecosystem surrounding the development of autonomous cars in the EU. An abductive and qualitative approach has been applied, which allowed the combination of existing literature and new empirical findings as to the foundation for building new theory. Data was collected through 21 semi-structured interviews and analyzed through comparison between codes on risks, roles, and risk mitigation strategies.

**Findings** – The already existing literature on business ecosystem risks was confirmed and nuanced. On top of this, two new risks were found, disintermediation risk (the risk of being fully or partially excluded from the ecosystem) and accountability risk (the risk of being responsible for other business ecosystem actors output to a third party). The findings also declare that risks vary between actors, but also due to other factors such as investment in the ecosystem and an actor's relative size to other actors. Finally, suggested risk response strategies for each risk were derived.

**Theoretical implications** - We have contributed to the literature on risks within business ecosystems by adding two new risks: disintermediation risk and accountability risk. We have also contributed to the overall literature on business ecosystems by combining the two sub-streams *risks in business ecosystems* and *roles in business ecosystems*. In addition to the theoretical implications for the business ecosystem literature, we have contributed to the risk management literature by applying it in the new context of business ecosystems to extend the applicability of the risk management literature.
Practical implications - Our findings shed light on how risks are distributed between different roles and can therefore provide guidance in this issue. The current study also contributes to the understanding of how risks vary with respect to other factors than roles, which could be valuable knowledge for managers. Finally, practical guidance on how risks can be mitigated is presented which is valuable for any actor in a Business ecosystem.

Keywords: Business ecosystem; business ecosystem role; business ecosystem risks; risk management
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1. INTRODUCTION

Entering and participating in business ecosystems (BE) is a growing collaboration trend among companies. Historically, the main form of business collaboration was composed of value chains (Porter & Millar, 1985). However, over the last decades, the nature of collaboration has changed due to increasing competition, which is driving the origin of BEs (Moore, 1993). Today, firms collaborate with several others for activities such as innovation, product development, and R&D. Just as these collaborations within BEs is a source of new opportunities to manage the intensifying competition for the individual actor, it also entails risk exposure (Adner, 2017). These risks are formed by dependency on others for your own success, which has strategically and practically important implications for an individual firm (Adner, 2006). As an example, finishing tasks on time is only valuable if others do so as well. Leveraging quality improvement of products to outcompete rivals must be coordinated with partners. Yet the most important implication is that risk assessment changes dramatically since the due diligence process at most firms is adapted to assess risks related to their own value creation. While participating in a BE risk assessment shift towards issues related to joint value creation (Adner, 2006). Therefore, this report seeks to explain how to pursue risk management in BEs. Throughout this study, we have chosen to contemplate risks by the definition provided by Mitchell (1995): "Risks are defined as a combination of the probability of loss and the impact of the loss", as it enables to distinguish risks from challenges, uncertainties, and other closely related factors. Also, this definition enables actors to estimate the severity of different risks, which is an important part of risk management (Dorfman, 1998).

According to Adner (2017), the term “ecosystem” has evolved to encompass several meanings, whereas two distinct separations on views can be made: Ecosystem-as-affiliation, which views BEs as communities of associated actors and focuses on questions such as access, architectural openness, and highlight questions like number of partners and network density (Adner, 2017). This perspective, which is adopted by several recent papers (e.g., Autio & Thomas 2014; Rong & Shi, 2014), offers a valuable view on BEs for interactions on a macro-level. The second perspective, ecosystem-as-structure, views the value proposition as the foundation and a starting point and seeks to identify the set
of actors required for the proposition to materialize (Adner, 2017). In contrast, ecosystem-as-structure offers a micro-level perspective which highlights the interdependence between actors, which has been adopted in previous BE risk related papers (Adner, 2006; Adner & Kapoor 2010). As BE risks also seem to vary between different BE roles (Adner & Kapoor, 2010), this study seeks to explain issues at an actor level. Therefore, the latter perspective has been adopted. The following definition of a BE, which originates from the ecosystem-as-structure perspective, has been chosen for this paper: “The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize” (Adner, 2017, p. 40). The alignment structure refers to the agreement of defined positions and activity flow among BE members. Multilateral refers to the multiplicity of partners and relationships that all depend on each other. The notion of Set of partners means that the participating actors in the BE have a joint value creation effort as a general goal. Lastly, a focal value proposition to materialize describes the value proposition as the unit of analysis of the BE’s productivity level. This refers to carrying through the activities necessary for delivering the value proposition (Adner, 2017).

The research on BEs has evolved to include several perspectives (Järvi & Kortelainen, 2017). Also, the labeling of ecosystems varies considerably between scholars. Some examples are BEs (Moore, 1993; Iansiti & Levien, 2004), digital BEs (Tsatsou, Elaluf-Calderwood & Liebenau, 2010; Selander, Henfridsson & Svahn, 2013), innovations ecosystems (Adner, 2006; Adner & Kapoor, 2010) and platform ecosystems (Thomas, Autio, & Gann, 2014). Over time, three units of analysis have been adopted for BE research: The individual actor (typically a firm), the relationships between actors, and the BE as a whole (Järvi & Kortelainen, 2017). The individual actor can play a variety of different roles, such as supplier, customer, and provider of complementary products (Järvi & Kortelainen, 2017). Although, the main interest at this level of analysis has been the BE leader or hub firm, performed by a variety of scholars (Moore, 1993; Iansiti & Levien, 2004; Li, 2009; Tee & Gaver, 2009; Gaver & Cusumano, 2014). The research deployed with the relationships between actors as its unit of analysis has its core on strategic interactions between independent complementors (Pierce, 2008; Adner & Kapoor, 2010; Ethiraj & Posen, 2013), while few scholars include other actors such as the leader/hub
firm and users. All the different actors and their relationships comprise the BE (Järvi & Kortelainen, 2017), which is the third unit of analysis. For this study, the individual actor has been adopted as UoA, as this paper seeks to explain risks exposure and risk management efforts from the perspective of the individual actor.

Different roles that organizations can adopt within BEs and what characterizes these roles have also been studied by several scholars (Iansiti & Levien, 2004; Kapoor & Agarwall, 2017; Sun, Wang, Zuo & Lu, 2018; Dedehayir, Mäkinen & Ortt, 2016). Some value adding artifacts supporting BE participants does exist, such as process interoperability framework (Figay, Ghodous, Khalfallah, & Barhamgi, 2012), BE formation methodology (De Wilde & Briscoe, 2011), trust failure detection framework (Hussain, Chang, Hussain & Dillon, 2007) and BE integration framework (Korpela, Mikkonen, Hallikas & Pynnonen, 2016). However, the knowledge on entering and participating successfully in BEs remains limited. This is especially prevalent for actors entering and introducing emerging technologies, such as machine learning, business intelligence, and data mining, to existing BEs due to the deficiency of frameworks and models supporting practitioners (Senyo, Liu & Effah, 2019). Considering the growing demand for BE solutions in practice, the current number of frameworks, models, and methodologies available for BEs is still limited (Senyo, Liu, & Effah, 2019).

Upon entering a BE, each actor faces the controversy of which role to adopt, which is assessed by several factors for an organization (Bosch-Sijtsema & Bosch, 2015). One important factor to consider is risk exposure. Risk exposure is distributed unevenly across different BE roles (Adner & Kapoor, 2010). This implies that different roles require different managerial efforts by actors facing BE risks, which has not yet been properly investigated. A BE role is defined as “a characteristic set of behaviors or activities undertaken by BE actors” (Dedehayir, Mäkinen & Ortt, 2016, p. 5). Through this definition, roles in BE are separated by the type of activities they perform. Risks are therefore most likely distributed unevenly across different BE actors. As an example, an actor providing the BE with complementary products would face one set of risks, while the actor orchestrating and coordinating all participants within the BE would have to deal with other risks. Scholars provide a set of specific BE related risks in the current
literature (Adner, 2006; Vaz, Nogueira, de Souza Rodrigues & de Souza Chimenti, 2013; Pierce, 2008; Smith, 2013). However, the literature on risks in the context of BE remains undeveloped, while the knowledge on how to manage BE related risks and capabilities necessary for this endeavor is limited (Smith, 2013). Also, the uneven spread of risks between roles remains unknown.

Smith (2013) provides useful insights on existing BE risk and how they vary depending on different types of BEs. However, the author does not clarify the connection to different roles or how these risks should be monitored and managed. Therefore, he emphasizes the importance of further research on identifying BE interaction and participation risks and to identify effective strategies to monitor and mitigate these risks. The growing demand of BE solutions (Senyo, Liu & Effah, 2019) and the need for further identification of BE risks and effective strategies for BE risk management (Smith, 2013) constitute the research gap this paper intends to investigate. According to Smith (2013), an actor must be able to navigate through BE risks, or they could face a multitude of serious challenges, which stresses the importance of further investigations in the subject.

Given this as a background, the purpose of this thesis is to advance the understanding of risk exposure for actors with different roles in BEs and how these risks can be managed. Therefore, the following research questions have been derived:

**RQ1:** What risks are different business ecosystem roles exposed to, and in what way?

**RQ2:** How can business ecosystem actors mitigate these risks?

To address the research questions a single case study on a BE has been deployed. The studied case lies in a cross-section between the automotive and telecom industries. The studied BE consists of 14 different actors with a variety of contributions to the joint value proposition of the BE. The actors span between automotive manufacturers, telecom equipment providers, service and software providers to universities and governmental institutions.
2. LITERATURE REVIEW

The literature review is divided into three main sections. The first section is used to define BEs and brings up the existing literature on BE roles and compares how different theories on roles relate to one another. The second section reviews the literature on BE risks, which yields four risks. The third section reviews the current best practices for risk management in a BE context.

2.1. Business Ecosystems and roles

The literature on BE in general and BE roles, in particular, is relatively new. Today, some 25 years after Moore (1993) first coined the notion of BE, the literature still provides several definitions on different roles within BEs. Even though there are several different definitions, most definitions are based on the activities undertaken by the BE actors (Dedehayir, Mäkinen & Ortt, 2016). Järvi and Kortelainen (2017) mention that the diversity in role definitions could partly be explained by the different views on the nature of a BE. For instance, some researchers tend to focus on the core of a BE (Moore, 1993; Iansiti & Levien, 2004; Li, 2009; Tee & Gaver, 2009; Gaver & Cusumano, 2014), while others adopt a wider approach by including customers and regulatory functions (Dedehayir, Mäkinen & Ortt, 2016). Another explanation of the diversity is the variety of different BEs studied. Some BEs, such as the BEs around Airbnb or Uber, do not involve as many individual actors as others surrounding large tech solutions. However, what all the different definitions have in common is the concept of leader(s) accompanied by one or several types of followers (Adner, 2017). Often followers are divided into two groups of actors, value creators, and value support roles. The following sections describe the literature on roles within BEs divided at a general level into three categories: leader roles, value creator roles and value support roles.

2.1.1. Leader roles

The leader is the most distinguishable role even though it has a variety of notions throughout BE literature. The common denominator for this role is that the leading firm constitutes the image associated with the BE and somewhat the hub of the BE. Kapoor and Agarwal (2017) claim that BEs constitute of one firm orchestrating the function and
underlying structure of the BE by providing a platform and setting the rules for other complementors (followers) to participate on. Iansiti and Levien (2004) refer to the BE leader as *keystone*, which aims to improve the overall health of the BE by providing a stable and predictable set of common assets. The concept of keystones is similar to how Rong, Shi, and Yu (2013) describe *hub landlords*, but at an early phase in the BE, since they can transform and adapt to other roles. Giudici, Reinmoeller, and Ravasi (2018) further develop the concept keystone by theorizing on two different approaches of BE orchestration performed by a keystone to ensure value creation for other BE members. According to the authors, BE orchestration can be performed as a *closed-system* or an *open-system*. Within a closed-system, the orchestrator acts directive to create centralized coordination of efforts within the system whereas, in an open-system, the orchestrator acts as a facilitator of decentralized efforts and supports followers with necessary resources. Another description of a leader role, but with a different denomination, is provided by Rong and Shi (2014) who describes *focal firm* as coordinators of large economic activities that create direct value for the end customers.

To conclude, the literature on leader may appear diverse due to several commonly used notions, but the different descriptions and definitions are in general similar. Regardless of the role is called keystone or focal firm it somewhat constitutes the hub for the BE and is associated with a lot of power.

### 2.1.2. Value creator roles

The literature on followers is more complex compared to the literature on leaders. As mentioned previously, this could partly be explained by scholars adopting different perspectives on what an BE is, and that BE roles can vary between different types of BEs. However, in most cases, the followers are divided based on the activities they perform with respect to value creation.

A thorough review of roles is provided by Dedehayir et al. (2016), whose division of followers is in more detail compared to other scholars. In addition to the leader role, the authors mention three main BE follower roles, where the first role is *direct value creators*. This role is associated with direct value creation for the BE’s end customer and include:
suppliers (delivers key component), assemblers (assembling components, materials, services and processing information, supplied by others in the BE), complementors (delivers key complementary offering) and users (contributes to value creation through information input). The general description of direct value creators is similar to how dominators are described by Iansiti and Levien (2004).

Dominators, originally formulated by Iansiti and Levien (2004) but used by several scholars (Sun et al., 2018; Isckia, 2009; Tellier, 2017), are characterized as the main value creators within the BE. Dominators are generating the majority of the cash-flow into the BE by offering value to third parties. According to the authors, Dominators are characterized as strong actors within an BE.

2.1.3. Value support roles

Niche players is another frequently mentioned role within the BE literature, also originally formulated by Iansiti and Levien (2004). There is a great variation between activities performed by different niche players, but they have similar traits. They provide specialized capabilities that facilitate the entire BE. They complement other players capabilities by filling the gaps towards a complete and competitive BE. According to the authors, niche players can be seen as value creation supporters. Niche players do not add direct value through delivering products or services to the end customer but do so by providing peripheral supporting elements within the BE. Bosch-Sijtsema and Bosch (2015) further develop the theory on niche players by dividing the definition into complementors and integrators. Complementors are characterized by adding complementary and often specialized assets to an already existing platform while integrators are characterized by integrating multiple elements from multiple actors. The authors also mention customers and end users as a follower since they are supporting user-driven innovation. Niche players can be further decomposed to component suppliers and complementors, which supply focal firms with supplementary inputs. (Choi & Phan, 2012). Choi and Phan's (2012) definition of niche players differs from most literature as most scholars put component suppliers into direct value creators.
The second additional role mentioned by Dedehayir et al. (2016) is called *value support role*, which includes *experts* (such as universities and research organizations) and *champions* (those forging connections between actors). The third additional role is called *entrepreneurial BE role* and center primarily around the incipient of the BE. Three specific actor types are mentioned within the entrepreneurial category: *entrepreneurs* (those starting new ventures), *sponsors* (those supporting entrepreneurs with resources) and *regulators* (those supporting entrepreneurial activities through providing economic and political/regulatory changes). It is not very common to include these sub-roles as part of a BE. Dedehayir et al. (2016) adopt a wider perspective of BE by including a broader set of actors compared to other scholars. Their findings are particularly prominent during the innovation BE genesis and highlight different activities carried out by different actors within the BE. Table 1 summarizes the major contributions to the literature on BE roles. The table divides different contributions in three separate categories (leader roles, value creation roles, value support roles), which gives a better overview of how different theories of BE roles from the text above relates to one another.
As said, the literature on roles in BEs is complex and ambiguous. The suitable division of roles seems to vary depending on the case selection. Although there are several potential role breakdowns in the existing literature, we found no definition entirely relevant for the studied BE. As an example, Iansiti and Levien (2004) divide roles into Keystone, dominator and niche players which is a role breakdown suitable when there is one actor (keystone) providing a common asset, for instance, a digital platform, to the BE. The studied BE is not united around a common asset but more around some actors. The leader role in the BE was similar to how Choi and Phan (2012) describe focal firms. On the other hand, the other roles described by Choi and Phan (2012) fitted poorly to the studied BE. Therefore, a combination of several sources was used to break down the actors of the studied BE into roles.

Since the studied BE is within the business of autonomous cars and the joint business circulating around the car manufacturers existing business, the involved car manufacturers (Beta and Gamma) were considered to possess the role of a focal firm in the BE. All actors...
creating value for the end customer by providing hardware, software or services were considered as direct value creators (Alpha, Delta, and Epsilon). For instance, tier one suppliers, telecom operators, and telecom hardware providers were considered as direct value creators. The last group of actors, the so-called value supporters, was a diverse group including specialized companies, e.g. government institutions, funding sponsors (Zeta, Eta, Theta & Iota) with one thing in common. They provide specialized capabilities that facilitate the BE or regulate the conditions. Value supporters do not add direct value through delivering products or services but do so by providing peripheral supporting elements. Often, they act as complementors by filling the gaps towards a complete and competitive BE.

2.2. **Business ecosystem risks**

The literature on risks connected to roles in BEs is currently limited. The most prominent articles within the topic are written by well-known authors in the field of roles in BEs, among them Ron Adner. Also, authors who do not explicitly write about risks directly mention risks when describing roles in BEs (e.g. Vaz et al., 2013; Pierce, 2008). Adner (2006) present three major risks when participating in a BE: initiative risk, interdependence risk, and integration risk. Vaz et al. (2013) add another type of risk by talking about opportunistic behavior within BEs and Pierce (2008) adds another risk by describing the devastating consequences for follower's imbalance in power may entail. These five risks are the major risks recurring in the literature about roles in BEs, while the initiative risk will not be considered in this report since it is not relevant for studying interdependencies on an actor level. A more detailed description of the risk follows below.

2.2.1. **Interdependence risk**

Adner (2006) explains interdependence risk as "the uncertainties of coordinating with complementary innovators". This could also be described as the joint probability that different partners will be able to satisfy their commitments within a specific time frame. This risk occurs when several firms participate in one project, and the success of that project is dependent on each actor delivering their commitments on time. The problem
that occurs is purely mathematical. There is always a risk that one or several actors fail their commitments. Therefore, the more actors involved, the higher the probability of failure. Consider the situation of the third generation of wireless network required for delivering services such as video streaming and location-based content. Mobile network operators collectively bided tens of billions of dollars for spectrum licenses, expecting large increases of revenue in 2003. The operators focused much of their attention on the infrastructure required for delivering these services. However, the realization of these services was also dependent on numerous of other innovations such as new software formats for live streaming videos on different devices and digital rights management to assure ownership and protection of intellectual property. In summary, the hardware infrastructure was necessary, but not enough, for delivering these new services. Adner and Kapoor (2010) mention a similar risk referred to an upstream component. The risk constrains the focal firm's ability to innovate or produce its product.

2.2.2. Integration risk

Adner (2006) describes the second major risk as the uncertainties presented by the adoption process across the value chain. He calls this risk integration risk. Even though he describes a BE he refers to the value chain which may seem notably. However, the integration risk refers to the likelihood and consequences of others not being able to, or not being willing to adopt the solution. Participants in an BE may cause failures to others if the goal alignment is inadequate. In 1997, Michelin developed a run-flat tire allowing drivers to continue for another 50 miles in case of a puncture. However, no consumer could buy it since car workshops required special training and equipment, each of whom had to buy before the end customer could use the innovation. This indicates a risk that the success of an individual innovation is often dependent on the success of other innovations in the firm’s external environment (Adner & Kapoor, 2010).

2.2.3. Risk of opportunistic behavior

Vaz et al. (2013) and Iansiti and Levien (2004) describes opportunistic behavior as a major risk while participating in an BE. Parida, Wincent, and Oghazi (2015) describe how opportunism is a prevalent risk within the field of global product development.
Customers and offshore suppliers might act opportunistically to secure self-interests which increases transaction costs. This can reduce the competitiveness of the offshoring relationship over time and ultimately lead to a collapse of the relationship. An important parallel to this is Iansiti and Levien (2004), who discusses the same risk with the danger of domination, but in the context of BEs. If some players extract too much value out of a network, it leaves too little behind to sustain the BE.

2.2.4. Power imbalance

The risk of being a powerless company among powerful companies (Vaz et al., 2013) is closely related to opportunistic behavior since it is one company within the BE that harms another company. Yet, there are differences between opportunistic behavior and power imbalance. The risk of power imbalance occurs when a powerful company changes the prerequisites in the BE, without any intention to compete with other participants. Pierce (2008) shows evidence for major financial losses powerless companies may suffer due to power imbalance within an BE. Tellier (2017) also describe a situation where a Keystone was hindered from innovating their business model due to their dependence and the strong power of dominators within the BE, which is another example of power imbalance.

2.3. Risk management in Business Ecosystems

BE literature is in need of further identification of interaction and participation risks and development of effective strategies to monitor and mitigate these risks. While the risk management literature has been developed over the last decades, the concept of risk management in BE is still relatively new and undeveloped. (Smith, 2013)

In general, risk management is the ongoing process of dealing with the possibility and impact of loss (Mitchell, 1995). Risk management is often described as a logical an ongoing process divided into three steps: risk identification, choosing a suitable risk response strategy and monitoring the outcomes (Dorfman, 1998). This thesis will primarily focus on the middle step, choosing a suitable risk response strategy for a specific risk. Within the field of risk management, prior literature has identified four main risk response strategies: Risk reduction, risk sharing/transfer, risk avoidance and risk retention.
Although this literature has not been introduced in the BE setting, some prior literature does mention activities that could be applicable from a risk management perspective. A more detailed description of the risk response strategies follows below.

**Risk reduction** includes activities that reduce either the probability of the occurrence or the severity of the impact of a certain event (Dorfman, 1998). Glancing at the current BE risks found so far, they tend to be attached to the relationships between actors. Risk reduction in the context of BE could therefore include proactive activities that secure the individual actor's position in the BE. Taking actions without the understanding of the impact of these actions can have negative consequences for an actor (Pierce, 2008). Therefore, it would be logical to pursue activities that reduce the probability or the impact of a certain risk, such as forging strong partnerships and building trust towards other BE participants. **Risk sharing/transfer** include activities that completely or partly transfer risks to another stakeholder, for example, a customer, partner or an insurance company (Dorfman, 1998). A common deliberation for BE actors is whether to adopt an active or a passive role within the BE, where an active role often implies higher risk exposure (Iansiti & Levien, 2004). Prior literature mentions that the ability to dynamically adapt to different engagement models (the type of relationship) for a firm becomes important (Bosch-Sijtsema & Bosch 2015). This indicates that a possible risk sharing/transfer response could be to embrace a passive role and let other actors pursue a portion of risk-related activities, such as manufacturing, assembling products or customer contact. However, these actions tend to lower the possibilities to capture value. **Risk avoidance** simply implies evading all possibilities that a certain event can occur (Dorfman, 1998). One way to avoid BE risks is to assess risks, opportunities and decide where to compete, and which BEs to avoid completely (Adner, 2006). **Risk retention** plays the opposite part of the other strategies, where the actor embraces the risk and attempts to profit from it through a so-called "risk premium" (Dorfman, 1998). Prior literature lacks examples of similar actions pursued by BE participants. However, one possible risk retention strategy could be to adopt all the responsibility of the value proposition towards the end customer, which would reduce risks for other participants. This strategic move
could possibly be used to leverage better terms and contractual agreements for the risk-bearing actor.

As previously mentioned, risk management is yet to be introduced to the context of BE risks. The risk management strategies with related examples mentioned above are mainly speculations and require a thorough investigation. The following chapter describes the method applied in this report to advance the understanding of risks and risk management in BE.
3. **METHOD**

This section describes the method used in the study. The method chapter consists of the overall research approach, followed by a description of how the data was collected and analyzed and ends with a discussion about quality improvement actions.

### 3.1. Research approach

Throughout this study, an abductive approach has been applied which allowed us to make use of empirical findings in combination with existing literature to build new insights (Dubois & Gadde, 2002). This approach was applied to fulfill our purpose and contribute to the understanding of how risks are related to different roles and how risks can be managed within BE. Therefore, an abductive approach was suitable for this study.

To fulfill our purpose and advance the understanding of risks and risk management in BEs, a single case study was deployed. This allowed for a deep understanding of the situation, such as risk exposure and relevant risk management actions deployed by different actors. Information from real-life cases is favorable when deriving new insights and theory (Eisenhardt, 1989; Yin, 2003), which is why the case format was chosen.

#### 3.1.1. Research context and case selection

The BE exists as a cross-section between the automotive and telecom industry, where the mutual goal is to develop and launch concepts for autonomous cars. The case involves several international participants collectively striving to achieve common value propositions surrounding IoT in the automotive industry. These solutions stretch between basic IoT communication between cars to fully autonomous car solution, spanning over different country borders. This specific case was chosen due to a set of different reasons: First, the case involved a wide spread of different actors such as universities, original equipment manufacturers (OEM), telecom providers and operators, and a set of different specialists of suppliers. This allowed for a richer and more varied data to be collected, with insights from large multinational corporations spanning over several industries, to small SMEs and startups. Second, the different actors involved were also considered to be experienced collaborators of global networks and BEs. Therefore,
their knowledge and understanding of BE roles, risks and risk management were considered advanced and well worth to study. Third, this case study allowed us to gather qualitative data from a wide range of actors in a representative case for large industrial BE, pushing the frontier of complex innovation, which in this case is autonomous car solutions. Fourth, the selected case allowed us to study the genesis of an BE, where the future roles were not settled. The genesis phase entailed the opportunity to study the actors considering several potential roles and how risk was considered for each role. As the perspective of this study was the individual actors within the BE, the unit of analysis comprised BE roles. Table 2 provides an overview of the different BE participants in the studied case.

Table 2: Overview of case study actors

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description of organization</th>
<th>Actions in the BE</th>
<th>Role in the BE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>Global leader and multinational hardware and service provider in the telecom industry</td>
<td>Leads the research project and develops mobile network solutions and cloud solutions.</td>
<td>Direct value creator</td>
</tr>
<tr>
<td>Beta</td>
<td>European automotive OEM</td>
<td>Develops automotive solutions and assembles different parts of the BE. Pursues customer contact activities.</td>
<td>Focal firm</td>
</tr>
<tr>
<td>Gamma</td>
<td>European automotive OEM</td>
<td>Develops automotive solutions and assembles different parts of the BE. Pursues customer contact activities.</td>
<td>Focal firm</td>
</tr>
<tr>
<td>Delta</td>
<td>European telecom operator.</td>
<td>Provides spectrum and operate telecommunication networks.</td>
<td>Direct value creator</td>
</tr>
<tr>
<td>Epsilon</td>
<td>Supplier of automotive products and services</td>
<td>Supplier providing car components to automotive OEMs.</td>
<td>Direct value creator</td>
</tr>
<tr>
<td>Zeta</td>
<td>Incubator within the mobility and connectivity industry founded by the BE actors</td>
<td>Supporting startups, mediate between large corporations and startups.</td>
<td>Value supporter</td>
</tr>
<tr>
<td>Eta</td>
<td>Technical Swedish university</td>
<td>Participate and contribute to research.</td>
<td>Value supporter</td>
</tr>
<tr>
<td>Theta</td>
<td>Global cross-industry organization of companies from the automotive, technology, and telecommunications industries</td>
<td>Unifies actors by establishing mutual goals, project plans and facilitating communication.</td>
<td>Value supporter</td>
</tr>
<tr>
<td>Iota</td>
<td>Regulatory authority within electronic communication</td>
<td>Sets up regulations and directions for telecommunication.</td>
<td>Value supporter</td>
</tr>
</tbody>
</table>
3.2. Data collection

The data was collected from a combination of primary and secondary data. Primary data was collected through interviews and was complemented with secondary data in the form of internal documents, reports and project files. During all the interviews we were two interviewers present, alternately initiating questions and taking notes. Most of the interviews were recorded to facilitate the transcribing’s. The secondary data served as a source of information for our own understanding of the project itself but had limited contributions to the actual findings. Interviews were held in three rounds where the first round was performed in an explorative way to get an overview of the case and the participating actors, for interview guide see appendix A. The second round constituted the bulk of the data collection and the purpose of the second data collection round was to identify commonly used risk management methods and actions. To make the interviews to be uniformed, a standardized interview guide was used, see appendix B. After the data analysis from the second data collection, the outcome was tested through the third round of interviews. In total 21 interviews were held during the three interview rounds. Table 3 provides an overview of the interviews conducted through this study.
Table 3: Interview informants

<table>
<thead>
<tr>
<th>Round</th>
<th>Informant</th>
<th>Organization</th>
<th>Time</th>
<th>Date</th>
<th>Type</th>
<th>Words transcribed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>Alpha</td>
<td>30 minutes</td>
<td>2019-02-19</td>
<td>F2F</td>
<td>Notes</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>Alpha</td>
<td>30 minutes</td>
<td>2019-02-22</td>
<td>F2F</td>
<td>Notes</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Beta</td>
<td>40 minutes</td>
<td>2019-03-06</td>
<td>Skype</td>
<td>2176</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>Alpha</td>
<td>45 minutes</td>
<td>2019-03-11</td>
<td>Skype</td>
<td>3731</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>Alpha</td>
<td>45 minutes</td>
<td>2019-03-12</td>
<td>F2F</td>
<td>2320</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>Gamma</td>
<td>55 minutes</td>
<td>2019-03-13</td>
<td>Skype</td>
<td>3721</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>Alpha</td>
<td>45 minutes</td>
<td>2019-03-18</td>
<td>F2F</td>
<td>2860</td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>Delta</td>
<td>40 minutes</td>
<td>2019-03-22</td>
<td>Skype</td>
<td>1443</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>Alpha</td>
<td>40 minutes</td>
<td>2019-04-04</td>
<td>Skype</td>
<td>2951</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>Alpha</td>
<td>45 minutes</td>
<td>2019-04-08</td>
<td>F2F</td>
<td>1995</td>
</tr>
<tr>
<td>110</td>
<td>110</td>
<td>Alpha</td>
<td>45 minutes</td>
<td>2019-04-08</td>
<td>F2F</td>
<td>Notes</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>Alpha</td>
<td>90 minutes</td>
<td>2019-04-09</td>
<td>F2F</td>
<td>Notes</td>
</tr>
<tr>
<td>111</td>
<td>111</td>
<td>Epsilon</td>
<td>40 minutes</td>
<td>2019-04-11</td>
<td>Skype</td>
<td>1340</td>
</tr>
<tr>
<td>112</td>
<td>112</td>
<td>Zeta</td>
<td>40 minutes</td>
<td>2019-04-15</td>
<td>Skype</td>
<td>3619</td>
</tr>
<tr>
<td>113</td>
<td>113</td>
<td>Alpha</td>
<td>60 minutes</td>
<td>2019-04-15</td>
<td>F2F</td>
<td>Notes</td>
</tr>
<tr>
<td>114</td>
<td>114</td>
<td>Eta</td>
<td>50 minutes</td>
<td>2019-04-18</td>
<td>Skype</td>
<td>Notes</td>
</tr>
<tr>
<td>115</td>
<td>115</td>
<td>Theta</td>
<td>60 minutes</td>
<td>2019-04-24</td>
<td>Skype</td>
<td>Notes</td>
</tr>
<tr>
<td>116</td>
<td>116</td>
<td>Alpha</td>
<td>45 minutes</td>
<td>2019-04-24</td>
<td>F2F</td>
<td>3661</td>
</tr>
<tr>
<td>117</td>
<td>117</td>
<td>Iota</td>
<td>40 minutes</td>
<td>2019-04-26</td>
<td>F2F</td>
<td>Notes</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>Gamma</td>
<td>35 minutes</td>
<td>2019-04-26</td>
<td>Skype</td>
<td>Notes</td>
</tr>
<tr>
<td>14, 118</td>
<td>Alpha</td>
<td>30 minutes</td>
<td>2019-05-14</td>
<td>F2F</td>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>
3.2.1. First round of interviews

The purpose of the first round of interviews was to get familiar with the BE, its actors and the underlying structure, context, and risks experienced by different actors of the BE. The structure of the interviews was exploratory and semi-structured, which was a suitable method to maintain a structure while still being able to dig deeper with additional questions regarding interesting subjects (Saunders, Lewis, & Thornhill, 2009). A total of eight interviews was held within the first round, and six interviews were recorded to facilitate the transcriptions used in the analysis.

3.2.2. Second round of interviews

The second round of interviews constituted the majority of the data collected throughout the study. The overall purpose of these interviews was to extract data about risk exposure variance and actions pursued by different actors to manage BE risks. These interviews were held with a variety of informants among different BE actors to secure a rich data sample. The structure of these interviews was semi-structured, which allowed a data set that was comparable between different informants, meanwhile allowing further questions to be asked preventing that valuable information was left out (Saunders et al., 2009). A total of 11 interviews with 6 different actors were held in this phase.

3.2.3. Third round of interviews

The third round of interviews was held to test and confirm prior findings once the first draft of the framework had been developed. The interviews were standardized and structured to secure reliable testing of the framework. In total, two interviews were held in the last round.

3.3. Data analysis

As an initial step in the analysis, the actors in the studied case were categorized into three roles based on what activities they performed in the ecosystem. Each organization’s activities performed in the ecosystem were compared to the different theories of role division in BE described in chapter 2.1 Business ecosystems and roles. As an example, Epsilon supplies the BE with car components to automotive OEMs and was therefore
considered as a direct value creator. The analysis displayed that the descriptions of the roles “focal firm”, “direct value creator” and “value support” was the most suitable definitions for the studied case and was therefore chosen as the definition for this study. All actors could be considered to belong to one of these roles and therefore no additional role was added. This step in the analysis did not contribute directly to answers related to the research questions. However, deriving suitable definitions of roles in the studied case was necessary to conclude risk variation between roles (RQ1).

To identify and define the different risks the transcriptions from the first round of interviews were analyzed and everything mentioned as a risk by an informant was compared to the four risks mentioned in the previous literature. The risks given in the interviews which did not match with previous literature were compared and categorized into two additional risks. Thus, the previous four risks (interdependence, integration, opportunistic behavior, and power imbalance) from the literature were confirmed, while two new risks were named and defined (disintermediation risk and accountability risk). The two additional risks were legitimized since none of the previous definition of risks matched with what the informants expressed as risks. This step contributed to the answering of RQ1.

The six risks were later compared with respect to the three roles to determine any connections between a certain role and a certain risk. Each informant was given questions during the second round of interviews about how risk exposure varies between actors with respect to the activities they perform and if the risk was varying with respect to any other factor. We could thereby make conclusions on the causes of risk exposure and conclusions on risk variation between roles. As an example, focal firms were found to be exposed to accountability risk to a larger extent than other roles in the studied case. This step also contributed to the answering of RQ1.

To determine the connection between risks and risk mitigation strategies an analysis divided into two parts was performed. We asked question during the second round of interviews on how certain risks were mitigated. The answers were often practical examples, for instance, “establish legal contracts is a way to mitigate interdependence risk”. The outcome from the first part of the analysis was a list of actions performed to
mitigate each risk (see table 6-13). These actions were then compared and matched to the four risk mitigation strategies described in the literature (*risk reduction, risk avoidance, risk transfer, and risk sharing*) as practical examples of the four risk mitigation strategies. Hence, the actual risk mitigation strategies performed could be derived from these actions. This step contributed to the answering of RQ2.

### 3.4. Quality improvement

To evaluate the quality of a qualitative study four measurements could be used: credibility, confirmability, transferability, and dependability (Lincoln & Guba, 1985). To improve credibility, interviews were held with informants from different actors within the BE, which allowed for the result to be based on several opinions from different viewpoints rather than on just a few. In addition, the informants had different positions within the companies they represented. When analyzing the data, triangulation was used to verify results by analyzing actors’ views of risk exposure for other actors within the BE, and not just their own. To obtain confirmability, common analysis models have been used which entails a result relying on the informant’s responses rather than our own conclusions. The results derived from the interviews were also confirmed by informants in the third round of interviews. The transferability of the study refers to the extent to which the findings can be applied in other situations than the applied research context (Shenton, 2004). To strengthen the transferability of this study, a thorough description of the studied case was provided. This allows the reader to evaluate whether the results are applicable to other situations. Throughout our research, we strived for high dependability, i.e. allowing for the research to be repeatable in a way that it ends up with similar results (Shenton, 2004). This was done by providing high transparency in terms of methods used to collect data, the case studied, interview guides, data, and results.
4. FINDINGS

This chapter aims to fulfill the purpose of the study and contribute to the closure of the identified research gap through a discussion of the analyzed data. Since the purpose of this paper is to advance the understanding of risk exposure for actors with different roles in BEs and how these risks can be managed, the chapter has been divided as follows:

Firstly, findings regarding risks occurring in BE is presented including the addition of two new risks to the literature. Secondly, the findings regarding the connections between risk and role are presented. Lastly, an analysis of risk mitigation actions suitable for each risk is presented.

4.1. Risks in business ecosystems

This chapter seeks to answer research question one and is divided into four parts. The first part presents findings and elaborates with previously defined risks from the literature. The second part identifies and defines two new BE risks. The third part presents how these risks vary with respect to different roles in the BE. Lastly, findings regarding other factors that influence risk exposure are presented.

4.1.1. Confirmation of already known risks

Previous literature has mostly described the interdependence risk as to the dependency on others delivering necessary products or parts at a given time to a given quality (Adner, 2006). By applying this existing knowledge to the setting of the studied case, which output is a service, we have been able to expand the understanding and knowledge of this risk. The analysis shows that interdependence risk also includes the dependency on other participants reliability, which is critical for the system. Thus, each individual participant’s reliability affects the total system’s reliability. Hence, the implications of interdependence risk when applied to a service BE becomes damage to service uptime.

The integration risk turned out to be a relevant concern in the studied BE. The informants provided several examples of how early-stage ideas and innovations’ biggest challenge was to integrate with surrounding technology and society. Within the studied automotive case, the actors are striving for their solutions to be adopted as industry
standards over competitors’ solutions, which is decided by institutions and governmental actors. This can result in a set of different solutions developed in parallel, which in turn becomes complicated to integrate with surrounding infrastructure, as illustrated in figure 1.

As illustrated above, solution 1, 2 and 3 need to be integrated to the same surrounding infrastructure, while each solution needs to be able to communicate with every other solution seamlessly across different infrastructures. In the studied BE, IT solutions developed by different automotive OEMs must be able to communicate with each other and work seamlessly between infrastructure developed by different telecom hardware providers, operated by different telecom operators. This cause risk exposure for the individual actor. Either the solution developed by a single actor is neglected since other solutions reach an industry standard level, or the whole system becomes too complicated to integrate, which affects all involved participants. The analysis also unfolds that another form of integration risk can arise within a BE, when one or several actors are dependent on another actor to take the initiative in the BE to move forward, as represented by the following quote: "I think that's a risk, waiting for an actor to take their natural role when they are absolutely not prepared" (I4, Direct value creator, Alpha).

The previous literature on the risk of opportunistic behavior in BEs primarily describes the risk as “the risk of being exploited by other actors in the BE”. The findings from this
study shows that an actor in the BE may also expose the entire BE to the risk by, for instance, advocate interests favorable for the own company instead of mutual interests of the BE as illustrated in the following quote: "Without collaboration, the solution can become more an advantage for them" (I7, Direct value creator, Delta). For instance, an actor pushing a technology that is not the most suitable for the BE but favorable for driving their own business would expose the entire BE to opportunistic behavior.

The analysis shows that power imbalance is a prevalent risk and phenomena within BEs. The outcome for powerless actors forced them to adapt to those with superior power, partly risking their business on behalf of what others decide, as one informant stated: “Yes, we need to influence and wait what the car OEMs will decide, we are not orchestrating this. So, they can say that this is all nice technology, but we found a different way" (I8, Direct value creator, Alpha). Although power imbalance is similar to opportunistic behavior, the statement indicates that this risk is unintended from actors exposing others for this risk. Yet, the magnitude was not experienced high in relation to other risks, as the informant continued: "Well we will not go bankrupt, but I would say that it depends a lot on the scope of this. In the following 2-3 years, the impact would be relatively low because it’s in an early face” (I8, Direct value creator, Alpha).

4.1.2. Moving beyond known risks

Throughout the analysis, concerns regarding two risks that could not be linked to already defined risks in the literature were continuously stated. This was an indication of BE risks yet to be documented and added to the literature. Therefore, a more thorough description and a definition of these two risks are provided in this section.

A recurring concern stated by the informants was the risk of being excluded or losing parts of one’s business because of others expanding theirs within the BE. Looking back at traditional value chains, companies operated with clear boundaries between suppliers and customers, gaining little to no insight in one another's businesses. However, working closely with the same actors in a BE that traditionally belonged in one's value chain adds tension as all actors try to balance business expansion with maintaining relationships. As one informant stated:
“What we see is two traditional value chains merging. When that happens, there is an interest from global players and companies that have a global footprint to expand their business. The tension arises when we are entering in the same interest as traditional customers might go into. What is happening if we try to offer the same thing as another actor is willing to provide?” (I4, Direct value creator, Alpha)

As the informant stated, the risk primarily lies within what used to be one’s value chain. The analysis shows that the individual firm with actions similar to other BE actors expose their position as others try to expand their business. Also, actors upstream (in previous value chains) tends to expose downstream actors by adding innovations interfering with the downstream actor’s value proposed to the BE, as illustrated in the following quote: “We are partly starting to compete with our existing customers in the traditional value chain, the risk lies in how the relationship will change” (I5, Focal firm, Gamma). This implies that there is a conflict between actors’ interests of existing opportunities within the BE. The risk also involves an overlap in capabilities between actors, as the following statement indicates: “You can have discussions with [an actor], they work a lot and then they realize that our tasks are not so difficult and that they can do it themselves” (I12, Value supporter, Zeta). As two actors within the same BE possess the same capability, one can argue that there is an inefficiency regarding the overall distribution of capabilities. Therefore, we argue that this risk increases whenever an actor relies on a capability that other actors possess, harming their uniqueness in the BE.

The data analysis shows that this risk is a prevalent concern by several actors in the BE. Thus, knowledge regarding this risk can be considered as valuable from both a practical and academic standpoint. Hence, we have chosen to name this risk Disintermediation risk, with the corresponding definition: The risk of being partly or entirely excluded from the BE due to an overlap in capabilities and interests between actors.

A second concern recurring in the analysis was the concern of being responsible for other actors’ actions within the BE. The analysis shows that the responsibility of the value proposition towards the end consumer varies between the BE participants. This implies that some actors will have to answer for other actors’ outcome in the value creation, as the following statement indicates: “This is surely a risk, and I do not think there will be
equal BE conditions when it comes to the responsibility” (I16, Direct value creator, Alpha).

We argue that this risk is two folded, where the first part is related to the legal liability of the provided solution, while the second part is related to brand exposure. The liability question turned out to be a big concern and a heavily discussed subject between BE actors: “The most complicated negotiations are about the liability issue” (I16, Direct value creator, Alpha). Although the liability issue is somewhat distributed among the BE participants through contracts, service level agreements, and key performance indexes, the brand exposure is not something that can be distributed fairly. Brand exposure occurs naturally in an BE since the definition of an BE involves joint value creation (Adner, 2017). Meanwhile, users tend to associate the product or service with mainly one company. Even though the product or service is a joint value proposition, one brand must be exposed towards the customer, as the following quote indicates:

“It does mean that we are cautious about who we partner with, in some way we still think that if you are a customer of [Gamma] and somehow buy car-related services via or in cooperation with us, it is we that will partly be responsible for that delivery. So, it is something that hinders us and forces us to be cautious, we do not want to risk our brand by working with the wrong partners” (I5, Focal firm, Gamma).

In the case of an incident, the implications for the liable actor in the BE is rather monetary. However, implications for brand exposure can cause much greater damage and is more difficult to quantify since it is related to the user experience of the brand.

As this risk was continuously recurring in the analysis, and could not be included in previously defined risks, we argue for the establishment of a new risk. Therefore, we have chosen to name this risk Accountability risk with the corresponding definition: The risk of being partly or entirely liable for the value proposition combined with one’s brand being associated with the joint value proposition towards a third party.

Table 4 below presents a summary of the studied risks with definitions and examples of each risk.
<table>
<thead>
<tr>
<th>Risk type</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Interdependence risk    | The joint probability that different partners will be able to satisfy their commitments within a specific time frame. | In one example, we worked with an American company that said they would deliver something. Now we have learned not to count on others promises. (I6, Direct value creator, Alpha)  
With two parties it will not be so complicated. But when there are more parties, 3-5 who has to contribute with different things it becomes trickier. Then there are so many conditions to be achieved. (I3, Direct value creator, Alpha)  
We have several SLAs when we work with uptimes and there we can, for example, be dependent on Amazon or Microsoft so absolutely, everything is really intertwined. (I9, Direct value creator, Alpha) |
| Integration risk        | The likelihood and consequences of others not being able to, or not being willing to adopt the solution. | There are two types, where the first one is the technical integration risk. You require an interface to system environments, and then if there are too many different variants it will not be scalable. The other type of integration is in some way social integration. (I16, Direct value creator, Alpha)  
This can only work with an ecosystem (the project). We don't provide our own solution, so the network operators need to embrace our technology, and so does the car manufacturers and the road authorities. (I8, Direct value creator, Alpha)  
The technical infrastructure is incredibly fragmented. For example, we would love to receive information about traffic light status in different cities, but if you do not agree on how that information is to be exchanged, it will be almost impossible to integrate. (I5, Focal firm, Gamma) |
| Opportunistic behavior  | The risk of others prioritizes to secure self-interests instead of the BE’s mutual interests. | We worked a bit with suppliers of IP equipment, they would sell and stand for a certain part of the solution and [Alpha] for another part. But then they had some products that were overlapping and pushed to sell them instead. (I6, Direct value creator, Alpha)  
…one is pushing for the cellular and the other one is pushing for WIFI. Until now they haven’t managed to agree on one. If the two camps remain, we will end up having two systems on the road and they will not be able to talk to each other. This is bad for road safety which is the main purpose of the project. (I11, Direct value creator, Epsilon) |
| Power Imbalance         | The risk of being a powerless company among powerful companies.             | It is difficult for innovation-driven companies to work with these huge global automotive or telecom companies. There needs to be a facilitator in between. (I9, Direct value creator, Alpha)  
A startup does not understand a large company why it is so slow, and a large company does not understand why the startup is so stressed and wants answers right away. (I12, Value supporter, Zeta) |
| Disintermediation risk  | The risk of being partly or entirely excluded from the BE due to overlap in capabilities and interests between actors. | The tension arises when we are entering in the same interest as traditional customers might go into … We want to provide more innovation, but we know we are limited by existing relationships. (I4, Direct value creator, Alpha)  
We are partly starting to compete with our existing customers in the traditional value chain unknowing of how that relationship will change. (I5, Focal firm, Gamma) |
| Accountability risk     | The risk of being partly or entirely liable for the value proposition combined with one’s brand being associated with the value proposition towards a third party. | I am a customer of [Beta], I am a customer of my car dealer, a tire company, and to all the companies providing components to the car. But when something in this goes wrong, to whom does the customer feel that it has the strongest relationship with, and who will be responsible? (I5, Focal firm, Gamma)  
It probably damages the brand in a way, I mean, if you know your friend has a different car and is able to do it, your vehicle may not be as attractive (I4, Direct value creator, Alpha) |
4.1.3. *Risks variation with respect to role*

In this section, the risk exposure with respect to an actor’s role is analyzed and presented. The roles studied in this BE consists of focal firms, direct value creators, and value supporters.

The connection between risk exposure and the role was not as strong as assumed. Instead, the variation in risk exposure turned out to depend on a number of factors and characteristics, certainly including role but also the actor's relatively size, type of business and investments in the BE. The common way to define roles is based on what activities the actors perform (Dedehayir et al. 2016). Only in those cases where the risk exposure depends entirely on what activities the actor performs a credible connection between risk and role can be stated. For some of the risks, for which the risk exposure first seemed to be corresponding to roles, one can assume the actual causes to the risk exposure was not the role itself. The similarity in other characteristics than the activities may just as well result in the same risk exposure. For instance, direct value creators tend to be of approximately the same size, have similar business models and similar internal and external processes. Even though the risk exposure seems to be equal for all actors having the same role, the role itself may not be the cause of risk exposure. However, for some risks, accountability risk, for instance, the risk exposure is clearly related to the role since the risk exposure certainly depends on the activities performed in the BE.

In the case of accountability risk, it was the focal firm that owned the customer relationship and was thereby liable and accountable towards the customer. The direct value creators and value supporters may certainly be legally liable towards the focal firm but will not suffer from brand damage in cases of failure of a delivery toward the end customer. Beta, that is a focal firm, illustrated how they are affected by this risk by the following quote:

“If I am a customer of [Gamma], I am a customer of my car dealer, a tire company, and to all the companies providing components to the car. But when something in this goes wrong, to whom does the customer feel that it has the strongest relationship with, and who will be responsible?” (I5, Focal firm, Gamma).
For accountability risk, the exposure is connected to the role. The focal firms will always have more exposure to the risk compared to direct value creators and value supporters from the start. It is rather a matter of how large share of the total amount of risk the focal firm can transfer to the direct value creators and value supporters.

Throughout the analysis, disintermediation was also found to vary with respect to specific roles. This affected direct value creators primarily, but also value supporters. As direct value creators strive to expand their business, they often end up crossing the line of other direct value creator’s business area, hence disintermediating others. In the following quote the informant indicated that their business lies closely to other actors, which entails risk exposure.

"We are in a very vulnerable position, and we might get run over. A typical squeezed in the middle syndrome. We are not at the top of the value chain, that is, the vehicle manufacturer and we are not at the bottom. There is an evident risk that we will be squeezed in the automotive industry" (I9, Direct value creator, Alpha).

The third risk varying with respect to the role was power imbalance, which varies depending on the relative amount of power in relation to other actors in the BE. The actor's power within the BE was connected to the actor's role. The focal firms have major power due to their role since they constitute the common basis for the entire BE. The direct value creators' power is also somewhat based on their activities in the BE due to the importance of value creation, at least as a group. However, the individual power for both direct value creators and value supporters vary within each role category. Thus, all direct value creators did not seem to have an equal amount of power within the BE nor did the value supporters.

Interdependence risk, integration risk, and opportunistic behavior seemed to lack connection to what activities the actor performed and thereby the role. However, for accountability risk, disintermediation risk and power imbalance the risk had a connection to what role the actor enacted due to the close connection to the activities the actors performed. A summary of how risk relates to roles is given in table 5.
Table 5: Overview of risk exposure in relation to roles

<table>
<thead>
<tr>
<th>Actors...</th>
<th>Performs the following activities...</th>
<th>And therefore, enacts the role of a...</th>
<th>Leading to higher risk exposure of...</th>
</tr>
</thead>
</table>
| Beta, Gamma | - Assembles products and services from surrounding participants  
- Performing customer relation-based activities | Focal firm | Accountability risk |
| Alpha, Delta, Epsilon | - Supplier of products and services associated with third party value creation  
- Supplies focal firm with supplementary inputs | Direct value creator | Primarily disintermediation risk but also power imbalance |
| Zeta, Eta, Theta, Iota | - Provides supporting elements to the BE | Value support role | Power imbalance risk |

4.1.4. Additional factors affecting risk exposure

Even though the purpose of this study was to advance the understanding of risk exposure connected to roles we have obtained some additional interesting insights. The connection between risks and roles was certainly possible to see, but the cause of risk exposure was in most cases not the role itself. For some risks, the actor’s role and activities had a major impact on the risk exposure. For some other risks, other factors such as the actor’s relatively size, type of business and investments in the BE, had more influence on the risk exposure. In this section findings and additional insights on additional causes to risk exposure will be presented and discussed.

The size of the company seemed to be a relevant factor for several risks. For instance, in the cases of power imbalance and opportunistic behavior, the risk exposure seemed to somewhat vary with respect to company size which seems reasonable. For instance, a direct value creator expressed how harmful their commonly used processes can be to a smaller company by saying “Well, our processes tend to smother small startups. We need processes to handle the disparity in size” (I6, Direct value creator, Alpha).

Also, the maturity of the BE seemed to influence risk exposure. The analysis indicated that as an BE evolves, the investments required by each individual firm increases. The probability of both integration risk and interdependence risk seemed to be uniformed within the BE whereas the negative impact seemed to be more distributed. We found
indications that the negative impact probably connects to investment and engagement as can be seen in the following quote.

"It depends on who has the most to lose or the one who has invested the most. Anyone who has invested many hours and capital and then everything is delayed so it takes a long time before you get any payback" (I6, Direct value creator, Alpha).

Actors spreading their risk, active in several BEs, are probably less exposed to the interdependence risk and integration risk since their investment in the BE is relatively low and they have less to lose.

An actor’s industry origin was another factor that seemed to affect the risk exposure of power imbalance. A company originating from the same industry that surrounds the BE naturally possess more power than those coming from another industry. A likely cause for this is that those companies are considered experts and therefore gains higher levels of trust and respect from surrounding actors, which the following statement indicates: “When defining whatever needs to be decided on an ecosystem level, I think we are considered extremely humble or irrelevant in that sense” (I8, Direct value creator, Alpha).

Another factor affecting primarily disintermediation risk and power imbalance tended to be a distinguished business model and value proposition towards the BE. In the disintermediation case, the distinguished business model to some extent spares the actor from being exposed to the risk, since the likelihood of overlapping interests decreases. A distinguished business model also seemed to increase an actor power, probably because of the unique activities this actor performs and hence, the critical value it brings. A direct vale creator expressed the concern of overlapping interest as the following quote indicates:

“…They originate from the hardware side, which is merging more and more with the software side. We come from the connectivity side, which branches towards the software side so somewhere we have a rather tough intersection where we both act. The intersection constantly moves.” (I9, Direct value creator, Alpha)

Hence, actors with similar business models providing value to the BE closely related to what other actors provide seem to be more exposed to these risks.
4.2. **Risk management in business ecosystems**

In the following section the findings of how the six different risks can be mitigated through the four risk mitigation strategies. Each of the four risk mitigation strategies will be presented separately with practical examples of how the risk mitigation strategies can be applied to each risk. Since risk reduction was more commonly used and applicable for several risks, a more in detail explanation of this strategy is given compared to the remaining three risk mitigation strategies. Therefore, the findings regarding risk reduction examines each risk individually, while the remaining three strategies examines the risks collectively.

4.2.1. **Reducing risks**

*Risk reduction* includes activities that reduce either the probability of the occurrence or the severity of the impact of a certain event (Dorfman, 1998). This strategy turned out to be the most frequently used in the studied case by several actors to mitigate risks. Actions pursued to reduce the *probability* of risks was found applicable to *interdependence risk*, *integration risk*, *opportunistic behavior*, *power imbalance*, and *disintermediation risk*. Also, actions pursued to reduce the *impact* was found in the cases of *Interdependence risk*, *opportunistic behavior*, and *disintermediation risk*.

As the *interdependence risk* refers to the probability of actors being able to satisfy their commitments, the actions pursued to reduce the probability of this risk included efforts to improve the collaboration amongst actors. Implementing agile methodologies was one tool used to intensify communication and reconciliation between actors. Another tool was to ensure goal alignment and create incentives for actors to reach a mutual understanding of the value creation, such as establishing KPI:s, legal contracts, and service level agreements (SLA). Actions pursued to reduce the impact of disintermediation risk was centered around the establishment of a backup plan. Having a plan B if the risk occurs reduced the impact of the event. Also, vertical integration was used as an investment to reduce the number of actors and hence the uncertainties of the collaboration. Table 6 exemplifies actions pursued in the BE to reduce the interdependence risk:
Table 6: Risk reduction for interdependence risk

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>There you try to work agile in sprints, and they end up in a demo. This means that</td>
<td>Agile methodologies</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>with short intervals you have reconciliations to see that everyone has come as far as</td>
<td></td>
<td></td>
</tr>
<tr>
<td>expected. So, it is very difficult to hide that you do not perform, it reveals itself</td>
<td></td>
<td></td>
</tr>
<tr>
<td>quite quickly what works and does not work (I3, Direct value creator, Alpha)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From the [Focal firms] perspective, this risk is quite significant. The actor will be</td>
<td>Create incentives through contracts</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>very careful and legally connect to contractually to create incentives for parties to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>act as they prefer (I16, Direct value creator, Alpha)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>We try to define the KPI with the requirements from the application side from the</td>
<td>Goal alignment</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>beginning. This gives at least the partner and the communication unit an idea of what</td>
<td></td>
<td></td>
</tr>
<tr>
<td>they need to provide. That definitely reduces the risk, but it doesn't eliminate them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I11, Direct value creator, Epsilon)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I believe that the cooperation in [Zeta] reduces this risk as it is a neutral arena</td>
<td>Collaboration with a neutral part</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>where these six partner companies are allowed to collaborate and experiment with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>startups at a level that involves low risk. (I12, Value supporter, Zeta)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It must be that you really call the cards and do a proper risk analysis with plan B</td>
<td>Backup plan</td>
<td></td>
</tr>
<tr>
<td>and C. If they cannot deliver these features, what should we do then? (I3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It would probably be vertical integration then, that you buy up subcontractors. It</td>
<td>Vertical integration</td>
<td></td>
</tr>
<tr>
<td>has happened when it has been for small companies. Then it's easier to buy them. (I9,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct value creator, Alpha)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As integration risk circuits around the adoption of the BE solution, the efforts to reduce this risk primarily focused on improving innovation processes through market research, testing and gaining knowledge about the provided solution. By iterating the solution with potential customers, users and the surrounding infrastructure and society, knowledge regarding its potential increases. This reduces the integration risk since the knowledge allowed actors to "fail fast" and hence spend fewer resources. Lobbying towards governmental institutions was also found as a useful tool to reduce the integration risk. Table 7 exemplifies actions pursued in the BE to reduce the integration risk:
Table 7: Risk reduction for integration risk

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing and demonstrating is one thing, getting it accepted in different standards is another way. (I3, Direct value creator, Alpha)</td>
<td>Testing</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>Try to talk to the different players and help them to agree on one solution. For a given application only one standard can be adopted. It is more lobbying and communication I would say and not on a technical level. (I11, Direct value creator, Epsilon)</td>
<td>Lobbying</td>
<td>Risk reduction (Impact)</td>
</tr>
<tr>
<td>It's about having a minimum viable product and failing fast which reduces the number of resources spent. (I3, Direct value creator, Alpha)</td>
<td>Fail fast</td>
<td>Risk reduction (Impact)</td>
</tr>
</tbody>
</table>

Risk reduction was also found applicable in the case of opportunistic behavior. As opportunistic behavior harms the BE through actors acting to secure self-interests instead of the BEs mutual interest, it is rather intuitive that this risk can be reduced by improving the overall relationships and collaborations between the BE actors. Actions found to do so was managing expectations, building trust between actors through communication and contracts and escalation. Table 8 exemplifies actions pursued in the BE to reduce the risk of opportunistic behavior.

Table 8: Risk reduction for opportunistic behavior

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>We talk a lot about managing expectations. It is necessary that each actors' expectations are clear and discussed (I12, Value supporter, Zeta)</td>
<td>Manage expectations</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>It is more lobbying and communication I would say, but not on a technical level. (I11, Direct value creator, Epsilon)</td>
<td>Lobbying</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>What you must do in some cases is to escalate. The problem is, companies are organized to munch into silos which leads to diffuse objectives. (I13, Direct value creator, Alpha)</td>
<td>Escalation</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>Well, it is important that you do proper preparation and get an agreement in place, so it is crystal clear, so there are no unclear agreements (I6, Direct value creator, Alpha)</td>
<td>Contracts</td>
<td>Risk reduction (Impact)</td>
</tr>
</tbody>
</table>

Risk reduction was also found applicable to the risk of power imbalance. However, the data collection regarding risk mitigation for power imbalance indicates that the suggested solutions are quite demanding. Most of the actions to reduce the risk of power imbalance circuits around a neutral actor with the possibility to mediate needs between actors. Therefore, powerless companies are more or less left in the hands of others to reduce this
risk. Powerless companies, which in general tends to be startups and SMEs, must prove their importance to the value creation process and their need for support to the other actors, and thus gain support from the BE. In the studied case, Zeta was found as an important actor able to facilitate the needs for powerless actors and communicate these differences towards the BE through escalation, thus establishing mutual understanding between actors. Table 9 exemplifies actions pursued in the BE to reduce the risk of power imbalance.

Table 9: Risk reduction for power imbalance

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small companies are exposed to power imbalance... That is why [Zeta] has been created, in order to find a good form for startups to be able to offer their ideas in a safe and secure manner to the large car-OEM companies, and through this program quickly go through a kind of accelerator phase. So [Zeta] is a way to handle Power imbalance. (I3, Direct value creator, Alpha)</td>
<td>Collaboration with a neutral part</td>
<td></td>
</tr>
<tr>
<td>The neutral party can also escalate to senior executives at the major companies, as they are generally positive to [Zeta]. (I12, Value support, Zeta)</td>
<td>Escalation</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>It is difficult for innovation-driven companies to work with these huge global automotive or telecom companies. There is a need for a facilitator in between. (I9, Direct value creator, Alpha)</td>
<td>Actor facilitating between others</td>
<td></td>
</tr>
</tbody>
</table>

Actors were found to reduce the risk of disintermediation by striving for a unique and secure position in the BE. This was done by using tools such as IP and contracts to protect the actor's contribution from others and by communicating its importance to the BE to gain power. Also, partnerships between actors were found to increase trust and hence reduce the risk of disintermediation. Table 10 exemplifies actions pursued in the BE to reduce the risk of disintermediation.
Table 10: Risk reduction for disintermediation risk

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Then it is important to think about when you design it, so you have the IP on your side and have a very well-developed platform that allows you to scale up different customer projects on the platform. (I9, Direct value creator, Alpha)</td>
<td>Intellectual property rights</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>Ensure that one's own contribution has an important role in the overall offer. The problem is that you do not know this until you set your own business strategy. If you realize that others have competing offers, you try to compete or disintermediate them (I16, Direct value creator, Alpha)</td>
<td>Ensure unique contribution</td>
<td>Risk reduction (Probability)</td>
</tr>
<tr>
<td>Probably some partnership, if the big players' partner they do some partnership with some small players they probably help them bring their ideas. Of course, there is a win-win situation. That is one way probably to reduce it. (I11, Direct value creator, Epsilon)</td>
<td>Partnerships</td>
<td>Risk reduction (Probability)</td>
</tr>
</tbody>
</table>

In summary, reducing the probability or the impact of BE risks is a frequently used method. The risk reduction mainly circuits around improving the overall collaboration within the BE through communication and different project management efforts. Also, improving the BE's structure in terms of value sharing through agreements, contracts and incentives for actors to act accordingly for the best of BE-related interests are all important risk-reducing actions.

4.2.2. Sharing or transferring risks

Risk sharing/transfer include activities that completely or partly transfer risks to another stakeholder, for instance, a customer, partner or an insurance company (Dorfman, 1998). Sharing or transferring risks to other actors within the BE turned out to be a less utilized risk mitigation strategy in the studied case. Although, the analysis shows that sharing or transferring risks can mitigate interdependence risk and accountability risk. In the case of interdependence risk, service level agreements were signed between the actors. These agreements function as a safety for all actors since those that are not able to fulfill their commitments are penalized, thereby transferring the risk to those underperforming. For the accountability risk, risk transfer was the most frequently used risk mitigation strategy used in the studied case, exclusively managed through contracts. This aligns with Iansiti and Levien (2004a), who mentions that adopting a more passive role in the BE would transfer a portion of risks towards other actors. In the current state of autonomous vehicles, the driver bears the liability of the car. Hence, one could argue that focal firms transfer the liability part of accountability risk to the drivers. For brand exposure, some
actors pursue actions to erase the association of their brand to a certain product or service, which transfers all the brand association towards other actors in the BE. Another risk sharing effort pursued is the establishment of an affiliate in collaboration with other BE actors, of which high-risk innovation can be performed. This new actor functions as a dummy of which the BE actors are less associated with, and thereby transferring both liability and brand exposure to this new actor. Table 11 exemplifies actions pursued in the BE to share or transfer risks to other actors in the BE.

Table 11: Sharing or transferring risks in BE

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is not that you say that &quot;it would be good if this thing worked, so the cars do not crash&quot;. Instead, service level agreements that include, as an example, 99.9% uptime with the following service agreement is determined are established. (I9, Direct value creator, Alpha)</td>
<td>Interdependence risk</td>
<td>Contracts</td>
<td>Risk sharing / transfer</td>
</tr>
<tr>
<td>It will be under the name of [Zeta] which is a neutral name. Although, it is still these six partner companies operating. So, in a way, they are less constrained to work and experiment. Afterward, we present what turned out desirable, not these challenges that might occur. (I12, Value supporter, Zeta)</td>
<td>Accountability risk</td>
<td>Create a neutral actor</td>
<td>Risk sharing / transfer</td>
</tr>
<tr>
<td>Anyone who takes a big risk from a liability perspective will set very clear demands on other players... So, you must have that kind of contractual commitment to secure the legal risk you take as the main anchor in the ecosystems at the beginning. If you take an anchor role then you have said that I am the main plane in this and the OEM is acting as a window towards its consumer market and perhaps even wants to enter the mobility service role instead (I16, Direct value creator, Alpha)</td>
<td>Accountability risk</td>
<td>Contracts</td>
<td>Risk sharing / transfer</td>
</tr>
<tr>
<td>We typically do not put our own brand up front, so people do not usually know it is [Alpha] behind it. (I8, Direct value creator, Alpha)</td>
<td>Accountability risk</td>
<td>Avoid brand association</td>
<td>Risk sharing / transfer</td>
</tr>
</tbody>
</table>

4.2.3. Avoiding risks

Risk avoidance simply implies evading all possibilities that a certain event can occur (Dorfman, 1998). The analysis shows that risk avoidance is frequently applied as a risk mitigation strategy in the cases of integration risk, risk of opportunistic behavior, and disintermediation risk. Avoiding risks in a BE simply means carefully selecting which BE to participate in and with whom. Therefore, risk avoidance cannot be applied to mitigate all BE risks, since this would lead to firms not participating in BEs at all. For the integration risk, risk avoidance is applied through actors choosing which BE to participate in based on their research on specific products or service potential. By conducting market research and forecasting future needs, companies estimate the potential of different BE offerings and how well these offers can be integrated with the surrounding infrastructure.
before deciding on where to participate, and which BE to avoid. Avoiding the risk of opportunistic behavior is performed by choosing whom to cooperate with, either by previous experiences with other actors or through investigating them before entering. A similar approach is applicable for disintermediation risk since actors with similar contributions and to the BE and business models can be avoided by deciding where to compete, and where not to. Table 12 exemplifies actions pursued to avoid BE risks.

Table 12: Avoiding risks in BE

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well, you have to choose your path wisely, you have to make sure to work even on the infrastructure in a conscious way. (I5, Focal firm, Gamma)</td>
<td>Integration risk</td>
<td>Market research</td>
<td>Risk avoidance</td>
</tr>
<tr>
<td>Choose your partners wisely, the ones you trust. (I3, Direct value creator, Alpha)</td>
<td>Opportunistic behavior</td>
<td>Due diligence</td>
<td></td>
</tr>
<tr>
<td>Make sure that one's own contribution has an important role in the overall offer... If you realize that many others have competing offers, you can avoid them (I16, Direct value creator, Alpha)</td>
<td>Disintermediation risk</td>
<td>Due diligence</td>
<td></td>
</tr>
</tbody>
</table>

4.2.4. Retaining risks

Risk retention plays the opposite part of the other strategies, where the actor embraces the risk and attempts to profit from it through a so-called "risk premium" (Dorfman, 1998). This risk premium is often described as monetary but could be any type of benefit. In the studied BE the profit from retaining risk turned out to circuit around an increase of power for the actor retaining the risk, which is a benefit difficult to quantify. Risk retention was found applicable for integration risk and accountability risk. Integration risk was somewhat mitigated through retaining the risk and applying a differentiated pricing strategy, which mitigates the scale-up difficulties that come with integration risk. Charging a higher price for innovations that are difficult to integrate to surrounding infrastructure could be beneficial, although it would probably lower the total sales volume. In the case of accountability risk, the actor retaining this risk gained benefits in terms of increased power towards other BE actors, allowing for a better starting position in negotiations, as an example. Table 13 exemplifies actions pursued to retain BE risks.
### Table 13: Retaining risks in BE

<table>
<thead>
<tr>
<th>Representative quotes</th>
<th>Risk</th>
<th>Risk mitigation actions</th>
<th>Risk response strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>You may be able to use differentiated pricing if you have considered in your cost calculation that it will be difficult to integrate. So, it’s about getting a reality-based impression for your own plans. (I16, Direct value creator, Alpha)</td>
<td>Integration risk</td>
<td>Differentiated pricing</td>
<td>Risk retention</td>
</tr>
<tr>
<td>Anyone who takes a big risk from a liability perspective will place very clear demands on other players (I16, Direct value creator, Alpha)</td>
<td>Accountability risk</td>
<td>Associate the offer with your brand</td>
<td>Risk retention</td>
</tr>
</tbody>
</table>

The findings of risk mitigation in BE displays current utilized methods and tools pursued by different actors. As previously stated, the most common risk mitigation strategy turned out to be risk reduction, while the other strategies are somewhat secondary. However, the findings do not declare that the currently used methods are the most effective for each given risk. By applying a risk management perspective of how to thrive in a BE, we hope to provide a foundation of which the current strategies can develop.
5. AN EMERGING FRAMEWORK FOR RISK MANAGEMENT IN BUSINESS ECOSYSTEMS

To provide a holistic view of the result and an answer aligned with the study's purpose and research questions, an emerging framework of risk management in BEs has been constructed (see figure 2). The purpose of the framework is to guide managers in their risk management efforts upon entering and participating in BE. The framework combines the separate findings regarding roles, risks, and risk mitigation actions into one unified figure and thus provide managers with options on how to mitigate the given risks while entering and participating in BEs.

The frameworks logic originates from the four risk management strategies in the smallest square (risk reduction, risk transfer, risk avoidance, and risk retention). The middle square declares role specific risks, which indicates that disintermediation risk, accountability risk, and power imbalance are more relevant for actors inhabiting certain roles. The largest square presents the risks exposing actors regardless of their role. The framework connects suggested risk mitigation strategies for each given risk. It should be viewed as a guideline for managers pursuing risk mitigation efforts in BE and should be used while designing engagement models and strategies for BEs. Managers can utilize the framework to identify which risks will be particularly important for the specific role they enact, and the risks that will be important to consider regardless of one’s role. Lastly, the framework suggests different risk mitigation strategies for each risk, where more detailed examples of these strategies can be viewed in chapter 4.2 Risk management in business ecosystems.
Figure 2: A framework for risk management in BEs
6. DISCUSSION

The purpose of this study has been to *advance the understanding of risk exposure for actors with different roles in BEs and how these risks can be managed.* The purpose has been fulfilled through the answering of how risk exposure varies with respect to roles and how BE risks can be mitigated in combination of the providing of a framework, which addresses this issue.

6.1. Theoretical implications

Previous literature provides a set of different BE risks (Adner, 2006; Adner and Kapoor, 2009; Pierce, 2008; Tellier, 2017). It was also known that these risks vary between different roles (Adner & Kapoor, 2010). However, previous literature did not clarify the connection to different roles or how these risks should be monitored or managed, which represent the research gap this study has investigated. We have been able to confirm and nuance four previously known risks by clarifying the distribution and explaining how the risks are practically experienced and managed. In addition, we have identified and added two new risks to the literature which previously has not been recognized. On top of this, this study sheds light on the claim that risk varies between roles (Adner and Kapoor, 2010), which our study also indicates. However, we found that risk variation in BE is not limited to roles exclusively. Instead, the results indicate that risk variation is dependent on other factors, e.g. a firm's relative size to other actors, the maturity of the BE and investment in the BE. The findings also show that the nature of risks in BE is different from traditional risks in, as an example, project management, where risks are experienced and managed in silos and the costs often are monetary. For BE, risks are highly intervened, and the exposure is derived from other actors’ actions. Hence, there is always two sides of the same coin, actors experiencing the risk, and actors exposing others with the risk, which has important implications for risk management in BE. Mitigating one risk might give birth to another. One example is how the reduction of accountability risk often entails lower power in the BE, thus exposing the actor for power imbalance. Therefore, the costs of mitigating risk are sometimes the exposure of another. Hence, one can argue that risks are sometimes traded between actors instead of mitigated. In addition to the theoretical implications for the BE literature, we have contributed to
the risk management literature by applying it in the new context of BEs to extend the applicability of the risk management literature. Thus, our theoretical contributions lie in a cross section between the literature fields of risk management and BEs.

6.2. Managerial implications

As previously mentioned, as companies are entering and participating in BE, they face the controversy of which role to adopt. This is essentially decided on which activities each actor carries through since BE roles are separated by the type of activities they perform (Dedehayir et al., 2016). One important part of this decision is the risk exposure that each action entails for the individual actor, which our findings confirm. Thus, the current study has important managerial and strategic implications on this controversy. Our findings shed light on how risks are distributed between different roles and can therefore provide guidance in this issue. We also suggest suitable risk management efforts for each risk, which in turn somewhat displays capabilities firms require to successfully thrive within a specific role. As an example, direct value creators are likely to face the risk of opportunistic behavior and must, therefore, possess exceptional communication and legal capabilities to mitigate this risk. Another example is how focal firms are likely to be exposed to accountability, which leaves them with the option to either (1) try to profit from this risk through risk retention, or (2) transfer this risk to other actors through negotiations and contractual agreements. The current study also contributes to an improved understanding of how risks vary with respect to other factors than roles, which could be valuable knowledge for managers. As an example, knowing (1) that your firm's relative size to other actors, (2) investment in the BE and (3) maturity of the BE will affect risk exposure can be of value as input for designing strategies and engagement models for entering and participating in a BE.

6.3. Limitations and further research

Like all research, also this study has limitations. Due to the diversity in constellations between different BEs, it is reasonable to assume that there will be deviations in risk exposure. There will probably not be a one-to-one match in risk distribution between two different BEs. It has been a trade-off between depth and generalizability where we
chose to renounce the generalizability in favor of depth in the study. However, the BE studied has been a generic case in the sense that it has no abnormal or extreme characteristics and thereby are the findings as generalizable as they can be, given the design of the study.

This leads to our suggestions for further studies where we see a room for complementing our results by applying a broader perspective and test these results in a generic sense in other BEs. Another interesting aspect to study more is the impact of maturity. There were clear indications that the BE's maturity plays a role in how risks are distributed. Also, each factor found in this study affecting the risk distribution should be studied in-depth to fully understand each factor and thus contributing to a further understanding of risks in BE.
REFERENCES


APPENDIX A: INTERVIEW GUIDE (ROUND 1)

Initial information
1. What’s your role at [company]?

2. Describe your contributions to the project/ecosystem

3. What are your gains from participating?

Identify risks (RQ1)
4. Are there any risks associated with participating in the ecosystem?

5. Are there any risks that certain actors are more exposed to?

Questions regarding risks from the literature (RQ1)
6. How are you exposed to:
   - Interdependence risk?
   - Integration risk?
   - Risk of opportunistic behavior?
   - Power imbalance?
   - Other risks that appeared during the interview?

Risks for other actors
7. How do you expect these risks affect the other actors in the ecosystem?
   - Actor 1
   - Actor 2
   - Actor n

8. How does that differ from how you are affected?

Ending
9. Given our conversation, is there anyone else you think we should talk to?

10. Can we reach out to you to ask complementary questions if required?
**APPENDIX B: INTERVIEW GUIDE (ROUND 2)**

**Introducing questions**

1. Which role fits your company/organization the most?

2. For your company, how would you describe risk X: (Interdependence risk, Integration risk, Risk of opportunistic behavior, Power imbalance, Disintermediation risk, Accountability risk)
   - Short examples
   - Do you think that you are more or less exposed to this risk than actors with other roles?
   - How do you mitigate this risk?
   - What would be the best way of managing this risk?

3. Apart from the risks we have discussed, are there any other risks you can think of that you are facing from this ecosystem?

**Ending**

4. Given our conversation, is there anyone else you think we should talk to?
5. May we come back to ask complementary questions if required?

**BACKGROUND INFORMATION TO INFORMANT**

We are studying the concept of Business Ecosystems and, how different types of actors/participant/roles in a business ecosystem are exposed/affected by risks. We are also investigating possible risk management actions suitable for each risk.

We would like you to take a couple of minutes to read through this document and reflect on what role your company has in [PROJECT] or in another ecosystem you are more familiar with. Please read through the given definitions of roles in a business ecosystem and try to find the one that fits your company/organization. Please read through the explanations of the seven risks and reflect on to what extent you are exposed to these risks. Finally, please reflect on how you mitigate or manage given risks. This will form the basis for our interview.
1. Which role describes your participation in [project] best?

<table>
<thead>
<tr>
<th>Role</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leadership role</strong></td>
<td>Undertakes four higher-level sets of activities – ecosystem governance, forging partnerships, platform management, and value management</td>
</tr>
<tr>
<td><strong>Direct value creation roles</strong></td>
<td>Roles associated with third party value creation</td>
</tr>
<tr>
<td><em>(e.g. Suppliers, Assemblers, Complementors, Users)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Value support role</strong></td>
<td>Contributes to the ecosystem by providing peripheral supporting elements. Not related to direct value creation for the end customer</td>
</tr>
<tr>
<td><em>(e.g. Research organizations, Universities, Consultants)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Ecosystem entrepreneur role</strong></td>
<td>Centers primarily around the incipient ecosystem. Supports the ecosystem with entrepreneurial, regulatory or financial efforts</td>
</tr>
<tr>
<td><em>(e.g. Sponsors, regulators, entrepreneurs)</em></td>
<td></td>
</tr>
</tbody>
</table>

2. Definition of risk used in this study:

“Risk is defined as a combination of the probability of loss and the impact of the loss”

3. Risk evaluation

Each of the following risks could be evaluated both in terms of probability and impact. Please use the matrix below when considering how your company is exposed to each risk. While evaluating risk exposure, please reflect on possible risk response actions/possible risk management solutions for each risk.
**Explanation of risks**

*Interdependence risk*

“The uncertainties of coordinating with complementary innovators”. This could also be described as the joint probability that different partners will be able to satisfy their commitments within a specific time frame.

This risk describes the situation of coordinating projects / work with other actors. The risk can be described as the total probability that different players can fulfill their commitments within the time frame. Thus, the result of the project is dependent on all actors delivering on time.

Example: N different players develops an electronics system for a car. In order for the project to succeed, all actors must deliver according to their commitments on time. The risk is thus higher the more actors are involved. If the probability of an operator succeeding is 96%, then the chances of succeeding becomes 0.96N where N is the number of players participating in the project.

*Integration risk*

Refers to the likelihood and consequences of others not being able to, or not being willing to adopt the solution

Example: One develops a product that the end customer appreciates, but the handling of the product in any intermediate steps becomes problematic for other players. One example is Michelin’s run-flat tire innovation. This innovation was expected to generate a lot of revenue. However, when the tire was introduced, no consumer could buy it. Because the tires connect to a vehicle’s electronic system, they can be used only
in vehicles whose systems have been designed to accommodate them. Michelin also had
to consider other intermediaries as well—garages, which will need to invest in new
equipment and training, and dealers, which will need to understand and support the
innovation.

Risk of opportunistic behavior
The risk of others securing self-interests which increases transaction costs. This can reduce the competitiveness of the ecosystem.

This describes a player who is exposed to the risk that others prioritize self-interests before the best of the ecosystem, which affects the ecosystem's results and others negatively.

Example: Company A exploit company B and company C and secure self-interest at the expense of company B and C.

Power imbalance
“The risk of being a powerless company among powerful companies”

This risk arises for those players who have little power in the ecosystem, and therefore do not have the opportunity to influence decisions etc.

Example: A company X with the authority to change the planning does so and thereby exposes a player with little power for power imbalance. The actor with little power cannot deliver his commitments in time and damages the ecosystem and himself.

Disintermediation risk
“The risk of being excluded from the ecosystem due to lack of unique capabilities and competence.”

Example: Suppose a telecom hardware provider also could take the role as operator in an ecosystem and thereby exclude the existing operator from the ecosystem through disintermediation. The operator is exposed to the risk of being excluded from the ecosystem.

Accountability risk
“The risk of being accountable for other ecosystem participants’ actions.”

Example: A car manufacturer is manufacturing cars that are served by a third party. The workshop performs insufficient service which leads to frequent breakdowns due to the poor service. The customers experience the car as low quality and the workshop’s performance has negative impact on the car manufacturer's brand.