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Renewing mature industries with business ecosystems
The case of big data in the European aviation Industry

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« L’université n’entend ni approuver, ni désapprouver les opinions particulières de l’auteur. »

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Résumé

Les écosystèmes d'affaires sont étudiés depuis trente ans et cette perspective d'analyse peut désormais s'appliquer à la plupart des industries. Les écosystèmes deviennent des structures populaires pour collaborer avec plusieurs acteurs et développer de nouvelles capabilités. Ils peuvent contribuer à l'innovation et au renouvellement stratégique d'une entreprise. Ces réseaux interdépendants d'acteurs créant ensemble de la valeur, peuvent être étudiés selon deux perspectives. L'approche par les écosystèmes comme affiliation, ou ECA, s'intéresse à la communauté économique d'acteurs qui interagissent pour faire évoluer ensemble leurs capabilités. L'approche par les écosystèmes comme structure, ou ECS, se concentre sur la structure d'alignement que des partenaires créent, pour faire émerger une nouvelle proposition de valeur. Mon étude vise à adopter ces deux perspectives conjointement, pour montrer comment des sociétés évoluant dans des industries matures peuvent utiliser des écosystèmes, pour enclencher leur renouvellement stratégique, renouveler leur modèle économique, tout en renforçant durablement leur avantage compétitif. Adopter de telles structures de collaboration innovantes est de plus en plus facilité par le développement des technologies digitales. La transformation digitale est une opportunité pour les acteurs industriels historiquement en position de force, qui peuvent créer de nouveaux ECS, afin de développer des capabilités dynamiques au niveau de leur écosystème. Ils peuvent ainsi redéfinir leur positionnement stratégique vis-à-vis de leurs partenaires et de leurs concurrents. Cette thèse contribue à la littérature sur les écosystèmes d'affaires par une étude empirique longitudinale. J'y explore la façon dont l'environnement d'un ECA influence la création d'un nouvel ECS, avant que ce dernier permette l'évolution de l'ECA construit dans la durée.

Mots-clés : écosystèmes d'affaires, écosystème comme affiliation, écosystème comme structure, renouvellement stratégique, capabilités dynamiques

Abstract

Business ecosystems have been studied for thirty years and this lens of analysis is spreading to all industrial sectors. Ecosystems tend to become mainstream structures to collaborate with several actors and develop new capabilities. They can play an important role for the success of a firm's innovation strategy and strategic renewal. Those interdependent networks of self-interested actors jointly creating value, can be observed with two perspectives. The ecosystems as affiliation approach, or EAA, considers the ties among actors, the economic community of interacting organizations and individuals who coevolve their capabilities. The ecosystems as structure approach, or EAS, focuses on the alignment structure that is designed by partners so that a new value proposition may materialize. My study aims at jointly taking those two perspectives into account, to show how companies evolving in mature industries can resort to ecosystems to foster their strategic renewal, renew their business models, and strengthen their long-term competitive advantage. Adopting these innovative collaboration structures is increasingly enabled by the surge of digital technologies. Digital transformation provides opportunities for historical leading industrial actors, who can create new EAS to codevelop dynamic capabilities at the ecosystem level, renew their strategic position among partners and towards competition. This dissertation contributes to the literature on business ecosystems through a longitudinal empirical study. I explore how an EAA environment influences the creation of a new EAS. This new EAS will then also contribute to the evolution of the longstanding EAA.

Keywords: business ecosystems, ecosystem as affiliation, ecosystem as structure, strategic renewal, dynamic capabilities

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Introduction

This dissertation aims at contributing to the literature on business ecosystems with a focus on how mature industries can achieve strategic renewal. This introduction defines key concepts, then presents my research object and research design, before giving an overview of my dissertation.

1. Research context

The last decade has seen an exponential growth of ecosystem studies, both in scholarly and practitioner strategy, innovation and entrepreneurship literatures (Felin & Foss, 2023; Bogers & al, 2019). The term “business ecosystem” has become a management buzzword and the word “ecosystem” occurs 13 times more frequently in annual reports than it appeared ten years ago (Pidun & al, 2019). Ecosystems are increasingly recognized as playing an important role for the success of a firm’s innovation strategy and renewal of its business model (Bogers & al, 2019; Daymond & al, 2023). It is crucial for companies to understand how to build such networks of cross-industry players, who jointly create new value structures. Longstanding firms seek complementary capabilities to shift their operating model. They tend to start new business ecosystems that can for example revolve around digital platform solutions (Pidun & al, 2022). The ecosystem concept encompasses key contemporary transformations including systemic changes that go beyond industry boundaries, coopetition with mutually interdependent actors or platform orchestration (Cozzolino & Geiger, 2024). The first studies of business ecosystems focused on IT related businesses but all industries, including mature environments such as automotive, banking, logistics, consumer products, health care, see an evolution of their products and services and a need to collaborate differently (Lang & al, 2019).

1.1 Defining business ecosystems

The concept of business ecosystem was introduced by Moore in 1993, with the will to "unite biology and business" and can be defined as

> *"an interdependent network of self-interested actors jointly creating value" (Bogers & al, 2019: 2).*

Even if there is still no widely accepted overall definition of the concept (Gueguen & Passebois-Ducros, 2011; Bogers & al, 2019; Davis & al, 2020), it provides a framework to understand the complex interdependencies and collaborations among organizations within an industry or market. Ecosystems are multilateral structures of actors that work together to build new joint value propositions (Adner, 2017; Cobben & al, 2022). These structures are distinct from other collaborative concepts (such as joint-ventures, alliances, networks, risk and revenue sharing partnerships) because they encompass a partially hierarchically controlled system, but also interdependencies and complementarities (Jacobides & al, 2018; Kapoor, 2018). Ecosystems can span several industries and markets (Moore, 1993), this is why the competitive advantage of an ecosystem illustrates how a specific ecosystem can outperform other ecosystems or individual firms (Cobben & al, 2022).

Innovation and coevolution are at the core of business ecosystems (Hou & Shi, 2021; Daymond & al, 2023). Innovation paves the way for growth and business evolution; it increasingly comes from outside the company because technology enables the development of new ideas and business models, but also the connection with other organizations (Ringel & al, 2019). Moore (1996) defined the concept of coevolution as a strategic concept to find ways to work with a network of actors, so that everyone can improve their capabilities. The connection between business ecosystem and innovation was also stressed by Adner (2012), with an emphasis on the importance of analysing and managing the broader network of stakeholders involved in bringing innovations to market successfully. The concept lacks a widely accepted definition,

yet Adner (2017) proposed to consider two sides of an ecosystem, with on the one hand an "ecosystem as structure" (EAS) perspective, and on the other hand an "ecosystem as affiliation" (EAA) perspective. The EAA is an economic community of interacting organizations and individuals who coevolve their capabilities (Moore, 1996), while the EAS is the alignment structure designed by partners so that a new value proposition may materialize (Adner, 2017). Before 2017, much of the literature adopted an actor-centric ecosystem as affiliation approach and Adner introduced

> *"a specific view of the ecosystem construct that hinges on the structure of the interdependent activities that underlie a value proposition" (Adner, 2017: 40).*

Membership and structure are two complementary sides of the ecosystem concept (Bogers & al, 2019). My thesis work will be based on these two perspectives.

The focus of this research is to explore how business ecosystems can be used by industrial actors evolving in mature industries, to renew their business models and strengthen their long-term competitive advantage. This focus requires the use of both structure and affiliation perspectives because maturity goes along with longstanding ties and path dependence (Sydow & al, 2009) that might have a strong impact on potential renewal.

Numerous long-standing industrial or manufacturing actors operate within industries that have evolved over the years, leading to heightened barriers to entry and concentration among key players. Traditional firms tend to collaborate with firms providing complementary capabilities to shift their operating model, as Maersk, the 120-year-old market leader in container shipping partnered with IBM, to launch digital platform solutions. Other examples of historical actors who launch their own business ecosystems include agriculture machinery manufacturer John Deere, or retail giant Walmart (Pidun & al, 2022). An industry can be categorised as mature when it has been existing for several decades, during which it experienced regular business within stable markets, before being exposed to increasing pressure to transform (Onufrey &

Bergek, 2020). These companies often operate within well-established sectors like computing, pharmaceuticals, automotive, or aerospace, among others. They have to foster innovation, broaden their horizons, and refresh their business models. Eventually, they may find themselves compelled to explore new business ecosystems and venture into uncertain terrain to evade the risk of becoming commoditized (Adner & Lieberman, 2021). Many endeavours originate from their research and development or strategy teams; however, these undertakings must consider the accumulated history and connections forged with the firm's environment and other associated entities. This rationale underscores the focus of my research on well-established companies that initiate new ecosystems as structure.

The use of the ecosystem concept is about a major shift in the concept of competition, to the extent that Moore (1996) even announced the death of competition. The key message was mainly that strategic management should stop focusing on internal resources and strengths because firms are embedded in their environment. They develop connections and evolve through time, next to other actors, with the consequence that future decisions are necessarily influenced by the past and current actions and relationships.

1.2 Defining strategic renewal

Strategic renewal can be defined as the process allowing organizations to transforming their strategic intent and capabilities (Agarwal & Helfat, 2009; Schmitt & al, 2018). It is required in the case of mature industries, when actors face the threat of technological discontinuity (Cozzolino & Rothaermel, 2017). They need to adapt to changing market dynamics and technological advancements. Strategic renewal involves the revitalization of business models (Teece, 2018), products, and processes to sustain competitiveness and address emerging opportunities.

To achieve strategic renewal (Agarwal & Helfat, 2009), longstanding actors can leverage their ecosystem as affiliation by forging partnerships and collaborations with various stakeholders, including suppliers, customers, technology providers, and regulatory bodies. Collaborative efforts within the ecosystem can facilitate the exchange of knowledge, resources, and expertise, enabling the development of new products and services, exploring novel business models, and driving innovation (Hannah & Eisenhardt, 2017).

Authors such as Helfat and Agarwal (2009), Winter (2011), or Adner and Kapoor (2016) have studied strategic renewal in mature industries. They emphasize the importance of dynamic capabilities (Teece & al, 1997) in enabling organizations to adapt and renew themselves in response to environmental changes.

Another source of strategic renewal can come from an evolution of the business model and the introduction of services, or servitization (Vandermerwe & Rada, 1988). This might be enabled, and to some extent required, in a context of strong development of digital technologies. Sustainable competitive advantage demands some kind of growth and industry maturity usually comes with a scarcity of options to continue growing on usual paths. Consequently, most traditional manufacturers and industrial longstanding companies have tried to enrich and balance their portfolios with services. In the context of digital servitization (Sklyar & al, 2019), digital technologies enable the transition from product-centric business models to service-oriented models.

Strategic renewal is achieved to avoid disruption. Competitive advantage formerly resulted from a firm's ability to perform the required activities at a collectively lower cost than rivals (Barney, 1991), or perform some activities in unique ways that create buyer value and hence allow the firm to command a premium price (Porter, 1991). Modern strategic renewal could be ecosystem strategic renewal (Adner & Liberman, 2021). Traditional rivals focused on their own execution to gain advantage in cost and quality; today’s challengers gather new groups of

partners to create value in ways no individual organization could hope to deliver (Adner, 2021). We are now in a time when firms need to approach their value creation holistically, when a winning position is not necessarily a dominating position (Iansiti & Levien, 2004) because domination means standing alone and against others, while ecosystem participants collectively deliver an output that is more valuable than any other output that would have been delivered by the actors on their own (Adner, 2017; Jacobides & al, 2018).

2. Research object

The focus of my research is at the intersection between ecosystems as affiliation and ecosystems as structure, to show how an ecosystem approach can help create value and impact the long-term competitive landscape of mature industries.

2.1 Competition in the era of ecosystems

Competitive position is usually measured in comparison to the world's best rivals. There might however come a time when an industry is starting to decline and its products or services risk becoming commodities, when goods or services become relatively indistinguishable from similar offerings produced by a rival firm (Cozzolino & Verona, 2022). Customer insight and great execution are no longer the key drivers of success because delivering value propositions has become more dependent on collaboration. It has become critical to align partners (Adner, 2021).

What does that mean in the era of ecosystems and what might be the impact within longstanding industries that are starting to fear the end of their life cycle? Taking into account a business ecosystem perspective might completely change the understanding of strategic management for

companies that need to compete and to sustain or renew their competitive advantage, in an environment where collaboration is a key variable.

The focus of my research is particularly on mature industries, when many ties have already been built, with partners, suppliers, complementors, customers and even with competitors, that all belong to the same ecosystem as affiliation. All actors need to innovate and look for strategic renewal (Agarwal & Helfat, 2009), which starts with an openness to new interorganisational relations, with the aim to develop new products or services. Before being able to develop new offers that will bring value to the focal firm, it is necessary to develop new capabilities, which can be learnt in the process of creating new ecosystems, in the perspective of ecosystems as structure (Adner, 2017).

2.2 Ecosystems as affiliation and ecosystems as structure

Adner (2017) suggested a clear distinction between ecosystems as structure (EAS) and ecosystems as affiliation (EAA) that brings clarity to the study of business ecosystems and even sheds light on how different definitions coexisted for almost thirty years.

Most studies before 2017 have been at the EAA level (Bogers & al, 2019), which includes a broad environment, but also allows to consider the history and past ties of companies. This approach however entails the major shortcoming that boundaries are hard to define (Shipilov & Gawer, 2020). Strategic renewal has to unfold at the EAA level but needs to be triggered by the creation of new activities or new innovation ecosystems that need to start at the EAS level, with a focus on actors, activities, positions and links, as the four basic characteristics of ecosystem structure (Adner, 2017). It has so far not been studied how incumbents adjust their structure when they are willing to lead the creation of a new ecosystem.

2.3 Value creation in mature business ecosystems

Value creation and appropriation are two other critical aspects of business ecosystems in an ecosystem as structure perspective and they vary across industries based on their unique characteristics, market structures, and regulatory frameworks. Value appropriation (Jacobides & al, 2006) refers to the allocation and distribution of value among ecosystem participants. While value creation is essential, capturing a fair share of that value is equally important for organizations. Ecosystem partners must navigate the dynamics of value appropriation to ensure sustainable growth and collaboration.

In some industries, such as technology intensive industries, value creation often revolves around innovation, intellectual property, and rapid growth. In contrast, industries with a strong focus on customer service, such as hospitality, emphasize value creation through exceptional experiences and personalized offerings (Cennamo, 2019). I aim to explore how this applies to a mature industry, when rapid growth is no longer an option. Innovation can be based on the use of new technologies and the creation of new services. As long as data is the new oil, fuelling new sources of value creation (Sjödin & al, 2022), I will study further if this quote can apply to a mature industry and if it needs to be jointly applied with a business ecosystem approach.

2.4 Research questions

Business ecosystems seem to become mainstream structures to collaborate with several actors and develop new capabilities. Boundaries between industrial actors tend to blur (Shipilov & Gawer, 2020), which brings new opportunities for collaboration but also new threats from strong actors that used to do business outside industrial longstanding environments (Adner & Lieberman, 2021). The recent research on business ecosystems helps distinguishing two complementary focuses on actors (ecosystems as affiliation) and on activities (ecosystems as structure). I will explore those two dimensions jointly to show how business ecosystems can be

used by industrial actors evolving in mature industries, to renew their business models (Teece, 2018; Tian & al, 2021; Sjödin & al, 2022) and strengthen their long-term competitive advantage. I thus wonder how industrial firms evolving in mature business ecosystems can create new ecosystems as structure to foster strategic renewal.

I will tackle this topic with two empirical chapters, each addressing a sub-question:

What are the key antecedents to a new ecosystem as structure allowing renewal in mature industries? (Chapter 4)

How can industrial firms use digital transformation and ecosystem to foster strategic renewal? (Chapter 5)

3. Research design

In order to answer those research questions, I made methodological choices revolving around an abductive approach and I selected an adapted field of study.

3.1 Methodological choices

When I started my research journey, I first focused on doing inductive research to see if I could identify insightful cases as extent research on business ecosystems in the specific context of mature industries is rather scarce. Once it was achieved, I had the feeling that I missed part of the theoretical impact because my literature review lacked some theoretical background. I started with an inductive approach to finish with an abductive approach. Induction was the first stage and form of reasoning, which relies on observations leading to conclusions. Abduction complements induction and deduction, to allow theoretical refinement, thanks to a better understanding of the situation through the elaboration of new complementary concepts (Wright, 2017). Abduction actually entails the central creative role of discovering the generative idea or conjecture, which can then be developed into theory (Locke & al, 2008; Saetre & Van de Ven,

2021). I first focused on doing inductive research to see if I could identify insightful cases (Chapter 3 and Chapter 4), dealing with business ecosystems in the context of mature industries. Then I led a second round of literature review before doing a second round of interviews (Chapter 5). Consequently, I started my doctoral journey with an inductive approach strongly anchored into my professional background and current position, to finish with an abductive approach that allowed me to draw connection between the literature and my empirical observations. Abduction is key to generate explanatory propositions and theoretical elements (Locke & al, 2008).

3.2 Empirical context

Well-established companies need to renew their strategy because they can be pushed to the brink by smart competitors and changes in their industries. The examples of Kodak, Nokia, BlackBerry are quite famous for their inability to have changed course quickly enough and initiate the major transformations that were necessary (Binns & al, 2013). They faced disruption because despite their efforts and investments, they were outrun by new competitors who were already in their ecosystem.

In mature industries, like the automotive or aerospace industry, strategic renewal is crucial to adapt to changing market dynamics, technological advancements, and customer demands (Jacobides & al, 2016). A business ecosystem perspective recognizes that organizations cannot operate in isolation and need to collaborate with other stakeholders to drive innovation and stay competitive.

When comparing the European aerospace industry to other sectors, such as automotive or healthcare, several differences and similarities emerge in terms of business ecosystems, strategic renewal, and value creation. For instance, the automotive industry has witnessed the emergence of business ecosystems, where traditional manufacturers collaborate with

technology companies, software developers, and mobility service providers. Strategic renewal efforts in the automotive industry involve transitioning to electric and autonomous vehicles, exploring new mobility services, and integrating digital technologies into vehicles and operations (Adner & Lieberman, 2021).

In comparison, the aerospace industry is also an historical manufacturing industry, that has strongly evolved in the decades following 1945 before entering a stable phase thirty years ago (Edouard & Gratacap, 2010). The market is clearly structured around a few leading players, there is almost no more concentration margin and the products sold in 2024 are very similar to those sold seventy years ago. There has been incremental innovation to increase energetic efficiency, reduce carbon footprint and improve the safety but no proper technological discontinuity. The situation is furthermore quite paradoxical for the main industrial players who stills have full order books but face a growing social discontent because of the impact of aviation on global warming. The aviation industry has committed to achieving net-zero flying by 2050 and decarbonization is a strong renewal challenge[1].

To achieve strategic renewal, Airbus, as a key player in the European aerospace industry, can leverage its business ecosystem by partnering with various companies, suppliers, customers, and technology providers (Edouard & Gratacap, 2010). Collaboration within the ecosystem can facilitate the exchange of knowledge, resources, and expertise to drive innovation, develop new products and services, and explore innovative business models.

Digital transformation is the integration of digital technologies into all aspects of a business, fundamentally changing how the company operates and delivers value (Sebastian & al, 2017; Warner & Wäger, 2019). A business ecosystem lens can be used to understand the broader network of organizations involved in the digital transformation journey. In the case of Airbus,

[1] www.un.org/en/climatechange/net-zero-coalition

the development of the Skywise big data platform, in partnership with Palantir, technology providers and other complementors, exemplifies digital transformation in the aerospace industry. Skywise collects and analyses vast amounts of aircraft operational data to improve maintenance, enhance operational efficiency, and enable predictive maintenance capabilities (Vial, 2019; Sjödin & al, 2022).

Through the Skywise platform, Airbus is not only transforming its own operations but also creating opportunities for collaboration within the ecosystem. Other stakeholders, such as airlines and maintenance providers, can leverage the platform to access valuable insights, optimize their operations, and improve the overall performance of the industry.

The European aerospace industry consists of various players, including manufacturers, suppliers, service providers, and regulatory bodies. Airbus, being a prominent player in this industry, can play a central role in orchestrating the ecosystem to drive innovation, foster collaboration, and enhance competitiveness.

The collaboration between Airbus and Palantir to develop the Skywise platform demonstrates the importance of partnerships and cross-industry collaboration for digital transformation. By leveraging Palantir's expertise in data analytics and partnering with multiple stakeholders, Airbus could harness the collective intelligence of the ecosystem and drive advancements in aircraft maintenance, operational efficiency, and customer experience (Vial, 2019).

This collaborative approach helps Airbus and its ecosystem partners to navigate the complexities of digital transformation, capitalize on the potential of big data, and create value across the industry value chain.

The concept of a business ecosystem might help provide a framework to understand the collaborative dynamics, innovation, and value creation within the European aerospace industry. Airbus development of Skywise platform might exemplify the application of digital

transformation strategies and the utilization of a broader ecosystem to drive strategic renewal, innovation, and operational improvements in the aerospace industry.

4. Dissertation overview

This dissertation is structured into six chapters.

Chapter 1 is a literature review that explores all key concepts related to business ecosystems and strategic renewal. It aims at identifying and highlighting the gaps that will be further addressed in the empirical chapters.

Chapter 2 displays my research choices and design. It notably details data collection and data analysis techniques used and highlights the reliability of the research approach.

Chapter 3 is a first case study, mostly based on archival and secondary data, to understand the overall aviation industry case, with a strong focus on the history of several leading actors and the development of services.

Some actors might be willing to renew their strategic position through the creation of a new ecosystem as structure (EAS). The starting point of my research has been to identify the aerospace industry, as a mature industrial sector, where actors are aware that they might soon undergo a technological discontinuity. I then decided to lead two empirical chapters, with a first one focusing on the inception of a new EAS, to focus on the key antecedents from the EAA allowing the emergence of the new structure. This third chapter helped me address the highly uncertain phase of birth of an EAS, before the first steps are visible, with the comparison of two EAS projects, led by two firms evolving in the same EAA.

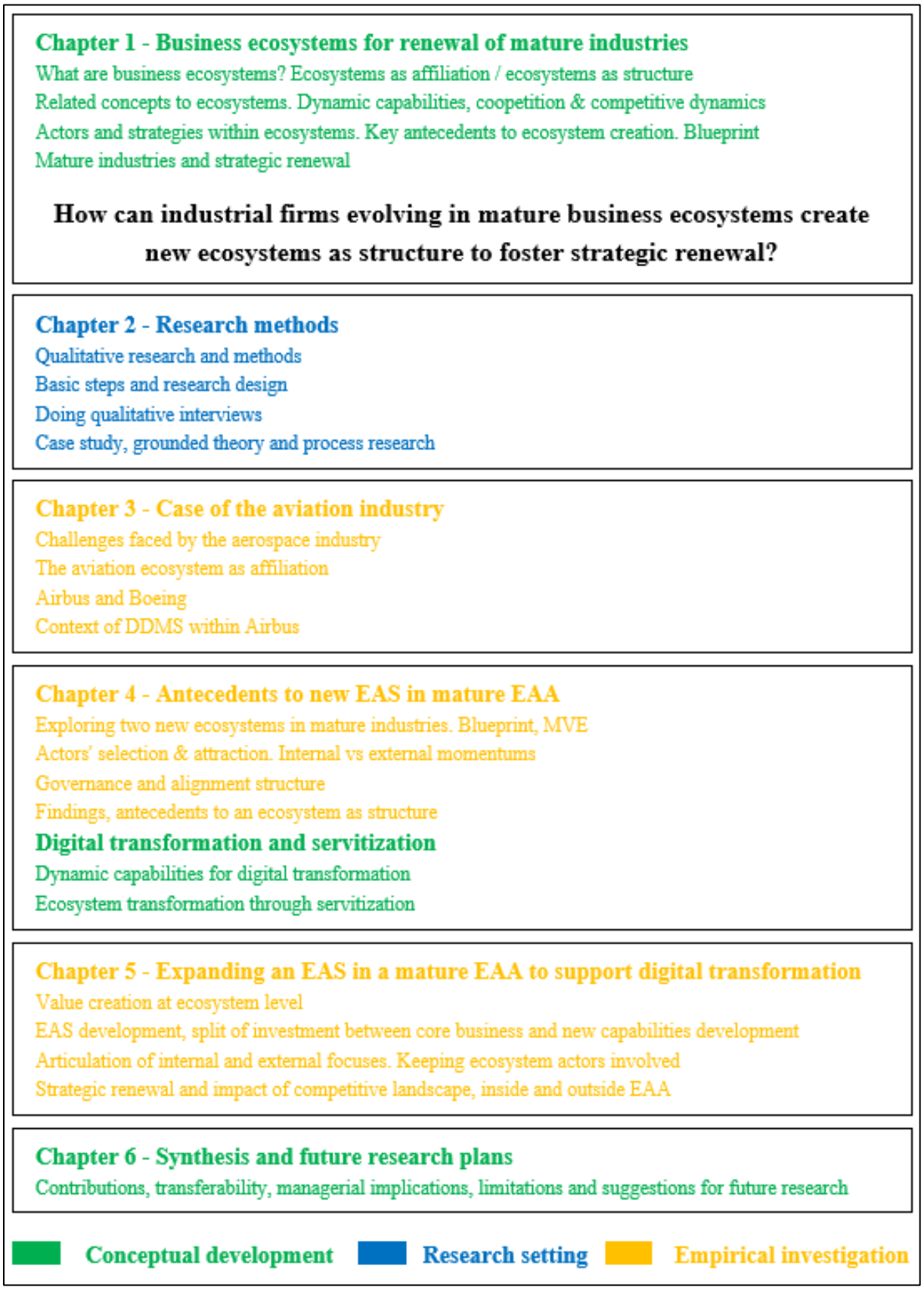
In Chapter 4, I investigate what antecedents from the EAA level are required for the emergence of a new EAS. In Chapter 5, I go on studying the development of the EAS and observe which impacts it has at the EAA level, to advance the knowledge on the use of business ecosystems

to foster strategic renewal. In Chapter 5, I thus focus on the value creation and sharing, the evolution of the governance structure and the actions led by all actors involved.

Finally, Chapter 6 summarizes the contributions, identifies transferability opportunities, suggest managerial implications, and draw potential future research.

Figure 1 details the structure of the dissertation and shows how conceptual development phases are intertwined with research setting and empirical investigations.

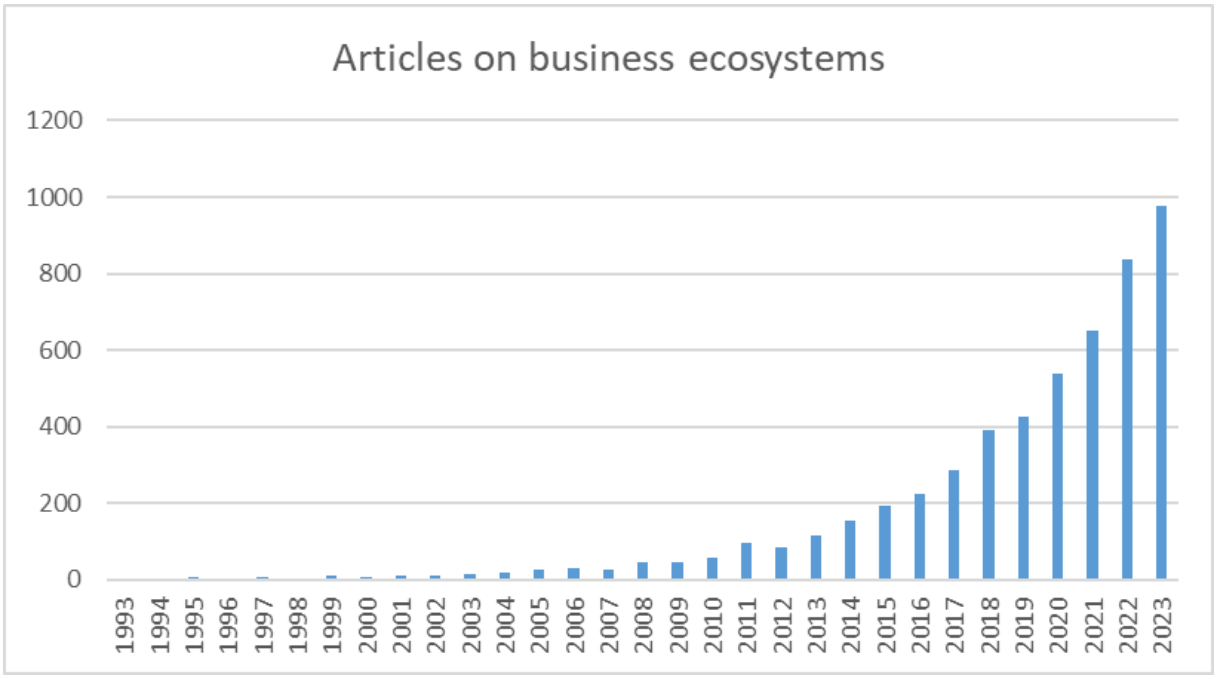
Figure 1 Structure of the dissertation



Chapter 1 Business ecosystems for renewal of mature industries

Since 1993 and Moore's first paper about business ecosystems (BEs), the interest for this concept has kept increasing at a steady pace, remaining below 10 articles per year until 2002, then below 100 until 2013, until reaching 977 in 2023. There were more articles published dealing with business ecosystems in one year than in the twenty years between 1993 and 2013.

Figure 2 Articles published in academic journals (Business Source Ultimate 06/03/24)



For Iansiti & Levien (2004), a change occurred in the last decades of the twentieth century. During most of the 1900s, it was too difficult and costly to create distributed business networks to the extent that modern businesses relied on vertical integration. The end of the century saw significant changes in the legal, managerial and technological capabilities which allowed organizations to collaborate and distribute operations over many firms (Iansiti & Levien, 2004). This trend to collaboration and creating more ecosystems has gone on developing until today, up to a dramatic change in the last decade, which is the frequency with which companies try to

create new ecosystems or participate in numerous ecosystems. This intensification has been strengthened by the digital revolution (Adner, 2021). Ecosystems were studied through the lens of several theories and scholars have linked the concept of ecosystems with open innovation (Chesbrough, 2003; Lifshtiz-Assaf, 2017), dynamic capabilities (Teece & al, 1997; Teece, 2007) and interorganizational relationships (Olivier, 1990).

With Chapter 1, I intend to define what business ecosystems are, to clarify some key related concepts, to focus on the different roles and strategies that actors can adopt to evolve in ecosystems, and eventually to define what mature industries are and how they can engage in strategic renewal. Section 1 clarifies how business ecosystems have been useful in management science over the last thirty years to understand how competitive dynamics evolve in a more interconnected environment (1.1). Several research streams such as innovation ecosystems and platform ecosystems help understanding the broader business ecosystem concept (1.2), the notion of coevolution and sources of competitive advantage. Those research streams led to major clarification based on the distinction between ecosystems as affiliation and ecosystems as structure in 2017 (1.3), depending on whether the focus of the study is on actors or activities. This progressive shift from actors to activities also allows to focus more clearly on business models and value creation (1.4). Section 2 explores complementary research streams that help understand business ecosystem dynamics, starting with resource base view (2.1), that shows how complementarity is a key antecedent to new ecosystem formation. Dynamic capabilities (2.2) are required to adapt to the evolving external environment and need to be studied with an ecosystem lens. Interorganisational relationships (2.3) and coopetition (2.4) help understand the different phases of ecosystem development and how competition dynamics can evolve among ecosystem as affiliation actors. Section 3 goes a step further in the exploration of ecosystems' characteristics, to understand which roles actors can adopt (3.1), the acknowledged motivations

to join an ecosystem (3.2), be that from the standpoint of a leading or a following actor. Past relations (3.3) and other kinds of connections among actors (3.4) are part of the blueprint (3.5), or vision that needs to be defined in the creation process, so as to attract partners and start showing a new value proposition and ecosystem structure (3.6). Section 4 then sheds light on the concepts of mature industry (4.1) and strategic renewal (4.2) that help understand what a mature ecosystem as affiliation can be and why some actors evolving in such environment can resort to new ecosystems as structure to strengthen their position. Dynamic capabilities (4.3) can thus help them transform their traditional environment (4.4).

Section 1 What are business ecosystems?

The term ecosystem was first used in the biology field (Tansley, 1935) to describe a basic ecological unit composed of both the environment and the organisms that live in it. This meaning is in line with the definition one can find in the dictionary:

> *"biological system composed of all organisms found in a particular physical environment, interacting with it and each other. Also in extended use: a complex system resembling this" (Oxford English Dictionary, 2017).*

The term ecosystem was taken up again by Moore (1993) to describe the systems of actors maintaining relationships of coopetition (Brandenburger & Nalebuff, 1996), trying to perform side by side instead of against one another.

Before giving his definition of business ecosystems, Moore recalls a definition of biological ecosystem from The New Penguin Dictionary of Biology:

> *"Community of organisms, interacting with one another, plus the environment in which they live and with which they also interact; for example, a lake, a forest, a grassland, tundra. Such a system includes all abiotic components such as mineral ions, organic compounds, and the climatic regime (temperature, rainfall, and other physical factors). The biotic components generally include representatives from several trophic levels; primary producers (mainly green plants); macroconsumers (mainly animals), which ingest other organisms or particulate organic matter;*

microconsumers (mainly bacteria and fungi), which break down complex organic compounds upon the death of the above organisms (Moore, 1996: 26).”

Adopting a business ecosystem approach leads to considering that companies always need to take their broad environment into account, including other companies but also other elements.

1.1 Origins of the ecosystem view in management science

Moore (1993, 1996) and Iansiti & Levien (2004) primary intention was to provide a conceptual framework to understand strategic management with a conceptual basis that would differ from those of Porter or the resource base view approach (Gueguen & Passebois-Ducros, 2011). The link between biology and business is known to have been made to underline that successful businesses were no longer to be seen the “old way”, which consisted in going head-to-head in an industry and battling for market share (Moore, 1993). For Iansiti & Levien, biological ecosystems can serve as a source of vivid and useful terminology as well as provide specific and powerful insights into the different roles played by firms (2004).

1.1.1 A new focus on collective approach to foster performance

Moore (1996) suggests that the central game of strategic management moved from managing oneself to leading a community of allies. Ecosystems have to be considered to understand business strategy rather than company and industry levels for four main reasons:

- Economic performance is no longer a function of how well the company is managed internally and how profitable, on average, is its industry, but it is rather a function of how a firm manages its alliances and relationships within the network that materializes its business ecosystem,
- Individual company growth has become less critical than developing a whole economic network and investing on keeping a strategic position within this network,

- Cooperation among actors is no longer limited to direct suppliers and customers but rather expanded to attract all relevant players, willing to search innovative ideas and coevolve,
- Competition moves from products or companies to be among business ecosystems, for what they can produce but also for leadership and centrality.

1.1.2 Actors involved and phases of development of business ecosystems

An historical approach to understanding business ecosystems needs to start with Moore (1993 & 1996), who focused on the personal computer industry from the 1970's and observed different stages or phases of evolution: birth, expansion, leadership and self-renewal. Moore focused on the cases of Apple and Tandy, which had different strategies to create rich ecosystems. Apple worked with business partners but had only a tight control over its computer design. It cooperated with software developers, independent magazines and computer stores, while Tandy had a more vertically integrated approach.

In his seminal article, Moore (1993) identified different actors that can be named in the early definition of business ecosystems, ranging from customers, suppliers, partners or innovators. He considered Apple, IBM, Ford, Wal-Mart and Merck as leaders of business ecosystems. He thus saw a broad range of industries such as personal computer, car, retail and pharmacy as good examples of his newly coined concept. His focus was on competing business ecosystems, such as IBM against Apple in personal computers.

Moore describes the BE as:

> *"an economic community supported by a foundation of interacting organizations and individuals, the organisms of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but*

> *the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles (Moore, 1996: 26).”*

This means that within the ecosystem, there are foreground actors, who are clearly dealing with each other and might have contractual relationships; but there are also background actors, who are part of the same environment and have no direct interactions, even if they might. The early literature hardly addressed the role of these background actors, who can yet have an influence on the others and on their relationships.

1.1.3 From biological ecosystems to business ecosystems, coevolution and boundaries

Moore (1996) acknowledged that competition was no longer about individual companies competing, but rather the way companies evolve in the middle of their environment, as if it were a biological ecosystem where species need each other to develop. The parallel between business networks and biological ecosystems was then strengthened by Iansiti & Levien (2004) who stressed that the specific features of biological ecosystems such as their structure, relationships among members, kinds of connections they develop and the different roles they may play, allow important analogies with business networks. Effective firms can range from large influential platform-designing keystones to smaller platform-leveraging niche firms. The key to their success is to balance concerns for internal capabilities and a focus on opportunities and challenges that go along with their dependence on the collective health of their ecosystem (Iansiti & Levien, 2004).

Moore (1996) however notices a major difference between biological and business ecosystems as long as a leader in the business ecosystem has the ability to see the big picture and understand the dynamics of the ecosystem as a whole.

A key concept of both ecosystems is coevolution, a process in which interdependent species evolve in an endless reciprocal cycle. For Moore (1996), a small number of the most effective firms in the world develop new business advantages by learning to lead economic coevolution. Moore considers that the notion of industry is expired because the business evolution is faster paced than it used to be in the 1950s. Because of this speed, the traditional industry boundaries are blurred, and the term of business ecosystem is more appropriate to define the way companies need to interact and coevolve capabilities. The boundary of the ecosystem is defined by the strength and type of organizational interactions that occur (Iansiti & Levien, 2004). It is however hard to establish the boundary of a given ecosystem and it is better to gauge the degree of interaction between different firms.

A business ecosystem faces cooperative and competitive challenges at each of its evolutionary stages (Moore, 1993). All actors need to be involved and cocreate a value proposition, but **some dimensions are not clear when it comes to the competitive challenges**. Moore suggests that a strong bargaining power should be sustained in relation to other players in the ecosystem, including customers and suppliers but this is unclear whether he observes the business ecosystem at the ecosystem level or at the leading firm level. The kind of commitments the actors involved have towards one another is also barely addressed. Moore (1993) mainly focuses on the examples of personal computer and car industry.

1.1.4 Keystone, dominator and niche strategies

Iansiti & Levien (2004) argue that firms can influence the health of their ecosystem while focusing on their individual performance if they choose the appropriate strategy between three options: keystone, dominator or niche firm. They build on the literature on biological ecosystems that suggests that some species serve as hubs or keystones and provide benefits to the whole ecosystem. Keystones naturally allow stability, diversity and productivity (Iansiti & Levien, 2004). Enhancing productivity of an ecosystem can go along with the removal or

limitation of the number of species. The ecological literature also identifies a dominator role, for actors who are much bigger in size than the keystones and who fail to encourage diversity.

A keystone strategy improves the overall health of the ecosystem and benefits the sustained performance of the firm (Iansiti & Levien, 2004; Cobben & al, 2022). Keystones enhance productivity by simplifying the complex task of connecting network participants to one another and by making the creation of new products by third parties more efficient. They also increase network robustness by consistently investing in and integrating new technological innovations (Iansiti & Levien, 2004). The two core components of a keystone strategy are to create value within the ecosystem and to share this value among all the members of the ecosystem. Value sharing is important to differentiate a dominator from a keystone.

A dominator strategy is an operating strategy that integrates vertically or horizontally to manage and control an ecosystem or part of an ecosystem. Dominators are firms that control both value capture and value creation in a part of the ecosystem (Iansiti & Levien, 2004). Unlike keystones, dominators progressively take over their ecosystem. Over time, they reduce the diversity of members that populate the ecosystem. This ultimately reduces the ecosystem's robustness to external shocks. In situations of consistent market or technological change, keystone strategies may be more effective than dominator strategies. They indeed encourage long-term innovation and niche creation for the ecosystem (Iansiti & Levien, 2004). This also implies that in domains where the pace of innovation is slow, dominators may have their place. A context in which innovations require large, focused and highly coordinated efforts, while transaction costs between firms are high, might be more adjusted to dominant firms. This may be the case for example in the pharmaceutical industry (Iansiti & Levien, 2004). Dominators always inhibit diversity, but it can be beneficial when too much variety threatens stability.

A niche strategy is an operating strategy that specializes capabilities to differentiate a business within an ecosystem domain (Iansiti & Levien, 2004). Niche players depend on other businesses

and it if they want to survive, they need to map out the characteristics of keystone and dominator players in order to see what they can bring. A common failure of niche players is to bind too tightly to a keystone, which increases the power of the keystone over the niche player and can eventually compromise the health of the entire ecosystem.

Table 1 displays the main differences and similarities between the approaches of Moore and Iansiti & Levien towards business ecosystems. 8 years separate Moore's article and Iansiti & Levien book and articles but no substantial work on business ecosystems was published in that time lap, as it was possible to notice on Figure 2.

Table 1 Main similarities and differences Moore vs Iansiti & Levien

	Moore (1993, 1996)	Iansiti & Levien (2004)
Business ecosystem definition	dynamic community of organizations that interact and collaborate to create and deliver value to end customers	network of interdependent organizations centered around a dominant keystone
Kinds of actors involved	customers, suppliers, competitors, distributors	networks of communities
Roles played by actors	leader and others	keystone, niche player, dominator
Coordination mechanisms	unclear	keystone for innovation
Ecosystem boundaries	not clear	not clear
Nature of ecosystem	community	network
Emphasis of the approach	collaborative relationships among organizations and mutual dependence for success	central role of the dominant firm and its control and influence over the ecosystem

Those two seminal works do not consider competition with the same attention: this is a central element for Moore, while this is only a second-order topic for Iansiti & Levien (Gueguen & Passebois, 2011). Moore (1996) announces the death of competition and proposes that firms should resort to collaboration or competition depending on different phases of the ecosystem development.

One of the limits of those works is the **difficulty to define the boundaries of ecosystems**. They bring several interesting concepts such as:

- The existence of foreground and background actors who can have an influence on the relationships inside the business ecosystem.
- The need for companies to interact and coevolve their capabilities.
- The evolution of business ecosystems to a stage of maturity when leaders of ecosystems can be obliged to undertake structural changes to survive.

All those aspects were conceptually appealing but the fact that so little literature was based in this line in the next years also shows that it was probably not reflecting a topical issue for businesses and strategic management. All cases presented to support conceptual development were observed once the business ecosystems were already thriving and there was a **lack of dynamic perspective** to see **how different roles and strategies unfold**.

This coevolution dimension of business ecosystems has however somewhat been overlooked by research (Tsvetkova & al, 2021) and a closer attention could be paid not only to **how value is cocreated in ecosystems**, structured by interconnected activities and interdependencies, but also to the **dynamics of business ecosystem formation and evolution** (Hou & Shi, 2021). This is a key dimension of my research to study how value is created at the ecosystem as structure level, before having an impact on how the ecosystem as affiliation evolves.

Hopefully, the interest in business ecosystems rose after 2004, at a time when one could also see other ecosystems concepts develop, as well as other related concepts, such as dynamic capabilities, interorganisational relationships or coopetition. Those related concepts help defining a business ecosystem as an "interdependent network of self-interested actors jointly creating value" (Bogers & al, 2019).

1.2 From business ecosystems to other ecosystems research streams

Since Moore's first paper about business ecosystems, different research streams have explored the innovation ecosystem (Adner, 2006), platform ecosystem (Ceccagnoli & al, 2012; Gawer & Cusumano, 2008), entrepreneurial ecosystem (Isenberg, 2010), service ecosystem (Vargo & Lusch, 2011), knowledge ecosystem (van der Borgh & al, 2012) and technology ecosystem (Wareham & al, 2014). Those streams help define an ecosystem as a structure used by several partners to interact and develop new products or services (Adner, 2017) but they also lead to conceptual proliferation for the ecosystem concept (Shipilov & Gawer, 2020; Cobben & al, 2022).

Jacobides & al (2018) identified three broad groups of papers about ecosystems: a "business ecosystem" stream, an "innovation ecosystem" stream and a "platform ecosystem" stream.

There is sometimes a confusion between platforms and ecosystems. On the one hand, platforms are solutions based on technology that allow multiple actors to interact. On the other hand, ecosystems are groups of connected products or services and the players that collaborate to produce them (Jacobides, 2022). Platforms and ecosystems are partly overlapping, and an ecosystem often rests on a platform; yet ecosystems do not necessarily need a platform to emerge and operate (Jacobides & al, 2024).

The business ecosystem stream focuses on an individual firm and depicts the ecosystem as a

> *"community of organizations, institutions and individuals that impact the enterprise and the enterprise's customers and suppliers" (Teece, 2007: 1325).*

Here Teece also pinpoints that the community includes complementors, suppliers, regulatory authorities, standard-setting bodies, the judiciary, but also educational or research institutions.

1.2.1 Innovation ecosystems

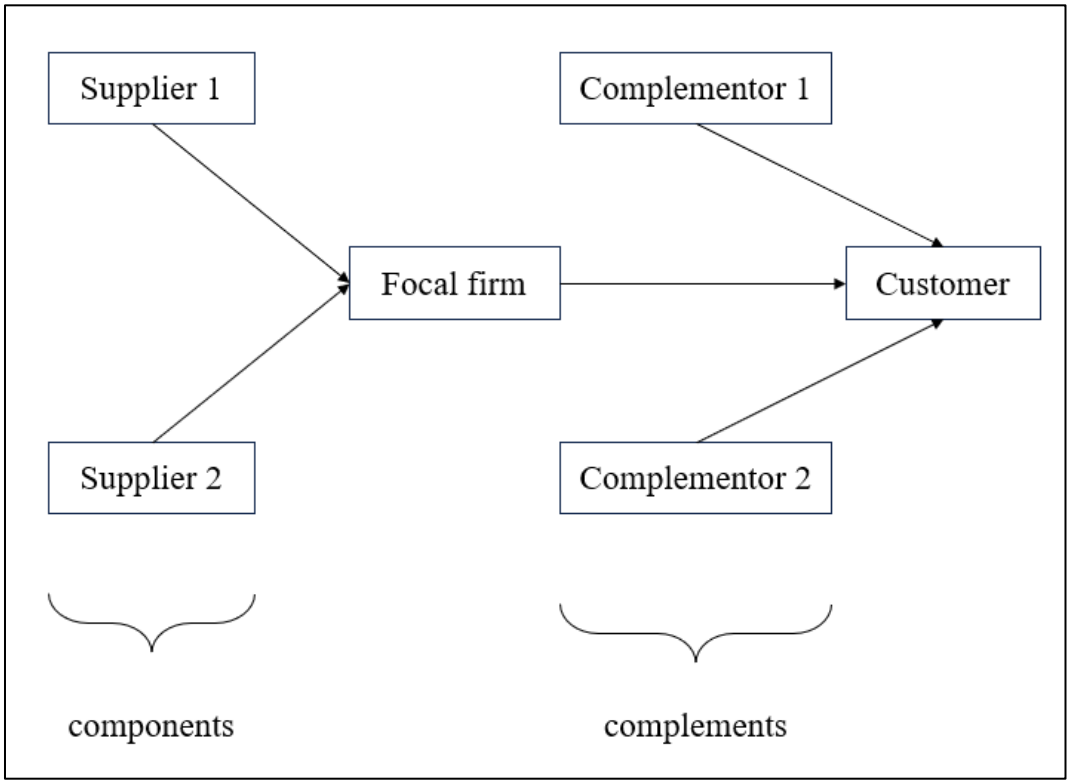
The second set of studies focuses on a focal innovation (Jacobides & al, 2018) and views the innovation ecosystem as

> *"the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution" (Adner, 2006: 2).*

The emphasis is on understanding how interdependent players interact to create and commercialize innovations that benefit the end customer. Here, the anchoring point is the system of innovations that allows customers to use the end product, rather than the firm.

> *"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: 40).*

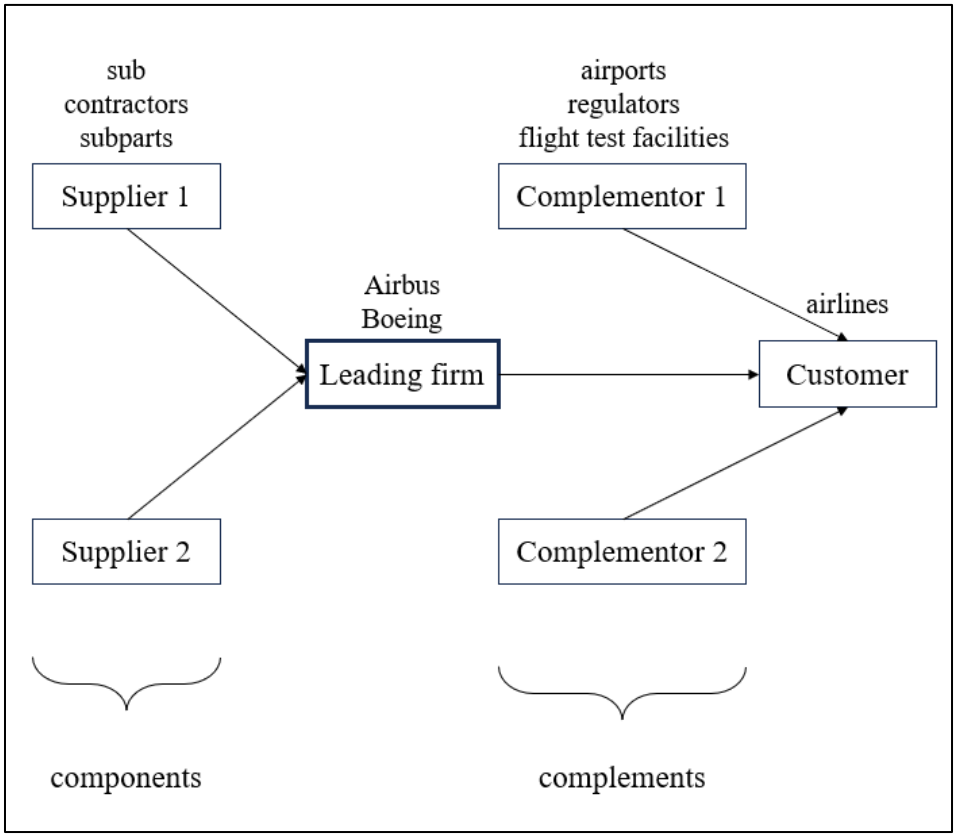
Figure 3 Generic schema of an innovation ecosystem (Adner & Kapoor, 2010)



To go further on this point, the article by Edouard and Gratacap (2010), focusing on a comparison between Airbus and Boeing and applying the model proposed by Adner and Kapoor (2010), shows the limits of this definition, or at least a key difference between business and innovation ecosystems. The innovation ecosystem is limited to a programme, which is one in several products into a portfolio.

As shown in Figure 4, Edouard and Gratacap focus their study on two programs by Boeing (787 Dreamliner) and Airbus (A380), which helps understand that a business ecosystem can be made of several innovation ecosystems. The link between business and innovation ecosystems are however not clearly defined, be that by Edouard and Gratacap (2010) or by Adner and Kapoor (2010). While Adner and Kapoor (2010) never mention the term "business ecosystem" in their article even if it is one of the keywords reported on their first page, Edouard and Gratacap expose an approach based on business ecosystems and compare Boeing and Airbus (2010).

Figure 4 Actors & roles within an innovation ecosystem (from Edouard & Gratacap, 2010)



They consider that competing programs to develop new aircrafts can be considered as innovation ecosystems and conclude that Boeing business ecosystem is regulated with a "Keystone" leadership, while Airbus business ecosystem is rather managed with a "Value Dominator" approach (Edouard & Gratacap, 2010: 180). Boeing's approach is shown as more opened and more collaborative than Airbus' one and they conclude that this innovation ecosystem approach was only possible because the actors committed on the Dreamliner project had already been involved on past projects with Boeing.

Innovation ecosystems thus seem to complement the business ecosystem approach but there remains a need to understand better the **antecedents of a new innovation ecosystem** in the **context of an existing business ecosystem**. This is what I will explore in my empirical section, with Chapter 4 and Chapter 5.

1.2.2 Platform ecosystems

The third set of studies focuses on platforms, which are a specific class of technologies, and the interdependence between platform sponsors and their complementors.

The following definition of platform can be used:

> *"We define internal (company or product) platforms as a set of assets organized in a common structure from which a company can efficiently develop and produce a stream of derivative products. We define external (industry) platforms as products, services, or technologies that act as a foundation upon which external innovators, organized as an innovative business ecosystem, can develop their own complementary products, technologies, or services" (Gawer & Cusumano, 2014: 417).*

This definition makes a difference between business ecosystems and external platforms and most of the empirical case studies dealing with platforms focus on the IT industry (Tsujimoto, 2018). Platforms can be found in several industries where start-ups, as well as big firms, can build hardware and software products for computers, mobile phones, or electronic devices.

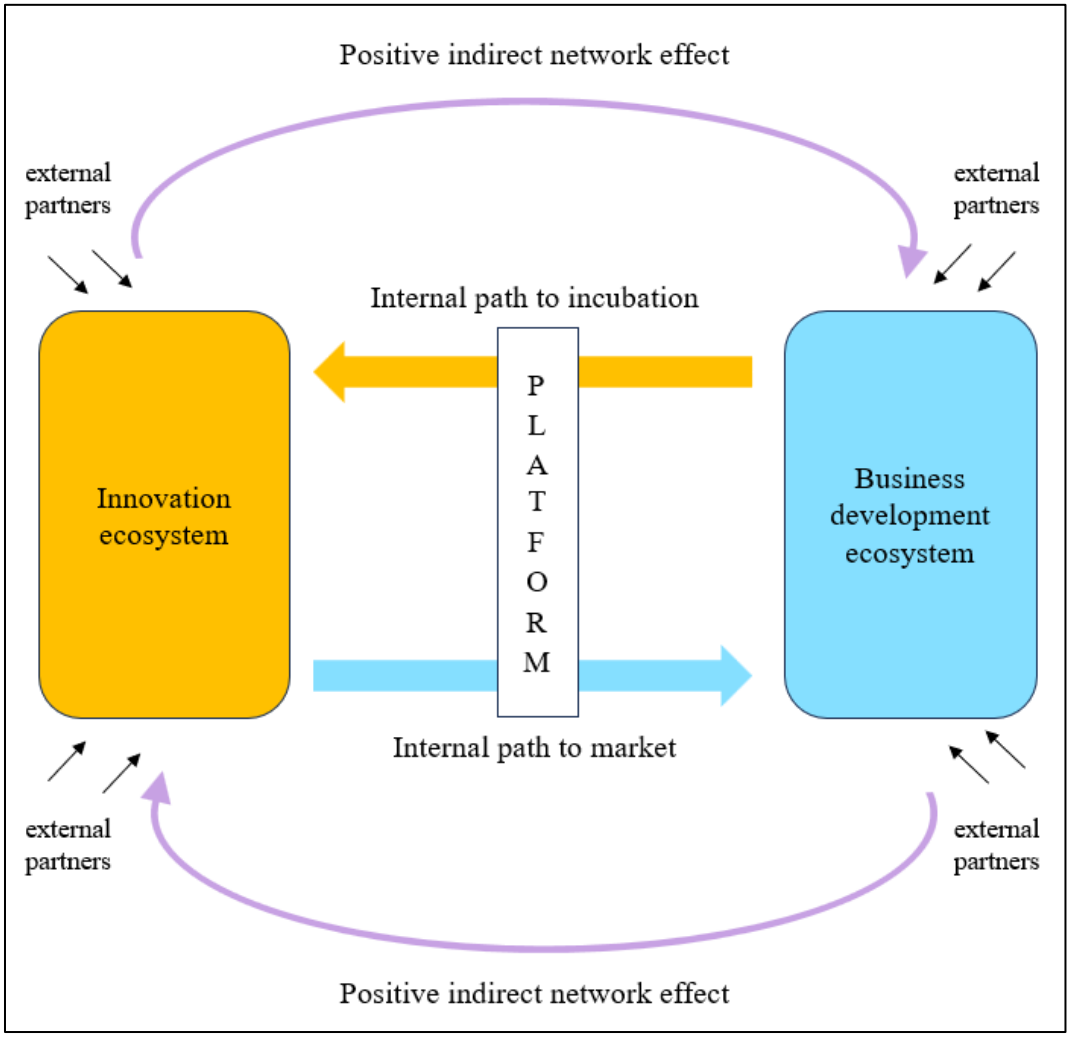
These platforms especially exist in high-tech businesses that rely on information technology, such as Qualcomm, Cisco, Intel, Google, Apple, or Microsoft (Gawer & Cusumano, 2014).
Platform ecosystems are particular business ecosystems (Koenig, 2012) that rely on digital platforms to facilitate innovation and creativity; they usually display an innovation side and a business development side (Isckia & al, 2020).
A key dimension in the platform ecosystem approach is that the system is very opened, be that on the customer side or on the complementor side. There can be hundreds or thousands of partners (Gawer & Cusumano, 2014).

In this set, the ecosystem is made of the platform's sponsor and all providers of complements that make the platform more valuable to customers. The platform ecosystem displays a system where complementors can connect to a platform to generate complementary innovation but also gain access to the platform's customers. Examples of studies paid attention to SAP and independent software vendors (Ceccagnoli & al, 2012) or to developers producing video games for specific consoles (Cennamo & Santalo, 2013). Following this definition, platform ecosystems can be seen as "semi-regulated marketplaces", which foster entrepreneurial action under the coordination and direction of the platform sponsor (Wareham & al, 2014).
The literature on platform ecosystems is interesting for broader research on ecosystems because it also focuses on sources of **power in the ecosystem,** on **motivation** and **incentives** that are created **to attract participants** and to the **governance** and **coordination mechanisms** that can be developed (Kretschmer & al, 2020). Platform ecosystems can be viewed as particular types of business ecosystems (Jacobides & al, 2024) and all new ecosystems launched in the context of mature industries have to take into account those dimensions of power, attractiveness and governance.

The literature on platform ecosystems is also enlightening because it includes a stream of research on platform ecosystem orchestration, which is the process used by platform providers to ensure the development and sales of innovations (Isckia & al, 2020).

The following figure shows how platform-based ecosystems, which are a subset of business ecosystems, display two complementary sides. The innovation ecosystem side shows that there must be a dedicated effort for innovation and technology development, while the business development ecosystem side shows that this second dimension requires different capabilities and activities.

Figure 5 Structure of a platform-based business ecosystem (adapted from Isckia & al, 2020)



1.2.3 Service ecosystems and technology ecosystems

Scaringella & Radziwon (2018) conducted a systematic literature review on ecosystems and identified that the most frequent terms were platforms, innovation, networks and orchestration. They studied 104 articles and books published between 1993 and 2016 that helped them identify four main ecosystem concepts: business, innovation, entrepreneurial and knowledge ecosystem. Those two last concepts accounted together for less than 10 % of the articles.

Since this review, three other ecosystem concepts are relevant, to the extent of the meaning that they cover and the number of articles that were published in the last years: platform, service, and technology ecosystems. I compiled all key definitions for those 7 ecosystem concepts in Table 2 that follows.

The service ecosystem literature underlines that an ecosystem is at one and the same time shaped by its macro-level environment with a trend to stabilization and a micro-level closer environment that allows the emergence of new structures (Vargo & Lusch, 2011). It recognizes that there is an exogenous environment to ecosystems and that coevolutionary dynamics can occur inside as well as outside ecosystems (Hou & Shi, 2021). The approach to study service ecosystems is highly focused on IT companies and the concept of service ecosystem is linked to service platform and value cocreation. An observed example is Apple, when the company enhanced service innovation, using the iPhone as a service platform, iTunes as the service ecosystem and iPhone discussion forums as a way to get in touch with actors contributing to value creation (Lusch & Nambisan, 2015).

This approach follows a service dominant logic.

> *"Technology ecosystems are often described as product platforms defined by core components made by the platform owner and complements made by autonomous companies in the periphery. These ecosystems have two primary characteristics:*
> *1) they should perform an important function within a "system of use" or solve an important technical problem within an industry, and*
> *2) it should be easy to connect or build on the core solution in order to expand the system of use and allow new and even unanticipated end uses (Wareham & al, 2014: 1197)".*

Table 2 Ecosystem taxonomy

Ecosystem	Definition
Business ecosystem	"An economic community supported by a foundation of interacting organizations and individuals [...] produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies." (Moore, 1996: 26) "Loose networks - of suppliers, distributors, outsourcing firms, makers of related product or services, technology providers, and a host of other organizations - affect and are affected by, the creation and delivery of a company's own offerings. Like an individual species in a biological ecosystem, each member of a business ecosystem ultimately shares the fate of the network as a whole, regardless of that member's apparent strength." (Iansiti & Levien, 2004: 2)
Innovation ecosystem	"The collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution. Enabled by information technologies that have drastically reduced the cost of coordination, innovation ecosystems have become a core element in the growth strategies of firms in a wide range of industries." (Adner, 2006: 2)
Platform ecosystem	"The network of innovation to produce complements that make a platform more valuable." (Gawer & Cusumano, 2008: 28) "Members of these partnership programs cocreate value with the platform owner by developing applications and solutions to be used on the platform." (Ceccagnoli & al, 2012: 264)
Entrepreneurial or entrepreneurship ecosystem	"The entrepreneurship ecosystem consists of a set of individual elements - such as leadership, culture, capital markets, and open-minded customers - that combine in complex ways." (Isenberg, 2010: 4)
Service ecosystem	"We define a service ecosystem as a relatively self-contained, self-adjusting system of mostly loosely coupled social and economic (resource-integrating) actors connected by shared institutional logics and mutual value creation through service exchange." (Lusch & Nambisan, 2015: 155)
Knowledge ecosystem	"The flow of tacit knowledge between companies and the mobility of personnel have been advanced as the main advantages of geographic colocation which characterize the hotspots. Such hotspots have been characterized as knowledge ecosystems where local universities and public research organizations play a central role in advancing technological innovation within the system (Clarysse & al, 2014: 1)
Technology ecosystem	Technology ecosystems are often described as product platforms defined by core components made by the platform owner and complements made by autonomous companies in the periphery. These ecosystems have two primary characteristics: 1) they should perform an important technical problem within an industry, and 2) it should be easy to connect to or build on the core solution in order to expand the system of use and allow new and even unanticipated end uses." (Wareham & al, 2014: 1197)

Wareham & al (2014) tried to understand the underlying purpose and mechanisms of the ecosystem. They focused on the main actors involved, their behaviours and micro or macro-level outcomes. Technology ecosystems are semi regulated marketplaces that gather autonomous, profit-seeking actors who make the choice to participate in some activities. The entry barriers are very low (Wareham & al, 2014). This study shows that ecosystems need to be regulated so that they may be attractive in the long run for complementors.

Jacobides & al (2018) also reviewed the literature about ecosystems and defined ecosystems as interacting but not hierarchically managed organizations, which are linked together by the non-redeployability of their investments that were specifically made for the ecosystem.
They require providers of complementary innovations, products, or services, who might belong to different industries and need not be bound by contractual arrangements, but have significant interdependence, nonetheless. Jacobides & al considered the three main research streams on business ecosystems, innovation ecosystems and platform ecosystems but eventually focus on the concept of "ecosystem", with a focus on two main characteristics: the non-generic complementarities among actors involved and the not fully hierarchically controlled structure of an ecosystem (Jacobides & al, 2018).

As it was underlined by Scaringella & Radziwon (2018), ecosystems can be viewed and analysed through other lenses such as organizational ecology (Amburgey & Rao, 1996; Hannan & Freeman, 1977). The population ecology theory analyses the response of organizations to the changes occurring in the environment. Some actors manage to adapt to those changes, while other do not. In the organizational ecology theory, success and failure are determined by population density, industry life cycle, organization age and organization size.

When a business ecosystem consists of firms focusing on new product development, scholars can refer to various names without clear distinction. For example, when an ecosystem gathers firms that focus on new service or product development, scholars can either refer to it as business ecosystem or innovation ecosystem (Scaringella & Radziwon, 2018). Figure 6 gathers the seven key ecosystem concepts that have been coined since 1993 and relate to ecosystems. Most of those are strongly intertwined and can be overlapping, except for the entrepreneurial ecosystem, which has often been neglected in other ecosystem reviews (Bogers & al, 2019). This concept mostly focuses on regional entrepreneurial clusters and studies deal either with a high-technology environments, or with links between universities and local firms. This is the only stream out of the seven identified that includes a regional boundary with a strong focus on spatial embeddedness (Brown & Mason, 2017). This stream also acknowledges a link with Moore's seminal work on business ecosystems, but it is the least relevant to my study.

Several streams of research evolved following initial research on business ecosystems, with divergent focuses on the characteristics of business ecosystems that were developed by Moore (1993; 1996) and Iansiti & Levien (2004).

I choose to keep the following definition of business ecosystem as

> *"an interdependent network of self-interested actors jointly creating value" (Bogers & al, 2019: 2)*

because it includes the two key dimensions of the concept that rely on value created and on the community of actors.

Figure 6 Key ecosystem concepts, authors, related concepts and sectors studied

Key ecosystem concepts	Authors	Related concepts	Sectors & actors
Business ecosystem	Moore 1993 Iansiti & Levien 2004	Innovation, competition, collaboration, governance	Apple, Tandy, Toyota & Ford, Walmart, IBM, Microsoft, Intel, Merck
Innovation ecosystem	Adner 2006	Technology substitution, value proposition, business model	Michelin (tires), Philips & Sony (TV), Apple, semi-conductor lithography
Platform ecosystem	Gawer & Cusumano 2008	Platform leadership	Intel, Microsoft & Apple, Cisco, IBM, Google & Nokia
Entrepreneurial ecosystem	Isenberg 2010	Economic development, entrepreneurship policy, geographical scale	Retail and other sectors where governments can support entrepreneurship
Service ecosystem	Vargo & Lusch 2011 Lusch & Nambisan 2015	Service innovation digital servitization	Apple, Amazon, Facebook, YouTube, Google, Twitter, Netflix
Knowledge ecosystem	Van der Borgh & al 2012 Clarysse & al 2014	Technological clusters, regional innovation systems, knowledge exchange	Biotech, innovative start-ups, technology partners such as universities for R&D collaborations
Technology ecosystem	Wareham & al 2014	Platforms, governance	Software (SAP, Oracle)

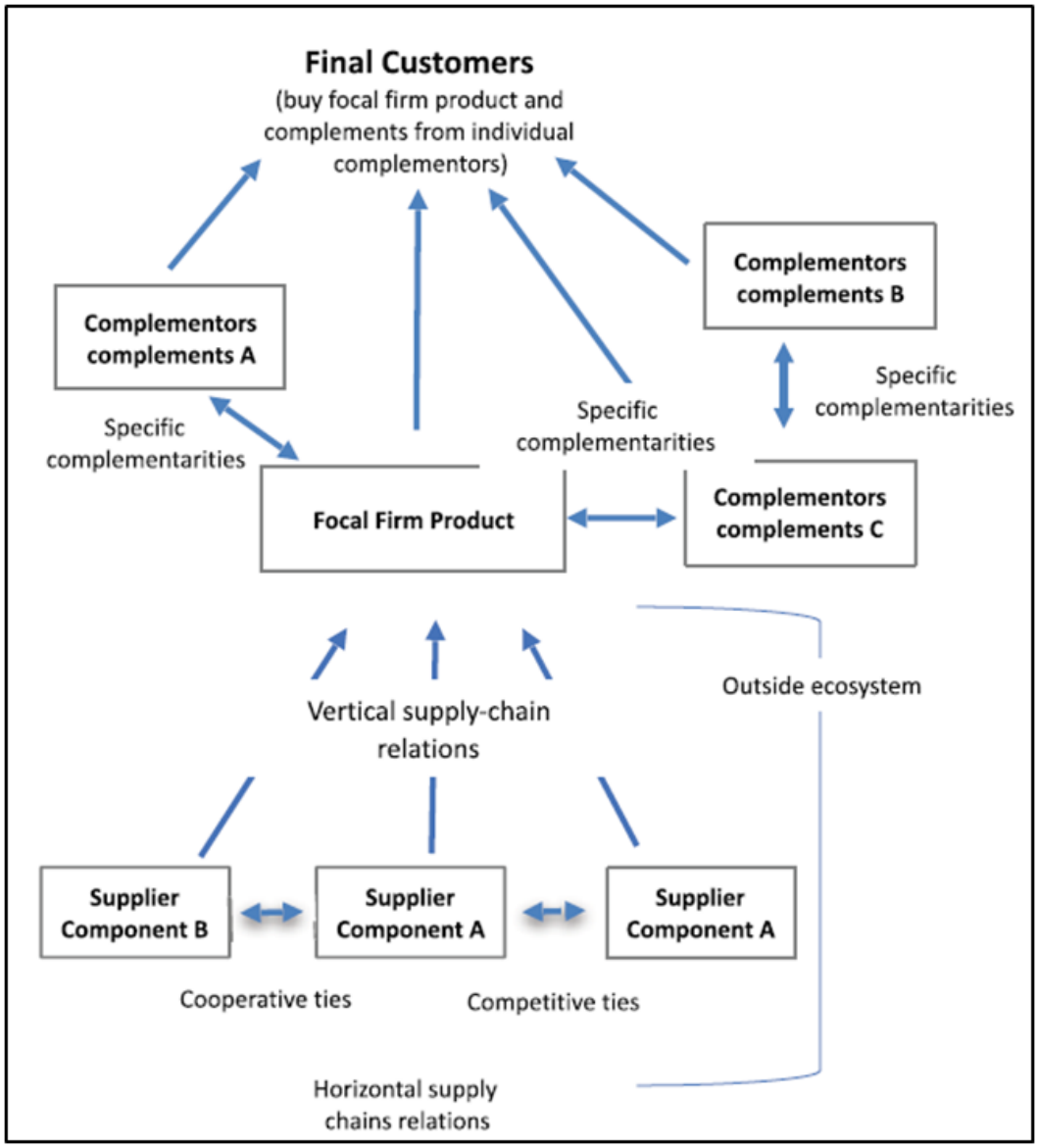
I will now dig further on the articulation between business ecosystem and innovation ecosystem, or rather on two distinct views of business ecosystems that are the actor-centric view of ecosystem as affiliation and activity centric view of ecosystems as structure (Adner, 2017; Tsvetkova & al, 2021).

1.3 Ecosystems as affiliation (EAA) and ecosystems as structure (EAS)

Contradictions between two definitions about business ecosystems are still standing. Indeed, there is a difference between Jacobides' and Teece's definitions relying on the link between belonging to an ecosystem because there are other organizations, whose activities might have an impact on your activities and belonging to an ecosystem because an actor commits to relationships with other actors of its environment. For Jacobides, the firms within the ecosystem are interacting, whereas for Teece, they belong to the same community and the ecosystem represents the environment that the firm must monitor and react to, which affects its dynamic capabilities and thus its ability to build sustainable competitive advantage. This difference can be found with other authors and there is a real split between two definitions (Koenig, 2012) of the business ecosystem that mention peripheral actors (Iansiti & Levien, 2004; Teece, 2007; Edouard & Gratacap, 2010) and those that exclude them (Pierce, 2009; Adner & Kapoor, 2016). There is a discrepancy that could already be observed in Moore's work (2006) when he started adopting an extensive definition of business ecosystem but then studied ecosystems constituted exclusively of firms. There actually does not seem to be one type of business ecosystem but several. Jacobides & al (2018) define the value proposition as the central element of the ecosystem. They also state that most ecosystem members are complementors.

The definition brought by Jacobides & al (2018) and synthesized in Figure 7 mainly concerns Business to Customers (B2C) markets, when the end customer can buy a product or service from a firm and have it improved when he buys some complementary products or services from other firms. Knowing that most studies of business ecosystems rather deal with B2C than B2B contexts (Dattée & al, 2018), it would be interesting to **explore B2B empirical environments** in order **to advance** the **research on business ecosystems.**

Figure 7 "Ecosystem-based" value system (Jacobides & al, 2018)



This representation is in line with the one of Adner & Kapoor (2010), even if it gets more in the details regarding suppliers, the focal firm and complementors. It highlights that suppliers are outside the ecosystem and that the final customers can buy from the focal firm as well as from different complementors.

Coming back to the definition brought by Iansiti & Levien (2004) who defined business networks as ecosystems, organized around a keystone species, and characterized by many

loosely interconnected actors who depend on each other for their mutual effectiveness and survival. Such definitions of ecosystems as networks of affiliated organizations are echoed in several other articles (Autio & Thomas 2014; Rong & Shi, 2014).

The unit of analysis in ecosystems research is often either the ecosystem as a whole or the focal offering that is provided by the ecosystem (Shipilov & Gawer, 2020). This is the split between two definitions (Koenig, 2012) that Adner distinguished as ecosystem-as-affiliation and ecosystem-as-structure (Adner, 2017). Those different definitions help understand that the starting point for ecosystem research is always the focal offer (Kapoor, 2018) but there remains unanswered characteristics such as the boundaries of an ecosystem. Research on ecosystems indeed tends to examine relationships across industry boundaries and it is hard to precisely define the scope of the ecosystem with this expansive view (Shipilov & Gawer, 2020). Therefore, I use the definition of ecosystem as structure (EAS) that was given by Adner, when he defined an ecosystem as

> *"the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize" (Adner, 2017:40).*

This definition complements the ecosystem as affiliation view,

> *"which sees ecosystems as communities of associated actors defined by their networks and platform affiliations" (Adner, 2017:40).*

With this view, Adner argues that

> *"if the same group of partners pursue multiple value propositions, the ecosystem as structure approach would place those initiatives in different ecosystems (Adner, 2017: 55)".*

The focus of my research is on incumbent actors evolving in mature ecosystems, who make the choice for new ecosystems to renew their strategic positioning. They thus try to create new EAS, to strengthen their position in the EAA. **No research so far has tackled those two**

concepts at the same time, and I aim at filling this theoretical gap that starts **from a new value proposition to impact an existing competitive landscape**.

Table 3 Ecosystem as affiliation & ecosystem as structure

Elements	Ecosystem-as-Affiliation perspective	Ecosystem-as-Structure perspective
Main authors	Iansiti & Levien (2004)	Adner (2017)
Scope	Actor-centric	Activity-centric
Actors	Entities that are tied to the focal actor	Entities that undertake activities
Positions	Derived from links to other actors	Specified locations in the flow of activities across the system
Activities	Too broad and hardly applicable	Single actions impacting the new value proposition
Links	Ties between the focal actor and the others	Transfers across actors
Value of the perspective	Helpful description of interactions at macro level	Clearly distinguishable set-up, actionable perspective
Focus on	Industry boundaries, rise of interdependence, number of partners, network density, actors centrality	Value creation, alignment structure, boundaries of dependence
Level of analysis and sectors	Industry level: healthcare ecosystem, Microsoft ecosystem, Silicon Valley ecosystem, entrepreneurial ecosystem	Business case level: run-flat tire
Expected outcome	Bargaining power	Joint value creation

There are three key aspects to this definition (Adner, 2021):

- the value proposition, thanks to which one does not focus on a single firm or technology,
- the identifiable set of specific partners who choose to interact in order to create a new value proposition,

- the ecosystem has a structure which means that the partners are aligned in some kind of collaborative agreement. They must at some point define roles, positions; and flows among them can be observed.

Another definition was given with the same focus on the value proposition but adding the dimension of why actors need to resort to an ecosystem.

> *"The ultimate purpose of an ecosystem is the materialization of a joint value proposition by several players that cannot be achieved by any one of these players in isolation" (Lingens & al, 2021: 3).*

This need for collective action starts bringing an element of answer to "why" actors adopt an ecosystem approach. It also calls for **further empirical research on the value jointly created** by several actors.

I adopt the definition of ecosystem-as-structure because it starts from the value proposition and clearly sets the boundaries of an ecosystem. Jacobides & al (2018) also consider the value proposition as the central element of the ecosystem. They state that most ecosystem members are complementors:

> *"Ecosystems are interacting organizations, enabled by modularity, not hierarchically managed, bound together by the non-redeployability of their collective investment elsewhere" (Jacobides & al, 2018: 2255).*

This definition entails two complementary dimensions that need to be explored further regarding the **"non-hierarchical" management of ecosystem** and the **collective investment made**. This might be contradictory to commit time and resources in a project that a firm does not control.

Adner (2017) and Jacobides & al (2018) consider ecosystems as structures of multilateral interdependences but they do not focus their analysis on the same features of ecosystems. When

Adner puts emphasis on value creation, Jacobides draws attention to value capture. Those two approaches can be regarded as complementary (Hou & Shi, 2021).

There has actually been a turning point in the way to define ecosystems from 2017 and Adner's article depicting ecosystem as structure in comparison to ecosystems as affiliation. As he explains it, most of the literature before that article focused on the ties among actors but this concept is limited because it is too broad. After this article, most definitions start from the products developed, or the actions, or the value proposition. The starting point for ecosystem research is the focal offer, not the focal firm or the alliance (Shipilov & Gawer, 2020).

In his article "Ecosystem as structure: An actionable construct for strategy" (2017), Adner however never mentions the term "innovation ecosystem" and refers only twice to the term "business ecosystem", when he defines his "ecosystem as affiliation" concept. This tends to show that a business ecosystem can be regarded as an ecosystem as affiliation (EAA), while an innovation ecosystem is an ecosystem as structure (EAS).

The value creation is central to an ecosystem as structure, and it always relies on a business model.

1.4 From Business models to value propositions in business ecosystems

Business models (Osterwalder & al, 2005) is the key concept to understand how a firm creates and captures value and this is a key construct for firm strategy, to take into account to be able to consider the value proposition at the ecosystem level (Adner, 2017). The concept of the business model represents a system-level approach towards explaining how firms do business, while observing the firm's activities (Snihur & Bocken, 2022). An ecosystem gathers a constellation of actors that need to work together and consider each other's business models so that a coherent value proposition might emerge. Even if the ecosystem lens leads to consider

the ecosystem-level value creation, all individuals involved in the ecosystem are employees of a firm and represent a source of cost, which is a line in a firm's business model.

The literature focusing on business ecosystems already considered that value creation mechanisms often span a focal firm or even an industry's boundaries (Zott & al, 2011).

There are four potential sources of value creation through business models (Zott & al, 2011): novelty, lock-in, complementarities and efficiency.

Firms can develop new business models with a focus on those sources, but they can also aim at creating and capturing value inside a value network that would include suppliers, partners and distribution channels, who would increase the resource base of the firm (Zott & al, 2011). As long as business models are acknowledged to create the infrastructure of business ecosystems (Ansari & al, 2016), the parallel with business ecosystems can be drawn and it would be interesting to check if those four sources of value creation do also apply to new business ecosystems.

The business model focuses on value creation and value capture, as well as on the focal firm's activity system, which includes connections with the ecosystem. A key difference between the two constructs is that the business ecosystem approach needs to take into account many additional interdependencies that are not directly included in the business model (Snihur & Bocken, 2022). This might be the case for potential complementors or competitors, or an impact of the development of a new ecosystem that would open new opportunities for other actors. If four basic elements characterize an ecosystem structure, being activities, actors, positions and links (Adner, 2017) and business model innovation needs to go beyond the boundaries of the focal firm (Zott & al, 2011), to the extent that strategic renewal of the firm could mean including a reflexion on how to create business opportunities for members of the ecosystem. This dimension needs to be explored in the development of new ecosystems as structure.

Firms can struggle to find innovative business models and one can assume that it is even harder to implement a new business model at the ecosystem level. I will explore this point in my empirical study to see **how value is created at the EAS level** and which **influence the focal firm traditional business model** has on these new developments.

Chapter 1 Section 1 Ecosystem definitions
What is known?
Business ecosystem formation & evolution Business ecosystem (Moore, 1993; Iansiti & Levien, 2004), characterized by similarities with biological ecosystems (coevolution and interdependences) Evolution in dynamic environments, traditional industry boundaries are blurred, need to compete and cooperate at the same time around innovation Keystone strategy improves the overall health of the ecosystem (Iansiti & Levien, 2004), different from dominator strategy Ecosystems need non-hierarchical management (Jacobides & al, 2018) defined by actors, stages Ecosystem as affiliation (EAA), ecosystem as structure (EAS) (Adner, 2017) Value co-creation (Lingens, 2021)
Where will I explore which gaps?
Business ecosystem formation (Chapter 4) and evolution (Chapter 5) Focus on EAA and EAS at the same time: from EAA to EAS (Chapter 4), from EAS to EAA (Chapter 5) What value is co-created, when, and by whom, with a focus on the non-hierarchical management of partners: focus on the blueprint phase in Chapter 4 and observe the unfolding in Chapter 5

Table 4 Synthesis of extent knowledge and gaps I will explore - Section 1

Table 4 gathers the most important concepts from the literature for my study, the associated gaps and the way I plan to explore them.

Section 2 Related concepts to ecosystems

Companies are part of business ecosystems (BEs) that cross several industries. In a business ecosystem, firms jointly develop capabilities around a dedicated innovation, this is coevolution. They need to cooperate and compete at the same time, striking a balance to support new

products, satisfy customer needs, and eventually incorporate the next round of innovation (Moore, 1996). Almost thirty years after its first definition, one can have a more precise understanding of the ecosystem concept, with ecosystems as structure (EAS) that develop around a value proposition, while ecosystems as affiliation (EAA) are at a broader level, with a stronger focus on ties among actors and on their interconnectedness (Adner, 2017).

These complementary definitions of ecosystems show that other management theories are linked to this concept, ranging from interorganizational relationships (Oliver, 1990), dynamic capabilities (Teece, 2007), coopetition (Brandenburger & Nalebuff, 1996) and business models (Osterwalder & al, 2005). I will study the literature about those concepts in order to define more precisely the concept of ecosystem and understand peripheral concepts that might help me understand how industrials firms in mature industries create new ecosystems to foster their strategic renewal. The resource base view (2.1) is a basis to understand how resources are developed at firm level with an internal focus and needs to be overcome with a dynamic capabilities' perspective (2.2). Focusing on both internal and external levels helps drawing interorganisational relationships dynamics (2.3) and the different steps of development of a business ecosystem. Coopetition (2.4) is also an insightful lens of study to understand the intersection of ecosystems as affiliation and ecosystems as structure, where value can be cocreated by actors, who eventually will compete in the long-run.

Following Porter's introduction of the concept of a resource base referring to the collection of resources and capabilities that a firm uses to create value (Porter, 1985), strategy of the firm and the way it can adjust to its environment and competition has been explored through two main lenses of research which are the resource-based view of the firm and the dynamic capabilities. Moore (1993, 1996) wanted to bring a new perspective while starting focusing on

the dynamic environment, interdependence and coevolution required, yet it is also necessary to consider which conceptual context he wanted to build theory in contradiction of.

2.1 Resource Base View

The resource-based view (RBV) is a model that emerged in the 1980s and which was considered as the most influential framework for understanding strategic management at that time (Barney & al, 2001). It develops the concept that sustained competitive advantage is only achievable provided that firms possess resources and capabilities that can be characterised as VRIN: Valuable, Rare, Inimitable and Non-substitutable (Barney, 1991; Wernerfelt, 1984). These assets can be tangible or physical, like buildings, machinery, equipment and capital. Tangible assets can easily be bought, notably by other actors, so they provide little competitive advantage to companies in the long run. Intangible assets are all the things that have no physical substance but can be owned by a firm, such as a firm's management skills, its organizational processes and routines, the information and knowledge it controls, or a brand history. These assets can be built over many years and thus usually provide more competitive value in the long run than tangible assets.

Following RBV approach, resources must also be heterogeneous and immobile. Companies actually have different skills and resources that allow them to implement strategies to do better than their competitors. Furthermore, the other assumption of RBV model suggests that resources cannot move from a firm to another. This is at least true in the short-term and especially true for intangible assets, which can be imitated or copied but not transferred.

A key outcome of the resource base view for ecosystem research is that mutual benefits can potentially be gained from collaborative interfirm relationships, which enables ecosystem partners to share complementary resources (Das & Teng, 1998).

The Resource-Based View of the firm shifts attention from the external environment to the internal environment. It suggests that key resources, such as assets, processes, information, knowledge or capabilities, can be used within the company to create a competitive and sustainable advantage (Penrose, 1959; Wernerfelt, 1984). This is however a limit of the RBV to be predominantly focused on the focal firm perspective; it is also necessary to have a much more comprehensive understanding of the value determinants in a business ecosystem context (Gueler & Schneider, 2021). The RBV follows in a tradition that situates the firm in an adversarial relationship with environmental actors but this focus on competition might hamper a comprehensive explanation on general growth (Nason & Wiklund, 2018). Firms actually not only face inter-ecosystem but also intra-ecosystem competition (Gueler & Schneider, 2021).

Another line of criticism regarding the resource-based theory also concerns the core construct as to what constitutes a resource. Better resources are not a guarantee for sustainable competitive advantage; what is fundamental is to use those resources better than the other companies (Szalavetz, 2022). A way to go further than the RBV approach is to consider the dynamic capabilities theory (Teece & al, 1997), which explains how firms can have the ability to make the most of their internal capabilities when the environment is uncertain and moving fast.

The heart of traditional strategy is usually considered to turn around a battle for competitive advantage, whereas the heart of ecosystem strategy is to reach alignment. The resources in an ecosystem also have to be valuable, rare and inimitable and this goes through the multilateral partnership that is built to issue a value proposition (Adner, 2017). This is how the RBV construct can be useful to better understand the ecosystem construct. The internal and external focuses need to be considered because sustainable advantage is only possible if relationships are maintained.

Furthermore, even if the ecosystem approach for a company is a source of competitive advantage in the long run, it only means that the firm needs to find a balance between a focus on internal and external resources. The ecosystem is defined by an alignment structure and an agreement among different actors to share investments. The RBV approach can help understand how resources are shared at the ecosystem level, which can be done with the use of dynamic capabilities.

2.2 Dynamic capabilities for business ecosystems

In ecosystems, the competitive advantage of all actors is impacted by their ability to choose a role and to monitor or react to internal and external changes. These adjustments require the use of dynamic capabilities (Teece, 2017; Jacobides & al, 2018). A dynamic capability indeed refers to a firm's ability to integrate, build and transform internal and external competencies. This approach emphasizes the development of management capabilities, and combinations of organizational, functional and technological skills (Teece & al, 1997).

Dynamic capabilities are different from ordinary or operational capabilities, which are easy to teach capabilities. It can be routines or standard operating procedures that are used to sell usual products to usual customers (Helfat & Winter, 2011). Dynamic capabilities are however idiosyncratic to each firm's past and culture. Those capabilities are difficult to develop and hard to imitate. Most importantly, they are required to allow long-term growth.

Despite original definition by Teece & al (1997) of dynamic capabilities being those enabling adaptation to external environments characterized by rapid or discontinuous change, the line between dynamic and operational capabilities is unavoidably blurry (Helfat & Winter, 2011).

Operational or ordinary capabilities are useful to maintain the everyday business and activities, while dynamic capabilities should support and enable strategic change. This is why they can be

considered as different organizational capabilities because they can lead to some changes in the firm's resource base (Schilke & al, 2018).

Eisenhardt and Martin (2000) underlined that dynamic capabilities were also useful and necessary in 'moderately dynamic' environments and capabilities that support existing businesses or apparently non-radical change can have key dynamic attributes. These capabilities furthermore always go along with a cost, to be developed and maintained. This is why firms tend to develop dual-purpose capabilities, that serve operational purpose and can help address new businesses. Change can take a long time, so the best indicator to assess if a capability can be regarded as dynamic is the potential economic impact allowed by the use of this capability. Indeed, capabilities that promote economically significant change are dynamic, even if the pace of change appears to be slow (Helfat & Winter, 2011).

The dynamic capabilities concept can be useful to understand how an ecosystem can be managed. Dynamic capabilities are developed by firms to adapt to changing contexts (Teece, 2007) and ecosystem leadership can be seen as a dynamic capability that is oriented towards the external environment of the firm (Foss & al, 2022).
Companies need to develop dynamic capabilities to adapt to the dynamics of the business ecosystem. They must continuously sense changes in customer preferences, technological advancements, regulatory shifts, and competitive actions. The ability to sense these changes and respond appropriately through dynamic capabilities ensures the company's relevance and sustainability within the ecosystem (Teece & al, 1997).

Business ecosystems often require collaboration and partnerships to leverage the collective capabilities of ecosystem participants. Dynamic capabilities enable firms to identify potential

partners, negotiate and form collaborations, and effectively manage these partnerships over time, thereby enhancing the collaborative advantage within the ecosystem (Teece, 2007).

As business ecosystems evolve, companies may need to reconfigure their resources, processes, and business models to remain competitive. Dynamic capabilities help firms identify the need for resource reallocation and enable them to make strategic decisions about resource allocation and deployment to capitalize on emerging opportunities or address emerging threats in the ecosystem (Helfat & Peteraf, 2015).

Dynamic capabilities play a critical role in fostering innovation within a business ecosystem. Companies with strong dynamic capabilities can continuously explore new ideas, experiment with different approaches, and rapidly commercialize innovations, contributing to value creation and differentiation within the ecosystem (Schilke & al, 2018). This idea supports the proposition that a new innovation ecosystem, or ecosystem as structure, can be created by a firm inside an existing business ecosystem, or ecosystem as affiliation. It however remains to be explored **how those dynamic capabilities are developed** and used.

Firms can use dynamic capabilities to alter many features of their external environments, if they have actions to transform regulations, to change technological standards, to start collaborating with new partners or other institutions in their business ecosystem (Teece, 2007). These are a few examples but there is a real need for further exploration of dynamic capabilities in the context of business ecosystems, with a focus on the associated costs (Schilke & al, 2018).

As long as **dynamic capabilities are required to adapt to a firm's external environment,** further exploration is required to **understand whether ecosystem dynamic capabilities exist.** And if this is the case, there is also a need to understand whether such capabilities are **developed**

at the level of the ecosystem. Those questions are closely related to the question of ecosystem boundaries. As dynamic capabilities are the capabilities needed to sense changes in customer preferences (Schilke & al, 2018), it would be insightful to study **how a new EAS allows several actors to satisfy their customers' needs through an ecosystem**, whereas they could no longer achieve that without the ecosystem. Another key dimension to explore is also to study how resources are reallocated from the firm level to the ecosystem level. Dynamic capabilities are supposed to allow the exploitation of new opportunities (Helfat & Peteraf, 2015) but companies have finite quantities of resources and need to optimize their allocation to keep performing. Starting a new ecosystem encompasses a high level of uncertainty and I will study the creation phase of new ecosystems in the context of mature industries in my empirical chapters (4 & 5) to see how resources allocation choices are made.

2.3 Interorganisational relationships

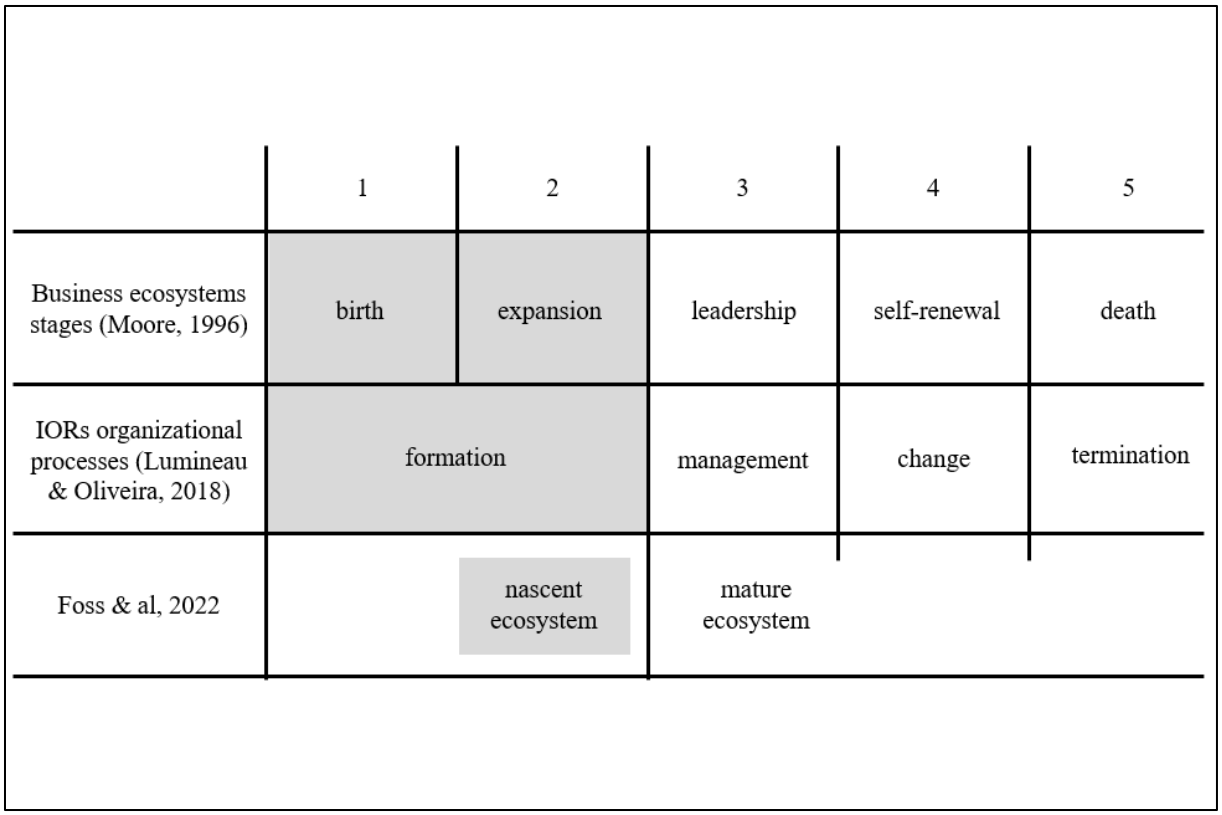
Interorganizational relationships (IORs) refer to the set of relationships between and among organizations. Therefore, IORs are a broad organizational phenomenon that has occurred for as long as autonomous organizations have related to one another (Lumineau & Oliveira, 2018). IORs were defined by Oliver (1990: 241) as

> *"relatively enduring transactions, flows and linkages that occur among or between an organization and one or more organizations in its environment".*

The field of IORs studies has converged around four key structuring elements, which are organizations, relationships, context and time (Lumineau & Oliveira, 2018). IORs involve organizational processes through which organizations are formed, managed, changed and terminated.

For Moore (1996), there were four distinct stages in the development of a business ecosystem: birth, expansion, leadership and self-renewal or death. A link can be made with the development of IORs. A parallel can be made in those two approaches, as shown in Figure 8.

Figure 8 Parallel of development stages between BEs and IORs



This parallel helps understand the link between the research stream on IORs and the one about business ecosystems. There is a difference between the two grids, with birth and expansion that can be included in the formation phase, whereas self-renewal and change go together. Management and leadership stages can be aligned, while change and termination on the IOR side are very similar to the last step for BEs that is made of self-renewal or death.

During stage 1, also named “pioneering an ecosystem”, the search for a viable new business ecosystem takes place (Moore, 1996). It is a brainstorming phase, during which visionaries

attempt to establish proof of concept to create radically better products or services than those existing and define the nature of value for customers.

Stage 2 is the expansion of the ecosystem; it starts with a core set of synergistic relationships and an investment to increase the scale and scope of the business ecosystem. During that phase, it is critical to identify and gather the most desirable potential allies, be that the best customers, the strongest suppliers or the most important channels. The challenge for the leading firm is to favour this development while keeping reasonable control over the new direction (Moore, 1996).

Stage 3 is the step of authority in an established ecosystem, when business ecosystems evolve toward stability and some players manage to keep a central and important role in the community. This stability also brings a vulnerability for incumbent firms who might be attacked by clones (Moore, 1996). During the formation and expansion periods, it is actually almost not possible for new players to get into the ecosystem because all the roles are moving targets. To stay successful, leading companies need during stage 3 to keep shaping the future direction and investments of the key customers and suppliers involved in the ecosystem. At this stage, the nature and structure of the ecosystem are visible to the extent that some competitors might try to replace incumbent firms.

Settled players in the ecosystem are challenged and this situation leads to stage 4 of either renewal or death.

Another approach in the literature suggests that there are 2 main broad stages of emergence and maturity for ecosystems that can be distinguished (Foss & al, 2022). Those two views are however not contradictory, it only means that stages 1 and 2 represent the emergence of the ecosystem, while stages 3 and 4 represent the maturity of the ecosystem.

Apart from this parallel on the different stages of development, the literature on IORs also displays an interesting focus on single party blindspot, that can be useful for the ecosystem literature.

Lumineau & Oliveira (2018) reviewed 475 articles about inter-organizational relationships published in top-tier journals between 1996 and 2016 and identified important issues that received too little attention. The first blindspot they identified is called 'single party focus' and consists of researching one party but drawing conclusions concerning the relationship between two or more organizations. IORs happen between actors within an ecosystem and this blind spot might be particularly relevant to make some headway in the research about ecosystems. This blindspot is a direct guideline for research on ecosystem, which requires to investigate a case from different points of view to have a broad and correct understanding. It however also can have consequences at the company level, for the actors evolving inside the ecosystem.

For this part, I referred to Moore's work, at a time when he did not make the difference between EAS and EAA. My understanding is that it applies to both levels and that a mature EAA can renew through the launch of new EAS. Those phases can be useful to understand how ecosystems unfold. Knowing that **most of the existent literature focuses** on the **first steps of an ecosystem** (Adner & Kapoor, 2016), which is phase 2, I will rather study the creation phase that is less documented (Dattée & al, 2018), mostly because

> *"researching a business ecosystem that does not yet exist is a challenge" (Tsvetkova & al, 2021: 26).*

More precisely, **I will study how actors that have a strong position in mature ecosystems react to the threat of being commoditized** by trying to create new innovation ecosystems, or EAS. My study is thus between phase 4 of the EAA and phase 1 of the EAS. My empirical

work in Chapter 4 will focus on the inception of new EAS in the context of a mature EAA, while Chapter 5 will mostly focus on the beginning of phase 2 at the EAS level.

2.4 Coopetition and competitive dynamics in ecosystems

Business ecosystems research usually deals with the way competition among firms is changing. Moore (1993) describes a shift from competition among individual companies to competition among business ecosystems. This way of seeing interorganizational relations is very closed to coopetition, which was depicted as a new mindset by Brandenburger & Nalebuff (1996). They state that in business, a firm's success does not necessarily require others to fail and that there can be several thriving companies. Two main constructs of the coopetition theory are about the "value net" and the "common pie".

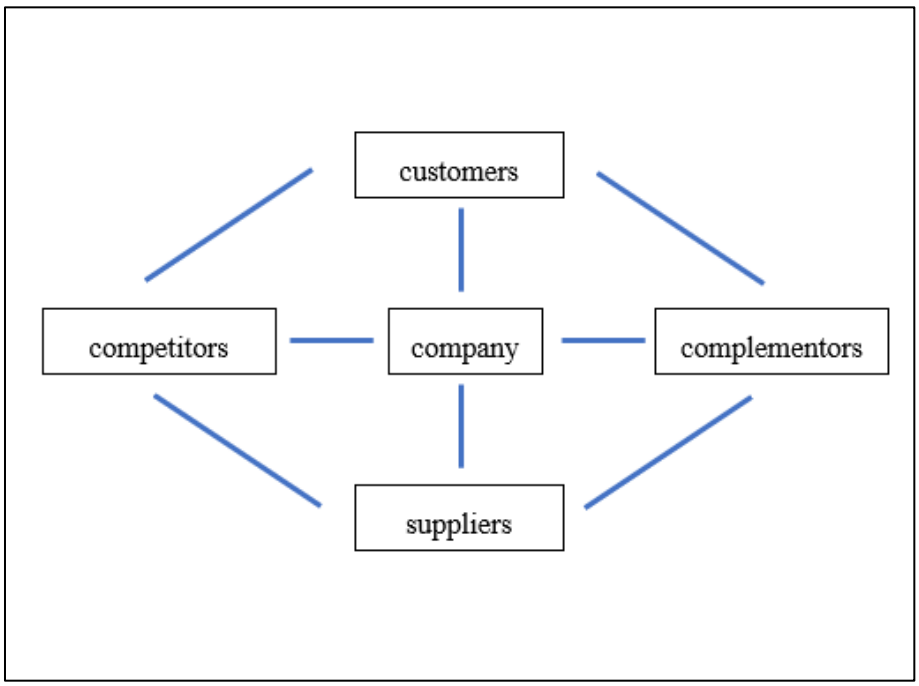
The "value net", as shown in Figure 9, is a construct depicting the actors and their relationships. The "common pie" is a construct to depict that a focal firm has a common interest with its competitors and complementors to increase their potential future production if they increase their common investment before trying to sell a product or service.

The value net can be compared to the representations of firms and their relations with ecosystem members, as it was depicted by Adner & Kapoor (2010) and by Jacobides & al (2018) and the two figures I included earlier (Figure 3 and Figure 7). The first important difference is that competitors are not directly included in representations of ecosystems. This shows that the literature on ecosystems focuses on a level of analysis which is more accurate than the one used for coopetition.

The coopetition framework is thus more in line with the approach of ecosystem as affiliation (EAA) than the one of ecosystem as structure (EAS). Competition indeed needs to be taken into account but more with a broad view and long-term approach. A key question in my particular

focus is thus to wonder **how the mature EAA landscape is taken into account before starting a new EAS**.

Figure 9 "The value net", Brandenburger & Nalebuff, Co-opetition (1996)



Even if the coopetition literature illustrates that competitors need to be taken into account as potential partners, it rather means that competition goes beyond the traditional boundaries, not that there is no more competition. Innovation demands investments that can be justified by potential anticipated returns. This expected growth will at some point be targeted by other actors or ecosystems. **Competition inside the mature EAA could be a triggering point** for new innovation ecosystem creation, with a will to **strengthen a strategic position in the ecosystem**. I will explore this dimension in my first empirical chapter, where I will focus on the antecedents to a new ecosystem in the context of a mature business ecosystem.

Complementors have an important role to play in a coopetition setup as well as in an ecosystem (Kapoor & Lee, 2013). They are in charge of producing complementary products or services

that contribute to the final value created. Complementors need to be compared to suppliers with a strong focus on interdependence. The focal firm has a supply-side interdependence with suppliers and a demand-side pooled interdependence with complementors, with customers (Kapoor, 2018). Basic supplier relationships entail dyadic contractual relations, while complementor relations means that the value is cocreated and that a multilateral alignment structure (Adner, 2017) needs to be agreed on.

Interdependencies in general and complementarities in particular are driving antecedents of alliance formation and of relationships among ecosystem partners. Interdependencies go along with complementarities, which are at the same time a key antecedent for collaboration with the external environment and a potential derailer of this collaboration, when dependencies are too asymmetric (Shipilov & Gawer, 2020).

Focal firms usually do not sell to or buy from complementors which might increase organizational design complexity (Kapoor & Lee, 2013). One main difference between coopetition and ecosystem lies in the standalone values of each actor and their products or services. A razor and a blade, as well as a mobile phone and a mobile operating system, or an aircraft and an engine all have a strong complementarity. The lower the complementarity, the higher the risk of coopetition.

The value net is very similar to an ecosystem and the idea of coopetition is always present in the literature about innovation ecosystems, for instance to posit that when they work, ecosystems allow firms to create value that no single firm could have created alone (Adner, 2006; Adner & Kapoor, 2010).

Research streams on cooperation and competition are central to the field of strategic management but have for long evolved independently (Hoffman & al, 2018). Scholars have

focused on why firms tend to form cooperative relations and investigated the reasons why partners were chosen instead of others, how alliances were managed and the consequences these choices had on alliance performance (Wassmer & Dussauge, 2011). This stream of research on cooperation shows that networks of cooperative relations have a direct positive impact on firm performance (Khanna & al, 1998; Gulati & al, 2012). In the meantime, competitive dynamics can generate tensions among alliance partners, and this could undermine collaboration, destabilize alliances and reduce resource exchanges (Das & Teng, 1998). The literature on cooperation is more emerging than the one on competition and both streams have evolved almost independently, following a different logic, depicting the other form of interaction negatively and making little empirical or theoretical effort to gather the two streams of research (Hoffman & al, 2018). Focusing on business ecosystems and coopetition help advancing those two streams together, as long as EAA and EAS perspectives can be gathered.

Hoffman & al (2018) define a research agenda based on six promising themes and directions where further research is needed in the context of joint cooperation and competition, that can apply to research on ecosystems on this specific dimension:

1) Antecedents, processes and consequences of cooperating with competitors
2) Value creation and appropriation
3) Temporal dimension
4) Capabilities and organization for supporting coopetition
5) Applying methods for studying cooperation and competition networks
6) Approaches for managing the tension between competition and cooperation

With my empirical study of new ecosystem creation in the context of mature business ecosystem, I will address a few issues that particularly apply, with a strong focus on the time dimension.

In Chapter 4, I will focus on the coopetition antecedents from the EAA level that have an impact at the new EAS level. In Chapter 5, I will explore whether the new EAS created can have an impact on the competition and collaboration dynamics at the EAA level.

Adopting the coopetition lens helps focusing on those apparently contradictory behaviours among two actors. Adopting the ecosystem lens allows to study the relationships among partnering actors, keeping in mind that they also go on belonging to a broader ecosystem as affiliation.

Hannah & Eisenhardt (2017) define ecosystems as being organized around a final product such that their components are complementary. This might mean that customers are excluded from the concept of ecosystem. However, Lifshtiz-Assaf (2017) shows that customers can be integrated in the value creation process. This is even one of the bases of open innovation. Lifshtiz-Assaf (2017) deals with open innovation, which consists of opening up scientific and technological problems beyond organizational and professional boundaries. Even if the word "ecosystem" is not written in this article about open innovation at NASA, there is a clear parallel to draw with innovation ecosystems, where individuals from a company have to open their traditional boundaries to create value with other actors. I already discussed the difference between business ecosystem (BE) and innovation ecosystem (IE) and the difference between those two concepts is the point of view one uses to observe the ecosystem relationship. When the literature addresses the BE, the focus is on the business as a central point and more precisely the value capture, whereas when the literature focuses on the IE, the point is rather on an innovation which is developed by several actors and on the **v**alue creation. Open innovation is in the line of this spread with customers being actors of the innovation and of the innovation ecosystem. Open innovation can be performed through acquisitions, technological collaborations, open sourcing, or venture capital investments and it requires broad and deep

capabilities that are referred as absorptive capacity (Cohen & Levinthal, 1990). This absorptive capacity is a dynamic capability that companies possess and need to identify, so that they integrate external knowledge that might be relevant to their activities (Zahra & George, 2002). All authors agree on the fact the ecosystems include interacting companies and other kinds of actors, who coevolve capabilities. In this organization, customers can be part of the ecosystem, as long as they have an active role and take either part of the value creation or value capture phase. Interactions are no longer along traditional industry boundaries but connect the destinies, strategies and operational capabilities of customers, suppliers, partners and competitors. Competitive and operational dynamics are reshaped at the most fundamental level (Iansiti & Levien, 2004).

This approach brings new opportunities and new threats because competition can come from all actors and at all levels.

Kodak was disrupted in 2012 and it was not a classic disruption, as when a new technology replaces another through direct substitution. Kodak underwent an ecosystem disruption (Adner, 2021), when a change in one location impacts another location. The camera started doing the job of the paper and thus killed the need for the printer. This disruption was not linked to a substitution but rather to a new definition of the value. The key difference between classic disruption and ecosystem disruption is that the source of the threat is not carried by a competitor, but rather from a cocreator of value (Adner, 2021).

Coopetition involves firms cooperating with competitors in some areas, while competing in others. The distinction between ecosystems as affiliation and ecosystems as structure can help better understand the concept of coopetition. There could indeed be a stronger focus on competition at the broader ecosystem as affiliation level, while at the ecosystem as structure

level, the focus rather lies on collaboration. As long as the ecosystem as affiliation is actor-centric, it might be insightful to focus on the impact of past relationships when some firms want to launch or be part of a new ecosystem as structure (Adner, 2017).

Adopting an ecosystem approach brings new complexity as long as actors involved at the EAA level do not necessarily have the same role at the EAS level. When a firm considers **starting a new EAS to sustain its competitive advantage and renew its strategic position**, it should also consider that **all partners in the new EAS might some day in the future turn to competitors at the EAA level**. This highlights the tension between collaboration and competition and **questions the antecedents** taken into account by a firm willing **to start a new EAS**. I will study this aspect in Chapter 4, to see whether actors chosen by a leading firm in a new EAS are chosen depending on their competitive potential for a near future.

Table 5 Synthesis of extent knowledge and gaps I will explore - Section 2

Chapter 1 Section 2 Related concepts
What is known?
Dynamic capabilities required to adapt to a firm's external environment (Teece & al, 1997) Coopetition (Brandenburger & Nalebuff, 1996) as cooperation & competition
Where will I explore which gaps?
Need research on antecedents to a new EAS Need for ecosystem creation study (Hoffman & al, 2018): Chapter 4 Is competition inside the mature EAA a strong antecedent for EAS creation (Chapter 4) ? What is the impact of the creation of a new EAS on the coopetitive dynamics at the EAA level (Chapter 5) ?

Table 5 presents the most important concepts from the literature of this section for my thesis that stem out from related concepts but are enlightening for the business ecosystems research stream. The two key concepts are the theory on dynamic capabilities and the literature relating to coopetition, which happens when collaboration and competition coexist.

Section 3 Actors and strategies within ecosystems

I have explained how the ecosystem concept moved from business ecosystem to ecosystem as structure (EAS) and ecosystem as affiliation (EAA) and my goal is to show to what extent industrial incumbents can make this strategic choice to foster their strategic renewal. In order to advance this exploration, I now need to dig further on key characteristics of ecosystems, seeing which kind of actors get involved in ecosystems and what kind of links may exist among them. As long as starting a new EAS requires to embark other actors, I will also explore the motivations to join an ecosystem. The use of an ecosystem as structure approach helps focusing on a new value proposition, where boundaries of the ecosystem are more visible. Yet, my aim is to shed light on the articulation between the ecosystem as affiliation and ecosystem as structure. From the EAA level, past relationships with many actors might play a role, be that on the choices made by a keystone or on the willingness of other actors to commit.

3.1 Actors committed in an ecosystem and roles they may play

I previously showed that Moore (1993, 1996) and Iansiti & Levien (2004) started discussing the two dimensions of actors involved and different strategies to adopt; but articles and reviews completed their approaches during the last thirty years, especially if we consider the split between ecosystem as affiliation (EAA) and ecosystem as structure (EAS) concepts.

Several dimensions can be considered, including the nature of actors, size and age of the actor, number of employees, before moving to the commitment and relationships. The time dimension is also to be taken into account, especially in this articulation between EAA and EAS, when an actor involved in an ecosystem as structure is already involved in other kinds of relations with the other members inside the ecosystem as affiliation.

Shipilov & Gawer (2020: 101) stressed that

> *"Adner (2017)'s view of an ecosystem was particularly interesting because the actors within the set are not those who are already linked through existing arrangements, but those who would need to align for a value proposition to get realized".*

Those actors are not necessarily historical partners and it is still not known who those actors are and which role they may play in the new ecosystem.

Those actors need to be chosen by the firm that starts the project and they must agree on the idea to start a new collaboration that includes a certain degree of uncertainty.

Iansiti & Levien (2004) stressed the role of ecosystem managers, "hub" or "keystone" firms, as the providers of stability (Jacobides & al, 2018). A keystone acts to improve the overall health of the ecosystem. He creates and shares value with its network by leveraging its central hub position in that network, while generally occupying only a small part of the ecosystem (Iansiti & Levien, 2004). This remains a parallel with natural ecosystems and it seems to be difficult to apply in the real context of dynamic competitive environments. First, I think one can question the will of an actor to take the whole health of its ecosystem as affiliation into account when it makes strategic decisions. This lies with the concept of coopetition (Brandenburger & Nalebuff, 1996) that firms can try to increase a "common pie" instead of grabbing a bigger share than their neighbours. It is even in their interest. I however wonder how it could be applicable to a present context. When one observes what happened in the past, one can probably connect decisions to overall positive impacts for the ecosystem but when the situation is unfolding, I doubt an actor can make a strategic decision following an ecosystem overall wealth. This is why I think that the concept of architect, or leader, is more appropriate to an ecosystem context. The presence of an architect, orchestrator or leader is an essential and distinguishing feature of an ecosystem. His role is to set a system-level goal, define the hierarchical differentiation of

members' roles, and establish standards and interfaces (Gulati & al, 2012; Teece, 2014). The orchestrator is the actor in charge of designing the alignment structure and he is the main decision maker within the ecosystem (Dattée & al, 2018; Lingens & al, 2021).

Iansiti & Levien (2004) also put forward that a given firm may act as a keystone in one domain while acting as a dominator or a niche player in others. The literature on keystones also depicts a contrasting dominator role. They often occupy a large part of the ecosystem, and they fail to encourage diversity. Dominators often eliminate species and consequently either take over the functions of the erased actors or eliminate those functions altogether (Iansiti & Levien, 2004). This might be compatible with the split between EAA and EAS, as long as those roles would unfold through time at the EAA level and be reinforced through specific new initiatives or contributions at the EAS level. Yet, there is no article that highlights a clear keystone or dominating stance from the launch of an ecosystem, so I suggest a need to question whether companies clearly make and communicate on that choice. It seems more plausible that a firm assumes to lead, and that the context or evolution leads to a keystone or dominator position.

The leading actor also enforces the governance rules, determines timing, and often reaps the lion's share of gains after the ecosystem is aligned (Adner, 2017). Those roles of keystone firm, architect or leader all focus on one firm which is leading others but there are also other roles to be taken in any ecosystem. In order to overtake the single-party blindspot (Lumineau & Oliveira, 2018), there is a need to define all roles that can be taken apart from the leading roles. A point that is **hardly addressed in the literature** is the **possibility of shared leadership.** Part of my empirical study in Chapter 4 will help me suggest some theory advancement because I will compare the birth of two new EAS, one of which relying on a shared leadership structure.

Leadership does not need to be a solo role and sometimes it can make sense, even for fierce competitors to put aside rivalry with the aim to launch a new ecosystem based on an alignment structure (Adner, 2021).

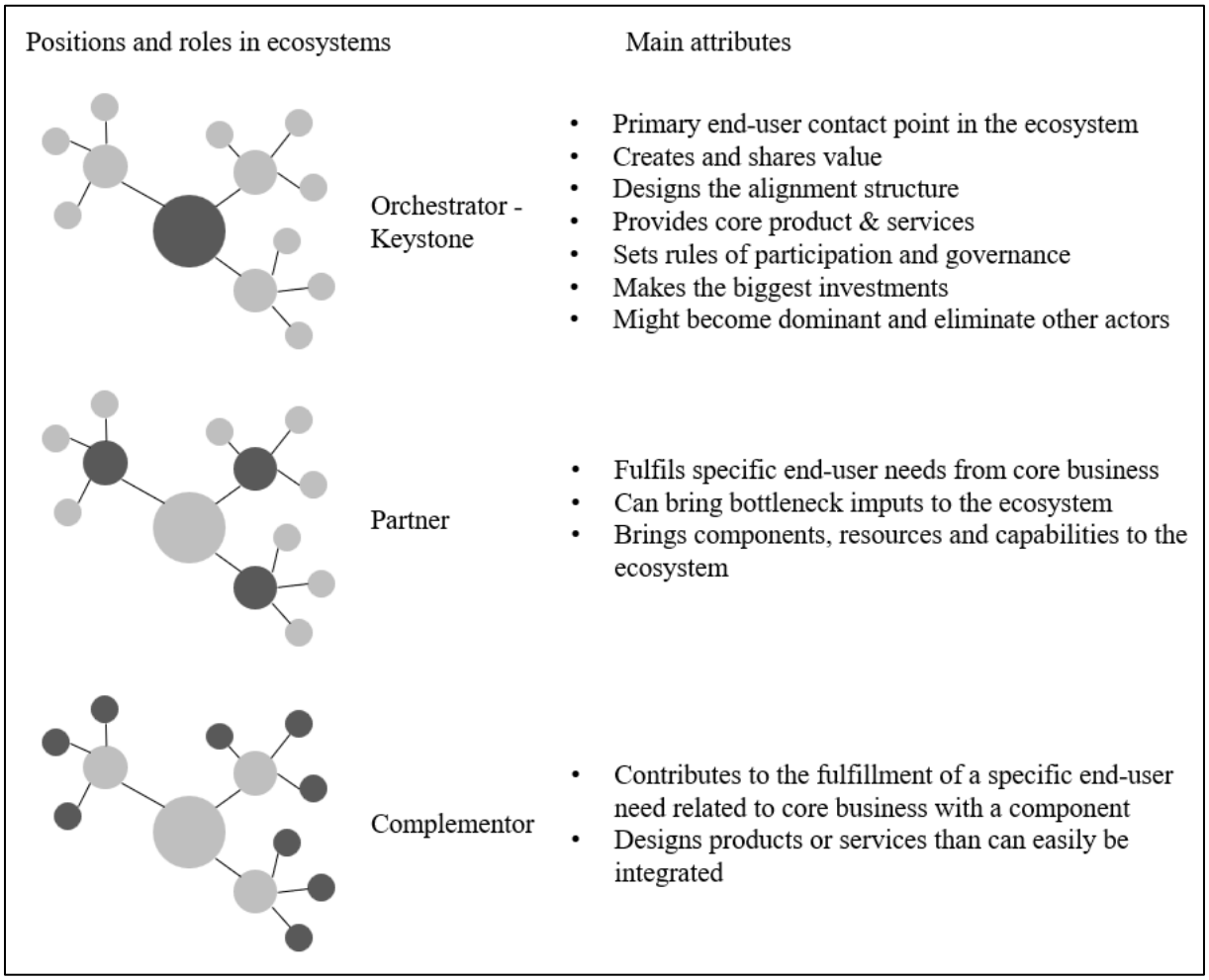
Another complementary approach considers that an industry's ecosystem is constituted of producers (including suppliers, competitors and complementors) from the supply side, distribution channels, consumers from the demand side, regulators, and other interested stakeholders from the institutional side (Ansari & al, 2016). Those roles can be taken by several partners and there is no study focusing as much on following partners as on leading partners, and the way they collaborate to end up with the best outcome. All actors bring components, resources and capabilities to the ecosystem, yet not all those complementary components are equally important to the ecosystem (Shipilov & Gawer, 2020; Gueler & Schneider, 2021). The actors who are more vital to the ecosystem can be called partners and bring bottleneck inputs (Hannah & Eisenhardt, 2017) to the extent that they impact the growth and performance of the ecosystem more than the other actors (Shipilov & Gawer, 2020). They can be compared to complementors, as it is shown on the following Figure 10.

This furthermore needs to be considered with a dynamic view as I indicated that firms are increasingly involved in several ecosystems at the same time. This means that they can play different roles in different ecosystems and that partners can also play different roles. Basic economics identifies four kinds of organizations: a focal firm, rivals, substitutes and complementors (Adner, 2021).

Rivals are classic competitors; they try to win the same race in almost the same way. Substitutes are also trying to win the same race but choosing a different path. Complementors enhance the

value of a focal firm but they can also in the long-run become a threat and disrupt a core firm. They can commoditize a core market, as it happened for example for IBM following Microsoft and Intel endeavour. Commoditization happens when goods or services become relatively indistinguishable from similar offerings produced by a rival firm (Cozzolino & Verona, 2022). They can also decide at some point to enter the core market. A third and even more powerful threat lies in value inversion; instead of losing its margins, the focal firm loses its market. Value inversion happens when complementors become substitutes (Adner, 2021). The Kodak case shows how disruption can happen even without a strategic intent, to the extent that smartphones were not developed to kill the market for photo printing.

Figure 10 Roles, positions and attributes of actors involved in ecosystems



Those different threats materialize when an actor eventually brings less value to its ecosystem, and it can help understanding how this can be avoided to apply the Resource Base View to the ecosystem stream. Four factors actually drive the value of a resource or an input in ecosystems:

1) contribution to value proposition,

2) scarcity and the ability to provide bottleneck inputs,

3) complementarity and

4) reputation of the input provider (Gueler & Schneider; 2021).

This scale is static in nature, in an environment characterized by dynamism. Consequently, there is a need to examine its applicability in ecosystems over a certain period of time and in the various stages of an ecosystem (Moore, 1993; Gueler & Schneider; 2021).

What past research also does not indicate is **how many partners a new ecosystem should gather** and to what extent some roles, starting with the **leading role, can be shared**. Observing unfolding ecosystems can also be useful to compare and understand if there are differences between what was anticipated and what eventually unfolded. The existent literature helps understand the different roles that can exist in a business ecosystem, but this is like a picture to which there is a need to add a movie perspective, showing why the different partners committed were chosen, by whom and why they decided to get involved. Before 2017, most of the research on business ecosystems focused on the ecosystem as affiliation level, with a focus on actors. Since then, the perspective on ecosystem structure helps understanding how a set of actors is organized to issue a new value proposition. I will use those two perspectives in the context of a mature EAA in Chapter 4, to see **how different roles can be taken in a news EAS**, with a particular focus on **how non leading actors are attracted**. I will have a focus on time dimension, to see whether **past relations** are required, be that from the leading firm or from complementors' perspective.

3.2 Motivations to join an ecosystem, investments & internal momentum

The parties involved in an ecosystem are motivated to seek both equity and efficiency outcomes because of a desire to preserve a reputation for fair dealing, that will enable them to continue to exchange transaction-specific investments under conditions of high uncertainty (Helper & Levine, 1992). Firms committing resources in an ecosystem are looking for performance through value creation and operational efficiency, two outcomes that require partners to bring technological knowledge and managerial skills (Shu & al, 2017). Moreover, performance is always a relative concept, and a company needs to perform better than its competitors. In the case of a mature industry, actors have longstanding relationships and usually rather established business models that allow them to focus part of their strategic effort on the long run.

The learning and competing dimensions are at the core of motivations to join an ecosystem (Hamel, 1991). Agreements with prior alliance partners allow firms the opportunity to exploit prior learning and avoid additional relation-specific investments in incentive alignment, monitoring and formal controls (Bingham & al, 2015). When Doz studied the evolution of strategic alliances (1996), he showed that successful alliances projects were highly evolutionary and passed through three steps of learning, re-evaluation and readjustment. All actors involved need a clear and common strategic context, which can be to have a common enemy. To achieve this clear starting context, partners need to jointly define the task to be performed, share their organizational routines and define a common interface. A successful ecosystem should also need the same kind of alignment. Companies find motivation to invest in a new ecosystem project for internal and external motivations and there is a need to commit resources to start a momentum on those two complementary dimensions (Dattée & al, 2018).

Yet, it is still to be explored if an **internal momentum** has an **influence on the performance** of the company or ecosystem when it comes to **addressing an external need**. For established

firms, the opportunity to anchor a new initiative with an internal customer is a “double-edged sword” (Adner, 2021). On the one hand, the internal need creates an opportunity to jump-start scale and show activity. On the other hand, this need can lead to an overestimation of the potential market demand. This is what experienced General Electric when they tried to launch Predix, which was an attempt to put a step in the industrial Internet of Things (IoT) market. Predix platform was meant to combine advanced analytics with engineering solutions (Jacobides, 2022). In 2015, Jeffrey Immelt who was CEO of GE declared that his firm would become a top 10 software company and he predicted sales of $15 billion by 2020. His expectations stemmed from GE’s own successful internal efforts at remote diagnostics for its jet engines. The aim at this point was to connect, monitor and manage as many machines as possible, to generate more insight for the customers and increase predictability. It has however been a failure because the attempt lacked partners to become a real and successful ecosystem (Adner, 2021).

Another strong motivation to join or initiate an ecosystem can also be to beat the competition, while adopting a more innovative organizational structure. When Kapoor & Lee (2013) studied the different types of organizational forms that firms can choose to manage interdependent activities with complementors, including arm’s-length relationships, collaborative alliances and hierarchical relationships, they came to the conclusion that alliance relationships were more efficient than arm’s-length relationships. The alliance, as well as the ecosystem demand more commitment that a simple arm’s-length relationship. It demands more investment, but it seems to be worth it. They also showed that alliances enabled greater adaptability than markets because cooperating partners have to develop communication channels and codes to facilitate knowledge sharing and coordination or interdependent investments and tasks (Dyer & Sing, 1998).

It thus seems that ecosystems could be an **efficient structure to maximize investment**, with less constraint than a fully integrated supply chain that leaves little space for trust and meaningful commitment. Apart from the conceptual work, there is a need to see how it applies on the field because ecosystem relationships entail more complexity than supply chain relations. This is a dimension I will study in the empirical chapters 4 and 5, to see what is exactly invested by focal firms to develop EAS.

The alignment structure is at the core of the ecosystem as structure concept developed by Adner, who clearly states that there is no special value to adopting an ecosystem logic in contexts in which other actors do not need to be aligned (Adner, 2017). In order to help understand better how ecosystems unfold, it is important to dig further on this alignment structure question. This point is linked to the questions of motivations to join an ecosystem, value creation and sharing and I will explore those aspects of **motivations to join** and **need for internal momentum** in my empirical part, in Chapter 4 and Chapter 5.

3.3 The importance of past relations to start a new ecosystem

An ecosystem connects more than two partners, which poses management, trust and performance challenges. When Davis focused on the group dynamics of interorganizational relationships (2016), he studied multi-partner alliances and suggested that longstanding dyadic relationships may be a necessary basis to launch more complex group processes, involving more than two partners. As it was underlined by Davis (2016), trust is an important foundation for intensive alliances, and it can apply to ecosystems. Trust enables partners to make commitments and take risky actions without implementing costly safeguards to protect against a partner's betrayal (Uzzi, 1997). Interorganizational trust emerges from a foundation of interpersonal trust between individual boundary-spanning managers and after many frequent interactions, this trust

becomes institutionalized (Ring & Van de Ven, 1994). There might however be a risk of poor value created when the partners involved in the new ecosystem are already connected. Firms must form ecosystems with partners who are connected with each other but also with partners totally disconnected from each other (Padula, 2008). These new partners are to be included because of their complementarity with the focal firm and pool of traditional partners. It thus can be wondered how trust emerges in relationships with new partners, be that with partnerships with young firms such as start-ups, or with companies that have historically evolved in different businesses. The "relational view" perspective (Dyer & al, 2018) shows that firms create value in alliances when they identify partners with complementary resources. It should also apply to ecosystems, where the focal firm needs to reinforce its uniqueness in the ecosystem, to sustain its competitive advantage. Having complementary resources helps creating a unique product or service and having a strong market position.

3.4 Links among actors involved in the ecosystem

Ahuja & al (2012) explored the idea of network dynamics and started defining the concept of network architecture. The architecture of any network can be conceptualized in terms of three primitives, the nodes that comprise the network, the ties that connect the nodes and the patterns or structure that result from these connections.

The difference between a network and a business ecosystem is that the starting point for research on networks relies on the presence or absence of formal interorganizational relationships, whereas focusing on an ecosystem means focusing on a focal offer, not a focal firm or alliance (Shipilov & Gawer, 2020). Thus, to define better a new ecosystem and after having defined which antecedents allow the choice of nodes or actors, I wonder what kind of **ties and patterns** can be chosen and how they are chosen. It could be **contracts, risk and revenue sharing** or a blend of ties that imply more or less commitment**.** I will explore those

aspects in my empirical study and especially in Chapter 4, with a focus on two new business ecosystems creations in the context of mature EAA. Ecosystems are supposed to be non-hierarchically managed but there should however be some kind of commitment on the complementors side, so that a value can be delivered.

Research on ecosystems design has been the subject of many studies, which have mainly focused on isolated aspects of alignment. Links among actors are a cornerstone of ecosystem design and can include the exchange of goods or money and the topics of how influence is spread among ecosystems and what is the governance structure (Lingens & al, 2021). This starts with the definition of the blueprint during the construction phase of a new value proposition. Those links among actors involved in ecosystems need to be explored both at the ecosystem as structure (EAS) and ecosystem as affiliation (EAA) levels.

In a new ecosystem, partners cannot govern their relationship fully contractually because it is unclear what specific tasks, processes, and decisions are needed to exploit the synergies fully (Davis & Eisenhardt, 2011). Writing clearly defined contracts can be a difficult step for collaborators who sometimes lack trust in each other if they did not have previous relationships. The whole ecosystem project can consequently be delayed, as long as it turns out to be a strong issue not to be able to agree on a contract which would draw future activities, returns. When the ecosystem does not exist yet, the value proposition cannot be clearly defined (Lingens & al, 2021). It is also difficult to establish an allocation of the resulting benefits, which cannot be determined clearly until the parties have invested in the ecosystem (Panico, 2017).

3.5 Blueprint and evolution of the partnership

> *"The ecosystem champion or "keystone" should come up with a compelling "blueprint" for the future ecosystem; one vision that clearly defines the ecosystem value proposition (what value is created, how, and for whom) and associated*

structures of governance and interaction (who does what, who controls what and how everyone will benefit)" (Dattée & al, 2018: 467).

As well as successful alliances (Doz, 1996), successful ecosystems evolve through a sequence of learning and adjustments. The actors need to learn about their environment, the tasks to be performed, the processes to define and adjust, the skills to find and develop, but also the goals to set. They also need to assess their efficiency and to readjust their task definition, the partners' routines and the interface structure**.**

Contracts bond the partners together in the business ecosystem, they are the first visible proofs of blueprint. They can have negative consequences because detailed contracts create an environment of vigilance, preventing the development of trust through the reduction of opportunities for a spontaneous display of good intentions (Frey & Jegen, 2001; Malhotra, 2009). Yet, contracts help in the development of trust through the reduction of information asymmetry between parties (Bastl & al, 2012; Liu & al, 2009). Contracts embody the commitment of all actors but the work of starting a new ecosystem is triggered before the contracts are signed.

Building a new value proposition highly depends on attracting and aligning partners. Three principles can help build a new ecosystem (Adner, 2021): establish a minimum viable ecosystem (MVE), follow a path of staged expansion, deploy ecosystem carryover.

The MVE is the smallest configuration of activities that can provide enough evidence of potential value creation in order to be able to attract new partners.

The expansion needs to be staged following a mapping of what each partner can bring and as long as the alignment of partners is a key dimension of the ecosystem success, some partners are attracted with the only aim to attract some other key partners. Each additional partner is on-boarded with those two objectives, of contributing to the value architecture and paving the way

for bringing on the next partner (Adner, 2021). Early partners are not enrolled to generate profits, they are instead attracted to create the evidence that the new partnership can be trusted.

A new ecosystem is defined by a new configuration of partners. When firms are already established, they have some past ties and relationships on which they can build. Sometimes, it is even possible to have some partners involved in the MVE in a new ecosystem without letting them know it explicitly (Adner, 2021). This is possible because a minimum viable ecosystem is not a minimum viable product (MVP). The MVP approach aims at testing markets; it helps innovators in the exploration of market demand and product design as early as possible in the development of a new service or product (Ries, 2011; Blank 2013). This methodology combines iterative low-cost prototyping and progressive customer commitment, which implies being mainly focused on the new service or product. A minimum viable ecosystem is rather targeted at aligning the partners needed to build a value architecture and to deliver a value proposition. The MVE is about attracting, aligning and preparing for scale, whereas the MVP is about prototyping (Adner, 2021).

Blueprint (Dattée & al, 2018) and **Minimum Viable Ecosystem** (Adner, 2021) are the two concepts that were coined to describe how architects of new EAS can try to **attract other partners** to join their new ecosystem, when they start defining a **value proposition** and **governance structure**. In the creation phase of a new EAS, **uncertainty** is very high so it would be interesting to explore further how the blueprint and MVE evolve, and which impact it has on identified partners. I will explore this dimension in Chapter 4.

3.6 Ecosystem structure

Ecosystem structure is visible through activities, actors, positions and links (Adner, 2017). Those four characteristics have antecedents, which can be observed and understood during the creation phase of a new value proposition.

An ecosystem is a combination of several direct relationships among actors, with several shades of flexibility and control (De Leeuw & al, 2019). Research on alliances has suggested that the choice of alliance scope is among the most important choices considered by partnering firms (Doz & Hamel, 1998). The broader the scope of activities carried out within the alliance, the greater the extent of common benefits that alliance partners derive from their relationships (Khanna & al, 1998). Yet, firms that make the choice to invest in a new ecosystem face a situation where the value proposition developed within the ecosystem is theoretically competing with the value proposition that could have been developed without this ecosystem. Moreover, only partially interconnected systems achieve a trade-off between efficiency and flexibility (Thietart, 2016). Therefore, a new ecosystem might need to be a portfolio of heterogeneous ties among partners. Coming back to Jacobides & al's definition (2018), which stated that organizations within the ecosystem were not hierarchically managed, the risk might be to sacrifice efficiency for flexibility. This definition has furthermore been contradicted, either by other definitions claiming formal mechanisms and rules being used by orchestrators to steer other members, but also during empirical studies that compared several case studies and observed that in all situations, the orchestrators were clearly designing the alignment structure (Adner, 2017; Lingens & al, 2021). They were thus hierarchically leading the complementors. In some cases, however, when a single orchestrator is not able to lead the ecosystem on its own, there can be several orchestrators. When this happens, there is **no hierarchy** among the **orchestrators** but there is one between them and their **complementors** (Lingens & al, 2021). I will thus question in my empirical research in Chapter 4, if some new

ecosystems can combine very different kinds of ties and connections to maximize the **balance between flexibility and efficiency**. Furthermore, to have a dynamic approach on the ties among actors, I also need to show what lies behind the nature of relationships and how this whole complex system is governed.

Every company can find itself in a niche player position if one of its complementors decides to become a substitute. There are some principles of ecosystem defence (Adner, 2021) which are to:

- modify the value architecture by recruiting and redeploying partners,
- identify defensible ground by finding like-minded partners,
- discipline one's ambition to sustain a defensive coalition.

This can be exemplified by the case of TomTom who was trying to outcompete Google from the market of high-definition mapping in the context of autonomous driving (Adner, 2021). TomTom identified emergent allies, customers and partners, who were also willing to avoid the threat represented by Google with its size, influence and investment capabilities. TomTom convinced its customers that it would only use data for its own internal mapping innovations. It would not sell the data to advertisers or data-mining companies. Firms like Apple or Uber chose TomTom rather than Google as the backbone of their mapping features because they saw their own data as a key asset and did not want to share it (Adner, 2021).

Whereas the logic of traditional competitive strategy is rooted in the military mindset of captured ground and direct confrontation, the logic of ecosystem strategy is rooted in the diplomatic mindset of coexistence, collaboration and finding shared strategic interests.

This example shows how hard it can be for a **leading firm evolving in an EAA to start a new EAS** because **potential complementors** might be **reluctant to** commit and **strengthen the leader's position in the overall EAA**. I will study this dimension in Chapter 4.

Table 6 Synthesis of extent knowledge and gaps I will explore - Section 3

Chapter 1 Section 3 Actors and strategies
What is known?
Ecosystem structure: activities, actors, positions, links (Adner, 2017) Keystone firm provides stability, improves the overall health of the ecosystem (Iansiti & Levien, 2004) Ecosystem leader designs the alignement structure (Dattée & al, 2018), main decision maker (Lingens & al, 2021) Firms join ecosystems to sustain their competitive advantage. They have internal and external motivations but the internal need is a "double-edged sword" (Dattée & al, 2018; Adner, 2021) Past relations bring trust, which is necessary to build at least part of a new ecosystem (Davis, 2016). New partners are also to be integrated for efficiency and complementarity (Dyer & al, 2018) Ecosystem blueprint: vision for the future value proposition and structure of governance (Dattée & al, 2018)
Where will I explore which gaps?
Why do actors commit? How are they selected (antecedents to new EAS at EAA level) and attracted (blueprint, MVE)? Chapter 4 Antecedents to be explored: past relations, internal/external momentums: Chapter 4 Is it possible to have a shared leadership? How do the ties among actors unfold (contracts)? Chapter 4 & 5

Table 6 gathers the key gaps I plan to address in the empirical study chapters 4 and 5 with a focus on actors involved in business ecosystems and strategies they might choose. Industrial firms evolving in mature EAA can resort to new EAS. For this purpose, they need to select and attract partners.

Business ecosystems have been studied for thirty years to depict how value propositions evolve and need to be produced following the collaboration of several actors, who need to modify their traditional boundaries among each other, be that with competitors, suppliers or customers. This evolution was started in the 1990's and driven by the personal computer industry and then with platform activities, but because of the surge of the digital age, it may push many other industries

to adopt ecosystem strategies. Traditional industrial actors see that they face strategic renewal challenges because they are coming close to the limit of efficiency improvements. They see other industrial sectors where the value is no longer driven by the products but by the services. This trend might push them to resort to ecosystems to avoid being outrun by new entrants.

Section 4 Mature industries & strategic renewal

Mature industries are defined as industries that have been existing for several decades, during which they experienced stable business within established markets, before being exposed to increasing pressure to transform (Onufrey & Bergek, 2020).

Many firms that have existed for decades evolve in industries that can be characterized of mature, where barriers to entry were raised through time and actors tended to concentrate. Those firms are frequently linked to well-established industries such as the computer industry, the pharmaceutical industry, the automobile industry, or the aerospace industry. Well-established companies however need to innovate, open their boundaries and renew their business models. At some point, they might be obliged to resort to new business ecosystems, to take some risks and commit in uncertain context if they want to have a chance to avoid being commoditized (Adner & Lieberman, 2021). Many initiatives are taken by their research and development or strategy teams, but this is to be done taking into account all the history and past ties that were developed through time with the firm's environment and other actors sharing it, at the ecosystem as affiliation (EAA) level. This is why I focus my research on mature companies who launch new ecosystems, new value propositions or ecosystems as structure (EAS).

Nascent ecosystems were studied with a focus on different strategies adopted, regarding the alternance of competition and collaboration (Hannah & Eisenhardt, 2017). What is not known

is **how incumbents adjust their structure** when they **create a new ecosystem** to **implement** their **strategic renewal. The ecosystem structure** can be defined by **actors, activities, positions and links** (Adner, 2017) around a value proposition. However, when it comes to a mature industry, path dependence (Sydow & al, 2009) could have an influence on the strategic renewal (Agarwal & Helfat, 2009; Schmitt & al, 2018) of incumbent firms. The concept of path dependence acknowledges that history matters and that any firm has a current position from which paths ahead can be chosen (Teece & al, 1997).

4.1 Mature industries

Mature industries characteristics need to be understood in order to identify potential threats and strategic renewal opportunities.

4.1.1 Mature industries characteristics

A mature industry is an industry in which incumbents can coexist with new entrants, where an existing industry structure can be disturbed by technological discontinuities (Cozzolino & Rothaermel, 2017). A mature industry has usually been existing for several years or decades, during which it experienced rather stable business within established markets, before being exposed to increasing pressure to transform (Onufrey & Bergek, 2020).

A mature industry is a sector or market that has reached a stage of stability and saturation in terms of its growth rate, technological advancements, and product innovation. In a mature industry, the pace of growth slows down, market demand becomes relatively stable, and competition among companies tends to focus more on market share, cost efficiency, and incremental improvements rather than radical innovations (Porter, 1991).

Characteristics of a mature industry typically include:

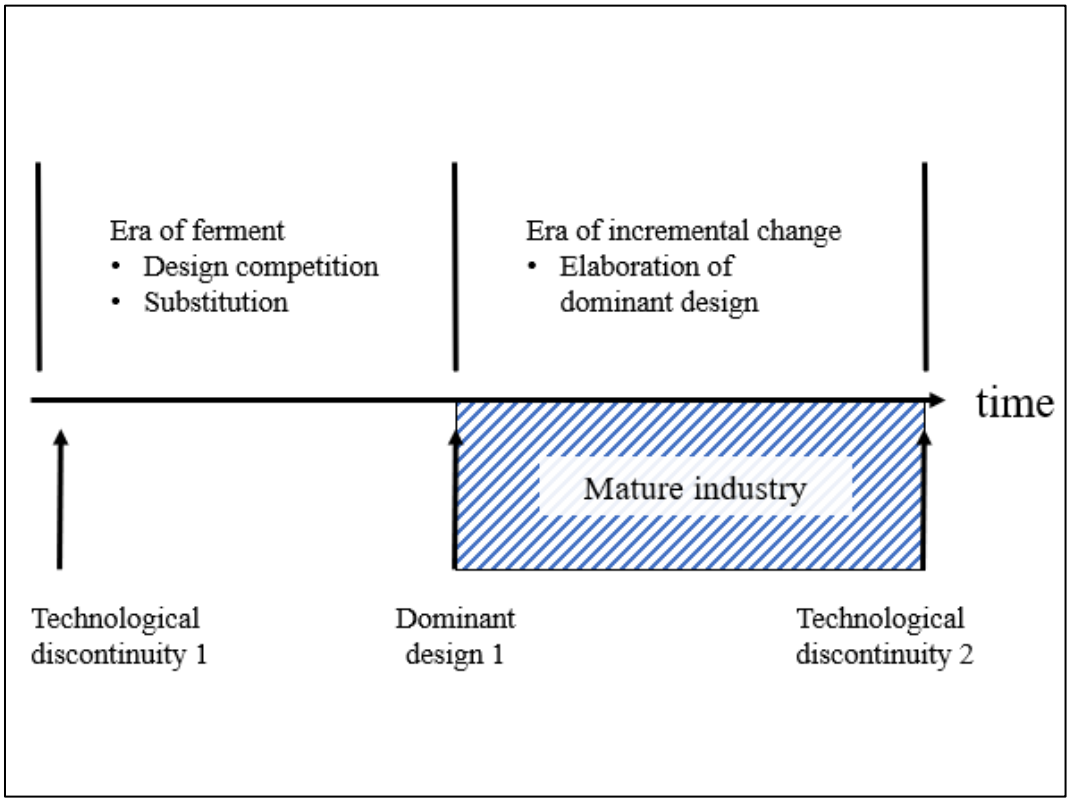
- slow growth (Teece, 1997): the industry experiences slow or even stagnant growth in terms of market size and customer demand.

- stable technology: technological advancements tend to be incremental rather than revolutionary, and the basic technology has become well-established.
- intense competition (Porter, 1991): competition among companies in a mature industry is usually high, leading to pricing pressures and a focus on cost reduction.
- market saturation (Christensen & al, 2018): most potential customers in the market have been reached, and further expansion requires innovative approaches.
- consolidation: Companies often consolidate through mergers and acquisitions to gain competitive advantages and reduce excess capacity (Moatti & al, 2015).
- emphasis on efficiency (Binns & al, 2013): companies shift their focus from product innovation to operational efficiency and cost reduction.
- resource-intensive character as one can observe in iron, steel, aluminium, or paper industries (Onufrey & Bergek, 2020).
- mature customer base: the majority of customers are repeat buyers or loyal customers, and efforts may be directed towards retention rather than acquisition.

As shown in Figure 11, the starting point of the mature industry can be dated to a “dominant design” phase, from which dominant actors start a phase of incremental changes. It supposes that during that phase, actors evolving in the mature industry need to focus on efficiency and undergo a progressive loss in financial margin.

Mature industries face technological change and experience it as an ongoing process which is undergone by all technology-based industries. The pressures on mature industries can either come from inside the industry or from their external environment (Onufrey & Bergek, 2020). These transformational tensions provide opportunities and challenges for the incumbent companies, who might be forced to renew their technology base or be doomed to see their market share shrink.

Figure 11 Technology cycle and mature industry (adapted from Anderson & Tushman, 1990)



4.1.2 Risks in mature industries

Most of the characteristics that I listed in the previous subsection encompass potential risks for firms evolving in mature industries that undergo decreased value creation opportunities. After phases of consolidation, they tend to focus on efficiency and on their core business, while the entry barriers on their markets shrink (Adner & Lieberman, 2021; Cozzolino & Verona, 2022). The competitive strategy literature has broadly documented the fact that settled incumbents often lose their advantage after the introduction of technological discontinuities (Cozzolino & Rothaermel, 2017; Christensen & al, 2018).

A critical factor in evolving markets is the commoditization of industries. This happens when customers are more informed about the products and are able to find substitutes, or when competitors are able to imitate and improve their products in order to provide alternatives to the customer (Reimann & al, 2011). Commoditization can thus have an impact on the competitive position of a firm within its industry. When it starts happening, it is usually a first step towards

industry maturity because it shows that competing dynamics are more focused on winning market share inside the market than looking for new customers.

All firms that have a dominating position in their market have to prepare for the future and think broadly about potential competitors, who might come from adjacent markets. Incumbent firms always need to renew their technology, business models, ecosystem partnerships and marketing capabilities (Gawer & Cusumano, 2014).

Maturity of an industry remains hard to assess because it goes along an assessment of a risk to be replaced, which can usually be assessed when it is too late and that the threat materialized in an alternative. Firms that evolve within mature industries however do not have to be victims of their environment because demand is not an exogenous variable. They can have an impact on the demand side if they manage to create new or complementary markets and this could be done using the creation of new ecosystems (Nguyen & al, 2022).

4.1.3 Potential strategic development in mature industries

In very mature industries, little innovation is often taking place and when changes occur, it is at a slow pace. In this situation, a small number of highly integrated firms can have a perfect knowledge and well-established processes, which helps them be much more effective than other firms that would opt for a more open ecosystem structure. Firms however often resort to mixed strategies, dominating one domain, while acting as keystones or niche players in some other domains (Iansiti & Levien, 2004). Ecosystems can be an alternative way for firms to step into new domains of business and create significant innovations without underinvesting their core business activities and without being forced to conduct distant search (Lingens & al, 2021).

Ecosystems could thus be a solution for settled firms to both focus attention on new fields of knowledge, thanks to limited but sufficient investments in a dedicated ecosystem structure,

involving several partners. We do not know yet how firms evolving in mature industries actually **separate their investments** with the focus on the one hand on **core business** and on the other hand on **new capabilities development.**

They can always select growth opportunities based on the development of new resources and capabilities that will be built to complement rather than substitute those already existing (Nguyen & al, 2022). This explicitly ties industry transformation through ecosystem development to strategic renewal. All firms are subjected to development phases and after a phase of formation, they can reach a comfort zone of dominant design. This phase also marks the beginning of a maturity phase, during which firms need to keep innovating because they face pressures from inside and from their external environment (Onufrey & Bergek, 2020).

Little is known so far on how they **develop dynamic capabilities** (see 2.2) and when they decide to resort to **new business ecosystems**. It is also to be explored **how actors evolving in mature industries** find the **good split of resources allocation** between their **core business** and **new activities development**, which can be resource consuming. I will study those aspects in my empirical chapters (4 & 5).

4.2 Strategic renewal

Over the last fifty years, the question of how firms sustain growth to secure their competitive advantage has been at the centre of strategic management research (Barney, 1991). This advantage is based on assets such as resources, processes or capacities (Teece & al, 1997; Eisenhardt & Martin, 2000). These capabilities are needed to allow a resource base renewal and are driven by an understanding of the surrounding environment of the firm (Helfat & Winter, 2011).

Strategic renewal refers to the process that allows organizations to alter their path dependence (Sydow & al, 2009) by transforming their strategic intent and capabilities (Schmitt & al, 2018). It is required in the case of mature industry, when actors face the threat of technological discontinuity (Cozzolino & Rothaermel, 2017).

The literature on strategic renewal defines it as

> *"the process, content, and outcome of refreshment or replacement of attributes of an organization that have the potential to substantially affect its long-term prospects" (Agarwal & Helfat, 2009: 282).*

A firm has always a range of possible futures that depend on its current position and the path it has already travelled because learning is often a process of trail, feedback and evaluation (Teece & al, 1997). It can be very hard for established or mature companies to react to internal and external transformation pressures by embracing new technologies and business opportunities because industry incumbents can struggle in a state of lock-in to their resources, capabilities, value networks or business models (Onufrey & Bergek, 2020).

Industrial dynamics has been a major field of inquiry in industrial economics and encompasses two complementary domains. The first one focuses on the entry, growth and decline of companies and how it relates to market structure dynamics. The second area has a broader scope and focuses on industry evolution, which is possible thanks to the evolution of knowledge and capabilities of the firms, as well as the impact of other actors who may have a role (Malerba, 2007). In the past, it was clearly stated that companies had to defeat their competitors in order to perform. The old industrial economy was driven by economies of scale, whereas the new information economy is driven by the economy of networks (Shapiro and Varian, 1998). Gawer and Cusumano (2002) extended this perspective by highlighting the critical role played by industry "platforms" such as Cisco, Intel and Microsoft, and argued for the importance of distributed innovation. These actors have become global giants, basing their development on

ecosystem approaches and going beyond the boundaries of their industries, thus putting a threat on traditional sectors and mature industries. It shows that the technological discontinuity can come from outside the industry or ecosystem as affiliation. I discussed in section 3.2 how actors could be motivated to join an ecosystem and make the necessary investments because they feared an external threat. Big actors managed to adopt an ecosystem approach to share innovation investments and develop to the extent that they represent threats for many traditional industries.

Several frameworks explain how companies can achieve and sustain a competitive advantage and one of the most famous is the Five Forces Approach (Porter, 1979), which focuses on industry structure and the actions that can be implemented by a company to defeat competitive forces and threats. This model can be adopted at the ecosystem level, be that from a focal firm point of view, or from the point of view of other stakeholders. As long as business ecosystems have started to spread among most industries, strategic renewal based on the use of ecosystems might become an imperative for mature EAA leaders.

Coming back to the Five Forces at the ecosystem level, **new entrants** could come **from outside the EAA** if other members of the EAA start new EAS; suppliers could increase their bargaining power while taking part into new EAS and develop new capabilities or find new partners; current members of the EAA could themselves become more competitive if they are part of other new EAS; new substitutes could appear and degrade the position of a focal firm. Eventually, **customers** might become more demanding, be that in B2C or B2B contexts, because the ecosystem approach and the development of new technologies allow them to **increase their expectations** towards products or services they purchase.

I will explore in my empirical study, in Chapter 4 & Chapter 5, **how firms occupying a leading position in a mature ecosystem as affiliation address those opportunities and potential threats**.

As firms and industries mature, attention tends to focus on efficiency and execution, which can create blind spots to outside-the-box threats and opportunities (Adner, 2021). A formal model of industry life cycle was created by Klepper (1996) and shows how an industry appears with a radical product innovation. During the first steps of this new industry, successful new actors introduce products and grow. Those entrants aim at reaching a certain size to guarantee their sustainability. Once this challenge is achieved, they engage in process research and development because they then need to start reducing their costs. Those economies increase the competition among actors and some disappear. There are also less entries over time because incumbents progressively raise barriers to entry. Product diversity decreases while industrial concentration is increasingly stronger. This model was developed for the car industry, but it is applicable to other industries like television or tyres (Klepper 1996, Malerba 2007). However, all industries come to a point where they are about to be commoditized. For almost a century, executives running firms in the auto industry needed to excel at management. Now, their environment has welcomed challenges and opportunities that cross multiple boundaries, from autonomy, to electric propulsion, to connectivity or also infrastructure reconfigurations. All of this seems to indicate that a new mindset, more focused on outside the company is required (Adner, 2021).

Research on industry transformations besides stresses that new entries play an important role, as well as firms outside the industry core, to allow and accelerate renewal processes at the level of the industry (Nguyen & al, 2022).

Market saturation and technology shifts are both important triggers of renewal activities (Schmitt & al, 2018). Firms need to open their perspective on opportunities and threats, on rivals and partners, on the construction and timing of value creation, otherwise they might devote too many resources to a wrong target. I already tackled the case of Kodak (section 2.4) that went bankrupt in 2012 because the company underwent an ecosystem disruption. In 2005, Kodak ranked number one in US digital camera sales and number three globally. In 2010, Kodak had fought its way to number four in the inkjet printer market and they managed to shift from an analogue printing profit base to a digital printing profit base. Yet Kodak collapsed, following the rise of digital viewing and sharing. They were not defeated by other printer or camera makers, but by the rise of screens (Adner, 2021).

This example of failure can however show a path for **strategic renewal for incumbent firms,** who might be in the position to **create new value** and **bottlenecks** (Jacobides & al, 2016; Hannah & Eisenhardt, 2017), after **developing new capabilities** thanks to the **creation of new EAS.**

Ecosystems, as well as strategic alliances may be an attractive alternative for accessing complementary assets in comparison to developing those assets within the firm (Barney & al, 2001). This is at least a way to avoid over-investing in a wrong direction.

Coming back to old theory of competitiveness, a firm's competitive advantage depends on its ability to create more value than its rivals (Porter, 1985). Greater value creation, in turn, depends on the firm's ability to innovate successfully and innovations increasingly depend on changes happening in the firm's environment. This perspective is outdated and competition as well as value creation also take place at the ecosystem level, which is not erasing the focus at the firm level but rather adding complexity because this is a complementary focus. Some suppliers can be confronted with significant innovation challenges to deliver components (Adner & Kapoor,

2010), as well as complementors and buyers. Even if a firm is doing well at its own level, it can be threatened in its performance if its partners do not perform enough.

It is increasingly acknowledged that opening the firm boundaries can foster strategic renewal (Laplume & Dass, 2015). Strategic renewal research can help understand how established firms break their path dependence and transform themselves to ensure their long-term prosperity (Schmitt & al, 2018).

Mature industries tend to focus their attention on efficiency and execution because they have become successful following this pathway. They managed to outrun competitors, to structure their market and reduce their costs. They thrived because they managed to develop valuable, rare, inimitable and non-substitutable resources and raised barriers to sustain their positions.

Despite this comfortable position, industrial dominant players need to keep investing in initiatives that shape their industry architecture, so that they can retain control over their customers and responsibility for their products (Jacobides & MacDuffie, 2013).

This dominant position however implies a strong focus on the inside of the firm and this carries new challenges of strategic renewal for longstanding actors. Strategic renewal is only possible if firms keep on understanding their environment and develop resources and dynamic capabilities to anticipate technology shifts. Traditional actors also need to renew their model regarding relationships with the other actors evolving in the same environment. They need to open their boundaries, collaborate more with other actors and to get involved in ecosystems. An ecosystem approach can help avoiding reaching a point of decline but my will to take at one and the same time the EAA and EAS perspectives demands to explore further how focal firms manage their interdependencies at both levels.

As long as **coevolution is ongoing at the EAA level**, if a firm decides to **launch a new EAS** to foster its **strategic renewal**, it should also have **consequences on its interdependencies with historical partners at the EAA level**. It remains to be shown to what extent **leading**

firms in new ecosystems do take this parameter into account and **invest to help their partners to innovate**.

Strategic renewal emerges from recursive interactions between a firm's strategy and its environment (Volberda & Lewin, 2003). All firms try to focus on their environment, to have some strategic watch activities but this is an ever-changing challenge to define what should be done in terms of interactions with the environment to always keep a step ahead, or even keep performing. The dynamic capabilities framework gives an insightful lens through which one can observe and understand strategic change in organizations (Schilke & al, 2018).

4.3 Dynamic capabilities as a tool for strategic renewal

Dynamic capabilities describe a firm's capacity to

> *"sense and shape opportunities and threats, to seize opportunities and to maintain competitiveness through enhancing, combining, protecting, and when necessary, reconfiguring the business enterprise's intangible and tangible assets" (Teece, 2007: 1319).*

Those dynamic capabilities are innovation based and can be opposed to operational capabilities that are much more ordinary (Helfat & Winter, 2011). Using ordinary capabilities, the firm can perform operational tasks such as production, sales, accounting, logistics or human resources management. On the one hand, those capabilities can rather easily be bought or outsourced. On the other hand, dynamic capabilities must be built because they are much harder to duplicate (Teece 2014; Warner & Wäger, 2019).

Dynamic capabilities and the transformation of the firm's resource base can be seen as the main drivers for strategic renewal (Teece, 2007; Agarwal & Helfat, 2009). They hence appear to be a perfect tool to allow strategic renewal in a context where there is no radical shift in the environment.

It remains to be explored how **developing a new ecosystem as structure** allows the **development of new dynamic capabilities** and if it is done at the **firm level** or in a **coevolution** and **cocreation** approach. I will mostly focus on those aspects in the empirical Chapter 5, with a **thorough case study of a developing new EAS**. I will try to advance the research on these aspects by **focusing on how innovation is produced** and **how the new value is created**.

Firms strive for two alternative strategic renewal outcomes: coalignment and cocreation. The coalignment approach implies the renewal of fit between a firm and its environment. It thus has theoretical connections with population ecology (Hannan & Freeman, 1984), which considers that significant evolutions to an organization's core competencies can be compared to creating a new organization. The cocreation approach rather suggests that strategic renewal is a way for companies to constantly renew their agility, while creating new opportunities and controlling its role among other actors evolving in the same environment or ecosystem as affiliation (Agarwal & Helfat, 2009).

4.4 Using ecosystems to transform industries?

Past research has extensively focused on battles between new entrants and incumbents, which is an important question for strategy research. Traditional organizations can try to use the structure and capabilities that made their success to develop new ecosystems. They can for example adopt a platform business model but this poses new challenges because it requires to look for complementors and also to change the approach towards customers (Hannah & Eisenhardt, 2017; Kretschmer & al, 2020).

Examples show that under certain industry conditions, a new entrant can be advantaged to launch a new ecosystem in comparison to an incumbent firm. Twenty years ago, Warner Music

teamed up with other music companies such as BMG and EMI, while Sony Entertainment partnered with Universal. They were both aiming at creating an ecosystem for digital music subscription portal. Both projects failed because potential complementors saw the project as a threat and preferred to join the Apple iTunes project (Kretschmer & al, 2020). It shows that the ecosystem as affiliation has a strong impact on the possibility to create new EAS. In that specific case, the actors in the ecosystem feared that a leading company could turn to a dominator and would hurt their own health. This turned to become an opportunity for an external actor. It tends to show that the ecosystem approach is necessary to transform longstanding EAA and that occupying a leading position in the EAA can turn to be a burden when the firm wants to start a new EAS with other members inside the EAA.

Table 7 Synthesis of extent knowledge and gaps I will explore - Section 4

Chapter 1 Section 4 Mature industries & strategic renewal
What is known?
Mature industry: stability (growth, market, customers) and saturation (intense competition), consolidation, emphasis on efficiency, pressure to transform (Cozzolino & Rothaermel, 2017; Onufrey & Bergek, 2020) Ecosystems to create innovation without underinvesting core business (Lingens & al, 2021) Strategic renewal = transforming strategic intent and capabilities to avoid path dependence (Sydow & al, 2009) Dynamic capabilities are drivers allowing strategic renewal (Teece, 2007; Agarwal & Helfat, 2009)
Where will I explore which gaps?
How to develop dynamic capabilities for strategic renewal? At firm or EAS level (coevolution)? Chapter 5 How to separate core business and new EAS resources alocation? Chapter 5

Table 7 gathers the key concepts from the literature on mature industries, dynamic capabilities and strategic renewal for my study of new EAS in the context of mature EAA, and the gaps I will explore.

I showed that several antecedents need to be taken into account and to be explored further to launch a new ecosystem as structure (EAS) in the context of a mature industry, where actors evolve in an ecosystem as affiliation (EAA). Those main antecedents are competition, complementarities, interdependencies (see section 2.4), but also the balance to find between internal and external momentums (see section 3.2), and the importance of past relations (see section 3.4). All actors occupy defined positions at the EAA level and have a history of relationships that can help build the new EAS thanks to trust and experience but can also threaten the new creation if the firm willing to start the new EAS is not fully trusted by the others. Firms that evolve in mature industries can rely on ecosystem approaches to develop new value propositions, develop dynamic capabilities and foster strategic renewal.

Section 5 Synthesis of identified gaps and research question

Business ecosystems are interdependent networks of self-interested actors jointly creating value (Bogers & al, 2019), who go through different phases of development, evolving from nascent to mature (Foss & al, 2022). This definition gathers two perspectives on business ecosystems that allow to study them further, either with a focus on the actors (ecosystem as affiliation or EAA) or with a focus on the structure and value creation (ecosystem as structure or EAS). The existing literature on ecosystems shows that mature industries display a landscape of actors that evolve in EAA, who might need to resort to the creation of new EAS to foster their strategic renewal and avoid being commoditized.

This context of mature industries has hardly been studied with the lens of business ecosystems and to my knowledge, no studies have so far considered the EAA and EAS perspectives jointly. This is why my research question is the following: how can industrial firms evolving in mature business ecosystems create new ecosystems as structure to foster strategic renewal?

The creation of a new EAS in this context is subjected to path dependence and to the existing context of the EAA. In the previous sections, I identified that several antecedents could happen at the EAA level and trigger or influence the creation of a new EAS. An EAS is characterized by an ecosystem structure that gathers actors, activities, links and positions (Adner, 2017). This structure is developed for the emergence of a value proposition, where value will be created by several actors and shared.

Figure 12 gathers the key antecedents that need to be taken into account from the EAA level to create a new EAS and key gaps I will aim at answering in my empirical chapters.

Figure 12 Key characteristics at the EAA level influencing EAS creation

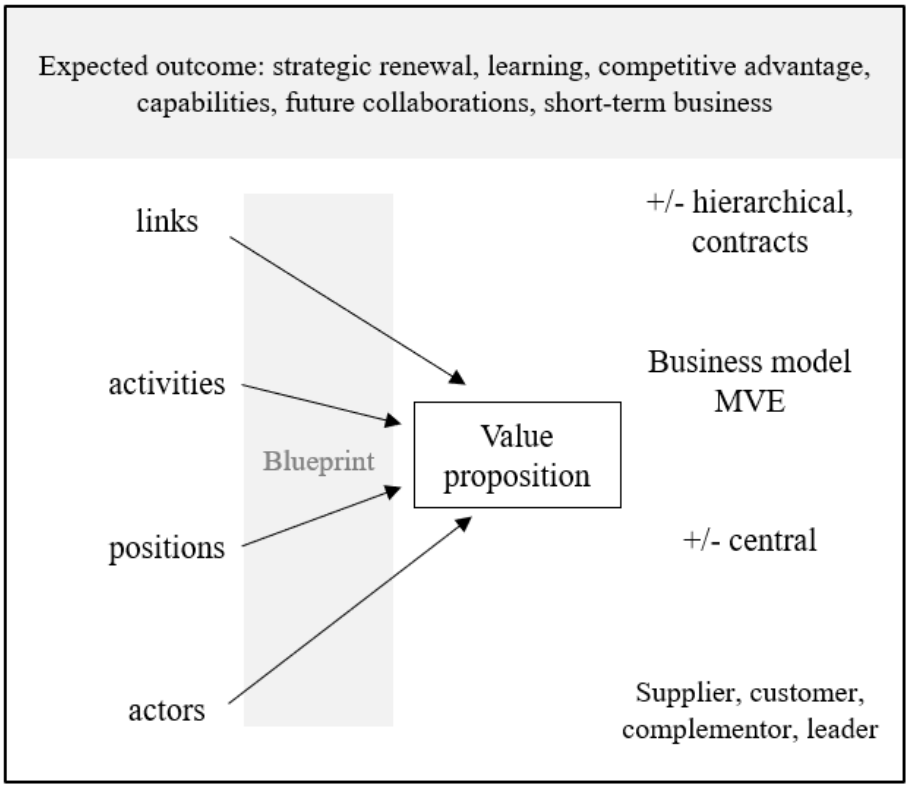
Antecedents	
Competition	Competitors evolve in the same EAA. Can they be partners in a new EAS? Can an EAS bring new competitors inside the EAA? Does competition at the EAA level has an impact on the choice of partners at the EAS level?
Complementarities	Source of value creation. If the EAA becomes mature, it might be required to attract new partners and complementors, who can bring new complementarities. Are the partners in the EAS chosen for those complementarities?
Interdependencies	Existing at EAA level and evolving with new EAS. Mature EAA means existing interdependencies that might have an impact on the new EAS design.
Opportunities	At the EAA level and external environment: how are new EAS projects chosen?
Internal / external momentum	Does a new EAS need to answer both an internal and external need? This dimension is linked to the motivations to join a new EAS.
Past relations	Starting an EAS in the context of a mature EAA is a complex set-up that might require to include former partners in the dynamic, to have a basis of trust. This needs to be explored. The perspective of the potential complementor also needs to be considered and can have an impact on their willingness to commit.

Actors evolving in a common EAA have historical ties and past relations in sometimes very different roles of partner, competitor, complementor, supplier or customer towards the other actors evolving in the same ecosystem. The maturity of their industry goes along with a need for strategic renewal to avoid being commoditized by external actors or by actors already inside

the ecosystems who would ally with external actors. Incumbent actors can renew their position and sustain their competitive advantage if they resort to ecosystems as structure, or new value proposition, gathering several actors that either come from the ecosystem as affiliation or from outside.

Figure 13 synthesizes the literature on what constitutes a new ecosystem as structure (EAS), which is dedicated to the emergence of a new value proposition.

Figure 13 Key characteristics of a new EAS



This figure gathers the four key characteristics defining an ecosystem structure that allow the emergence of a value proposition. These can be observed when the ecosystem is in development phase. Before being visible and leading to value creation, it needs to be built by one or several leaders.

All actors eventually involved have to be attracted because an ecosystem journey is uncertain and demands investment. Figure 13 collects the key concepts discussed in the existing literature and lead to several questions that I will explore in my empirical work. In both empirical chapters I will consider the link between EAA and EAS levels. In Chapter 4 the focus will be on understanding which antecedents at the EAA level trigger and influence the development of the EAS and to rank those antecedents. In Chapter 5 the focus will starting from the EAS level with a strong attention on value creation and dynamic capabilities to understand the impact it will have on the competitive dynamics and evolution of the EAA.

Links among actors can be more or less hierarchical because an ecosystem is not a standard supply chain. This has consequences on trust among partners, complementarities and interdependencies. A key question I will explore is how the management of the ecosystem unfolds if it is not fully hierarchical.

Activities in a context of innovation encompass several key dimensions for my research, to wonder what the blueprint (Dattée & al, 2018) and MVE (Adner, 2021) are, how they are connected to past activities. This characteristic is strongly linked to the actors who make the activities. In Chapter 4, I will focus on how they are chosen and wonder why they commit or not, what are their motivations and expectations.

The “positions” of actors inside the EAS can also be studied with a focus on the past links at EAA level and with a focus on competitive dynamics or evolution of the position at the EAA level. I will mostly focus on focal firms who occupy a strong position inside a mature EAA and seek strategic renewal. If they fear to be commoditized, their new EAS effort could help them renew their strategic positioning at the EAA. This might be consistent with the coopetition view and the keystone strategy, if they manage to increase the “size of the cake to share” (Brandenburger & Nalebuff, 1996) and to help the other actors inside the EAA to renew their capabilities portfolio.

The literature on competitive dynamics could address the question of ecosystem creation but this is a complicated task, on a methodological ground, to follow the emergence of an unknown entity, when it is not possible to know ex ante who the actors involved in the emergence process will be (Gawer & Cusumano, 2014). This is why empirical studies should start by an exploration phase at the industry level, to check whether new collaborations are implemented with more than one partner and the will to issue a value proposition.

Scholars agree that the ecosystem literature lacks consensus on the empirical scope and key theoretical features to understand how ecosystems operate. Research on ecosystems suffers from conceptual proliferation (Shipilov & Gawer, 2020; Cobben & al, 2022) and several studies stress the need for qualitative studies testing to what extent the ecosystem concept can apply in specific contexts (Gulati & al, 2012; Jacobides & al, 2018).

Most of the literature focuses on the first steps of an ecosystem, when the structure is easier to observe (Adner & Kapoor, 2016) but the creation phase of ecosystems, which happens before the first steps are visible, remains largely unexplored (Dattée & al, 2018). As long as most businesses must deal with a longstanding and evolving environment, they adopt strategies to further sustain their competitive advantage. Prior research conceptualizes ecosystem strategies as static and focuses on cooperation or competition (Hannah & Eisenhardt, 2017). Studies have called for an investigation of the antecedents of ecosystems and a focus on *why* and *when* players align, when most of the existing research describes the *what* and *how* (Jacobides & al, 2018). To address those gaps, I consider ecosystems in their competitive context (Jacobides & al, 2018) and adopt a dynamic approach, questioning current decisions with regards to historical ties, path dependence (Teece & al, 1997; Sydow & al, 2009) and strategic choices. I also intend to overcome a major blindspot in IOR literature of single-party focus (Lumineau & Oliveira, 2018) and observe the ecosystem in its creation phase, when the structure is being designed.

Four basic elements characterize an ecosystem structure: activities, actors, positions and links (Adner, 2017). The intended outcome of such structures is to generate value. Creating new ecosystems as structure could be a solution for mature industries that face strategic renewal challenges (Agarwal & Helfat, 2009; Schmitt & al, 2018).

Value creation and value capture considerations have been extensively studied but the management challenges and control mechanisms multilateral collaborations face did not receive comparable attention (Wareham & al, 2014; Doz, 2019). Eventually, my focus is on a business-to-business market (B2B), when a large focus of the literature rests on customer-facing firms in existing business-to-consumer (B2C) markets (Dattée & al, 2018).

The question of how new ecosystems emerge in the context of mature industries is still not very well understood. As I showed, the distinction between ecosystem as affiliation (EAA) and ecosystem as structure (EAS) was only made in 2017, while most of the historical literature focused on the EAA level, which limits the ecosystem's boundaries definition. It should be valuable to start looking for emerging new EAS and observe what antecedents motivate this creation. Several antecedents based at the EAA level seem to influence the unfolding of the new EAS and this needs to be dug further, to check and assess their influence. There could be an evolution from internal platforms to external platforms (Gawer & Cusumano, 2014). An internal platform unfolds at an EAS level but if it evolves at an external level, it then moves to the EAA level. Those interactions and cross influences between ecosystem as affiliation and ecosystem as structure levels need to be explored further.

There is also a need to follow how new ecosystems develop after their birth and to see how an ecosystem governance is structured and to what extent it can be controlled. The ecosystem should not be fully hierarchically managed (Jacobides & al, 2018) but without governance and leadership, a new project can fast come to an end.

The orchestration process of ecosystems is a dynamic process that partly relies on experimentation and platform development fails more often than it succeeds (Isckia & al, 2020). This is why there is a need to study several new ecosystems in their early stages, to compare projects that succeed with some that fail and to explore those which thrive in the long run to see how and why they evolve through time.

One can focus on new innovation projects and start wondering which collaboration projects are started with which actors, with a focus on interdependencies and complementarities (Kapoor, 2018). This would help understand which antecedents at the EAA level are required for a new ecosystem as structure to emerge. Innovation and collaboration are the starting points, but a business ecosystem also needs to generate value and to allow a sharing of this new value.

Ecosystem governance should actually pay attention to allowing some sharing of the value created and commit to enable appealing business models for all members. Complementors and partners will not sustain their incentives to invest and produce complementary innovations unless they do see a return on investment (Gawer & Cusumano, 2014). This is why there is a need to focus on the first two stages of ecosystem development: birth and expansion (Moore, 1996).

It also leads to asking what activities firms undertake themselves and what activities are carried out by other firms in the ecosystem (Kapoor, 2018). This is the natural link between antecedents, evolution of the ecosystem and ultimately strategic renewal. Partners in a new ecosystem have to be chosen on criteria and they have new roles and activities in the new structure. Those activities and interactions are allowed by investments, that lead to a value proposition and is only possible because new capabilities are co-developed.

Actors in the ecosystem also face the problem of how to design their internal organizations so as to manage the interdependencies with other actors (Kapoor, 2018). Their actions have a direct

link with dynamic capabilities and future research should explore what is done internally, what is outsourced to partners and how that evolves through time.

If an ecosystem structure is characterized by four dimensions being the actors involved, the activities they undertake, the positions they occupy and the links between each other, there is still a lack of understanding of how these dimensions materialize and in which order (Adner, 2017).

The whole black box of new EAS has to be opened, with a focus on the blueprint that is designed by the ecosystem leader, which will help understand why and when players align (Jacobides & al, 2018) and if the leader applies a Minimum Viable Ecosystem approach (Adner, 2021). There is also a substantial lack of research on control mechanisms in business ecosystems (Wareham & al, 2014). This point can be studied with a complementary focus on the contractual part of the interorganisational relationships among ecosystem actors, that are supposed to be at least partially non-hierarchically managed (Jacobides & al, 2018).

We know that there is a need to include competition better in the landscape of ecosystem research because research streams on collaboration and competition have mostly evolved independently (Hoffman & al, 2018). It appears in the coopetition literature, and it was the basis of analysis by Moore with the death of competition, yet, it might be a key driver for ecosystem initiatives. This is part of the antecedents to dig at the EAA level, to better understand the creation of new EAS.

Future longitudinal research focusing on one or two companies with an ecosystem perspective could help understand the transformation processes and strategic renewal of mature industries, especially if the studies take into account the development of strategic choices and the dynamic interrelations between business and innovation strategies over time. It could bring insight on

the need to share resource interdependencies to realize new value propositions and renew business models (Onufrey & Bergek, 2021).

One of the key challenges for firms that evolve in ecosystems as affiliation is that they know they need to renew their models and that they could resort to EAS to do so. There is however a lack of understanding of how to conciliate the traditional business approach and the new approach, especially when new entrants can occupy a more favourable position than incumbents, who can be seen as threats by the other firms that belong to the same EAA and could be potential complementors in the new ecosystem (Kretschmer & al, 2020).

Mature industries are characterized by stable business and decreasing profits, which does not leave much margin to invest on new projects and avoid declining. Ecosystems were shown to be efficient structures to step in new domains and create significant innovation without under investigating core business (Lingens & al, 2021). This articulation between focus on the core business and new developments however needs to be searched further to the extent that we do not know if the required investments are totally separate or if some part of the investment on one side can be reused on the other side.

The majority of case studies on renewal processes explore cases in situation of overall declining performances of firms, due to environmental changes (Nguyen & al, 2022). As research also shows that new entrants and firms that are outside the core industry can play a key role to catalyse strategic renewal processes (Jacobides & al, 2016), focusing on firms that rather perform, adopt an ecosystem approach to renew their processes should bring new conceptual insights.

In Chapter 2, I will develop my research methods, research choices, and describe the main steps of my research journey.

Chapter 2 Research methods

My literature review exposes at one and the same time that research on business ecosystems suffers from conceptual proliferation (Shipilov & Gawer, 2020; Cobben & al, 2022) and a need for further qualitative studies exploring to what extent the ecosystem concept can apply in specific contexts (Gulati & al, 2012; Jacobides & al, 2018). I chose the specific context of mature ecosystems as affiliation with a will to focus on relationships among actors, who try to renew their strategic positioning while co-evolving capabilities. In this second chapter, I will explain my choice for qualitative research and how I plan to generate theory with an abductive approach. I chose to collect three kinds of empirical material with interview, archival data and observation during four years of field study. I will further explain how I selected my cases and sampling approach, with a first phase of exploration and a second phase of confirmation. Then I will delve into how I collected and analysed data, following a case study approach, combined with grounded theory and process research.

Section 1 My choice for qualitative research and methods

I consider my epistemological perspective as interpretive or constructivist, which can be used interchangeably (Merriam & Tisdell, 2016), because I assume that reality is socially constructed. I do not intend to make truth claims about what I find but rather to provide some deep insight into phenomena that could not have been obtained without engaging the people who experienced it.

Unstructured phenomena are better documented with a qualitative examination, whereas research on an established phenomenon is more likely to demand the calibration and

generalizability that come from deductive quantitative research (Bluhm & al, 2011). Even if "business ecosystems" is a concept that can be dated back to more than thirty years, there is a relative newness to this process adoption because it used to be mostly applicable to industry giants and now tends to become more common, as a strategic tool for big companies that evolve in mature industries.

1.1 The goals of qualitative research

I opted for a qualitative approach because I am interested in how people contribute to firm level or ecosystem level developments, how they construct their worlds and to what meaning they attribute to their experiences. My key concern has been to understand the phenomenon of business ecosystem development from the participant's perspectives (Merriam & Tisdell, 2016). Qualitative research has a purpose that goes along the state of literature on a given topic.

Qualitative research is essential for uncovering deep processes in organizations and understanding how those processes unfold over time. Heterogeneity is what makes narrative analysis and qualitative research a powerful and helpful framework. It empowers researchers to customize their analysis in ways suited to their research question and data (Pratt & al, 2020). This is also why I chose a field of study that I know well, thanks to my professional environment[2], which allowed me to access informants that would otherwise have been difficult to identify and get in touch with. I am the primary instrument of data collection and analysis and that can also decrease the quality of my research if I had not been aware of my biases, but I tried to overcome and monitor these potential flaws and subjectivities (Merriam & Tisdell,

[2] Since 2017 I have been the administrator of ECATA, the European Consortium for Advanced Training in Aerospace. I am in daily contact with top executives of the European aerospace industry from companies like Airbus, BAE Systems, Dassault, Leonardo, Liebherr, MTU, SAAB, Safran.

2016). All researchers have biases that they can overcome with rigor but writing good qualitative research does not only rely on actions check lists to follow.

Doing good qualitative research requires having several skills, some of which are tied to the fieldwork to achieve: asking and interpreting relevant questions, listening, being adaptive and flexible, being knowingly unbiased, and having a firm grasp of the issues being studied (Pettigrew, 1990). I also chose this qualitative approach because it goes along the qualities I have developed in the past. I have been working for fifteen years in the education business and have always had part of my job dedicated to understanding whom I have in front of me and what solutions I can provide to help them develop their own skills.

1.2 My approach to theory building

The purpose of qualitative research is to generate theory, which can be defined as 'the answer to queries of why'. Theory is about the connections among phenomena, a story about why acts, events, structure, and thoughts occur. Theory emphasizes the nature of causal relationships, identifying what comes first as well as the timing of such events. Strong theory delves into underlying processes to understand the systematic reasons for a particular occurrence or non-occurrence' (Sutton and Staw, 2005). This is why I mostly focused my interviews on understanding what happened, before moving to interpretations from my informants' points of view. I aimed at having enough complementary opinions to reach data saturation.

Theory provides an understanding of the causal relations among a set of focal phenomena. It is a statement of concepts and their interrelationships that shows how and why a phenomenon occurs (Gioia & Pitre, 1990; Gehman & al, 2018). It is of no use unless it initially surprises, or changes perspectives and brings a new dimension to a phenomenon (Mintzberg, 2005). Theory must be useful or somehow have utility in its application, either for other organizational

researchers or for practicing managers (Corley & Gioia, 2011). It was my initial ambition to generate some useful observations and synthesis, so that they may be more aware of their working environment and more skilled to contribute to the ongoing strategic renewal of their business.

Building theory also means going beyond simple correlations (Gehman & al, 2018). As a researcher I needed to come up with an underlying reason explaining the connection between constructs. I tried to connect collaboration and competition, dynamic capabilities and strategic renewal, ecosystem as affiliation and ecosystem as structure, among others. I chose constructs and underlying theories that I thought to be potentially interesting for concrete strategic choices, even if I was fully aware that most of the concepts are not directly applicable to the real life. Theory can have a different meaning from the point of view of a practitioner and from the point of view of a scientist: practitioners make decisions based on theories that were developed following their education and experience, but seldom formally tested. Scientists, however, have to take a more systematic and rigorous approach to develop and then test theory (Wright, 2017). It was a challenging element in my research on ecosystems, which has become a buzz word over the last three decades and that one can easily read about in the news or vulgarised scientific literature. This broad interest around the ecosystem concept provided me with a fruitful ground for reality-based theory building (Siggelkow, 2007).

1.3 Using abduction to build theory

Theory building involves three processes: induction (data-driven generalization), deduction (theory-driven hypothesis testing), and inspiration, which must be driven by creativity and insight (Langley, 1999).

Those processes can also be seen as different stages and forms of reasoning. Induction would be the first step and it relies on observations leading to conclusions. Then comes a second step

with deduction, which consists of predicting what consequences can be expected in a particular setting. The third step and form of reasoning can then come with abduction that provides the foundation for a complete theoretical progress. Abduction allows theoretical refinement, either following the failure of new observations, or thanks to a better understanding of the situation through the elaboration of new complementary concepts (Wright, 2017). I first focused on doing inductive research to see if I could identify insightful cases dealing with business ecosystems in the context of mature industries. Once it was achieved, I had the feeling that I missed part of the theoretical impact because my literature review lacked some theoretical background. This is why I decided to lead a second round of literature review before going back on the field for a second round of interviews (Chapter 5). Consequently, I started my doctoral journey with an inductive approach strongly anchored into my professional background and current position to finish with an abductive approach that allowed me to draw connection between the literature and my empirical observations.

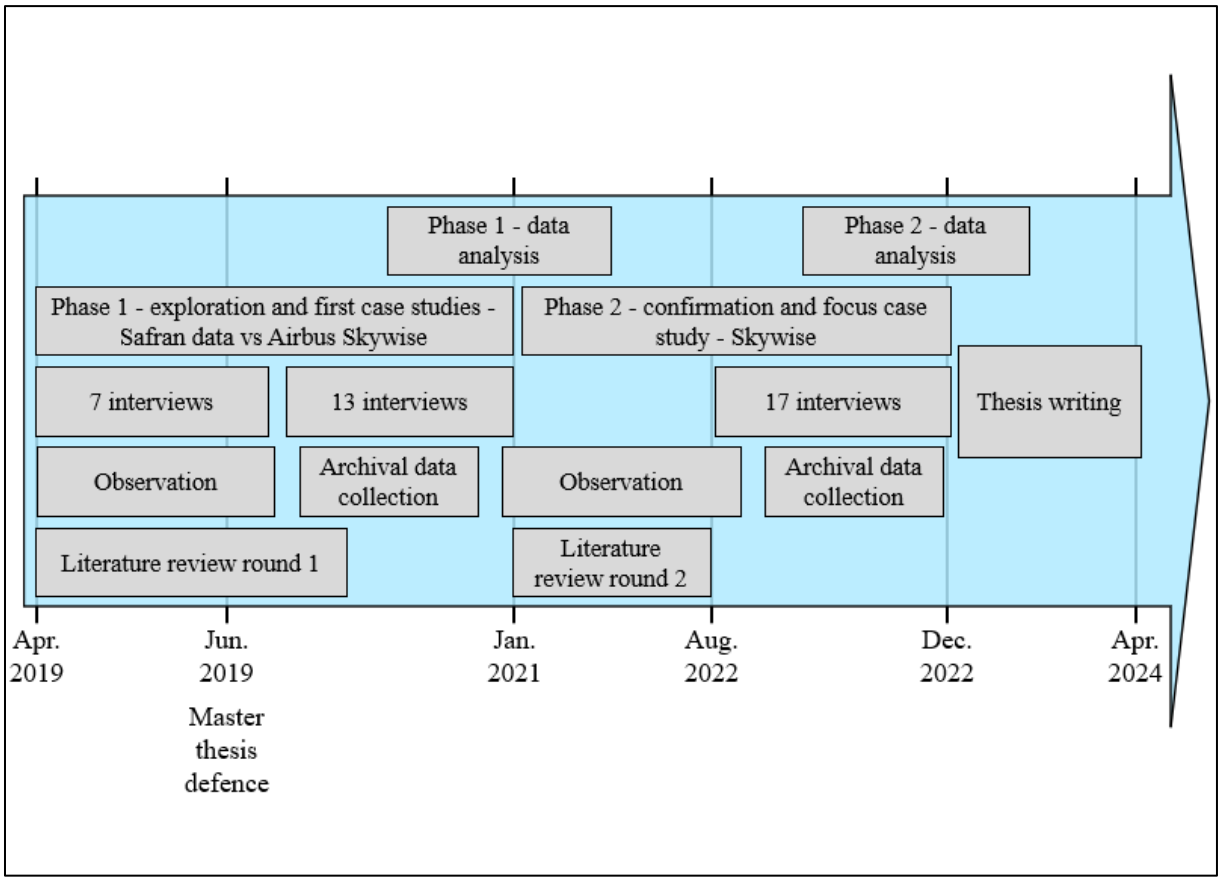
An abductive approach is fully compatible with a qualitative approach based on grounded theory. The topic of literature review is indeed controversial in grounded theory research. Glaser & Strauss (1967) suggest that grounded theory researchers should delay literature review as much as possible so that they may stay neutral toward the existing research and theories, whereas Charmaz (2006) or Corbin & Strauss (1990) recommend building strong theoretical basis thanks to an early literature review. I decided to go back and forth between literature review and empirical study, which lead me to have three phases of interviews and two phases of literature review that are somehow intertwined, As shown in the following Figure 14.

1.4 Four years of qualitative research process

Figure 14 gathers the different steps of my research journey during which I alternated phases of literature review, data collection, data analysis and thesis writing. This four years' research

setting was necessary to say that I adopted a longitudinal case-based approach (Rumelt, 1974; Pettigrew, 1990). This approach can be fully coherent with an analysis of ecosystems that focuses on the dynamic evolution of the product/service system (Tsujimoto & al, 2018).

Figure 14 Overview of research journey timeline



This figure illustrates the adjustments I needed to bring to my design when I understood at the end of phase 1 that only one of the two cases I was studying was still on-going.

Section 2 Basic steps & research design

Most qualitative studies use several methods for data collection, typically for purposes of triangulating findings to increase reliability. Interviewing is the most popular method of data

collection for qualitative research, followed by archival data. Then come observation data, questionnaire data, focus groups, discussion & informal conversation, diaries, intervention, critical reviews and content analysis (Bluhm & al, 2011). The studies that employ multiple data collection methods have a larger influence on the field than single-method studies. Thus, qualitative researchers would rather triangulate their findings through multiple methods for their work to have greater impact (Bluhm & al, 2011).

2.1 Case selection and sampling approach

Snowball, chain, or network samplings are perhaps the most common forms of purposeful sampling (Merriam & Tisdell, 2016). “By asking a number of people who else to talk with, the snowball gets bigger and bigger as you accumulate new information” (Biernacki & Waldorf, 1981; Patton, 2002: 237). Put forward by Glaser and Strauss (1967), theoretical sampling is the process of collecting data to generate theory by an analyst who jointly collects, codes, and analyses his data and decides what data to collect next, where to find them, so as to develop his theory as it emerges. Lincoln and Guba (1985) recommend sampling until a point of saturation or redundancy is reached. In purposeful sampling, the size of the sample is determined by informational considerations. If the purpose is to maximize information, the sampling is terminated when no new information arises from new sampled units; thus redundancy is the first and most important criterion to be considered. The number of interviews per case firms varied due to reaching data and theoretical saturation, when nothing new was being added. Theoretical saturation is the point at which no new insights are obtained, no new theme is identified, and no issue arise regarding a category of data (Strauss & Corbin, 1990).

I used theoretical case sampling (Eisenhardt, 1989; Yin, 2003) based on several criteria. First, the cases selected needed to correspond to the definitions existing in the management literature. The concept is relatively new and, as I showed, there are still different views on the ecosystem

construct. This leads to confusion about what can or cannot be labelled as an ecosystem (Jacobides & al, 2018). It is often difficult to assess whether a firm is taking part into an ecosystem or not. For those reasons, I decided to apply Adner's (2017) two definitions of ecosystem as structure and ecosystem as affiliation and to use them both, with a strong focus on the ecosystem as structure, which allows to clearly distinguish the boundaries of ecosystems (Shipilov & Gawer, 2020).

Here are the criteria that I derived from Adner (2017) but also from other definitions and studies that built on this definition (Jacobides & al, 2018; Shipilov & Gawer, 2020):

1) An ecosystem must focus on a clearly describable value proposition that addresses customers' needs of product or service.
2) The ecosystem can be characterized by the joint value proposition, which is issued by the ecosystem partners, who need to share some non-generic complementarities.
3) Multilateral links among actors need to be apparent. The relationships among actors cannot only rely on independent bilateral relations.

My case selection was not really a straightforward process. I rather had an iterative approach between case selection, data collection and data analysis. After a first round of interviews and data analysis, I decided to focus on 2 cases of emerging ecosystems as structure.

Several factors underpinned my selection of those cases. My interest in business ecosystems came from the discussions I had between September 2017 and January 2019 with managers evolving in the aerospace European community[3]. I was surprised to observe how those people evolving in the same industry were at one and the same time competing and collaborating. This

[3] ECATA has existed since 1992 and trains around 25 future leaders of the European Aerospace community every year. This is an executive development programme that targets skills development to ease collaboration at the European level. The training programme lasts 15 weeks every year and I spend around 25 days per year either attending seminars with the delegates or business network gathering and industrial visits with the alumni of the programme.

is why I first focused on research streams dealing with coopetition and interorganisational relationships. In that exploration phase, I lead my first interviews with people that had been working in their industry for at least ten years and were in job positions where they needed to interact with counterparts from other companies. At that stage, I mostly focused on understanding the business of their companies and how they considered their competitors.

2.2 From exploration with 2 cases to confirmation with 1 case

Pursuing empirical research in ecosystems requires to develop a high level of contextual knowledge, with a focus on numerous parameters such as actors involved, how they are connected to a technological architecture and how they agree on economic transactions that encompass both supply and demand-sides interactions (Kapoor, 2018).

Given the limited theory and evidence produced so far on business ecosystems in the particular context of a mature industry, I conducted a theory-building, multiple case study (Eisenhardt & Graebner, 2007) during an exploratory phase. Chapter 3 is a sectoral case study with an historical approach, including secondary data and interviews. This long-term and broad understanding focus was necessary to identify revelatory case studies. Chapter 4 is an exploration of two nascent ecosystem as structure projects, that can be called “Skywise” and “Safran data”. I went on my research project focusing on one single case, in Chapter 5, to go deeper in my observation of Skywise ecosystem and see what I could confirm from my first phase. I focus on two cases regarding historical leaders in the European aerospace industry, Safran and Airbus, who have tried since 2017 to be the starting points for new business ecosystems in the field of data exploitation.

The two case studies I focus on are both in their early stages. Airbus started Skywise business in 2017 and Safran launched its data ecosystem project in 2019. I first led an exploration phase, between April 2019 and June 2020 and then focused my interviews on the data exploitation

context. Those interviews were lead with actors from Airbus commercial, Safran analytics, Safran Nacelles, Dassault Aviation, Airbus Defense & Space, Sopra Steria. The aim has always been to discuss the ties, actors, ecosystem approach for each focal firm, but also to gather views on the partners, to avoid biases and check data gathered in secondary sources or from other interviews.

Table 8 Overview of evidence dataset 1

Phase 1 - exploration & first case studies

Respondents	Companies	Number of interviews	Length of interviews (min)	Number of pages of transcript	Respondent code
President	Dassault Aviation	1	120	12	source A
Programme manager - civil side	Dassault Aviation	2	150	15	source B
R&T manager - military side	Dassault Aviation	3	240	18	source C
Strategy communication VP	Airbus	1	110	10	source D
Programme manager - satellite programs	Airbus DS	1	100	8	source E
Programme director	Safran Analytics	1	75	7	source F
Business development director	Safran Nacelles	1	95	10	source G
Business strategist - Digital Transformation Office	Airbus	3	270	24	source H
Programme director	Safran	6	450	42	source I
Director	Sopra Steria	1	115	9	source J
	Total	**20**	**1725**	**155**	

From April 2019 to January 2021

For my second empirical chapter, I made the choice to go on focusing on the Skywise case because specialness can pay off, as long as it permits particular insights that allow one to draw inferences about more normal firms (Siggelkow, 2007).

Table 9 Overview of evidence dataset 2

Phase 2 - focus case study

Respondents	Companies	Number of interviews	Length of interviews (min)	Number of pages of transcript	Respondent code
Industrial digital business manager	Airbus	2	140	8	source 1
Business development & partnerships	Navblue	1	130	12	source 2
CEO	Knowmore	1	50	6	source 3
Aftermarket Strategy Director	Airbus	1	105	9	source 4
CEO	Open Airlines	1	115	9	source 5
Partner in aerospace performance	Oliver Wyman	2	155	14	source 6
HO engineering quality transformation	Airbus	1	95	10	source 7
Performance management digital expert	Sopra Steria	1	100	9	source 8
Skywise Solution Training Engineer	Airbus	1	110	9	source 9
Head of Skywise for Airbus & supply chain	Airbus	1	85	8	source 10
Head of Skywise for airlines & ecosystem	Airbus	1	115	11	source 11
Skywise SAFe Solution Manager	Airbus	1	95	9	source 12
Head of Skywise Product & Service Line	Airbus	1	80	7	source 13
Digital programme manager	Airbus	1	90	6	source 14
Head of Digital Solutions & Marketing	Airbus	1	100	8	source 15
	Total	**17**	**1565**	**135**	

From August 2022 to December 2022

I focused on identifying managers with a link to the strategy definition and application, for the two projects, from the focal companies but also from partners and peripheral actors.

To bring rich and new elements to the existing literature on ecosystem strategy and antecedents, I focus at the same time on what was happening and what could have happened. This is part of my study to try to understand which options are considered by a focal firm along its strategy making process.

Section 3 Collecting and analysing data

3.1 Doing qualitative interviews

I considered that interviews were the best tool to collect qualitative data on a very specific context that requires to collect data from precisely identified respondents. The study of business ecosystems and strategic renewal of businesses implies that the targeted activities are rather peripheral activities inside the focal firm. These are also innovative activities, with an exploration and a competition dimensions, which prevents the firm to broadly communicate on what is done. This is why I found little secondary data on my field of study. I opted for what is acknowledged to be the most common form of interview, the person-to-person interview, when the researcher wants to find out what is on someone else's mind (Patton, 2002: 340):

> *"I interview people to find out from them those things I cannot directly observe. I cannot observe feelings, thoughts, and intentions. I cannot observe behaviours that took place at some previous point in time. I cannot observe situations that preclude the presence of an observer. I cannot observe how people have organized the world and the meanings they attach to what goes on in the world. I have to ask people questions about those things. The purpose of interviewing, then, is to allow us to enter into the other person's perspective".*

Interviewing was thus necessary for my research because I could not observe what people think, how they feel and how they understand the situations they experience. It is also necessary to understand what happened in the past.

Semi structured interviews

I opted for semi-structured interviews. Avoiding technical jargon and terms or concepts from a particular disciplinary orientation is a good place to start from (Merriam & Tisdell, 2016). I never asked about "business ecosystem" or "dynamic capabilities" but rather focused on collaboration and innovation projects, at least at the beginning of my interviews. I asked open-ended questions so that I may encourage my informants to share detailed and descriptive data. I also tried to avoid multiple questions (because the researcher will confuse the interviewee), leading questions (because of the bias included) and "yes or no" questions (because they encourage to answer with yes or no instead of developing). I tried to keep in mind that I was the first and most important instrument of data collection. I always prepared to adjust during interviews and focused at one and the same time on the questions to ask but even more on the answers provided. I consider that the interest of using semi-structured interview guide is to provide a basis to launch discussion with the informant. It is reassuring for them to start speaking about what they know better, which is their everyday job or evolution inside the company. I use my written guide as a basis and then always try to trigger conversation from the answers that my informants provide. I also always take notes for further development because I try not to interrupt them in their flow.

Content and form are also to be considered in interviews and as very often, the form is almost as important as the content. I always try to be friendly and be able to vary the pace of the interview to set up a quality and confident relationship with the interviewee. I assume that agreeing on being interviewed for a PhD thesis can seem intimidating, especially when you are

recorded. This is why I tried to make it as simple and friendly as possible, using short sentences, reformulating when I had the feeling my question was not clear enough and asking very basic questions if I did not understand what was said by my informant.

I think that the timing of the interview is also a key dimension. The researcher needs to check from the start how long the interview can last and to stick to the previously agreed length. Some interviews might be a bit frustrating because the researcher can end up with a feeling that everything was not said, even if the important questions were rephrased several times. I think that the most important point was however to develop a good quality relationship with my interviewees. If they enjoy the time spent, if they have the feeling that the exercise is interesting because this is a win-win situation, they will then probably be happy to start again in the future, or help me, as a researcher, to get in touch with other interviewees. Some of my respondents accepted to meet me several times and all of them accepted to do as many interviews as I assessed necessary to reach data saturation. It shows that I managed to gain their attention and that they were satisfied with the time spent with me.

Interview guide

I built a basic interview guide for my first interviews and then I adopted an iterative approach, with a step after each interview to adjust the interview guide for the next one, improving my list following the last interview and depending on the profile of my next informant. I also used secondary data at this step of my research journey, to complement some information that were discussed during the interview. The secondary data I gathered ranged from sectoral analysis, to specialized press articles, industrial press releases, market studies or consulting reports. I could sometimes pretend I knew about something that happened during the interview, in order not to interrupt the interview, so I needed to update my knowledge in between two rounds.

I used a mix of more or less structured questions, and my interview guide was rather built around issues to be dealt with. I had three major orientations in my interview guides, depending on the three different phases of my research journey. I started with a broad approach when I was focusing mostly on the ecosystem as affiliation level, asking about collaboration and competition at a broad level, in order to identify precise cases that I could dig further. Once I identified the two cases I needed to explore further, I focused on the birth phase of two new ecosystems as structure and focused on the decisions that were made. The two projects were unfolding, and I could observe the evolutions from one interview to the next. During my third phase of interviews, my interview guide was more structured.

My interviews had three sections. The first covers the informant's background and role. The second was a detailed narrative of the firm's and ecosystem's history from founding (or last interview) to the present. The focus is on specific actions of firm executives with respect to the performance of the firm and the way ecosystem strategy is defined, unfolded, readjusted. My goal was to understand major ecosystem management processes and how they were reassessed depending on their achievement or not. The third section went deeper in the ecosystem reality and the relationships among actors. I always explored topics that arise in the interview. For more details on my interview guide, see the annexes.

Interviews in practice

Interviews lasted between 45 and 130 minutes, were recorded then transcribed. Where necessary to fill in gaps, I used follow-up interviews and emails. I also used WhatsApp quite often to get in touch with my informants. All interviewees received the questions before the interview. They were informed beforehand that they would be recorded and received the transcript not later than two weeks after the interview, so that they may amend it. All

respondents validated the final versions, and I ended up with 290 pages of transcribed interviews after the two phases of data collection.

The interviews with non-focal firm participants allowed me to triangulate insights. Complementors (Sources G and J during phase 1, Sources 2, 3, 5, 6 and 8 during phase 2, see Table 8 and Table 9) brought an insightful point of view regarding efficiency within the company. Their point of view was different from the one inside the focal firm because they could only assess the performance of the firm on what they do outside. They were mostly focused on their own performance, and they had different biases. They also tended to be more talkative on their perceptions than the informants who were inside the company. Qualitative research is not only about facts and figures; it is also about understanding how firms try to control their development. Each company has its own culture and ways of speaking about its business. Looking for outside point of views brings perspective, as long as there are several interviews in time, and a will to develop a dialog with the informants inside as well as outside the companies.

In my interviews, I asked questions about the different foreseen scenarios and which value creation was anticipated. I wondered about the endeavour realized to onboard other partners, seeing to what extent the blueprint was collectively defined and what was up to negotiation.

I always recorded and transcribed my interviews. A researcher needs to focus on listening in order to be able to follow-up from what the interviewee says and I always tried to maximize the time I spent with my interviewees, which goes with writing as little as possible during the interview. I wrote some key elements from their answers, but this is mostly to show them that I valued what they say and to think about following up the discussion, without interrupting them. I asked for their agreement far in advance to record our conversation but then, during the interview, I tried to lead them to forget that they were recorded. I tried not to interrupt and if I missed an information, I preferred to focus on following up instead of coming back to what was

said, exactly as I would have done in a conversation at work or with a friend. This was possible because I relied a lot on my recording and on the time I would spend transcribing the interview. My stance was also that even if after transcribing the interview, some parts of the conversation were still blurred, I would write at the end of my transcript the questions I would need to ask during my next interview with the same person. As it can be seen in Tables 9 and 10, I did not always have a second interview with my respondents because it was not always required.

Even if I tried to avoid interruptions, I used reformulation to rephrase and sometimes show that I had not perfectly understood. An interview needs to be a smooth and sustained exchange and the researcher always needs to show his interviewee that he pays attention to what is said, that he understands it.

Interview transcription is then a rather time-consuming task. For a 60 minutes interview, I take between three and four hours of transcription. Some researchers prefer to use transcription tools or to pay someone else to do this job; I have however never considered this option because I feel this step helps me do the research work of data analysis. I take time to understand what was said, which I did not thoroughly do during the interview.

Beyond my basic interview guide and work to progress and narrow my focus in time, I also tried to focus on leading my interviewees to share insightful data. It goes along with asking details on dates, facts, numbers, names and figures, be that on expenses, turnover, amount invested. Those are sometimes sensitive information, but I always tried to get into those details. Most of the interviewees were ready to share what they know, sometimes, they would just give me the information and asked me not to share it in my thesis. It however helped me become more knowledgeable interview after interview.

3.2 Data sources and collection

I made the choice to base my empirical work on interviews mostly (Eisenhardt & Graebner, 2007) but also on archival data and observation (see 3.4).

By using different data sources, researchers can triangulate, that is, adopt, different angles from which to observe the same phenomenon (Jick, 1979; Pettigrew, 1990; Stake, 2013; Yin, 1994), thus making their findings more convincing and accurate (Tracy, 2010). This is why I used two main data sources: interviews and archival data. These secondary data was particularly important as long as I made the choice for qualitative research based on a very little number of cases to study. Newspaper articles, experts case studies or industry benchmarks bring perspective and show what is publicly shared by the companies. When it comes to strategic management, firms tend to be cautious with what they publicly share. Archival data can thus complement the interviews data. It can also help collect more quality or rich data during the interviews, as long as I was able to give concrete elements from past news in my discussions, which incited my respondents to also give concrete examples and more details. I lead semi-structured interviews with focal firm executives and managers, from private and public sectors. This data collection was aimed at gaining a deep understanding of the day-to-day evolution of ecosystem practices and management. I focus on the strategic renewal of mature industries through the use of business ecosystems. This is a very specific case, but the aerospace industry can be compared to other historical industries that might face the same need for renewal. The management of ecosystems is a critical point that I want to explore because a business ecosystem demands a coordination among actors who are not hierarchically managed. This increases the complexity of the structure. To gain an in-depth understanding of the ecosystem strategies in the organizations, I collected data during visits to the organizations, which mains that I did most of my interviews on site, directly where the teams working for the ecosystem did work on an everyday basis. I conducted 2 waves of interviews with firm executives about

the strategy, objectives definition, management processes and control points regarding the ecosystem. Internal informants are individuals within the focal firms such as program managers, directors, Research and Technology (R&T) managers, functional managers, strategists or communication executives. External informants include individuals connected to specific firms (investors, complementors) and especially actors that have an impact on the strategic moves and value creation within the ecosystem.

Bogdan and Biklen (2007) offer useful suggestions to analyse data during the collection process that I tried to apply:

1. I made the effort to start from a broad view and progressively make choices to narrow the case. Each researcher should collect as much data as possible in order to ease the selection process on what can bring the most value to the study. When it comes to the final analysis, it is however time to narrow down the selection (Bogdan & Biklen, 2007).

2. I made the effort to choose as fast as possible the kind of study I wanted to achieve. I wanted to expose a rich and specific context so that other researchers could easily compare future cases on different features.

3. I tried to develop analytic questions. Some of my questions were probably too generic at the beginning of my research so I led an iterative improvement work to eliminate some questions and replace them by some other points that brought more insightful answers. It also sometimes depended on the interviewee profile and willingness to share information. This is why part of that adjustment job was always done during the interviews, that were semi-structured.

4. I strived to plan my next data collection sessions depending on what my previous interviews revealed. First, this was possible through proper planning of the interviews, and I tried not to plan two interviews in a too short schedule, so that I may have time to transcribe each interview before moving to the following. I also tried to plan an optimized sequence of interviews, coming to the most important, on a strategic positioning inside the organisation plan, at the end of my

sequence. I reviewed field notes and memos as I went along and modified my interview guide. Including some past answers in future questions helped checking facts or collecting richer data.

5. I took time to write some "observer's comments" on the transcripts that I could sleep on and come back to later. I knew from the start that it be a very lonely journey and that I needed to plan actions to leave space for critical thinking. This is notably why I always preferred to type my transcripts instead of using some AI transcription tool. I needed this step to think over the discussion I had with my informants, and I often had the feeling that I was discovering the discussion from the first time.

6. I wrote memos to myself about what I discovered and what was new to me following the interviews. This was more on the conceptual framework, and I wondered if I might need to explore further some new theories to understand better the case I was depicting.

7. I tested my concepts and themes with my informants. I usually did that as a complement to my interviews, in order to keep the interview time for new insights. This is why I usually planned a preparation phone call or visio-conference call to discuss my past work and the interview guide. I only did it with informants that I felt would be willing to contribute on that dimension.

8. I started exploring the literature while I was on the field. As long as I chose to lead an overall abductive approach, I decided to alternate phases on the field with phases studying the literature because the inductive study can only be efficient provided that connections can be made with the existent literature.

9. I tried to resort to visual synthetic figures and tables to rewrite what I did understand from the cases. It is indeed critical to invest in developing tables and visual aids to demonstrate the theory's underlying empirical support and the anticipated richness of the case data, and to tie those tables clearly to the text (Eisenhardt & Graebner, 2007).

3.3 Data analysis and theory building

As it can be seen on Figure 14, I started analysing data early, while I was collecting it. I wanted to organize and manage it because I wanted to have emergent results to confront to my interviewees during the next interviews. I however led several rounds of data analysis, only finishing it once I had collected all my data (Merriam & Tisdell, 2016).

For my data analysis, I wanted to explain how I translated raw data into field notes, how I organized the data, and the process I adopted to analyse before coming up to conclusions. Between April 2018 and December 2022, I did 37 interviews, representing 3290 min spent discussing with the respondents, or rather 55 hours, which were then transcribed in 290 pages. Before or while being analysed, data needs to be managed. This involves coding the data and creating an inventory of the entire data set.

I used from the start of my research journey the qualitative data analysis software NVIVO, which has been very useful to bring rigor to my data analysis phase. That kind of tools actually supports researchers in systematically coding and organizing voluminous amounts of data and in managing the analysis work of developing categories, tracing linkages between concepts, and understanding relationships among categories (De Massis & Kotlar, 2014).

To present results, it is important to distinguish between two types of data to be displayed: the raw material and the synthetic evidence. Scholars should pay particular attention then to interlace their story with the emerging theory to prove a close connection between empirical evidence and emergent theory (De Massis & Kotlar, 2014). I will develop it further in Chapter 4 and Chapter 5 but in those two chapters I had the same approach to organize quotes and create a data structure from first-order findings to second-order themes and aggregate dimensions.

The use of grounded theory to analyse my data

I used grounded theory (Glaser & Strauss, 1967; Gioia & Chittipeddi, 1991; Charmaz, 2006) to analyse my data, following three primary steps. First, using interviews and field notes, I used open coding to capture informants' meanings of their work, organization and perception of ecosystem reality. I generated codes from the raw data and continued to add and refine codes as I progressed through the data multiple times. I tried to follow the approach developed by Gioia (Corley & Gioia, 2011), looking for a systematic presentation of both first-order analysis, derived from informant-centric terms or codes, and second-order analysis, derived from researcher-centric concepts, themes and dimensions (Gehman & al, 2018). When all first-order codes and second-order dimensions were assembled, I was able to build a data structure on that basis.

I revised my codes iteratively, moving among existing data, new data, and the literature (Locke, 2001). I also engaged in constant comparison by comparing data across participants while allowing the emerging analysis to benefit from my interpretation (Charmaz, 2006). I then moved to more theoretical abstraction by creating second-order themes to identify relationships among first-order codes. The details of my approach are shown in Chapter 4 and Chapter 5.

Finally, I used this second-order coding to search for relationships within and between the codes to convert them to more-abstract categories. To do so, I engaged in an ongoing dialogue between my data and extant literature to ground constructs consistent with my data but abstracted from the aerospace context. This leads to aggregate theoretical dimensions.

My second step was to use the aggregate theoretical dimensions to engage in brainstorming, captured in analytical memos (Lempert, 2007). My goal was to generate a process model that pictured my empirical observations but also to develop theory outside of the immediate context.

Third, I tested my interpretations by reviewing the data again and looking for both confirming and disconfirming information (Miles & Huberman, 1994). After reaching initial conclusions

about the data, I checked with key informants about my developing ideas and asked for feedback (Lincoln & Guba, 1985). I used several data sources to check key interpretations and created tables to provide additional empirical support to the quotes I included in the findings section (Pratt, 2008). I also used peer debriefings to discuss my emerging theory with colleagues not involved in the study (Lincoln & Guba, 1985). In particular, my first draft article, which is detailed in Chapter 4, was presented to colleagues during an international doctoral workshop organized by a consortium of three partners[4] in March 2021. The same draft was also accepted and presented at the AIMS conference in June 2022.

3.4 Using archival data and observation

I focused most of my analysis on interviews but also used observation and document analysis. I started observing my research field in September 2017 and started collecting archival data in January 2018. I collected historical reports and press releases. My observation also started in September 2017 when I started my job position as administrator of a training programme created to help managers develop their leadership skills. Every year, a group of 24 managers coming from at least 8 different companies, live together during 11 weeks and work together to deep dive a topical issue for their industry.

I spent approximately 30 days with each new group every year during 6 years. I stay at the same hotel, have all meals with them, which allows me to create strong trust relationships and ask questions about their professional environment. I have also always been totally transparent about my research journey and shared my questioning with at least 150 managers over the last years. It definitely helped me to adjust my sample of respondents and lead me to read or consult secondary data sources I had not identified so far.

[4] The doctoral workshop was organized by Toulouse School of Management, WHU Otto Beisheim School of Management and Lancaster University School of Management.

Table 10 Observation and archival data collection

Observation between January 2017 and March 2024	
Number of days of managers' observation	180
Number of in person meetings with European aerospace executives	58
Number of industrial sites visits	16
Number of lectures by experts of the sector attended (min. 2 hours)	52

Archival data collected and used between January 2017 and March 2024	
Number of press releases gathered	26
Number of specialized press articles read	73
Number of industry market studies collected	21
Number of historical reports consulted	12
Number of annual reports studied	26

Archival data were coded with Nvivo but mostly appear in my empirical chapters inside the verbatims of interviewees because I always used them to enrich my interview guides or do follow-up interviews.

Section 4 Case study and process research

There is a wide range of qualitative research strategies, from which seven are more commonly used: basic qualitative research, phenomenology, grounded theory, ethnography, narrative analysis, critical qualitative research and case study (Merriam & Tisdell, 2016).

A grounded theory study seeks not just to understand, but also to build a substantive theory about the phenomenon of interest. Narrative analysis uses the stories people tell, analysing them

in various ways, to understand the meaning of the experiences as revealed in the story. Critical qualitative research focuses on societal critique in order to raise consciousness and empower people to bring about change (Merriam & Tisdell, 2016). I will discuss these types of qualitative research further in my dissertation, with a particular focus on grounded theory and on case study.

My choice has been to build my research in two steps, with a first exploration phase during which I compared two cases, before focusing on a single case for a confirmatory phase. I also led a first step inside the first phase to explore the field and decide upon which cases I could research. I chose to use case study research, grounded theory and process research as complementary approaches.

4.1 Case study research

Case studies are particularly relevant to organisation and management studies because they promote

> *''understanding the dynamics present within single settings'' (Eisenhardt, 1989: 534)*

by using a variety of lenses, which allows for multiple facets of the phenomenon to be revealed and understood.

A case study is a rich empirical instance of some phenomenon, typically using multiple data sources. Modern case study research has antecedents in anthropology, sociology, and psychology. Although case studies can include quantitative analyses and historical data, my focus is on case study as a form of qualitative research. Qualitative case studies share with other forms of qualitative research the search for meaning and understanding, the researcher as the primary instrument of data collection and analysis, an inductive investigative strategy, and the end product being richly descriptive (Merriam & Tisdell, 2016).

Miles and Huberman (1994) describe the case as a phenomenon of some sort occurring in a bounded context. A case study is thus characterized by a unit of analysis and not by a topic of investigation. The bounded context means that the data collection needs to be finite; there must be a limit to the number of people involved, who can be interviewed.

I opted for case study because it is an ideal approach when a complex phenomenon is little known and existing aspects are incomplete, contradictory or fragmented (Eisenhardt, 1989; Yin, 2003). As shown in my introduction and literature section, this is the case for business ecosystems, and even more specifically, for their strategic renewal, at the ecosystem as affiliation level, based on emergent ecosystem as structure.

I wanted to make an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 1994) and there is a real need to better define the boundaries when it comes to business ecosystems.

Apart from the boundaries, there is also a need to understand the actors, interactions, sentiments, and behaviours occurring for a specific process through time. Those were the main objectives that I sought by choosing a case study set-up (Woodside & Wilson, 2003).

As a case researcher, I looked for a deep understanding by directly observing in real time and asking participants questions to understand what is happening, what were the triggering events leading to what happened, what was the meaning of what happened and what was going to happen next (Woodside & Wilson, 2003). This was particularly the case during my exploratory phase, when I was trying to understand how the two new ecosystems within Airbus and Safran were unfolding.

Theory-building case research allows a freedom to make adjustments during the data collection process, be that in the choice of informants, depending on the results of each interview, number of interviews, with the target to reach data saturation or content of the interviews (Eisenhardt,

1989). Case study research thus brings a lot of freedom to the researcher, which is appealing but also requires a good structure because the basic task is to move from rich and interesting observation of what happens, to suggested nascent theory that will be tested through other methods, in order to lead to generalizability.

Case studies indeed emphasize the rich, real-world context in which the phenomenon occurs. A major reason for the popularity of theory building from case studies is that it is one of the best bridges from rich qualitative evidence to mainstream deductive research (Eisenhardt & Graebner, 2007).

Single cases tend to lead to theory that is more idiosyncratic to the case, is often overly complex, and may miss key relationships or the appropriate level of construct abstraction. When using theory building from cases as a research strategy, researchers also must take the added step of justifying why the research question is better addressed by theory-building rather than theory-testing research (Eisenhardt & Graebner, 2007). Despite the fact that ecosystems have been researched for more than thirty years, there is still a lack of consensus on the boundaries of the concept. I focus on the intersection of research between ecosystems and mature industries. For that, I start from the definitions given by Adner (2017) of ecosystem as affiliation and ecosystem as structure. Most studies so far have focused on the ecosystem as affiliation trend, that consists of firm-centric approaches and lacks accuracy because there are too many details to consider. I decide to focus on the ecosystem as structure approach, which is activity centric, with a focus on all actions that impact a new value proposition. Theory-building is justified in my situation because I consider situations where uncertainty is very high, to the extent that I cannot know which theories I would like to test before starting my interviews.

Theory-building research using cases typically answers research questions that address “how” and “why” in unexplored research areas particularly well (Edmondson & McManus, 2007).

Informants are “knowledgeable agents”. People at work know what they are trying to do and they can explain to researchers quite knowledgeably what their thoughts, emotions, intentions, and actions are. This relationship to interviewees is a basic of grounded theory by Gioia and also requires the adoption of an opening stance of well-intended ignorance (Gehman & al, 2018). Prior theory obviously still needs to be known, but it also needs to be set aside, in order not to influence the content of the interview.

Case study is appropriate for building theory in situations where there’s either no theory or a problematic one. There is theory on business ecosystems and the concept is even said to suffer conceptual proliferation. I however showed that a major clarification was made in 2017 by Adner, who distinguished the ecosystem as affiliation concept from the ecosystem as structure approach. Those two concepts can apply simultaneously and help understand the strategic renewal of industrial actors evolving in mature industries. There is no theory on this precise point.

There can be different approaches to qualitative methods as it is shown by Gehman, who made the exercise to draw the differences between Gioia’s, Eisenhardt’s and Langley’s specificities. Yet, they are united by process questions such as “how do things happen” questions that can be opposed to “what” and “how much” questions (Gehman & al, 2018).

The case study design appears to be a well-suited methodology, if it (1) copes with the situation in which there are manifold variables of interest that are embedded in the context of investigation and (2) relies on multiple sources of evidence, with data needing to converge in a triangulation fashion (Yin, 2003). Researchers who decide to use a case study approach must choose what type of case study will be conducted (Yin, 2003). An explanatory case study should be used when the aim is to understand why a phenomenon takes place.

Case study research, as all research designs, can be discussed in terms of its relative strengths and limitations. Perhaps because a case study focuses on a single unit, a single instance, the issue of generalizability looms larger here than with other types of qualitative research. However, much can be learned from a particular case. What I learn in a particular case can actually be transferred to similar situations. As a researcher, I share details on the cases I study and links with emergent theory and it is then up to the reader to determine what can apply to his or her context. Another potential weakness is that qualitative case studies are limited, too, by the sensitivity and integrity of the investigator. The researcher can lack of rigor in the collection, construction, and analysis of the empirical materials that give rise to this study. This lack of rigor is linked to the problem of bias, which is introduced by the subjectivity of the researcher and of the others involved in the case. However, the strength of this research design is precisely to include difference and not to attempt to simplify what cannot be simplified (Merriam & Tisdell, 2016).

There is a belief that case study research is not as valuable as quantitative research because it lacks generalizability and rigor. Case studies can however provide valuable insights, especially in understanding complex, contextual and unique phenomena. Context-dependent knowledge can sometimes lead to more generalizable knowledge, but the starting point is to find a situation where the theory needs to be advanced.

There is also an argument that case study research is inherently subjective and too open to researcher biases.

Objectivity thus has to be enhanced by transparency, reflexivity and well-defined research protocols. As every researcher, I have my own background and biases that need to be considered. I accessed the context of my study through personal and professional relationships, with a very low level of immersion. My main objective when I was leading the interviews was

to understand the facts, dynamics and to lead my interviewees to say what they thought about the situation. My only motivation has always been to engage an interesting discussion and to share what I understood from the literature and past interviews I made, in order to encourage my contacts to share more than if I would from the start ask questions. I always tried to be transparent about my research motives in order to have as little impact as possible on the content of the data gathered (Tracy & Hinrichs, 2017).

Flyvberg (2006) underlines the misconception that case study research would not be theory-driven, because it would lack theoretical foundations and be too descriptive. Studying cases needs to be done after having understood the theory and with identified research gaps and questions that even require a qualitative approach. Case study is appropriate for building theory in situations where there's either no theory or a problematic one. (Gehman & al, 2018).

My focus on business ecosystems and strategic renewal for mature industries required this methodological approach.

The last two arguments regard replicability and rigor. Critics often question the replicability of case study research due to its focus on unique cases and contexts. I focus my research on the aerospace sector, which is characterized by specific elements and dynamics, such as long product development cycles, high entry barriers, substantial capital investments and complex regulatory landscape that might differ from other industries. Similar phenomena of increased collaboration with past competitors or will to develop services, to renew business models of traditional industrial actors, can however be observed in different settings to enhance external validity (Siggelkow, 2007). Critics may finally perceive case study research as less rigorous due to its flexible nature. Flyberg argued that rigorous case study research involved clear research designs, systematic data collection, rigorous analysis and proper validation of findings (Flyvbjerg, 2006).

Table 11 Most important biases for qualitative research, adapted from Merriam & Tisdell, 2016

Bias	How it happens	Ways to correct or minimize
Researcher bias	Qualitative researchers are actively involved in data collection and analysis, which can introduce researcher bias. This bias occurs when the researcher's personal beliefs, values, and experiences influence the interpretation of data and findings.	Researchers must be aware of their own biases and take steps to minimize their impact on the research process. All interviews were read and validated by the interviewees.
Interpretive bias	In qualitative research, researchers often engage in interpretive processes to make sense of the data. This subjectivity can lead to interpretive bias, where the researcher's interpretations are influenced by their theoretical perspectives or preconceived notions, potentially leading to selective or distorted understanding of the phenomenon being studied.	Data needs to be triangulated and steps have to be followed to enhance trustworthiness. Use of tables helps organize data, analyse data, display evidence, showx findings (Cloutier & Ravasi, 2021)
Confirmation bias	This bias, as mentioned earlier, is relevant to qualitative research as well. Researchers may seek evidence that confirms their initial assumptions or preconceptions about the research topic, leading to a narrow or one-sided interpretation of the data.	Confirmation has to come from rich enough data and saturation.
Interviewer bias	In qualitative studies that involve interviews, the way questions are asked and interactions between the researcher and participants can introduce interviewer bias. This bias occurs when the researcher unintentionally influences participants' responses, leading to skewed or incomplete data.	Preparing an interview guide and passing it before the interview helps containing this bias.
Sampling bias	Qualitative research often uses purposive or convenience sampling, which may lead to sampling bias if certain groups or perspectives are overrepresented or underrepresented in the sample. This can limit the generalizability of the findings.	I always looked for different perspectives on my research which was easy because business ecosystems imply a lot of actors, from different companies, which different roles
Observer effect	In observational studies or case studies involving direct observation, the presence of the researcher may influence participants' behavior or actions, leading to the observer effect. Participants may alter their behavior or provide responses that they believe align with the researcher's expectations.	Most of my questions are focused on what has already happened and on what is planned. I try to focus on facts and always came to the interviews with no particular expecations.
Reporting bias	In qualitative research, there might be a temptation to highlight certain aspects of the data or provide an incomplete representation of the findings, which can lead to reporting bias and potentially distort the conclusions drawn from the study.	I tried to spend a lot of time reading and interpreting my data, and start from scratch at least twice: reading it all, before identifying themes and dimensions.

From cross-case to within-case case analysis

I led two phases of data collection and analysis, with a first phase adopting a cross-case approach, while I focused on a within case analysis during phase 2.

Cross-case analysis consists of comparing patterns that emerge from several cases (Barratt & al, 2011). I selected the two cases, Safran data and Skywise because they both corresponded to the characteristics of new ecosystem blueprint, where companies wanted to create a new value proposition with several partners. I compared the two cases and analysed them after having selected key constructs from the literatures on business ecosystems so that I may look for evidence. My focus was on looking for similar patterns.

Once I had decided to stop my exploration phase, I decided to go on with a within-case analysis focusing on Skywise ecosystem, so that I may have more time to dedicate to this particularly exemplary case. This approach helped me select the case that had the highest potential to be analysed in-depth (Moller & Skaaning, 2017).

4.2 Process thinking and process research

Variance thinking and process thinking are the two different kinds of thinking that underlie most of social research. Most scientists rely on variance thinking and look at the relationships between variables. However, if a researcher is aiming at understanding how things evolve over time, process thinking is more adapted (Langley, 1999). This form of understanding is mainly based on flows of activities and events. It is important to study processes over time as well as movies are more insightful than pictures. Process is also extremely important from the perspective of practitioners to the extent that it helps them to understand how to move from a point A to point B (Gehman & al, 2018).

Process research covers dynamics that unfold over time, and describing and demonstrating the temporal coherence (Pettigrew, 1990) of these requires space.

A process paper must coherently present three elements: (1) a narrative that offers data on the case history or histories; (2) concepts to interpret temporal chunks (events, episodes, or periods) of that narrative; and (3) a model or integrated theory that connects concepts and explains the empirical case (Berends & Deken, 2021).

One of the first principles of process research is that the researcher has to study things over time. This is a prerequisite, and it requires rich longitudinal data. It was not the first intent of my research and I first focused on a grounded theory approach but as long as I am exploring the connections between ecosystems as affiliation (EAA) and ecosystems as structure (EAS), there is a need to focus on what happens with details on a present situation (for the EAS) and also to have a more longitudinal approach, that takes into account the process development over time (for the EAA). Process research is thus about evolution, activity, and flow over time, this needs to be reflected in the data.

Process researchers often use retrospective interviews as part of their databases, real-time observation or time-stamped archival data and repeated interviews are generally important to capture processes as they occur, rather than merely their retrospective reconstruction (Gehman & al, 2018). This is why I used repeated interviews and spent the required time during my interviews to ask questions about the past.

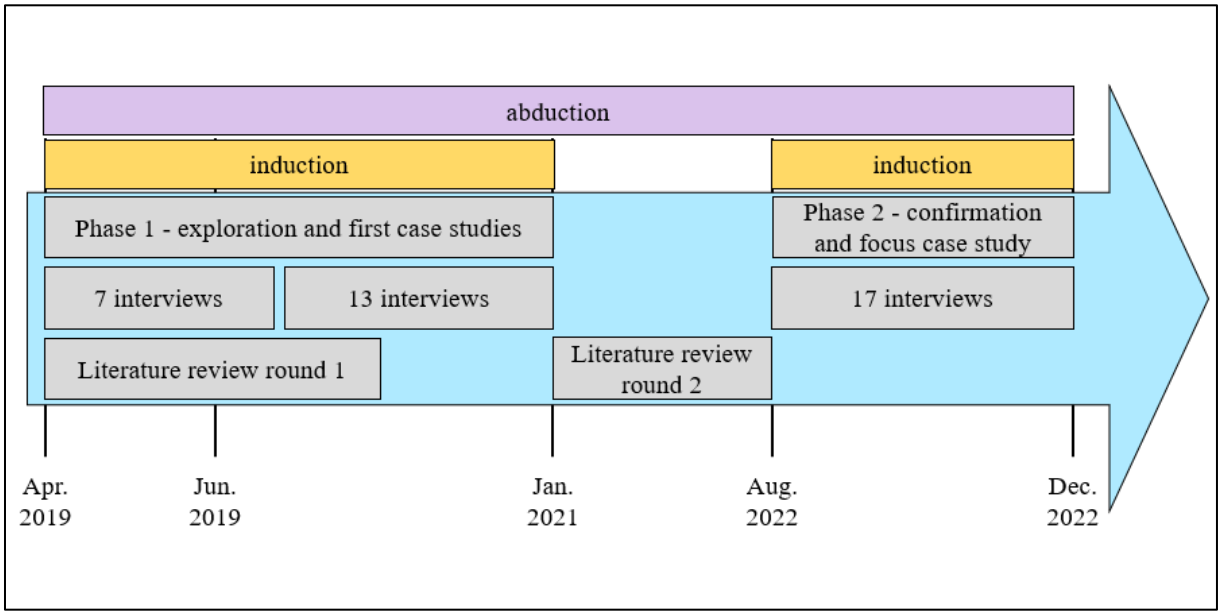
Case study research, grounded theory and process research can be used as complementary approaches, as long as the differences between those three methodologies are understood.

For Eisenhardt, theory building from cases is an inductive approach that is closely related to deductive theory testing (Gehman & al, 2018). This is a difference with the approach from Gioia of grounded theory because the fact to have multiple cases to compare obliges to check that the patterns are observable for several cases. This can however lead to simplification of the emerging theory because some patterns might not be applicable to all cases.

If as a researcher I want to generate a theory that can be tested deductively, the Eisenhardt method may be the place to start; if I want to understand the lived experiences of informants, the Gioia method may be the place to start; and if I want to understand temporal or practice dynamics in organizational life, Langley's approach may be a source of inspiration (Gehman & al, 2018). I made the choice to combine those three approaches with an abductive overall approach, including phases during which I spend most of the time doing empirical research with inductive phases.

The inductive research approach is sometimes acknowledged as being particularly suitable to build grounded theory from case study data (Eisenhardt, 1989; Glaser & Strauss, 1967; Strauss & Corbin, 1998). It all starts with the selection of cases, because they are particularly suitable for illuminating a phenomenon and for extending relationships and logic among variables (Eisenhardt, 1989; Graebner & Eisenhardt, 2004).

Figure 15 Research journey timeline, an abductive approach



In my approach, I started focusing on several possible case studies, to understand better how the whole European aerospace industry was a space for collaboration and competition in a

business ecosystem. I then decided to focus on the development of two new emerging ecosystems. And in a third round, I focused on one of the two that I previously observed because it turned to be more promising. I moved from an inductive approach to an abductive approach, with three rounds of interviews that took place over 4 years.

Whenever researchers conceptualize data, they are engaging in deduction and that effective grounded theory requires “an interplay between induction and deduction (as in all science)” (Strauss & Corbin, 1998). This is a question of dynamic and if I start saying that researchers need to know the extant literature, I cannot say that they are purely inductive in their approach. As it is stated by Ann Langley (Gehman & al, 2018), the idea of induction might be overemphasized because researchers cannot be completely theory free. Therefore, I am rather relying on abduction than on induction in my approach. To develop a richer understanding of the world, I need to connect to prior theory. Abduction means connecting what one sees in the empirical world with theoretical ideas that also exist and can be further developed.

Section 5 The need for validity, reliability and ethics

As a researcher, I am concerned with producing valid and reliable knowledge in an ethical manner. I strived to engage seriously in source-critical practices to explain how the data I collected could be triangulated and to avoid biases.

Triangulation is the most famous strategy to shore up the internal validity of a study and four main kinds of triangulation are usually considered: the use of multiple methods, the use of multiple sources of data, the collaboration of several investigators, or the use of multiple theories to confirm emergent findings (Merriam & Tisdell, 2016).

A key question researchers should bear in mind regarding source critique is how far and with what justification they may move from noting that this is what a person told in an interview to claims about behaviour, episodes, cognitions, emotions or even narrative identity and experiences (Schaefer & Alvesson, 2020).

Research which reproduces what people say or believe without much critical questioning seldom offers much new insights or stimulation to critical reflection.

Intra source critique consists of three elements: (1) careful consideration of the rationales influencing interview talk which involves an alertness for other motivations than efforts to report "the truth" (including experiences); (2) possibility to repeat and vary interviews, change context, location and framing, and allow for comparison between one and the same interviewee's interview statement checking consistency over time and space; (3) asking insightful questions which reflect researchers' gradual learning about the subject matter during a research project and handling the uncertainties of the situation better through "instant source-checking."

To check for consistency and richer insights, I tried to use repeated interviews, at least with some interviewees that I selected because of the relevance of the approach, to see whether interview statements are tied to a specific time context. It was particularly important to understand how the ecosystem developed through time and to compare how their perception evolved through time.

I also tried to vary the site of interviews (office, home, restaurant, online conference) and vary the formality or informality of interviews. Most of the interviews took place on their working site, because it was easier for my informants, and I liked to go on site because it eases the snowball sampling. Being on site is a good reason to get in touch with past informants or meet new potential interviewees. I however also lead some interviews online, at my home or at some

interviewees home. Being home obviously leads to very informal interviews, even if those interviews were not necessarily more insightful than the more formal ones.

Table 12 Strategies for validity and reliability, adapted from Merriam & Tisdell, 2016

Strategy	Description
Triangulation	I interviewed respondents from different companies, always shared my previous results with new sources. I included a strong temporal dimension in my approach, always asking about the past, present and future. I mixed my sources of data, searching for new secondary data and also asking access to other archival data to my respondents (industry reports, consulting reports, annual reports, press releases). When I found interesting articles in specialized press, I got in touch with the journalist to identify new sources.
Member checks	I took data and tentative interpretations back to the people from whom they were derived and asking if they were plausible. It always was but I sometimes needed to dig further some dimensions that I had not included in my findings.
Adequate engagement in data collection	During Phase 1 I went on interviewing my respondents until I reached a point of saturation, which was achieved when I did not learn anything new about antecedents to new business ecosystems. During Phase 2, I stopped when the last two new respondents almost said nothing new in comparison to all data already gathered.
Reseracher's position or reflexivity	Critical self-reflection by the researcher regarding assumptions, worldview, biases, theoretical orientation and relationship to the study that may affect the investiation.
Peer review & examination	I discussed with peers regarding the process of study, the congruency of emerging findings with the raw data and tentative interpretations. I presented my intermediary results to seminars, workshops and a conference.
Audit trail	I had a clear will to do inductive research based on case studies, with two different empirical phases. The uncertainty was however high during my phase 1 and I did not know whether the two explored cases would allow me to go on my study after that phase. I reassessed my account of the methods, procedures, and decision points in carrying out the study in January 2022.
Rich, thick descriptions	I tried to provide enough description to contextualize the study such that readers will be able to determine the extent to which their situations match the research context, and whether findings can be transferred.
Maximum variation	I sought diversity in Phase 1 of my study in my sample selection to allow for a greater range of application of the findings by consumers of the research.

Several criteria were defined to assess quality qualitative research, which can be marked by: (1) worthy topic, (2) rich rigor, (3) sincerity, (4) credibility, (5) resonance, (6) significant contribution, (7) ethics, and (8) meaningful coherence (Tracy & Hinrichs, 2017).

1) A worthy topic is one that is relevant, timely, significant, and compelling. One path to worthiness is for a topic to challenge taken for granted theoretical, practical or methodological assumptions. It thus allows new contributions and understandings of the social world. The worthiness of my topic was highly uncertain at the start of my study because I went for an exploratory approach on a topic suffering conceptual proliferation due to a lack of alignment on the boundaries of the concept. After an exploration phase, I eventually managed to identify two initiatives of new business ecosystems that could be compared. This made my topic worthy because the two cases were comparable and different approaches were chosen.

2) Rich rigor can be a challenge with quality qualitative research that is marked by a rich complexity of numerous descriptions and thorough explanations. The demonstration of rigor should start in the methodology section of research reports through the description of data collection and analysis. In this section, researchers detail the amount of data collected, the duration of time spent in the field, and the different kinds of data contributing to the study (Tracy & Hinrichs, 2017). This is what I developed in the previous sections.

There are four main criteria that have been adopted to assess the rigor and trustworthiness of case study research (Eisenhardt, 1989; Gibbert & al, 2008):

3) Sincerity can be achieved by qualitative researchers through self-reflexivity, vulnerability, honesty, and transparency (Tracy & Hinrichs, 2017). Every researcher has a background and biases that need to be considered. Researchers must be transparent about how they accessed the context of the study, their level of participation and immersion.

Table 6
Approaches to enhance validity and reliability in case study research.

	Construct validity	Internal validity	External validity	Reliability
Challenges	• Identifying correct operational measures for the concepts being studied	• Seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions	• Defining the domain to which a study's findings can be generalised	• Demonstrating that the operations of a study – such as the data collection procedures – can be repeated leading to the same results
Key issues	• To choose an appropriate operational set of measures: subjectivity vs. objectivity	• To make inferences in a case study	• To generalise the study findings (from an analytical point of view)	• To minimise errors and biases in a study
Research strategies for remedy	• Triangulate data from multiple sources • Read your conclusions with the participants • Conduct your research together with other investigators	• Explanation building • Pattern matching • Cross-case comparison	• Use replication logic in multiple-case studies • Use theory in single-case studies (also rival theories)	• Use a case study protocol • Use techniques for data preparation • Develop a case study database

Adapted from Campbell (1975) and Yin (1984).

From De Massis & Kotlar, 2014

When I lead interviews, I needed to be self-reflective about my motivations in order to have as little impact as possible on the content of the data gathered. Every research project contains unexpected twists and turns that need to be acknowledged and explained afterwards. As I already mentioned, I had very little certainties about my research outcome at the start of my field study. I lead exploratory interviews that turned out to generate very little insightful data. Even if my informants were opened to discussing strategic topics, they were not aware of business ecosystems projects inside their companies and depicted their interorganisational relationships as simple compilations of dyadic relations or supply chain management. I also faced some deception on the study of military business as well as space business because those two kinds of businesses are very linked to public fundings, which leaves very little place for generalizability of the results. Transparency needs to be applied at all stages of the research journey and that starts in the interviews process. I always took time to discuss my approach and my expected outcomes to my informants. I sent them the interview guides at least one week before our meeting and sent them the transcript in the following week, so that they may review and bring adjustments if needed. Before all my second-round interviews, I shared with my informants the article that presented the results of my first round of interviews. Beyond

transparency, I noticed that when you start sharing interesting observations and conclusions with an informant, he or she will be more willing to share complementary views.

4) Credibility in quantitative research is achieved through reliability, replicability, consistency, and accuracy of a study's findings. Qualitative researchers attain credibility using thick description, crystallization of data, evidence of multivocality and engaging in member reflections with participants (Tracy & Hinrichs, 2017). I needed to show enough details so that the reader can come to the conclusions himself. However, even in qualitative research, a kind of reliability needs to be reached. Publishing qualitative research in top journals can be a challenge and researchers increasingly ask for a 'quantification' of qualitative research because reliability must be assessed to evaluate whether a measurement is valid or not (Wright, 2017). Crystallization goes along with triangulation and helps solidify findings while including different kinds of data, people or methods. I always tried to engage member reflections or member checks, to make sure they understand what I have studied so far. Researchers need to gauge the impact and relevance of their findings and allow for sharing and dialoguing with participants about the study's findings, and providing opportunities for questions, critique, feedback, affirmation, or even collaboration.

5) Resonance is the extent to which a text meaningfully impacts an audience such that a reader can make connections between the themes or findings in the study at hand and generalize those trends to his or her own life or other areas of research (Tracy & Hinrichs, 2017). The knowledge produced in qualitative research is rooted in contexts that need to be described so that the readers might link the findings to other contexts.

6) Significant contribution is a target for any researcher and relies on achieving to produce findings that extend existing bodies of knowledge, theories, or practices in new and insightful ways. Qualitative research can be significant in four different domains: theoretical, heuristic, methodological, and practical. A heuristic contribution would provide new knowledge on a particular topic and suggest interesting ties for future research (Tracy & Hinrichs, 2017).

7) Producing ethical qualitative research can be summed up as respecting all stakeholders involved and questioning all choices to make during the research process wondering what consequences could result. One key dimension at this point is to develop sustainable relationships and particularly with the interviewees. I had to make an ethical decision twice, when I lead interviews with informants working for suppliers inside the focal firm I was studying. They both had first agreed on doing the interviews, we did it and after I sent them the transcripts, they told me that their hierarchy did not want them to share the data. It was disappointing because the work had been done and I could have used the data, but I erased all the interview material.

8) Meaningful coherence eventually refers to the overall consistency, soundness, and rationality of a study. It is also about the logical and intuitive connection of various arguments or concepts in a single study (Tracy & Hinrichs, 2017). My abductive approach to qualitative research with a focus on the renewal of mature industries lead me to study three concepts that were never studied together: business ecosystems, dynamic capabilities and digital transformation. I can now start focusing on the context of my research.

In this chapter, I explained my research setting and choices for qualitative research. This was a necessary step before delving into the empirical investigation of my study, in the three following chapters.

Chapter 3 Case of the aviation industry

The aviation industry has developed over the last century, with a strong growth in the last fifty years and a phase of concentration, which allows to speak of a mature industry (Wittmer & al, 2021). Barriers to entry are quite high, there is not much space left for more concentration after several waves of mergers and acquisitions, be that on the OEM market or on those of key suppliers. The situation of this sector is very specific with on the one hand the uncertainty that can seem very low, because of the entry barriers and because on the other hand, this is a very long-term oriented industry. Boeing and Airbus are the two main actors, and they have developed dominant positions and exert a quasi-duopoly in the world. Despite this situation, those actors invest a lot on innovation, be that on the product, service, or business model side. They have always tried to shift their core position towards more centrality and added value with regards to their suppliers and customers. Longitudinal data can be collected through historical, archival, and real-time field observation and interviews (Langley & al, 2013). Before delving into two empirical chapters that will explore the interplay between the ecosystem as affiliation (EAA) and ecosystem as structure (EAS) concepts, I needed to study the history of the broad aviation industry. Questioning the renewal of a mature EAA through the use of a new EAS first requires understanding how players evolved and forged their competitive landscape.

Airbus and Boeing have historically faced uncertain strategic situations due to various factors in the aerospace industry. These factors include fluctuations in demand, geopolitical tensions, technological advancements, regulatory changes, and intense competition between the two giants. The commercial aircraft market is cyclical, and both Airbus and Boeing have experienced periods of high demand and robust order books as well as challenging periods with lower demand and order cancellations. Economic conditions, airline profitability, and global travel trends heavily influence the level of orders and expectations from their customers.

Factors that may contribute to an uncertain strategic situation for Airbus and Boeing include global economic conditions, technological advancement, regulatory changes, supply chain disruptions, geopolitical factors, competition and customer preferences.

Economic downturns or geopolitical events can impact airlines' profitability, leading to reduced demand for new aircrafts and a slowdown in orders. Advancements in aircraft technology, such as more fuel-efficient and environmentally friendly planes, may influence airlines' preferences and drive them to consider upgrading their fleets or placing orders with competing manufacturers. Changes in aviation regulations, emissions standards, or safety requirements can impact aircraft design and fleet decisions, potentially affecting both manufacturers. Disruptions in the supply chain, such as those caused by the COVID-19 pandemic, can affect production rates and delivery schedules, impacting customer expectations and satisfaction.

Geopolitical tensions and trade disputes can influence aircraft sales and orders, as countries may impose tariffs or restrictions on certain products.

Airbus and Boeing face fierce competition not only from each other but also from emerging aircraft manufacturers, starting with the Chinese emerging actor Comac and also in the regional jet and narrow-body aircraft segments (Harrison, 2011). Airlines' preferences and fleet strategies can shift based on factors like changing passenger demands, route expansion plans, and cost considerations.

Section 1 Challenges faced by the aerospace industry

The aerospace industry is a technology-based industry that has been evolving in an era of incremental changes for over fifty years and undergoes pressures from inside and outside its ecosystem. Deloitte’s outlook survey 2023 underlines that incumbent firms need to navigate uncertain times to capitalize on change (Berckman & al, 2024). Several factors are to be taken

into account to understand the current context of the aerospace industry, ranging from 1) sustainable aviation, 2) digitalization and connectivity, 3) urban air mobility, 4) space tourism and commercial spaceflights, 5) autonomy and artificial intelligence, 6) additive manufacturing, 7) Industry collaboration and partnerships, 8) cybersecurity and 9) talent and workforce development.

1) Sustainable aviation can no longer be overlooked. There has been a growing emphasis on sustainability and reducing the environmental impact of aviation. Aircraft manufacturers and airlines invest in research and development of more fuel-efficient planes, exploring alternative propulsion technologies (electric and hybrid-electric aircraft), and implement measures to reduce carbon emissions throughout the aviation lifecycle.

2) Digitalization and connectivity are necessary capabilities to sustain competitive advantage. The aerospace industry has been increasingly adopting digital technologies to improve operational efficiency, enhance safety, and optimize maintenance processes. Internet of Things (IoT) and data analytics are leveraged to gather real-time data from aircraft and predict maintenance needs proactively.

3) Urban Air Mobility (UAM) represents at the same time an opportunity and a threat for traditional actors. The concept of UAM gained traction, with companies working on developing electric vertical take-off and landing (eVTOL) vehicles for short-distance urban transportation. UAM hold the promise to revolutionize urban mobility by providing efficient, on-demand air transportation within cities.

4) Space tourism and commercial spaceflight might seem far away from the traditional business of the aerospace industry, but most incumbent actors of aeronautics also have space divisions and those businesses need to share the same investment sources. The space tourism sector has been witnessing significant growth, with companies like SpaceX, Blue Origin, and Virgin

Galactic conducting test flights and making plans to offer commercial spaceflight experiences to private individuals.

5) Autonomy and artificial intelligence are also potential game changers in the aerospace industry. The aerospace industry has been exploring the potential of autonomous aircraft and incorporating artificial intelligence (AI) in various applications, including pilot assistance, air traffic management, and unmanned aerial systems (drones).

6) Additive Manufacturing and 3D printing are increasingly used in aerospace manufacturing processes, enabling more complex designs, reducing production costs, and improving supply chain efficiency.

7) Industry collaboration and partnerships between aerospace companies, governments, and research institutions has been on the rise to address complex challenges and accelerate innovation. Public-private partnerships and international collaborations have always been necessary to advance aerospace technologies, notably because the required investments are huge and because the aerospace sector entails a duality between civil and military domains.

8) Cybersecurity is a necessary concern for the industry because of all the risks associated with increased digitalization and connectivity. Efforts have been made to bolster cybersecurity measures to protect critical systems and data.

9) Talent and workforce development have always been a concern for companies, but the aerospace industry is particularly struggling to keep developing a skilled workforce. Apart from technological advancements, the aerospace industry faces a decreasing attractivity for young engineers who are increasingly aware of their footprint and impact. Training programs and initiatives to attract and retain talents are implemented, while the industry is also looking for a new meaning to give to its activities.

Those challenges have an impact on all strategic decisions that historical actors make.

I started considering the broader landscape of all aerospace actors and then decided to focus on the main firms addressing the civil market because I considered there would be more valuable outcome, as long as military activities and investment choices rely on governments sovereignty choices. I also knew from the start of my study that I wanted to focus on the European market because it was much more accessible than the other markets.

It is yet interesting to take a look at the world landscape of aerospace actors and the way they position themselves in terms of revenues, as it can be seen in Table 13. I consider that for this context and research setting section it was necessary to collect historical data about three main companies: Airbus, Safran and Boeing. Airbus and Safran are ranking in the top 10, despite their mostly civil positioning.

Boeing and Airbus are the two main Original Equipment Manufacturers (OEMs) in the aerospace sector. They play the central role in their industry, with a direct connection to suppliers on one side and with customers on the other. A parallel can be made with the automotive sector, where similar positions and powers exist. Competitive bidding among suppliers is a regular practice. It gives OEMs more margin to demand cost reductions than the transfer pricing associated with vertically integrated component production. This is why OEMs usually prefer having external suppliers than internal divisions. OEMs can be considered as dominant firms because they keep all activities that have more value in their industry: they are accountable for certification and legal issues; they have the link with final customers. The only big difference with the automotive industry is that engine manufacturers play a balancing role in the aeronautical industry.

During my first round of interviews, I was trying to understand how the European aerospace ecosystem unfolded through time and how the different actors found their place to strike an efficient balance between competition and cooperation. If I stick to the basic definition of

business ecosystems, the aerospace industry provides an insightful case study of alliances and partnerships where no actor can perform without aligning its business and those of its partners.

Table 13 Top 25 aerospace companies in the world[5]

Top 25 aerospace companies in the world by revenue ($ millions)					
		Sales (revenue) 2022	Sales (revenue) 2021	Country	Creation
1	Raytheon Technologies	67 074	64 388	United States	1922
2	Boeing	66 608	62 286	United States	1916
3	Lockheed Martin	65 984	67 044	United States	1912
4	Airbus	61 791	61 642	Europe	1970
5	Northrop Grumman	36 602	35 667	United States	1929
6	Rostec	30 045	27 956	Russia	2007
7	GE Aerospace	26 050	21 310	United States	1917
8	Safran	20 016	18 329	France	2005
9	L3Harris	17 062	17 814	United States	1895
10	Leonardo	15 471	16 708	Italy	1948
11	BAE Systems	13 793	16 122	United Kingdom	1999
12	Honeywell	11 827	11 026	United States	1886
13	Rolls-Royce	11 524	10 872	United Kingdom	1906
14	AVIC	11 313	12 296	China	1993
15	Textron	9 336	9 203	United States	1923
16	General Dynamics (Aerospace)	8 567	8 135	United States	1952
17	Dassault Aviation	7 286	8 550	France	1916
18	Bombardier	6 913	6 085	Canada	1942
19	MTU Aero Engines	5 605	4 950	Germany	1934
20	TransDigm	5 429	4 798	United States	1993
21	Hanwha Aerospace	5 063	5 635	South Korea	1977
22	Thales	5 054	5 276	France	1893
23	Spirit AeroSystems	5 030	3 953	United States	2005
24	Israel Aerospace Industries	4 477	4 477	Israel	1953
25	Mitsubishi	5 511	5 511	Japan	1928

[5] from Flight International Top 100, published 18 August 2023

In order to understand better how the ecosystem construct can apply to the aerospace industry, I first focused on the ecosystem as affiliation level, trying to understand the competitive and collaborative dynamics among actors and through the years. This was the basic step before moving to new value creation projects involving several interdependent actors.

Section 2 The aviation ecosystem as affiliation

During my first round of interviews, I met informants evolving in the European aerospace industry, with a strategic position. Before starting my first round of interviews, I had the opportunity to observe during two years executives from 8 of the 25 most important aerospace companies in the world: Airbus, Safran, Leonardo, BAE Systems, Dassault Aviation, Thales and MTU Aero Engines. I interviewed people about the civil market, military market, on commercial aircraft business, the jet-engine business and on the space sector. After this first round of exploration, I focused on the aircraft civil market. The world aerospace market is strongly led by two main leaders, Airbus and Boeing. I also chose to focus on Airbus and on the European market because of my geographical location. This is what lead me to focus on Airbus and Safran ecosystems as affiliation.

2.1 Airbus

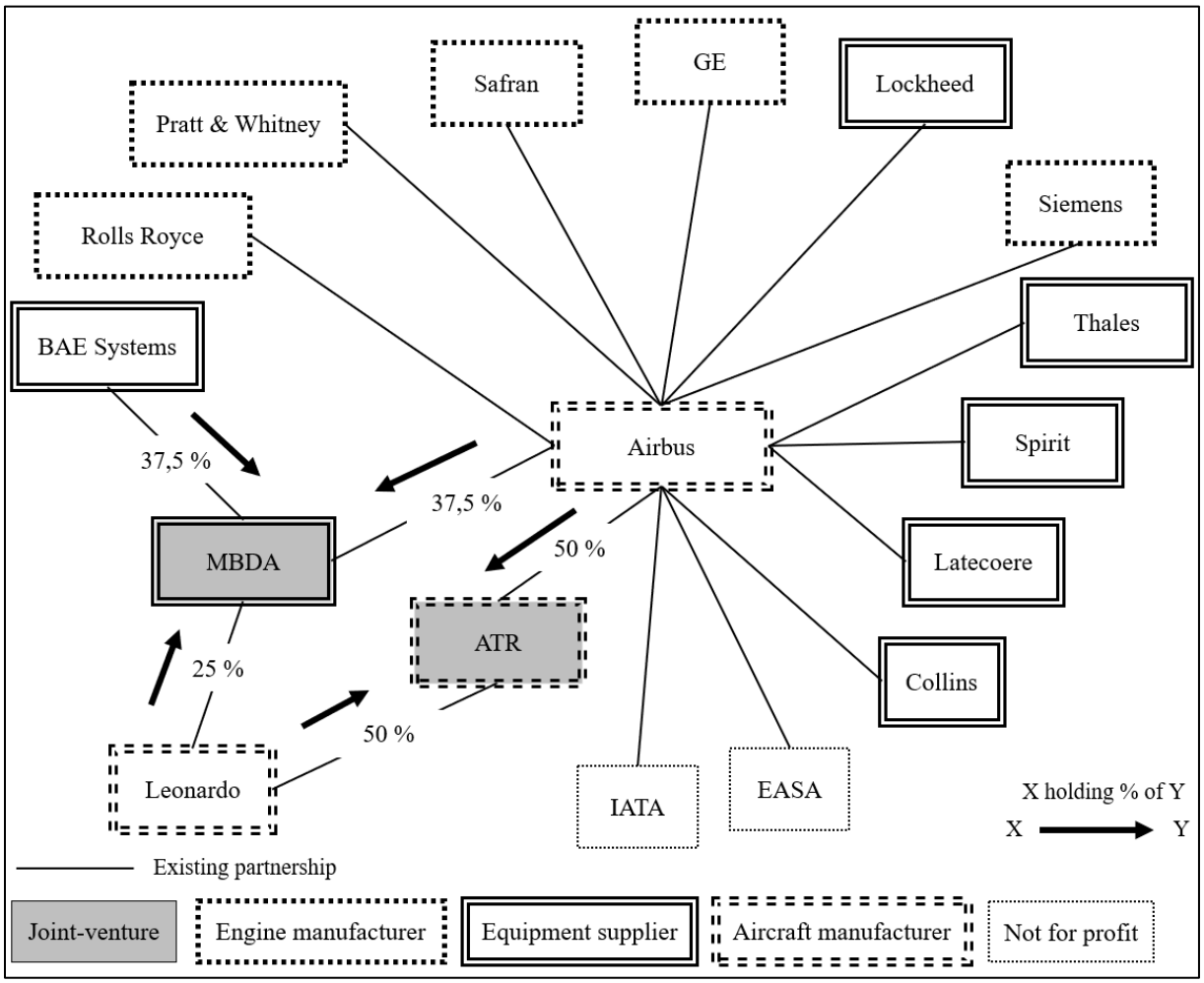
Airbus has been a leader in designing, manufacturing and delivering aerospace products, services and solutions to a customer base that spans the globe, with operations for commercial aircraft, helicopters, defence and space, since 1970.

Airbus has been part of the European aerospace business ecosystem for more than fifty years and developed its portfolio of relationships with engine manufacturers and with suppliers.

Boeing was the clear market leader in the 1980s but Airbus came out as a threatening competitor when it first managed to catch 50 % of the market in 1997.

Figure 16 and Figure 17 show how Airbus and Safran are positioned in their ecosystem as affiliation landscapes. They have longstanding ties with first rank suppliers, customers, complementors and not-for-profit actors who are directly connected and rely on one another to do business. All the ties represent contractual agreements to deliver value propositions that are part of Airbus and Safran core businesses.

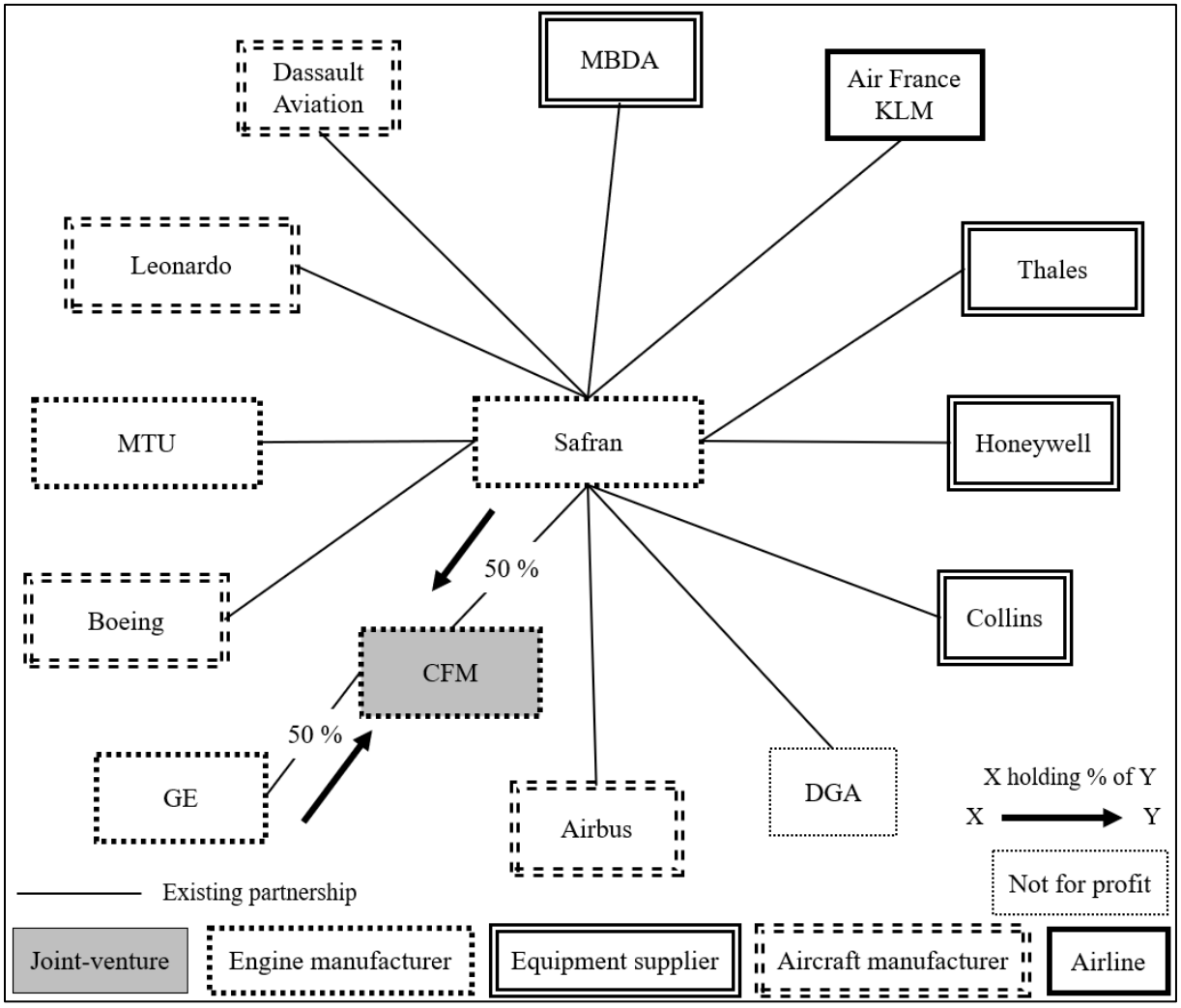
Figure 16 Airbus in its ecosystem as affiliation of longstanding ties (since 1970)



2.2 Safran

Safran is a high-tech industrial group operating on all continents, a key player in the propulsion and aerospace equipment, space and defence sectors. Safran was created by the merger of Snecma and Sagem in 2005 but the beginning of the group activities dates back to 1896, when Zodiac produced its first airship. An important date in the group history is 1974 when the joint company CFM International was created with General Electric Aircraft Engines.

Figure 17 Safran in its ecosystem as affiliation of longstanding ties (since 1974)



Those two figures show that Airbus has direct and strong ties with all Safran direct competitors (engine manufacturers), while Safran also has strong links with all aircraft manufacturers. The

whole aircraft industry has been mostly structured by the development of OEMs (Original Equipment Manufacturers) so I will spend some time on showing how Boeing and Airbus developed their business and evolved their strategic positioning over the last century.

Section 3 Airbus and Boeing

When technological changes occur faster and business cycles are shorter, unpredictable events can undermine firm strategic assets. To balance this higher uncertainty, firms try to accumulate new strategic assets and get ready for coming change. Airbus is a European consortium that was created as a joint partnership between Germany, France and the United Kingdom in 1967. After twenty years, it had turned to be a pioneer in the commercial aviation thanks to its technological advance. The competitive landscape for Airbus seems at first sight to have become increasingly clear over the last decades. Airbus was established as a consortium while Boeing took over its former opponent, Mc Donnell Douglas, in 1997. In the meantime, aircraft manufacturers such as Convair or Lockheed have pulled out of the civil aircraft market. This was also the time when the Soviet Union collapsed, which left the Russian aviation in a weak position. Boeing and Airbus thus progressively unveiled as two strong actors in a global duopoly, in the market for jumbo jets and other large commercial jets. All data used to write this section are secondary data that come either from institutional website (for Airbus[6] and for Boeing[7]) or sectoral studies and consulting reports.

[6] www.airbus.com/en/our-history
[7] www.boeing.com/history

3.1 Airbus, Boeing and the commercial aircraft global ecosystem

In 2023, Airbus delivered 735 aircraft and won the deliveries crown for the fifth year in a row. Deliveries were up from 566 in 2020, 611 in 2021, 661 in 2022 but remain well below the company's all-time record high of 863 shipments in 2019. Airbus is expected to retain the deliveries lead for the foreseeable future due to the company's comfortable backlog lead over its American rival. Prior to 2019, Boeing had out-delivered Airbus every year since 2012. In 2023, Boeing delivered 528 aircrafts, an increase in comparison to the 480 aircrafts delivered in 2022.

There are two core factors on which Airbus has based its sustainable growth. On the one hand, they have managed to steadily accumulate strategic assets with an incremental development of programmes. On the other hand, Airbus unfolded a strategy based on keeping as much commonality as possible among its various programmes developed. Airbus managed to go quite fast during its consolidation phase and to keep on taking over Boeing thanks to a strong focus on collaboration. Airbus indeed explored the technological capabilities of its partners (Kazeminia, 2021).

Aircraft firms keep on innovating to anticipate the various threats and uncertainties that pop up in their environment and they mostly seed those innovations based on new aircraft developments. Those programmes require tremendous investments, which explains why the main firms always base their developments around alliances (Garrette & al, 2009).

An historical overview of Airbus development is key to understand how they developed their programme capabilities and interorganisational relationships capabilities. Airbus drove three main cycles of new product development in relationship with the A300, A310 and A320 programmes. In 1967, the three founding countries, Germany, France and Great Britain, started mutualizing their complementary technological and financial assets. The A300 was designed in

collaboration with two airlines, Lufthansa and Air France, as a two-engine aircraft. From the start of the adventure, customers were involved in the design of their supplier. The design of the aircraft was finalized in 1969 and the product was introduced to the market in 1973. Before the 1960s, aviation companies based in Europe did business at a country level but they were too small to be able to compete with American aircraft counterparts. Consequently, the three main European governments with industrial firms involved in the aerospace sector, wrote a memorandum: "for the purpose of strengthening European cooperation in the field of aviation technology and thereby promoting economic and technological progress in Europe, to take appropriate measures for the joint development and production of an airbus" (Airbus website). While Airbus was putting its first aircraft on the market with the target of offering the "most economical aircraft", the founding directors already had a plan to cover all aircraft needs. From the start, they had an objective of eventually gaining a 30 percent market share in the coming years. Even if Airbus is today a civil market actor, the governments have played an essential role in its birth and there is no way such an actor could rise today without a strong support from a country or group of countries. When the first A300 went into service in May 1974, it displayed a strong competitive advantage in comparison to all American jets because it had one less engine. It was a perfect timing with the 1973 oil crisis and that helped starting to sell Airbus aircrafts outside the European boarders.

A second cycle of new product development started for Airbus in 1976, when it decided to address the market for smaller aircrafts and designed the A310. Airbus was aiming at leveraging the assets of the A300 to go further with a lighter, more resistant and more economical aircraft. The A310 was thus at the same time very different from the A300 but illustrating the Airbus strategy of sharing a maximum level of commonality from one plane to the next. Airbus made an entry into a well-established industry where for example, Boeing Airplane Company was

established by William Boeing in 1916. From its earliest moments, the operational leaders of Airbus had the long-term objective to build a family of aircrafts that would answer a broad range of needs that their customers can have. Airbus went through 3 first cycles to build the basis of its family with the A300, A310 and A320, all targeting different distance options and different levels of capacity. In the first cycle, Airbus needed six years to have its first aircraft ready to fly, from 1967 to 1973. It then managed to make the most of its experience to take only five years to develop the A310, which was announced in 1978 and delivered for its first flight in 1983. The dynamic went on in the next years with the same kind of incremental development and asset improvement. It led to a third cycle with the A320 being announced in 1983, before its delivery four years later in 1987. The strength of Airbus has also been to progressively build its own credibility, to give trust to customers and potential partners, first in Europe and then in the whole world. The aircraft industry requires huge financial investments to start producing and sustain technological developments. The step from A300 to A310 was crucial in the success of Airbus, which managed to obtain over 100 orders after it announced the project to release its second aircraft. On the technological side, Airbus built its competitive advantage on a steady and wise culture of headways allowing economies for their customers. In 1977, a version of the A300 was the first two-engine aircraft to get permission to take long-distance routes. This was a breakthrough, especially in the context of the oil crisis that took place in 1979 and happened as an external shock in the environment. This crisis put a stronger constraint on airlines to reduce their fuel consumptions. This was the good timing for Airbus to announce the future launch of the A320 programme with the target of being the most fuel-efficient aircraft on the market.

Airbus success was also initiated as an alliance at government level, even if there was a strong threat during phase 1 when the British government left the consortium, before coming back in

1979. As soon as 1969, the UK withdrew from the Airbus partnership because they preferred to support a domestic competitor, which could have killed Airbus at its birth. During its first cycle, Airbus was thus endangered because of booming costs and because of internal competition with other aircraft programmes inside European countries. They however managed to readjust the initial design of their first aircraft and first adopted a compatibility strategy, to be sure that their first aircrafts would be as similar as possible as a Boeing 747. This strategy was the best way to control the first costs, allow an easy maintenance and get approval from the airports. After this fragile first cycle, the British government came back into the consortium and granted a 50 billion pounds in a returnable loan, in exchange of a 20 % share in Airbus Industrie. This was only possible thanks to a strong support from the newly nationalised British Aerospace company. The Labour British government of that time was actually considering rather taking part in a Boeing project. At this point in time, Airbus started to look attractive for partnerships, be that on a customer or partner side and the European consortium wanted to go beyond its borders. In this period, Airbus had developed technological capabilities and sold enough aircraft to attract other aircraft manufacturers for partnerships to produce smaller aircrafts. McDonnell Douglas, which was the fourth American aircraft manufacturer with North American, Lockheed and Boeing, was the first company to propose Airbus joint development programs. Boeing also tried to partner with Airbus but it was a failure because Airbus refused to become a sub-contractor of an American competitor.

This attractiveness was mostly due to the continuous technological improvements that Airbus aircrafts displayed, including composites in primary and secondary structures, new cockpits, fly-by-wire and other design changes that were breakthrough and exemplary at that time. Composite components were more resistant and much lighter than other materials. The new cockpit included digital gauges that replaced the former analogue gauges. This was a real

landmark because it cancelled the need for a flight engineer in the cockpit. Moving from 3 to 2 pilots was thus enabled. Despite these important technological advances, the most important one for Airbus has been the introduction of “fly-by-wire”, a ground-breaking technology that shaped the development of the commercial aviation industry. From this point, pilots no longer needed to control the deflections of the flight control surfaces on the tail and wing because they are computer driven. Fly-by-wire facilitated flight controls, reduced weight and improved the reliability of flights because pilots could no longer engage in manoeuvres that would have been outside the aircraft capacity. All these technologies came along with the third cycle of Airbus development. The A300 and A310 aircrafts were mostly conventional aircrafts, whereas the A320 offered a high-level of high-tech with the ambition to outrun Boeing. This cautious and steady development needed to be translated into commercial progress and Airbus was doing great to receive pre-orders for future aircrafts, which had still not been designed. In 1978, the first airline to order an A310 was the airline SwissAir. It was followed by Air France, Lufthansa, Iberia, KLM, Martinair, Sabena and Air Afrique. This dynamic was possible because Airbus had innovated on the technological side but also on the partnering side. They had started blurring the lines between actors in the ecosystem as they included their customers in the design teams of their new aircrafts. Airbus innovation was also on the commercial side where they needed to convince new customers. It was at that time key to sell to customers in Asia and in the US and Airbus took the risk to lease its airplanes. In 1978, Airbus was facing many protectionist measures, so they agreed to lease one A300 aircraft to the airline Eastern Air Lines, for free and for 6 months. The airline only had to pay for the pilot training, the used spare parts, fuel and operating costs. Eastern Air Lines was so satisfied by the product that they bought 23 A300 in the following months. This was a strategic move from Airbus because this financial effort granted a large access to the American market, where the highest barrier was the

certification process. Eastern Air Lines had the planes certified by the FAA (Federal Aviation Administration), which allowed Airbus to sell aircrafts to any other airline in the United States.

In 1979, Airbus started seeing the results of its commercial efforts, in the US as well as in Asia, where the Philippines, Malaysia, Indonesia, Iran and Pakistan were new customers. In 1980, Airbus had sold 256 aircrafts and had conquered one quarter of the civil aircraft market, with 32 different airlines as customers. At that time, the dynamic was launched and when Airbus announced the new A320 programme in 1983, already 80 orders for this plane had been received. Despite this strong entrance on the global aviation market, it took a few more years for Airbus to play in the same playground as Boeing. In 2003, Airbus outran its main competitor in terms of deliveries as well as in terms of orders.

Airbus progressively developed and raised barriers for potential new entrants because they focused on a commonality strategy. Thanks to those commonalities among Airbus aircrafts, customer airlines could easily switch from one plane to another, be that for pilots or cabin crews. They demanded shorter times to be trained for one aircraft or the other. That had a strong positive contribution to cost efficiency. This strategy was very hard to imitate for other players.

If I focus a bit more on the direct competition between Airbus and Boeing, there is a need to come back to the first steps of the American major company. Boeing has for long been the dominant market leader, in the aerospace industry which is built on long-term commitments.

Boeing Company is headquartered in Arlington, Virginia and is a leader in the design, development, manufacture, sales and services for commercial jet aircraft, military aircraft, missiles and spacecrafts.

Most of Boeing’s business takes place in the US while its partners and suppliers are spread around the globe.

Manufacturing in the aviation industry includes the production of fuselages, engines, electronic equipment, components and flight management and control systems. The aviation industry has been at the forefront of advanced manufacturing technologies, which are regularly used in other industries such as the car industry, electronics or metal products.
The supply-chain for civil aircrafts gathers thousands of firms around the world.

Research and development costs are extremely high because the development of a new aircraft takes several years before even starting production. Manufacturers thus need to sell a large number of planes before breaking even. Boeing Airplane Company was established by William Boeing in 1916. Boeing managed to become the dominant actor in the aerospace landscape thanks to military contracts signed with the US Army during World War I and World War II. Boeing first manufactured seaplanes (Boeing Model 2), fighters (Boeing Model 15), mail airplanes (Model 40) but they also created airlines. In 1928, Boeing built a 12 passengers biplane, the Boeing 80, which was the first aircraft built with the only purpose to carry passengers. A breakthrough was made in 1933 when the Boeing 247 was introduced and became the best aircraft because it was safer and faster than its competitors. This was the first twin-engine plane which was able to go on flying if one of the two engines was damaged. Boeing made the most of this successful aircraft, notably because the first 59 aircrafts were directly operated by its United Airlines subsidiary. This kind of operations was clearly putting the barriers for competitors too high, and a law was passed in 1934 to prohibit aircraft manufacturers and airlines to belong to the same company. Boeing success through history has always relied on an agility to switch from civil to military markets. During World War II, the military business took the lead and Boeing built hundreds of B-17 and B-29 bombers, to the extent that when the war ended, several thousand people lost their jobs at Boeing. Technology advanced a lot during the 1950’s and Boeing issued its first commercial jet airliner in 1958,

which allowed the American firm to compete with the actors who had put such planes on the markets a few years earlier: the British De Havilland with its Comet (first flight in 1949, last flight in 1997, 114 planes delivered), the French Sud Aviation with its Caravelle (first flight in 1955, last flight in 2005, 279 planes delivered) and the Soviet Tupolev Tu-104 (first flight in 1955, last flight in 1986, 203 planes delivered). The Boeing 707 made its first flight in 1957 and 865 planes were delivered. Thanks to this aircraft, Boeing outran its competitors to be the dominant manufacturer in the 1960s and 1970s. The business of plane builders has always been closely tied to those of engine manufacturers and airlines. The different 707 models were either equipped with Pratt & Whitney or Rolls-Royce engines. The 707 success opened the way to other jetliners series by Boeing that were highly cost-efficient, like the 727. This narrow-body airliner first flew in 1963 and was a major commercial success with 1832 planes delivered. It was quite soon followed by the issue of one of the two best-selling commercial jet aircrafts in aviation history, the 737, which first flew in 1967 and of which 11 324 planes were delivered. This is approximately at this time that three European countries were giving birth to Airbus. Two years later, in 1969, another iconic Boeing plane was flying, with the 747 which is a large, four-engine long-range wide-body aircraft. The last 747 was delivered in January 2023 and 1574 units were delivered. After more than fifty years of commercial activity, it could be forgotten that Boeing took big financial risks issuing so many different aircrafts in a very small timeframe. There was a recession between 1969 and 1970 that hurt Boeing with no 747 being sold to any American airline for three years. The 1973 oil crisis moreover did not help selling seats in large aircrafts. The trend of 747 orders started rising again in 1977 with 42 aircrafts sold and reached a high point in 1990, with 122 planes ordered during the year. This long-term success was only possible because Boeing kept on innovating and issuing new versions of its aircraft.

In the 1960s, Boeing was doing all the activities on its own, from the design to manufacturing of its 727. Only 2% of product value was imported. This however changed in the 1970s when Boeing started opening its production in order to enable exports. This change went on steadily over the years to the extent that when they are calculated by value, outsourced parts of Boeing airplanes account for 90% of the design and subsystems. The firm purchases components and subsystems globally and has its major suppliers based in Australia, Canada, China, Italy and Japan. Boeing made the choice to reduce investment and risk by sharing the costs of development and manufacturing with its partners. Boeing thus changed its role from a producer to being a manager of external production and a marketer of final products, with a focus on design, R&D and services.

The Airbus A320 has recently turned to be the most popular airliner in the world. It was introduced on the market in 1984; almost two decades after Boeing started selling the 737 and passed its competitor in 2019, when 15 522 A320 had been sold, while 15 156 Boeing 737 had been sold. The A320 was a very complex and innovative plane, which helped the adoption of breakthrough technologies such as fly-by-wire. This technology had in the past only been used in the design of high-performance fighter jets and for the supersonic Concorde.

In the 1960s, American manufacturers started a first wave of mergers and acquisitions. It led to the formations of North American Rockwell Corporation in 1967, of McDonnell Douglas Corporation and of Textron Inc. A second big wave took place thirty years later, in 1994 and 1995, when four airframe manufacturers merged into two, to become Lockheed Martin Corporation and Northorp Grumman Corporation. Boeing was also very active to strengthen its position. They acquired Rockwell International’s space and defence units and then merged with McDonnell Douglas in 1997, thus creating the world’s largest aerospace company.

In Europe, there was the same trend of consolidation with even more radical mergers for concentration. In Great Britain, the landscape moved from 12 companies in 1960 to one major actor, BAE Systems that was created in 1999.

Table 14 Main historical events for Boeing and Airbus development

BOEING	Year	AIRBUS
William Boeing creates Boeing Airplane Company	1916	
707 first flight	1957	
727 first flight	1963	
737 first flight	1967	
747 first flight	1969	
	1974	A300 first flight
767 first flight	1981	
737 Classic start of production (2nd generation)	1984	A310 first flight
	1987	A320 first flight
Cancellation of Boeing 707 production line	1991	Ultra long-range family rolled out (A340-300) First operating profit
Launch of 737 Next Generation (600/700/800/900)	1993	A340 first flight
777 twin jet first flight	1994	A330-A321 first flight
Boeing merges with Rockwell	1996	"Large aircraft division" setup 1000th delivery milestone
The Boeing Company merges with McDonnell Douglas Corp	1997	Airbus wins 50% of the market for the first time
Rollout of the Boeing Business Jet	1999	Airbus Military setup
737-900 first flight (3rd generation) Net total orders for commercial jetliners above the 15 000 mark	2000	Fully Integrated Company (EADS)
Boeing merges its business units into one called Integrated Defense Systems	2002	First A340-600 delivered
Boeing ceases production of the 757 jetliner	2003	Airbus overtakes rival in deliveries for the first time
	2007	A380 first flight
787, Dreamliner first flight	2011	
777X development announced with 777-8 and 777-9	2013	A350 first flight
	2014	A320neo first flight
	2015	
737 MAX (4th generation) first flight	2016	A321neo first flight
	2017	A319neo first flight
737 MAX grounded for 20 months after 2 crashes	2019	
	2021	A380 program stopped

The other European countries hosted the mergers of all main aerospace actors in 2000 to form EADS, as the gathering of French Aerospatiale, Matra, German Dasa, and Spanish CASA. It became at that time the third largest aerospace company in the world, behind Boeing and Lockheed Martin.

The duel between Boeing and Airbus started in 1972, when the first Airbus A300 flew. I only focus on this relationship among two actors because the duel turned to a duopoly in the 1990s, following the mergers that took place within the global aerospace industry.

The following figures (in Figure 18) of aircraft orders illustrate that Boeing was a step ahead of Airbus until the end of the 1990s. The threat was however becoming increasingly tangible as Airbus registered more orders for the first time in 1994 and delivered more aircrafts for the first time in 2003.

Airbus as well as Boeing encountered some issues in the development of their new products, be that with the A380, 787 Dreamliner, or 737 Max.

The A380 can be considered as a commercial failure for Airbus because the programme was long-delayed, over-budget and it never managed to challenge the dominance of Boeing on the large aircraft market[8]. While the target of Airbus was to sell at least 700 A380, only 251 were delivered and production was stopped in 2021. Airbus spent about 25 billion euro on the A380 program, which is more than twice as much as initially planned[9]. Airlines moved away from the hub-to-hub model that such a superjumbo demanded. Few airlines took the financial gamble because operators need flights to be well-filled to break even.

In 2019, the Boeing 737 MAX was grounded after two fatal crashes and the plane was out of action for 20 months. The jet went through numerous and rigorous testing and analysis by the

[8] www.bbc.com/news/business-47225789
[9] simpleflying.com/was-the-a380-programme-profitable/

FAA and EASA before being gradually recertified. The direct consequence can be seen on the following graph with more cancellations of orders than new orders for 2019 and 2020.

The Boeing 787 Dreamliner is a long-haul, widebody, twin-engine jetliner that was designed with lightweight structures. It is the first commercial aircraft to have most of its airframe made of carbon fibre reinforced polymer.

The 777X is Boeing's newest family of twin-aisle airplanes. In 2013, Boeing launched the airplane with 259 commitments from 4 customers. This is the third generation of the 777, with two models: the 777-8 and 777-9. Production of the 777X was scheduled to begin in 2017 and first delivery was targeted for 2020. The delivery of the first 777-9 has however slipped to 2025, with the justification that it reflected an updated assessment of the time required to meet certification requirements (Boeing Q1 2022 earnings release). The FAA (Federal Aviation Administration) and regulators have actually adopted stricter processes to certify aircrafts after issues on the MAX aircrafts.

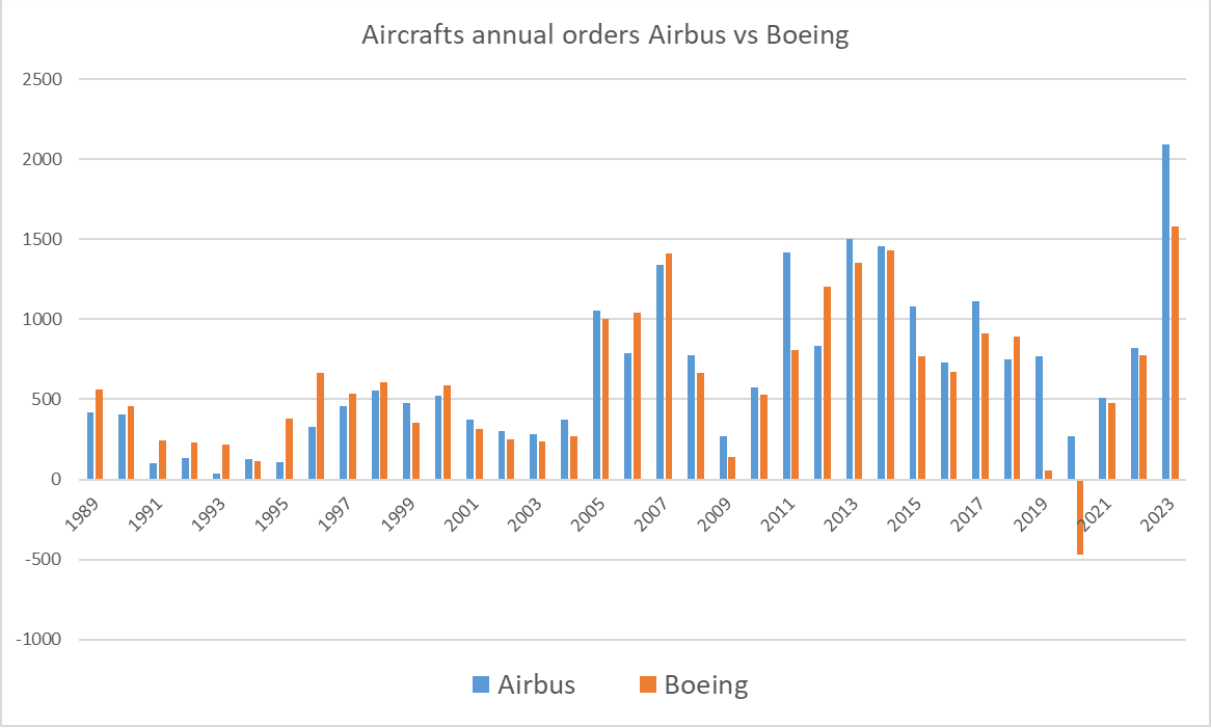
A picture of the present situation seems to indicate that Airbus is keeping the lead because Boeing faces stronger production issues while Airbus managed to secure more orders in 2023. As of September 30, 2023, Airbus had delivered 488 aircrafts, while Boeing only delivered 371. Despite a strong demand and visibility on future sales for at least ten years, the last years have also shown that Airbus and Boeing evolve in an uncertain environment.

Airbus has a history of working with partners that are based all around the world. Around 7 700 suppliers work from 20 countries to deliver components, parts, systems and hardware for Airbus aircrafts. Airbus focused year after year on developing a group of trusted and long-term partners that are named Tier One suppliers. Those actors are involved in joint development and collaboration to foster lean design and manufacturing.

Airbus has always had a dual organization with the civil commercial aircraft division and the military side, with defence, space and helicopters divisions. During my first round of

interviews, I asked top executives from Airbus which partners they considered as the main partners for their company. The first name that usually came was always Safran (Source A, Source D, Source E), as an engine maker both on the civil and military sides, with the A400M. Their next key partners cited were then Palantir, Siemens, Bombardier, Rolls-Royce and BAE Systems. Those firms are all very different actors and have a peculiar relationship with Airbus for different reasons. Palantir is an American company founded in 2003 and specialized in big data analytics. Palantir has around 4000 employees and started working with Airbus in 2016, with the first objective to help accelerate the production of the A350 aircraft.

Figure 18 Aircrafts annual orders for Airbus & Boeing 1989 - 2023



3.2 Airbus, Boeing and services

In comparison to the market of aircraft manufacturing where Airbus is in a duopoly situation with Boeing, on the services side Airbus has thousands of competitors (Source 4). Airbus displays a large portfolio of services including cabin modifications, digital solutions for

maintenance, spare parts or major repairs. Over the last ten years, Airbus has focused on moving from a product centred approach to a customer needs centred approach (Source 4). They regularly question their internal organization in comparison with how their competitors do business. Boeing relies much more on a cross-divisional approach than Airbus so they wondered whether it might be effective to gather the services teams for aircrafts, helicopters and space divisions within Airbus. The conclusion was however that the customers are far too different, be that in their numbers, operations, or needs so they kept on focusing on services separately. Airbus aircraft has around 200 customers who can be profitable if they operate their planes efficiently. The key indicator for an airline is the Revenue per Available Seat Kilometre or RASK. On the one hand they focus on choosing the right routes and aircrafts, on the other hand they need to focus on their customers. Their operational marketing consists of dealing with passengers, doing yield management to set the best prices while filling the aircrafts. All other activities such as maintenance or crew management come next. 90 % of Airbus turnover on services is done with airlines, the other customers being leasing companies or centres of professional training (Source 4). The overall aeronautical services market represented $ 95 billion in 2022. In the world, there are around 2000 airlines, of which 1000 have more than ten aircrafts (Source 5).

The addressable market share for Airbus is however around $ 20 billion because the biggest part of the market goes with engine maintenance. On this market, Airbus manages to capture approximately $ 4 billion (Source 4) in 2022. Before the covid crisis, Airbus had set its “road to 10” target for 2025. The target was erased but it is interesting to understand what was forecasted for the $ 6 billion missing. A first part of this sales should have come from more aircraft sales and organic growth. A second part was supposed to come from acquisitions, but those two targets were stopped with the covid crisis. It was also planned to develop new services such as imagery from aircrafts, to compete with the satellite imagery sector. The target of $ 10

billion for 2025 was eventually readjusted to $ 5 billion, which remains an ambitious target because it would mean a market share progression (Source 2; Source 4).

Comparing Airbus and Boeing performances on services

Respondents (Source 2, Source 4, Source 5, Source 15) who work on the development of services acknowledge that their market is much more opened to competition than the aircraft manufacturing market. They also acknowledge that part of the services sold by Airbus are sold in the continuity of the aircraft sale. This is why a key insight on Airbus performance is to compare with how Boeing is performing with services sales. At first sight, Boeing seems to be doing much better with a target of $ 50 billion in services (Source 4). Despite this very high target, Boeing saw its revenues for global services go from $ 15,5 billion in 2020 to $ 17,6 billion in 2022 (Boeing Annual report 2022 p. 42). However, this amount encompasses a cross-divisional approach, and it includes military services as well as services sold to the US government (Source 4, Source 6). Boeing is also a much older company than Airbus and the older the aircraft, the higher the maintenance costs. Because of this experience and history, Boeing has been able to generate cash and to start investing in mergers and acquisitions much earlier than Airbus. They acquired Jeppesen in 2000 for $ 1,5 billion, which was 6 times its turnover at that time. Jeppesen is the world leader in flight operations, flight planning products and software. It was founded in 1934 and gathers 3200 employees. Airbus is competing with Jeppesen on the flight operations market and needs to differentiate, customer by customer, to achieve a turnover of around $ 100 million (Source 4). 75 % of the $ 4 billion turnover done by Airbus in services is due to maintenance, spare parts sales and aircraft modifications.

> *"Today, Skywise has almost no weight in the services sold by Airbus and we tend to sell applications that have existed for twenty years. It is a pity because Skywise is a very powerful tool. We could probably have found synergies between our internal needs and airlines needs because they are sometimes very similar" (Source 7).*

There are opportunities for services development that arise with the development of Skywise platform but the big size of Airbus and the historical organization are slowing down the pace to turn those opportunities into business and value creation.

Other competitors on the services market

On the aircraft services market, all traditional partners are potential competitors. One of the biggest actors is Lufthansa Technik, whose revenue grew from € 4 billion in 2021 to 5,6 billion in 2022 (Lufthansa Technik annual report 2022). They sell maintenance, repair and overhaul of aircraft parts. Many suppliers of Airbus then can be seen as direct competitors on the service market, such as Collins, Thales, GE Aviation and other engine makers, Honeywell and companies like Akka that can offer cabin modifications and flight planning (Source 4).

> *"Among the main competitors for Skywise, we can count Aviatar, which is rather a competitor for Skywise Health Monitoring (SHM), but also big data tools that are not necessarily aeronautics oriented" (Source 11).*

This shows that in order to compete on the aircraft services market, actors can either come from the existent aerospace ecosystem as affiliation or be big data tools and platforms providers.

From the context to my research choices

I decided to make a focus on two potential competitors for Skywise and to wonder which strengths and weaknesses they could have comparatively. First, I focused on the case of OpenAirlines, an aeronautics services pure player based in Toulouse that can also bring some insight on the performance of Skywise. Secondly, I focused on the case of SITA, a consortium created after the second World War by airlines to provide services for airlines (Source 6).

OpenAirlines aims at providing tools to airlines so that they reduce their CO_2 emissions. The company was created in 2007 (see Table 22 for an overview of the main steps of their development, their core offer and key partners) for a comparison of and their initial business

was to help airlines plan their crews shifts. They decided to enter the software market in 2009 and launched their platform, SkyBreathe in 2013. During four years, they worked with other start-ups and answered a European Clean Sky call for proposal to produce the research and development at the root of their software. Their platform analyses big data and uses artificial intelligence to reduce aircraft fuel consumption (Source 5; company website). OpenAirlines mostly uses flight data, with weather forecast data and flight control data. Their first customer was Transavia, and they had 52 customers in 2022, with different business models, be that low cost, charter, flight carriers, cargo, legacies or regional airlines. They started with low-cost companies because they are more sensitive to cost savings, they are relatively more risk taking and innovative than big airlines (Source 5). In comparison with Skywise, it was a competitive advantage to belong to Airbus to reassure some airlines, but it can also be a competitive disadvantage towards small actors like OpenAirlines who will have the same level of bargaining power as airlines. Their business model is quite classical for software providers and consists of selling subscription, which changes depending on the number of aircrafts in the fleet and types of aircrafts. The agreement with customers is that they pay more if they burn less fuel. It is easy to understand and there is no additional option to the subscription that includes the software, updates every three weeks, maintenance, support and hosting in the cloud. OpenAirlines is currently operating in 36 countries. In 2022, they had 62 employees and planned to register a turnover of € 6 million, with a strong growth in comparison to € 3,6 million in 2019, before covid crisis, € 2,6 million in 2020 and € 3,9 million in 2021. OpenAirlines considers it faces a direct competition with three actors: Boeing, Honeywell and GE (Source 5), even if they are ahead their competition:

> *"130 airlines are equipped [with fuel efficiency solutions], which stands for 15 % of the market. We were behind Honeywell until 2020 but we overtook them, be that considering the number of customers or the number of aircrafts" (Source 5).*

In order to understand better how OpenAirlines creates value for its customers, it is insightful to observe how it is structured and how many employees work in each division. All employees have a very close link to the airlines:

> *"sales and marketing account for 20 % of our team. Customer success is constantly in touch with our customers, for consulting and implementation and they also account for 20 % of our team. Then there are the R&D, finance and administration teams, including the product teams, which are regularly in touch with the airlines. I want everyone to be in direct contact with the airlines and one of our strengths is to understand them. We learn from their ideas and feedbacks" (Source 5).*

OpenAirlines is thus a small actor that has strong prospects of growth. In comparison to Skywise, they benefit from a much easier position, notably because they are not structured as a business ecosystem. Their digital services are also their only offer so they can focus on developing resources for this sole objective and focus their commercial efforts towards this target. Even if they are a small actor, from the point of view of airlines, it must be much more appealing than Skywise solutions that must seem too complex and not adjusted to their needs. The key take-away for Skywise is that they will need to invest more time on customer relations if they want to increase their revenues.

Another insightful example of competitor for Skywise with a different approach is shown by SITA, which was created as a consortium in 1949, operates as an air transport communications and information technology provider, employs around 4500 people and made a $ 1,34 billion turnover in 2020. SITA is owned by members of the air transport industry[10]. The structure of SITA is interesting because it is a consortium where airlines are at one and the same time shareholders and customers (Source 6). SITA displays three domains of expertise, with SITA for aircraft, SITA at borders and SITA at airports. SITA for aircraft aims at

[10] www.sita.aero

> *"enabling digital transformation for over 400 customers and across 18 000 commercial aircraft, together with more than 90 air navigation service providers" (SITA website).*

SITA can finance what they call "big bets", which are innovative projects that need to be explored:

> *"once the ideas are chosen, they try to develop projects using Agile methods. They have their own digital platform and digital tools, so the technical part is not an issue. The key issue has rather been to know how to bring data to their platform" (Source 6).*

Their activity is highly linked to airlines business so 2020 and 2021 were bad years with a turnover of around € 1,5 billion, where they could target a 2,5 billion objective during a normal year. Within their portfolio of activity, they have the will to achieve between € 600 and 800 million in 2023 with digital services and then a middle term objective of € 1,3 billion for 2028 (Source 6). SITA claims to be the "anti-Skywise" because they introduce themselves as "the airlines actor, speaking to the airlines" (Source 6). They do not face the same difficulties as Skywise at the launch of the project to access the data, but rather issues to know what to do with the data, to valorise it (Source 6). This can explain why Skywise struggles to generate value out of its big data solutions, when one can observe that even a competing actor that has easy access to data and a strong technical solution, with a long-standing trust relationship with customers, still struggles to sell them new services. One of the key strengths of SITA is furthermore to have a world footprint, which is quite comparable to the one Skywise has.

> *"Inside SITA, there are 80 to 100 people working as a network from all over the world. They can be based in Atlanta, London, Geneva, Singapore or Dubai. They are very close to their customers, the airlines" (Source 6).*

Another difference with Airbus is that almost all resources working on these projects are internal, there is no fall back on suppliers. This can bring more control but less flexibility:

> *"There is no such relationship as Palantir or Skywise Partner for SITA. They keep those capabilities internal" (Source 6).*

SITA's business model is mostly based on communications for airlines, when the aircrafts are flying, which is linked with their historical activities. They do not necessarily see Skywise as a threat for their future business:

> *"They see Skywise as a forerunner of digitalization, as a landmark on the market. They do very little marketing and go at their own pace" (Source 6).*

In 2011, Airbus bought Satair, a global company and world leader in the commercial aerospace aftermarket, for $ 500 million. Satair was founded in 1957 in Denmark. This was the first strong move from Airbus to start blending its portfolio and relying less on aircrafts sales only. In 2011, Satair achieved a turnover of $ 400 million.

The same year, Airbus also acquired Metron Aviation, an American air traffic management services company. Metron Aviation was reorganized to support the launch of Navblue.

> *"Navblue was supposed to be the armed wing of Airbus in software and flight operations" (Source 5).*

> *"Airbus has a strong strategy focused on developing services, but it is easier to say than do. Five years ago, we had started a "Road to 10" strategy, based on a target to achieve € 10 billion of turnover in 2025. After the covid crisis, the new ambition is rather around € 5 billion" (Source 2).*

> *"At the beginning of Skywise, market studies were carried out by consultants, who advised to follow the Apple model to sell applications and generate € 2 billion of turnover" (Source 2).*

Airbus is at one and the same time in a favourable position to engage a strategic shift towards being a service provider for airlines and faces hitches that were most of the time not anticipated or underestimated. Data sharing can be a bone of contention between partners.

> *"Data sharing can be a real blocker for airlines. When you give access to your data to your OEM, you trust him, especially when it is Airbus, because Airbus is well-known actor regarding data protection and cybersecurity. This is an advantage in front of small players who need to reassure and convince the airlines. It might also however turn to a drawback as some airlines can fear losing negotiation margin if Airbus uses those data in the context of future aircraft sales" (Source 2).*

Airbus strategy is to capitalize on its capabilities to assemble aircraft and transfer its integration skills to the service market, using digital tools as a catalyst (Source 4):

> *"We wish to become an integrator of services, the way we do it for aircrafts. We offer a rather large range of services that can be packaged together thanks to digital tools and platforms. This is how we can go beyond the existing services."*

This is for example what they tried to do when Navblue partnered with OpenAirlines in 2017. In this partnership, Navblue is a seller of OpenAirlines solution (Source 5). Navblue initiated the relationship, and it was appealing to OpenAirlines which expected to benefit from Airbus strong position to open the doors to new airlines. The result is however quite disappointing after 5 years of partnership with only two new customers on-boarded through this channel (Source 5). The reason might come from the complexity of Airbus offer:

> *"The context of Airbus and Navblue is much more complex than ours because we know how to be very fast and customer-oriented, with simplicity in our offer" (Source 5).*

Despite this clear will inside Airbus, there is not necessarily the same perception of openness from the point of view of other actors who also evolve on the aircraft services market:

> *"Skywise opened its platform to third party developers very late. It was either because of a lack of maturity of their platform or because they wanted to keep control on who does what. I also think that they wanted to keep some applications only for their own needs" (Source 5).*

Section 4 Context of DDMS within Airbus

Airbus has built more than 13 500 commercial aircraft over the last fifty years and they have constantly evolved their production techniques.

> *"New digital technologies help to deliver on time while maintaining quality, keep flexibility to adjust aircraft production, and reduce the impact of manufacturing activities on the environment for improved sustainability" (Airbus website).*

Airbus has launched a major digital transformation named DDMS, for Digital Design Manufacturing and Services, in 2017. It represents Airbus's commitment to harnessing the power of digital technologies, data analytics, and automation to transform how aircraft are designed, manufactured, and operated. The goal of DDMS is to improve efficiency, reduce costs, accelerate innovation, and enhance customer experiences throughout the entire lifecycle of Airbus products.

Key elements of the DDMS initiative include digital design processes, advanced manufacturing techniques, and data-driven services. Airbus seeks to integrate various digital tools and technologies into its workflows, from initial concept and design stages to production and maintenance.

The uncertainty of dynamic environments has been addressed by strategic management scholars through the lens of the dynamic capability perspective (Teece & al, 1997). Dynamic capabilities can be processes or capacities that are needed by a firm to adjust its resource base and maintain its competitive advantage to sustain growth over time (Helfat & Winter, 2011). Research & Development capabilities are among the most important assets to develop new products, services or technologies (Eisenhardt & Martin, 2000). As long as I focus on how firms grow and adjust, the relevant empirical studies are mostly qualitative studies and case studies (Langley & al, 2013). Firms usually develop their capabilities in interaction with their new product development processes (Danneels, 2002). Studies on the growth period seldom focus on large firms, or on new large products and very few studies have dug into the case of the commercial aircraft industry, despite its importance (Kazeminia, 2021).

The broad European aerospace industry can be seen as a mature industry in which historical actors evolve in an ecosystem as affiliation. Their strategic renewal might depend on the

creation of new business ecosystems, in the sense of ecosystem as structure. I will dig further on this question with a focus on the antecedents allowing the emergence of new business ecosystems in Chapter 4.

Table 15 Key figures for product & services markets in the aeronautical world industry[11]

		sources
Airbus turnover	€ 66,7 billion	public
Airbus turnover with services	€ 3,5 billion	2, 4
Boeing turnover (2022)	$ 66,6 billion	public
Boeing turnover with digital services	$ 1,2 billion	6, 4
Overall aeronautics service market	€ 95 billion	4, 6
Adressable aeronautics service market for Airbus	€ 18-20 billion	4, 6, 15
Cost of DDMS	€ 1,5 billion, end planned in 2027	14, 7
Cost of SAP	€ 50 - 80 million per year	14, 6
Skywise cost per year for Airbus	€ 40 million	8, 6
Sopra Steria cost per year for Airbus	€ 8 million	8

In the following chapter, I will focus on the first steps of development of a new business ecosystem, with a particular attention on digital transformation.

[11] Available figures in December 2023

Chapter 4 Antecedents from mature EAA to create new EAS

Ecosystems have been studied for thirty years and this lens of analysis is spreading to all industrial sectors. Scholars explore this concept as an extension of research concepts ranging from interorganizational relationships (IORs) to strategic alliances or networks. Despite thorough literature reviews on the topic, several definitions of business ecosystems still coexist, either focusing on the structure around a focal value proposition, or on the interconnectedness of participants evolving in a common environment. I dig on the creation phase of an ecosystem, adopting an ecosystem as structure lens (Adner, 2017). This approach helps focusing on the steps occurring before the ecosystem is visible, in the context of a mature industry, where most actors already have long-standing ties with their business environment, which can be considered as the ecosystem as affiliation perspective. Those two perspectives are complementary, and my intent is to see how they complement each other. These long-standing ties have an impact on the creation of new structures, made of actors and embodied by their activities. After precising the literature on ecosystems with a focus on the articulation between ecosystem as affiliation (EAA) and ecosystem as structure (EAS), I focus on the antecedents that allow the emergence of a new value proposition, potentially leading to the renewal of a mature industry. I use a case study of two potentially competing value propositions in the European aerospace industry and shed light on antecedents of ecosystems, at the intersection of path dependence (Sydow & al, 2009) and strategic renewal. This chapter helps understanding how, why and when players align to allow the emergence of a new value proposition. I eventually suggest a ranking of eight antecedents to ecosystems.

For a long time, scholarly attention to strategic alliances in business focused largely on bilateral collaborations (Doz, 2019). Yet, sectors become increasingly dynamic and interdependent

(Adner, 2012) to the extent that most companies now need to address their strategic development through a portfolio of relationships, rather than through several dyads. Since 1993 and Moore's first paper about ecosystems, the interest for this concept has kept increasing and different research streams have explored the innovation ecosystem (Adner, 2006), platform ecosystem (Ceccagnoli & al, 2012; Gawer & Cusumano, 2008), entrepreneurial ecosystem (Isenberg, 2010), knowledge ecosystem (van der Borgh & al, 2012) and technology ecosystem (Wareham & al, 2014). Those streams help define an ecosystem as an alignment structure for several partners who need to interact so that a new value proposition may emerge (Adner, 2017).

Most of the literature focuses on the first steps of an ecosystem, when the structure is easier to observe (Adner & Kapoor, 2016) but the creation phase of ecosystems as structure, which happens before the first steps are visible, remains unexplored (Dattée & al, 2018). As long as most companies have to deal with a longstanding and evolving environment, they adopt strategies to further sustain their competitive advantage. Prior research conceptualizes ecosystem strategies as static and focuses on cooperation or competition (Hannah & Eisenhardt, 2017). Studies have called for an investigation of the antecedents of ecosystems and a focus on why and when players align, when most of the existing research describes the how (Jacobides & al, 2018). To address those gaps, I consider ecosystems in their competitive context (Jacobides & al, 2018) and adopt a dynamic approach, questioning current decisions with regards to historical ties, path dependence (Sydow & al, 2009) and strategic choices. I also intend to overcome a major blindspot in IOR literature of single-party focus (Lumineau & Oliveira, 2018) and observe the ecosystem in its creation phase, when the structure is designed. Four basic elements characterize an ecosystem structure: activities, actors, positions and links (Adner, 2017). The intended outcome of such structures is to generate value. Mature industries face strategic renewal challenges (Agarwal & Helfat, 2009; Schmitt & al, 2018), which might

imply new structures for new ecosystems. Value creation and value capture considerations have been extensively studied but the management challenges and control mechanisms multilateral collaborations face did not receive comparable attention (Wareham & al, 2014; Doz, 2019). Research on multipartner alliances often treats them as a collection of independent dyads, neglecting the possibility of third-party influence and interference in dyads (Davis, 2016). This limitation applies to ecosystems and can be extended to more partners with which a focal firm has a history. I will thus study how ecosystem characteristics are chosen in a new ecosystem. Eventually, my focus is on a business-to-business market (B2B), when a large focus of the literature rests on customer-facing firms in existing business-to-consumer (B2C) markets (Dattée & al, 2018). Thus, I ask:

What are the key antecedents to a new ecosystem as structure allowing renewal in mature industries?

Observing those antecedents should help understand why and when partners align.

I conduct a two-case theory-building study (Eisenhardt & Graebner, 2007) based on a unique access to field data from managers involved in the creation phase of two new and potentially competing business ecosystems. My setting is the data exploitation business in the European aviation industry. Using interviews and archival data, I study how Airbus and Safran build on their history, past relationships and experiences to develop new capabilities and address a market of services, which is outside their core business. I made 20 interviews between April 2019 and January 2021[12]. My study allows a better understanding of how to launch a new EAS

[12] See Chapter 2 Section 2.2, Table 8 and Table 9

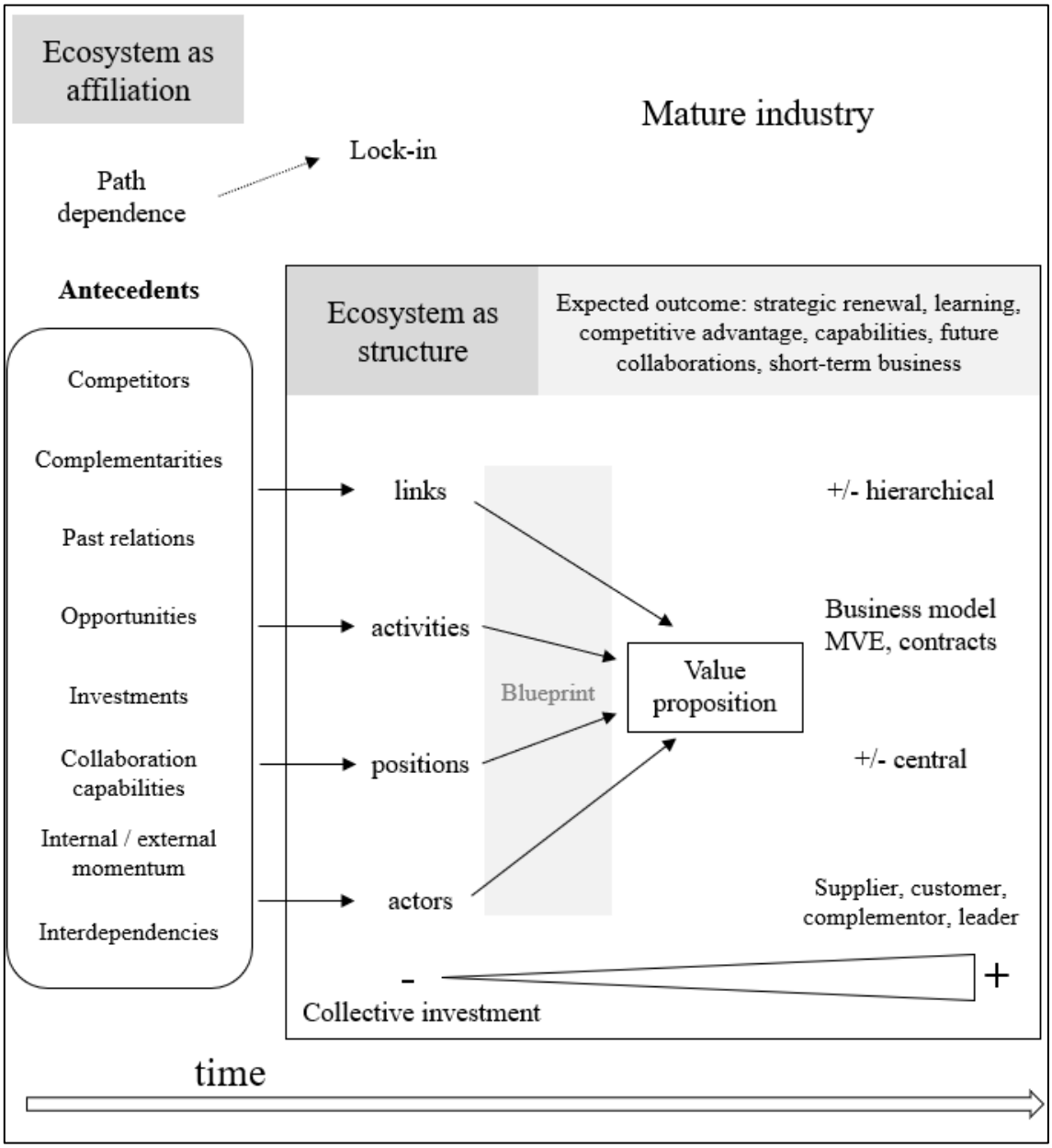
in the context of a mature EAA. A firm leading a new EAS will need to attract partners from inside its existing EAA but also from outside it, to strike a balance between efficiency, trust, complementarities and value creation. My contribution is to advance knowledge on the governance of EAS in this particular set-up. I show to what extent the new structure needs to be led by one firm. I also show how new ecosystems can rely on a non-fully hierarchical management.

Section 1 Exploring two new ecosystems creations

Based on the synthesis of my literature review on business ecosystems in the particular case of a mature industry, I want to shed light on the extent to which several identified antecedents play a key role in the emergence of new business ecosystems.

Figure 19 is a synthesis of Figure 12 and Figure 13 that articulates how several antecedents at the ecosystem as affiliation level can have an impact on the creation of a new ecosystem as structure. My aim with the following empirical work was to assess how those identified antecedents in the literature really were taken into account during ecosystems creation phases. Depending on how they were considered and on the impact they had on the final outcome, I will rank them.

Figure 19 Antecedents to a new EAS in a mature industry



Section 2 Methods

As explained in Chapter 2, I started my empirical work with an exploratory study focused on the European aerospace industry, which I had identified as a mature industry. It was a first step in my overall abductive approach. I conducted an exploration phase to check if some actors resorted to an ecosystem approach to develop new businesses, in collaboration with other

actors. This is how I identified two different but comparable projects, inside Airbus and Safran, that could be considered as new ecosystems as structure.

Table 8 details the interviews[13] I made between April 2019 and January 2021. I explain my methodological choices in Chapter 2 and especially the way I collected and analysed data in Section 3.

Section 3 Findings, antecedents to an ecosystem as structure

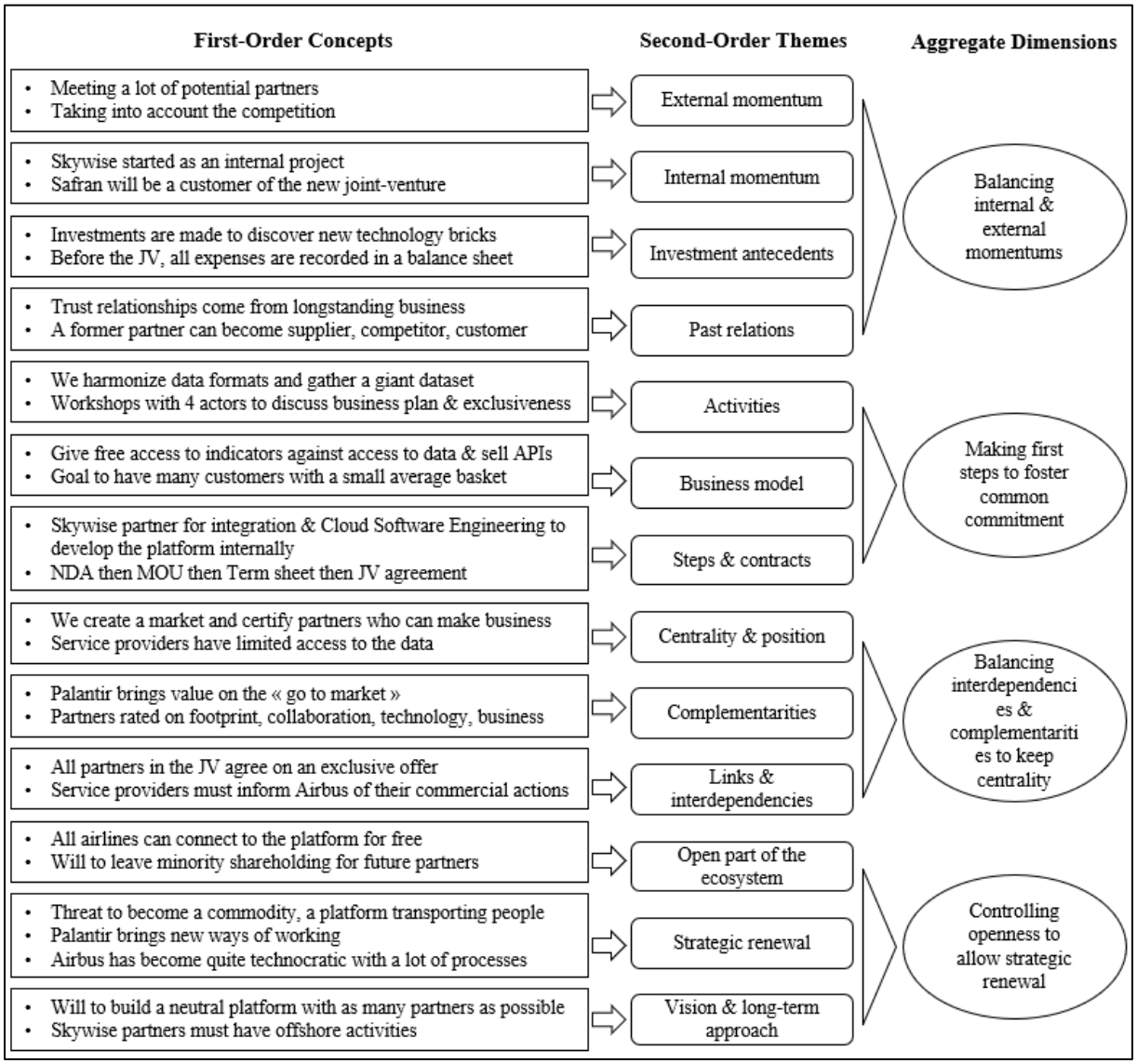
The findings of this empirical chapter are gathered in a data structure, which is a synthesis of all empirical material collected. I then dig into the details of each identified aggregate dimension, displaying revelatory quotes that I used to identify and rank key antecedents. These results are the basis to understand why and when actors decide to get involved in a new ecosystem as structure, or EAS.

3.1 Data structure and cases overview

I coded the sentences and ideas mentioned by respondents, so as to identify first-order categories of codes that reflect their opinions with their own words.

[13] See Chapter 2, Section 2.2

Figure 20 Data structure



Then I identified connections among those first-order concepts to create second-order themes (Miles & Huberman, 1994). Those themes helped me build aggregate dimensions in order to achieve a broader level of abstraction in my coding.

Figure 20 is the data structure that emerged following my data exploitation that stresses four aggregate dimensions of key antecedents to new ecosystems.

Both projects were new ecosystems because they gathered actors with different degrees of commitment and strived together towards a common value proposition emergence. Yet, two very different strategies were chosen by Airbus and by Safran.

> *"Skywise is an analytics platform. It is the first time that a giant dataset is gathered. We harmonize data formats" (Source H).*

Skywise sells Application Programming Interfaces (APIs) to airlines.

Safran also aims at selling services to airlines, based on the exploitation of data circulating through the planes but they opted out for a neutral platform, driven by four partners tied together by a joint venture.

Table 16 that follows, gathers data from interviews (Source D, Source F, Source H, Source I, Source J) crossed with secondary data (press releases and articles).

This table shows that the two projects can be compared because they have strong common basis but that they are also very different in the strategic choices made. On the comparison ground, Airbus as well as Safran are two strong and dominating actors evolving in the same ecosystem as affiliation. They want to create new ecosystems as structure to create value, based on the use of data.

Airbus has rather vertical approach, while Safran aims at adopting a more horizontal approach. Airbus looks for very complementary partners, with Palantir as the main provider of a big data platform, while certified partners are attracted to deploy the solution in the world. Palantir is a small player that had no footprint in the European aerospace ecosystem as affiliation. The model is strongly driven by Airbus. For Safran project, the focus on partners is more horizontal because they aim at creating a pool of partners that will share equal responsibilities.

Table 16 Comparison of 2 new ecosystems as structure

	Skywise	Safran data
Focal firm position	strong leadership by Airbus	neutral project, actors want to create a community
Vision summary	freemium model + strong Airbus leadership + from internal need to external opportunity	pool of partners for a neutral proposition + very open partner research + long-term focused value proposition
Customers	airlines	airlines
Ecosystem openness	freemium access to attract as many companies as possible and have them share their data	meet all competitors to introduce the project, will to welcome start-ups
Collective investment	100% Airbus, no risk and revenue sharing but partners have to show capabilities to be chosen by Airbus and be able to make business in the ecosystem	takes more time for launch because need to reach consensus with 4 partners within the JV, who will share the major investment
Control structure	service providers work for Airbus and have limited access to the data	JV in charge of P&L, board in charge of long-term aspects
Internal momentum	75% of users are inside Airbus	Safran will be the first user but services designed for external needs
Integration	made by partners	we have technological partners but do the integration ourselves
Partners added value	Palantir creates the easy and fast-to-use tool, other partners help deploy the solution globally	credibility, neutrality, brand image
Competitive advantage	1st on the market, geographical cover thanks to partners	neutral project and direct link from data to solution to bring value to customers
Competitive disadvantage	Skywise shows the data but components are under OEM guarentee	time to market and big machine to launch
HR working on the project	Around 200 Airbus people end 2019	20 people from Safran + partner 2 + provider end 2019
Main difficulties	setting boundaries to allow partners to create value and going from freemium to understandable and profitable business model	launching the JV despite the covid crisis

The analysis of my interviews leads to identify first-orders concepts, that I gathered in 13 second-order themes, before regrouping them in 4 aggregate dimensions.

3.2 Balancing internal and external momentums

For Airbus, the new ecosystem starts with an internal need that cannot be addressed with usual capabilities and requires consequent investment. Digital transformation is at the heart of those

two new ecosystems because the value created is generated using data and providing new services.

3.2.1 Starting the new ecosystem as structure to answer internal needs

Quotes	First-order concepts
"We have discussed a lot with digital platforms companies and this a 10 years' adventure, that usually starts as an internal project" (Source H)	internal project
"Anyone in Airbus can log to Skywise and subcontract projects to providers" (Source H)	internal widespread dynamic
"75% of Skywise users are inside Airbus, with 17000 users" (Source D)	internal dynamic
"Airbus had a lot of data internally that they could not exploit. They needed to lead this revolution inside first." (Source J)	internal focus first
"People working on the 350 programme say they could not have achieved their ramp-up without Skywise" (Source H)	internal focus is the basis
"Safran will be a customer of our new JV, it is essential to show that we have faith in the project" (Source I)	focal firm as customer of the new EAS
"Skywise investment was initially made for internal needs" (Source D)	internal focus first
Airbus decided to invest in a very costly project with a high potential. After 1 year, it secured the A350 production" (Source J)	focus on internal cost savings first

On this aspect, the two projects are not opposed but Safran project aims at addressing external needs first. They will however be customers of their new joint-venture to show that they trust the project.

3.2.2 Taking into account the external momentum

Regarding Skywise, the internal need was at the beginning to start using all available data with common frames and tools:

> *"Airbus had a lot of data internally that they could not exploit. They needed to lead this revolution inside first" (Source J).*

Quotes	First-order concepts
"We met a lot of potential partners, every actor that has a platform project and is aware that it is hard to set up if you are alone. Discussions are very long. A no some day might turn to a yes" (Source I)	potential partners
"We need to convince engine makers to share their data for predictive maintenance" (Source H)	potential partners
"If several OEMs partner, there might be a risk of dominant position" (Source I)	potential partners / competition
"GAFAs and other actors who exploit data have become potential competitors" (Source D)	competition
"Safran solution aims at answering a need of airlines who do not want to join Skywise" (Source I)	competition
"Some potential partners agreed with the project but did not join us because they already had started another project" (Source I)	potential partners
"Opportunities emerge following a mix of formal and informal activities. We have a marketing and competitive intelligence unit but also discussions happen playing golf or having dinner, also with competitors" (Source G)	competition / potential partners
"Competitors are not necessarily engine makers, it is rather the actors who exploit data and provide services. The engine is only one data provider among others" (Source I)	competition

Trying to benchmark how other companies lead their digital transformation helped understand the threat to become a commodity while specialists of data exploitation like the GAFAM could progressively become competitors:

> *"The main threat on the future is that we may become a commodity, a platform transporting people" (Source D).*

> *"We have discussed a lot with digital platforms companies and this a 10 years' adventure, that usually starts as an internal project. GAFAs and other actors who exploit data have become potential competitor" (Source H).*

Safran started meeting most actors of the aerospace ecosystem to discuss and see if usual competitors could become partners in their new ecosystem project. It was also a way for them to start testing their project and gather new ideas:

> *"We met a lot of potential partners, every actor that has a platform project and is aware that it is hard to set up if you are alone. Discussions are very long. A 'no' some day might eventually turn to a 'yes'" (Source I).*

3.2.3 Investments need to be made by all partners to start the new EAS

On-going investments and past relations are thus key antecedents justifying the why and when actors take part into a new ecosystem.

> *"Some potential partners agreed with the project but did not join us because they already had started another project" (Source I).*

Quotes	First-order concepts
"We are in a logic to progressively unlock funding depending on the demand evolution" (Source I)	investment following external demand
Skywise represents a huge investment for Airbus, mainly because Palantir costs a lot" (Source D)	investment to attract external partners
When there is a new opportunity for service providers, everyone struggles to be chosen by Airbus	investment of partners to join the new EAS
"During the phase before we have a JV we share a balance sheet. All expenses will be counted as capital or assets so that we have a fair mutual effort." (Source I)	shared investment record
"The JV between Safran and GE was made to share development costs" (Source G)	mutual investments for the EAS
"We currently strive to step in Silicon Valley and discover new technology bricks" (Source D)	investments for innovation
"Our technological partners are suppliers during the build phase and would be interested by RRSP. This gives them credibility and brand image towards the industry" (Source I)	shared investments and motivations to join
"We have identified topics for our future development, like digitalization, on which we can invest" (Source J)	meaningful investments for renewal
Airbus needs to decrease its costs, Palantir charges around 1 M€ every 3 months" (Source J)	investments that need to be controled

The potential partners can share the acknowledgment, have the same idea about solutions, have the investments capacity and complementary resources and capabilities but eventually not join the business ecosystem project because the timing is not good.

Therefore, several antecedents always have to be taken into account. There actually needs to be an alignment of antecedents so that the collaboration starts. A single antecedent can turn to be a blocker. Complementarity is for example a key antecedent, but the time dimension and current situation for each potential partner might lead to a choice of partner which is not the best when objective criteria are taken into account:

"We met potential partners that could have been a lot more complementary but there might be a snowball effect when the project goes public and some might join later" (Source I).

Competition is a key antecedent to the choice of actors with whom a focal firm starts a new ecosystem.

3.2.4 A new EAS in a mature industry needs to take past relations into account

Quotes	First-order concepts
"We usually start with simple buying contracts for 2 years, then there are more complex contracts, up to 10 years. Then we can move to RRSP, before possibly moving to JV" (Source G)	binding contracts require time and trust
"We have true trust relationships because those actors have longstanding business histories" (Source F)	trust stems from longstanding relations
"SAP or IBM have been working with French industrials for years and we are more used to such interfaces in comparison to Palantir softwares" (Source I)	past relations influence possible choices
"Sopra was in charge of the bundle Finance and Business Intelligence for 6 years, before Capgemini and Palantir won the current bundle on big data" (Source J)	positions in the EAA can evolve with new EAS
"We have already worked with our first partner, but on different topics" (Source I)	A new EAS needs to be based on some past relations
"The aeronautical world is small, we have to learn to be customers, suppliers, partners, competitors of each others" (Source G)	An actor can play different roles in time

3.3 Making first steps to foster common commitment

3.3.1 First activities define the blueprint of the new EAS

On Safran side, activities are the first steps of collaboration. Potential partners start signing NDA (non-disclosure agreements) then, after a first round of meetings and sharing their views, formalize MOU (Memorandum of understanding):

"The NDA only defines a scope, the MOU describes the project with more details, explaining how the partnership is lead" (Source I).

Quotes	First-order concepts
"Skywise is an analytics platform. It is the 1st time that a giant dataset is gathered. We harmonize data formats" (Source H)	first activities and blueprint
"We are building a steering committee with permanent members" (Source I)	defining a governance structure
"All certified partners compete to take the lead on projects started by Palantir" (Source J)	competition inside the new EAS to create value
"We are preparing a Minimum Viable Product during 9 months that we will then test with customers" (Source I)	product development to test new market
"We have a bundle with Palantir, we pay licences and they help us develop and deploy the platform" (Source D)	collaboration to deploy a platform
"Workshops with 4 actors to discuss business plan, contribution, competition and exclusiveness" (Source I)	project management for blueprint and governance
"Skywise summits are staged all around the world to gather customers and show the value generated by the platform" (Source J)	communication and marketing to attract partners and customers

The following steps are to agree on a term sheet and then to finalize a joint venture agreement. These steps can take between one and two years.

> *"The first 2 partners have already invested on the project with people working on the topic. The 2 other partners will carry a due diligence to assess if the cash was wisely spent" (Source I).*

They are in the blueprint definition phase that should eventually lead to the emergence of a value proposition.

> *"Workshops are organized with 4 actors to discuss business plan, contribution, competition and exclusiveness" (Source I).*

The following four dimensions illustrate the whole complexity of such a multipartner relationship, which is characterized by a will to address value creation and value appropriation topics at the same time:

> *"The 4 groups are on business, governance, operating model and technical aspects" (Source I).*

3.3.2 Business model definition and value creation prospects

Quotes	First-order concepts
"Potential customers are targetted for 5 years" (Source I)	market study to target customers
"We sell APIs to airlines (Application Programming Interfaces)" (Source H)	same customers but new revenues
"KPIs defined to assess performance with market share, customer loyalty, turnover" (Source I)	performance assessment with KPIs
"Skywise model is to give free access to indicators against access to data" (Source D)	data sharing to sell services
"We want to have a scalable business model" (Source H)	target of scalable business model
"We will sell affordable services. The goal is to have many customers with a small average basket" (Source I)	potential turnover assessment
"It is easy enough to start analyzing data in a few hours" (Source H)	added value of the new services

Trust is also a key dimension that allows actors to discuss openly about what they will share and what they will keep for themselves. Exclusiveness refers to defining what service will be provided by the ecosystem and only by the ecosystem, to the extent that it could even be seen as a competing service to other activities from the partner companies.

> *"We have true trust relationships because those actors have longstanding business histories" (Source I).*

Trust is in the case of Safran directly linked to past relations and foreseeing a new joint-venture involving more than two partners is only possible because those partners have already contracted through less committing interorganizational relationships:

> *"We usually start with simple buying contracts for 2 years, then there are more complex contracts, up to 10 years. Then we can move to risk and revenue sharing partnership, before possibly moving to joint venture" (Source G).*

Airbus made a different choice of starting structure which allowed them to go much faster on the first steps. Skywise is an Airbus service based on three pillars: Airbus, Palantir and two partners' contracts.

> *"Airbus developed 2 contracts for Skywise, 'Skywise partner' allowing to be integrator of Skywise solution for airlines and MRO and 'Cloud Software Engineering', a bundle started in June 2019 to develop Skywise platform inside Airbus" (Source J).*

3.3.3 Different contractual arrangements to collaborate and make headway

Palantir is a new actor in the aerospace landscape whereas the 6 other partners are historical partners of Airbus.

> *"We have a bundle with Palantir, we pay licenses, and they help us develop and deploy the platform" (Source H).*

This contractual relationship has been at the root of Skywise platform development and was aiming at the beginning to answer an internal need. However, it has been used almost from the start to address an external need:

> *"Skywise summits are staged all around the world to gather customers and show the value generated by the platform" (Source J).*

This option to address at the same time an internal and an external need was an opportunity to compensate faster for the important investment that was required.

> *"Skywise model is to give free access to indicators against access to data" (Source D).*

It thus appears to be a smart move to bring value to traditional customers as long as they share their data. The basis of Skywise ecosystem is to collect data or rather to create a platform on which partners share their data and can in return use tools that are useful to improve their operational activities.

Quotes	First-order concepts
"We lost 1 partner because of covid, went from 4 to 3. All companies review their investments" (Source I)	from intention to committments
"2 contracts for Skywise: Skywise partner allowing to be integrator of Skywise solution for airlines and MRO and Cloud Software Engineering, a bundle started in June 2019 to develop Skywise platform inside Airbus" (Source J)	contracts signed to develop the platform
"We have agreed on a MOU (memorandum of understanding) explaining how the partnership is lead" (Source I)	uncertainty reduction through contracts
"The NDA only defines a scope, the MOU describes the project with more details" (Source I)	steps of contracts definition
"when it comes to shareholding, it can take time because every company has different rules" (Source G)	shareholding contracts are demanding
"The first 2 partners have already invested on the project with people working on the topic. The 2 other partners will carry a due diligence to assess if the cash was wisely spent" (Source I)	different expectations to get involved in a new EAS
"Airbus uses specifications to select its partners, with lengths from 3 to 5 years" (Source J)	partners selection experience
"After NDA and MOU, next steps will be term sheet and then JV agreement" (Source I)	different kinds of contracts
"1st step of collaboration is discussing of skills to share, potential partnership" (Source G)	progressive committment
"The biggest partner of the 4 stopped its committment because of covid crisis. They might come back later" (Source I)	identified partners can give up
"Tom Enders, former CEO went to the Silicon Valley to learn good practices. He met Palantir and decided to make a POC" (Source H)	partners have to test their compatibility
"We aimed at on-boarding partners 3 & 4 at the same time, we need to rewrite the agreement for 3 instead of 4" (Source I)	contracts writting can take time
"At Safran we consider our suppliers as partners. We sign contracts for the length of the programmes and very often as risk and revenue sharing" (Source G)	risk and revenue sharing allows an even sharing
"There is one contact point per company and there are always 5 or 6 people per working group. The 4 groups are on business, governance, operating model and technical aspects" (Source I)	blueprint and governance definition
"For June, we aim at having a term sheet, in which all actor includes his imputs, be that technology, licenses, resources" (Source I)	clarity required on partners imputs

3.4 Balancing interdependencies and complementarities to keep centrality

The ecosystem leaders are those who identify other partners and define the boundaries of their new value proposition project. Airbus has strong complementarities with Palantir and they were fully aware from the start of the project that they needed Palantir's capabilities to create Skywise. Palantir has key skills to find value for customers and an experience on customer orientation which was not an asset within Airbus.

As it was stated by another supplier of Airbus,

> *"Palantir was chosen instead of IBM because they were more on customer services than on engineering" (Source J).*

This has justified a heavy investment ("Palantir charges around 1 M€ every 3 months", Source J) from Airbus to work with Palantir so that the A350 Programme could achieve its ramp up in 2018.

3.4.1 From EAA position to EAS position, about keeping centrality

Quotes	First-order concepts
"Airbus does not have full control because the components are under OEM guarentee" (Source I)	central position but no full control
"Service providers who work for Airbus have limited access to the data" (Source I)	limited access of the partners
"Airbus has the strategy to be less dependant on partners than partners depend on Airbus" (Source D)	centrality at the EAA level
"We observed a shift in strategy for Airbus, 4 years ago, from one partner per skill to dual sourcing" (Source J)	keeping a strong bargaining power
"Airbus certifies Capgemini, which can sell solutions to Air France. Capgemini pays for certification. We create a market" (Source H)	developing a new integrator position

Palantir is said to be more than a supplier within Airbus because they bring a lot of value:

> *"Palantir is a supplier but we think of strategy together, they bring value on the go-to-market" (Source H).*

> *"Palantir deployment strategists have the mission to find value for their customers, they have technical and business strong skills" (Source H).*

Airbus has agreed to spend a lot on this contract because they saw it as pure investment that would generate revenues for several years. Airbus also drives interdependencies with its pools of partners like Sopra Steria, Accenture, Capgemini or FPT, who are ready to make substantial efforts to be part of those pools. Those actors have been working with Airbus for several years

and being part of Skywise means benefiting from new short-term business opportunities as well as strengthening their long-term position towards their competitors.

> *"Skywise clearly asks its partners to have development capabilities all over the world" (Source J).*

In Skywise, Airbus has started the initial contact with customers and provided the initial version of the service offered. However, Airbus made the most of its past relationships and dominant position in its ecosystem to attract new partners and be demanding on their respective capabilities and investment potential.

As it is stated by a partner of Airbus,

> *"the purpose of Skywise partner is to outsource support; we are ambassadors" (Source J).*

3.4.2 Partners are chosen for potential complementarities

Airbus is leading the ecosystem and openly relies on its partners to develop business. Doing so, they ask their partners a strong commitment and investment.

Quotes	First-order concepts
"the 3rd pilar is made of certified partners who are allowed to develop the platform for airlines" (Source H)	partners to develop Skywise platform
"We want to have start-ups involved in the project" (Source I)	involvment of start-ups
"Skywise clearly asks its partners to have developement capabilities all over the world" (Source J)	need for partners with a worldwide footprint
"Palantir deployment strategists have the mission to find value for their customers, they have technical and business strong skills" (Source H)	technical and business skills are required
"We have rated all potential partners on footprint, location, international brand image, collaboration capabilities, technological imput, business aspects" (Source I)	partners are rated to bring value
"Palantir is a supplier but we think of strategy together, they bring value on the go to market" (Source H)	partners can take part to strategy
"A key challenge is to interface with airlines IT systems, this is the job of integrators" (Source I)	integrators interface with customers
"The purpose of Skywise partner is to outsource support, we are ambassadors" (Source J)	partners play complementary roles
"Thanks to Palantir, Skywise provides value creating use cases in a few weeks, it is very fast" (Source H)	go to market complementarities
"We decided not to include integrator partner, we prefer business partners who help finding more customers and technology partners" (Source I)	partners to develop business

The partners are ready to meet that demand because they see an opportunity and consider they have a limited uncertainty thanks to the contract that ties them to Airbus. The contractual framework has however been developed to challenge the partners:

> *"All certified partners compete to take the lead on projects started by Palantir" (Source J).*

This is how Airbus fosters its centrality and makes sure a collective investment is sustained.

3.4.3 Links with partners are developed, while interdependencies are managed

Safran rated all potential partners on

> *"footprint, location, international position, brand image, collaboration capabilities, technological inputs and business aspects" (Source I).*

Quotes	First-order concepts
"We need partners with complementary capabilities (technology, software, integration, brand image, business)" (Source I)	capabilities interdependence
"Service providers have monthly meetings with Airbus to inform of their commercial actions" (Source J)	collaboration routines
"JV is not the best collaboration form for the future, it is too binding. 50/50 is not the best set-up" (Source D)	EAS brings more flexibility than classical joint venture
"An issue in the JV agreement is that we demand all partners to agree on an exclusive offer" (Source I)	need for more flexible contracts than JV
"We are quite dependent on Airbus and we've been trying to work more with Boeing for 10 years" (Source G)	interdependencies at the EAA level impacting news EAS
"Airbus has partnered with Delta Airlines and formed an alliance to develop new services in Skywise" (Source D)	new partners integration
"RRSP is just below joint-venture. We are 2 industrials and join forces to address a market" (Source G)	value cocreation relies on RRSP
"The JV is in charge of the P&L but the board is in charge of the strategy and partners pool" (Source I)	task allocations and governance structure

At the beginning of the project in 2019, they clearly stated it was not necessary to have integrators in the partner pool. In terms of added value, they assessed it as non-critical to integrate their digital solutions for customers. The covid crisis has however changed this stance. Some actors who were ready to invest and be part of the partners' pool had to reassess their

investments, leaving some space for integrators who have business in other sectors than the aerospace, which were less impacted by the crisis.

3.5 Controlling openness to allow strategic renewal

3.5.1 New EAS need to have an open part

Airbus made the choice to control most of its new ecosystem, with a bundle with Palantir and then 2 partners' pools that bind actors for 3 to 5 years.

Quotes	First-order concepts
"Airbus has its own customer service. They have access to the data and can do everything. We are in a partnership relation, with a lot of trust. There is always a counterpart" (Source J)	openness of the ecosystem, data sharing
"New apps can be developed internaly or outsourced but we currently face difficulties with stakeholder management and strategy" (Source H)	open environment where partners can create apps
"Skywise platform collects data from all airlines planes who agreed to connect" (Source D)	free services for data sharing
"Our plan is to leave some minority shareholding for other partners" (Source I)	shareholding for partners
"Meeting all competitors to present the project, dinners with top executives" (Source I)	discussions with many potential partners
"Will to make Skywise an open platform so that customers can create value" (Source H)	open platform for more value

Despite those ties, Skywise is presented as an open platform, with a freemium business model, thanks to which all actors of the aeronautical sector can connect. Airbus is clearly mixing a relational antecedent consisting of suppliers' selection through specifications:

> *"Airbus uses specifications to select its partners, with lengths from 3 to 5 years", Source J*

and calls for bids, with a new approach based on the selection of a key partner that brings new capabilities. It is observed from inside Airbus as well as from outside Airbus with testimonials from suppliers that Palantir helped Airbus improve its processes and habits:

"Palantir brought new ways of working" (Source J).

3.5.2 Attracting new partners to foster strategic renewal

This is actually about internal change but also about renewing the model of Airbus:

> *"We believe in Skywise because it helps us change our model. We need to help our customers to reduce their operating costs" (Source D).*

Quotes	First-order concepts
"Palantir was chosen instead of IBM because they were more on customer services than on engineering" (Source J)	new partner chosen for new capabilities
"Palantir people are driven by customer value which can be very short-term oriented and lead to some relational issues with some Airbus people who are much more long-term oriented" (Source H)	customer value new focus
"Threat on the future is that we become a commidity, a platform transporting people" (Source D)	risk of becoming a commodity
"Airbus has become quite technocratic with a lot of process and administration, while Skywise is driven by science and data" (Source H)	need for more agility
"Skywise was started by the DTO and competed with internal digital services in partnership with IBM. Palantir defeated IBM's solution, despite the historical partnership with IBM." (Source J)	renewal with new capabilities
"Palantir brought new ways of working" (Source J)	new ways of working
"We believe in Skywise because it helps us change our model. We need to help our customers to reduce their operating costs" (Source D)	focus on customer needs
"Skywise is a big project in a business which is not core for Airbus. It shows our will to digitalize." (Source I)	new business out of core activities

3.5.3 Defining and communicating a long-term vision is not an easy task from the start

Skywise project started as an internal project, to help Airbus go further with its digital transformation. From the outside, Skywise does not seem to have been anticipated as a clear business model.

Quotes	First-order concepts
"From the outside we wonder if a business model was defined for Skywise, it rather looks like an overall concept with steps ahead following opportunities" (Source J)	lack of vision for the long-term
"Airbus included in its specifications to be a partner in Skywise to have some offshore activities" (Source J)	future developments anticipated
"Starting point of discussions between 2 partners on shared values and reasons to do it together instead of everyone on his side" (Source I)	focus on shared values first
"Will to build a neutral platform with as many partners as possible" (Source F)	neutral and open platform
"We met potential partners that could have been a lot more complementary but there might be a snowball effect when the project goes public and some might join later." (Source I)	EAS that will remain open for new partners

This is at least the view from historical partners. Airbus has developed its pool of partners to create value within Skywise. This pool allows value creation and value sharing.

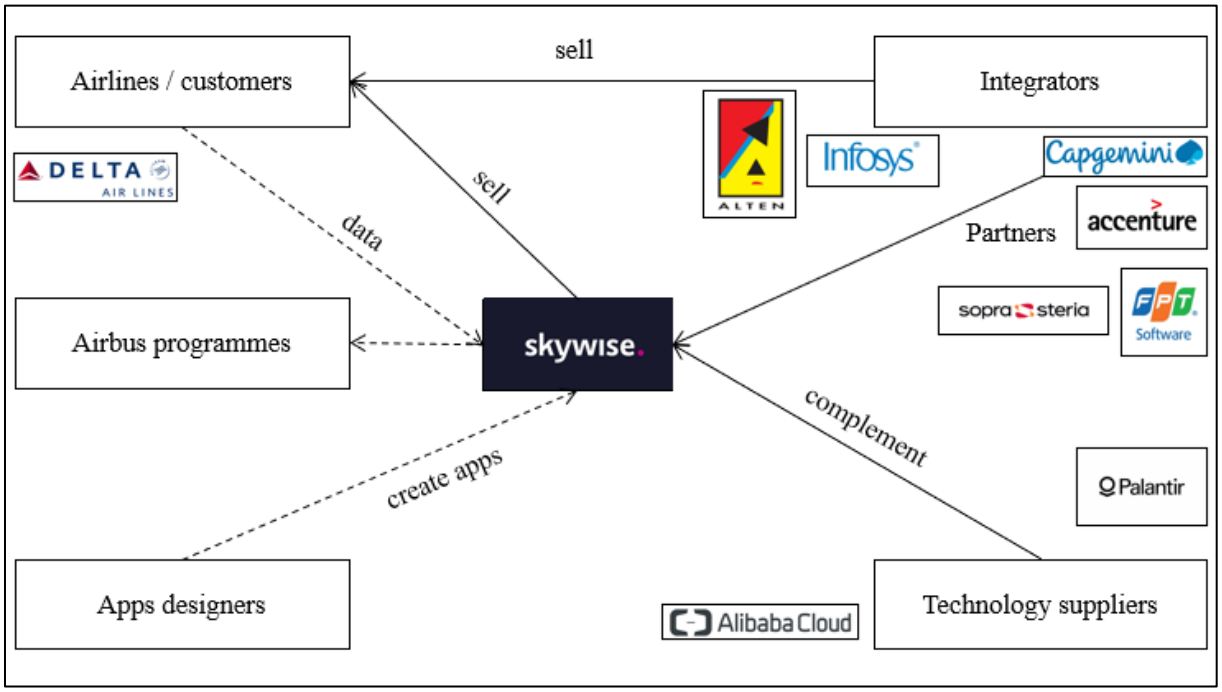
Figure 21 illustrates how Airbus is keeping centrality although a major part of the ecosystem is open. The competitive advantage of the value proposition is directly linked to the unique architecture around that platform.

On the partners' side, long-term relationships are a key driver. All those companies have had business with Airbus for years and are ready to invest on a new ecosystem for several reasons, ranging from preserving their current activities, beating their competitors on a bid and showing Airbus that they remain faithful partners:

> *"When there is a new opportunity for service providers, everyone struggles to be chosen by Airbus" (Source J).*

Skywise is however also an open platform, be that for airlines who can join for free, share their data and use Skywise algorithms to compare their indicators to those of other companies, or for app designers who can connect to the platform and sell their services to airlines.

Figure 21 Airbus Skywise ecosystem



Despite this openness, Skywise structure questions Jacobides definition of an ecosystem as not hierarchically managed interacting organizations. There is indeed no chance that an actor would take control of this ecosystem or even that an actor could take a bigger advantage out of it than Airbus.

The main competitive advantage on Airbus side in Skywise setting is that they have more control on the data than the other partners:

> *"Service providers who work for Airbus have limited access to the data" (Source J).*

Airbus keeps increasing its centrality as long as more and more partners share their data in order to access Skywise platform. However,

> *"Airbus does not have full control because the components are under OEM (Original Equipment Manufacturer) guarantee" (Source F).*

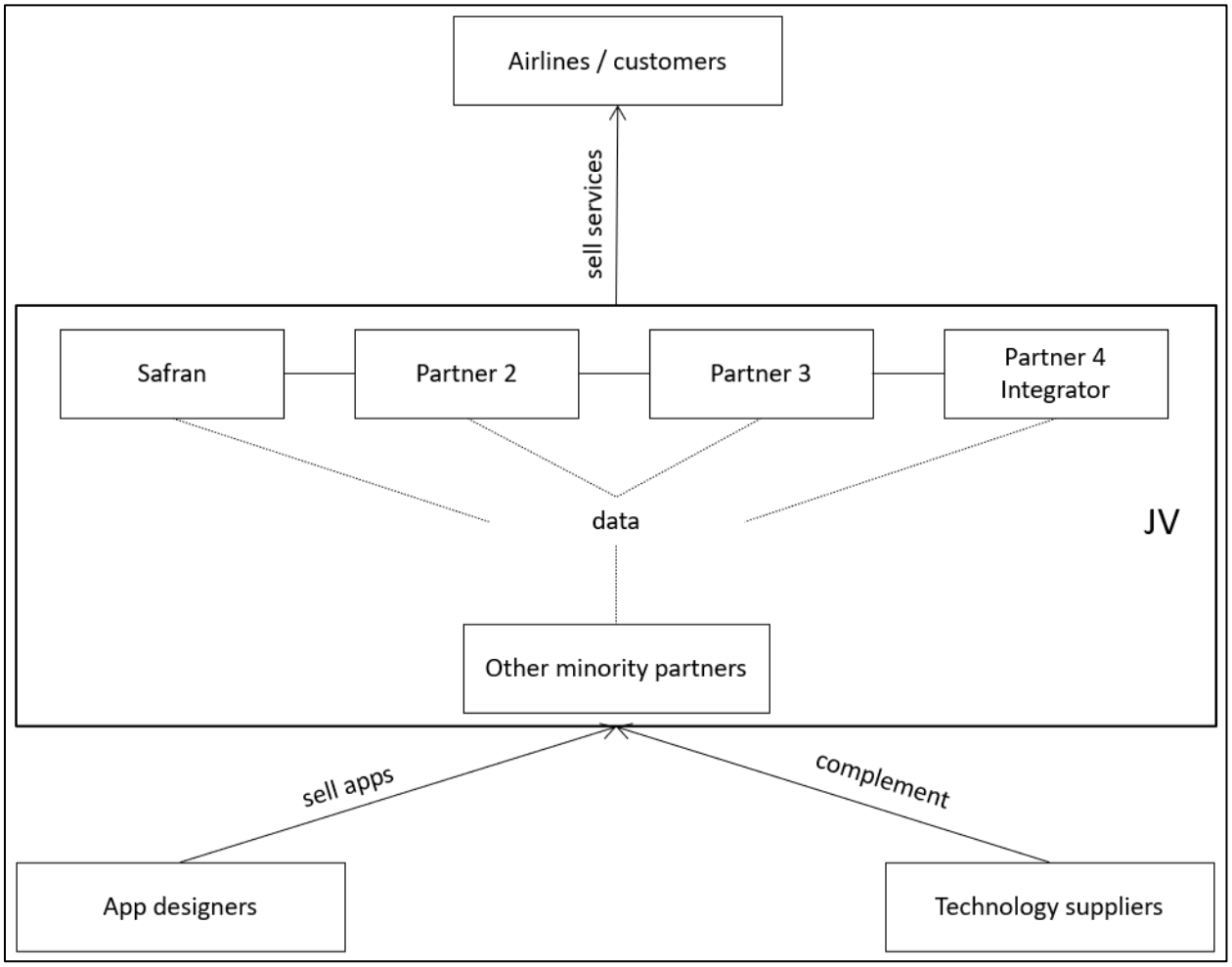
Safran decided from the start of its project to set openness and neutrality as a basis, as part of its vision and shared values among partners:

"the starting point of discussions with a potential partner was usually on shared values and reasons to do it together instead of everyone on his side" (Source I).

The main difference with Airbus project is that the will is, from the start, to launch a shared governance:

"Our will is to build a neutral platform with as many partners as possible. Our plan is to leave some minority shareholding for other partners" (Source I).

Figure 22 Safran Data ecosystem project



3.6 From intra to inter cases coding to ranking the antecedents

Table 17 gathers the ranking of the eight main antecedents I identified and compared.

Table 16 exposes the main characteristics of both ecosystems as structure creation, which were launched in 2017 and 2018.

Table 17 A ranking of the antecedents to a new ecosystem as structure

Rank 1 essential antecedents	internal / external momentum	past relations
Rank 2 important antecedents	complementarities	opportunities
Rank 3 nice to have antecedents	competition	collaboration capabilities
	interdependencies	investments

Some antecedents are clearly determinant for both cases, such as the importance of past relations, while some others do not seem to have a clear impact on that ecosystem process, like competition. Some others are more balanced, with strong different choices that were made in the two cases. Between the start of my study and the start of my second round of interviews, Safran ecosystem project was however stopped, while Airbus Skywise ecosystem went on developing. This unfolding of the two projects leads me to consider that when they did not opt for the same configuration, it was well done the ongoing project and not a good choice on Safran project.

On Airbus Skywise ecosystem project, the most important antecedents were past relations and the balance between internal and external momentums. They built their ecosystem with several groups of partners, that can be separated in Palantir on one side and the others, on the other side. All the certified partners had longstanding relationships with Airbus and accepted to commit resources on the project because they knew that even if it did not lead to value creation, they would go on having other businesses with Airbus. This dimension is also the most important for Safran ecosystem project, where all partners already had business with Safran in the past. An ecosystem is a very complex structure to create and it can only thrive provided that most of the partners have already developed business together.

The balance to be found between internal and external momentums is the main difference between the two projects. Inside Airbus, the ecosystem project was from the start meant to be answering inside and outside needs, while Safran clearly wanted to avoid this dual positioning. The facts tend to prove Skywise right and this all about risk mitigation and justifying heavy investments in a new project. If it starts from an internal need and it can in addition become a new business opportunity, it can justify extra investments. If it is only based on an external need, it becomes harder to sustain consistent funding for an uncertain project.

The other strong choice made by Safran in comparison to Skywise was to launch a neutral project in terms of shared leadership. They spent a long time discussing, being ready to move forward but waiting for two of the four partners to make headway and it was eventually too late to start the project. This tends to show that a strong leadership is required for a new ecosystem as structure launch.

All antecedents identified in Table 17 have an impact on the new value proposition that will emerge. It is however necessary and possible to rate them. I opted for three categories of importance, from rank 1 to rank 3 antecedents, assessing and weighing to what extent each antecedent was impactful on the new ecosystem. Rank 1 means that it is so critical that the survival of the ecosystem depends on it. Rank 3 means that it is taken into account as a criteria, but that there are solutions whatever the outcome is.

The first antecedent to be considered is the spread of **internal and external momentum** that justifies the will of a focal firm to commit resources and investment in a new ecosystem. The results of my research tend to indicate that a new ecosystem can emerge either following a main internal need, as with Airbus Skywise, or following an external need as with Safran. It is however the first antecedent to consider because it has a structural impact on the whole structure of the new ecosystem.

If there is an internal need, this allows a strong leadership from the focal firm, which will be able to address its internal need and engage suppliers to become partners for the external need:

> *"Skywise partners first focused on being suppliers for the internal need. External opportunities come next" (Source H).*

Safran project is driven by an external momentum and a need to be part of what they define as a neutral data platform:

> *"Our project is only dealing with external aspects. We do not address internal needs with a joint venture" (Source I).*

Be that for Airbus or for Safran, the 'internal/external momentum' antecedent is the most important element justifying the 'why' these new ecosystems emerge.

Past relations are also first order antecedents because they are the basis for trust and allow actors to build new and innovative contractual relationships in a viable timeframe.

As it was stated by a Safran executive, it can take up to ten years of increasingly more committing contracts, before agreeing on a joint venture with a partner. An ecosystem relies on a complex structure, involving more than two partners, not fully hierarchically managed. These interacting organisations are bound together by the non-redeployability of their collective investment elsewhere. Skywise as well as Safran data project mostly rely on past relationships, at the firm level. My study however reveals that trust also needs to be developed at the interpersonal level, which can take time and put the project at risk:

> *"The project goes on, but a new trust relationship needs to be built among project managers" (Source I).*

This is what my main informant on Safran side said, in January 2021, at a time when after two years of investment on the project, they still did not exactly know when the project would be public.

Past relations are also a key antecedent from the point of view of non-leading actors in the new ecosystem. When those actors have already been involved in other contractual relationships with the ecosystem leader, they have developed specific capabilities and invested resources. Former commitments decrease the cost to take part into the new ecosystem, even if the future value creation is highly uncertain. It can however happen that new partners are chosen instead of historical partners. This increases the uncertainty around the project but it is a way to break path dependence and to favour complementarities to past relationships:

> *"Sopra was in charge of the bundle Finance and Business Intelligence for 6 years, before Capgemini and Palantir won the current bundle on big data" (Source J).*

Complementarities are key for such projects but can evolve in the very short run. They rather help answer the 'when' of creating a new ecosystem than the 'why'.

This is a structuring dimension. An actor who decides to invest on an ecosystem instead of trying to meet a market need with its own capabilities, does it because he expects greater return from the ecosystem. For Airbus, the expectation is at three levels: they expect Palantir to bring the unique technical solution to create value, they expect airlines to join the project and share their data and they expect their partners to be ambassadors for Skywise and develop the business:

> *"Airbus certifies Capgemini, who can sell solutions to Air France. Capgemini pays for certification. We create a market" (Source H).*

On Safran side, the two main expected complementarities were at the beginning of the project on business potential and geographical footprint, but it evolved in two years; here is what they stated in September 2019:

> *"we decided not to include integrator partner, we prefer business partners who help finding more customers and technology partners" (Source I).*

The situation however evolved because of the covid crisis, to the extent that integrators henceforth have key complementarities, in January 2021:

> *"we identified an integrator willing to take financial risk. The 3 other actors are aeronautics pure players, who suffer from the crisis. Integrators have multi-business positions. It is an opportunity for everyone" (Source I).*

This is the reason why I rank complementarities as rank 2 antecedents: they are key but their positions and weight can evolve in a very short notice.

I also consider opportunities as rank 2 antecedents. Actors evolving in mature industries devote investments to innovation and they spend time discussing outside their businesses to identify new opportunities. As it was stated by an executive from Safran:

> *"Opportunities emerge following a mix of formal and informal activities. We have a marketing and competitive intelligence unit but also discussions happen playing golf or having dinner, also with competitors" (Source G).*

On Airbus side, the story is very similar when it comes to understanding how the opportunity emerged:

> *"Tom Enders, former CEO went to the Silicon Valley to learn good practices. He met Palantir and decided to make a POC (proof of concept)" (Source H).*

There cannot be a new ecosystem without opportunities, but opportunities always end up appearing when they are sought.

I then ranked four other antecedents as rank 3 because they can have an impact on the new ecosystem structure, without being critical.

Competition has to be taken into account because it can be a motivation to get involved into a new ecosystem. Airbus fears the competition of the GAFAs, therefore they decided to develop new capabilities and to learn to work with new actors. The threatening actors are however so big and at the same time so far away from the traditional business of aerospace, that it even allows considering collaborating with usual competitors. A parallel was made during one of my interviews with the way the two main German car manufacturers, BMW and Daimler, have

created several joint ventures together to address the mobility market with ridesharing, parking services and charging for electric vehicles activities. Therefore, competition is only a rank 3 antecedent. It is mitigated by the strategic renewal context, which demands a huge investment and innovation to allow the emergence of an interesting value proposition. There is however a limit to this openness:

> *"If several OEMs partner, there might be a risk of dominant position" (Source F).*

The other insightful element about competition in the case of data exploitation in the European aerospace context relies in the relationship between Airbus and Safran. Both companies have grown thanks to one another over the last fifty years. Competition antecedents thus is strongly linked to interdependencies.

As it was stated by a Safran executive:

> *"We are quite dependent on Airbus and we have been trying to work more with Boeing for 10 years" (Source G).*

This is a key characteristic of mature industries to gather already very interconnected actors, especially when the past decades have seen waves of concentration. As one can see on figures 3 and 4, Airbus works with all four global engine makers while Safran works with all aircraft manufacturers.

During my interviews with executives from Skywise, when I addressed the topic of relationships with Safran, they answered that it would be meaningful and interesting for everyone to have them join the ecosystem:

> *"We need to convince engine makers to share their data for predictive maintenance" (Source H).*

Their first intention was to increase the value of Skywise while aggregating more data of different sources. The consequence would however also be to increase interdependencies with Safran. Eventually, having more interdependencies also leads to more control or at least less

uncertainty on what a strong actor evolving in the same ecosystem could otherwise do to address the topic of data exploitation.

As it was stated by an Airbus executive:

> *"Airbus has the strategy to be less dependent on partners than partners depend on Airbus" (Source D).*

This shows that interdependencies are antecedents to consider because they are part of the long-term and overall strategy of leading firms. It is also a dynamic process, in which strong leading companies always try to renew their approach in order to keep centrality and a step ahead. Suppliers can see it:

> *"We observed a shift in strategy by Airbus, four years ago, from one partner per skill to dual sourcing" (Source J).*

This is a way to secure the production but also to increase Airbus bargaining power.

Past investments and investment capacity are also Rank 3 antecedents. Some potential partners do not get involved because they have already committed resources on other similar projects.

In the case of Safran project, one partner that was initially onboarded, left the project in June 2020 because of the covid crisis. However, the third partner also saw his investment capacity decrease a lot but managed to remain on board.

There cannot be a new project without investments. I have already showed that Skywise cost a lot to Airbus but that they justified these expenses a necessity to secure the A350 programme ramp up. Then they made the most of this investment to address an external need and build an open data platform, which is accessible to their partners. All partners, whatever their roles, have to anticipate those costs and define a plan for the coming months and years to wonder when they will break even. For Safran project,

> *"Our logic is to progressively unlock funding depending on the demand evolution" (Source F).*

For partners of Airbus, like Sopra Steria, their investment is also part of an overall strategy:

"We have identified topics for our future development, like digitalization, on which we can invest" (Source J).

Getting involved in such new projects is also a way to develop new dynamic capabilities, that will bring new business opportunities.

Collective investment is the first step of collective value creation and I showed that there are two possible ways when it comes to starting a new ecosystem: either there is a strong leadership from a focal firm that invests a lot for an internal need and attracts other companies to join the dynamic and share the value created, or this is from the start a collective dynamic focusing on an external need for all actors. In the case of Safran, there is a high risk in so far as all actors need to align to define when to start investing. This can be a risky situation because the more the first actors start working on the project, the higher the risk the other actors refuse joining later and agree on the engaged costs. On the other hand, the collective investment needs to be triggered so that value is created.

Collaboration capabilities are the last but not least of antecedents and are partly linked to the past relations antecedents. As long as I consider the context of mature industries, those actors evolving in the same ecosystem as affiliation have longstanding relationships and reputations. I showed that Safran clearly rated all potential partners on several criteria including collaboration capabilities. They based their ratings on past relationships and reputation but also on the meetings they staged with top executives from the potential partners. This was a way to test their blueprint, test their project and assess the collaboration capability of a potential new partner. This is a very subjective criteria as it relies on an assessment of relational compatibility between managers and between presidents, yet it has to be taken into account because the future of the project will rely on interpersonal relationships. It happened once that a potential partner represented a real business opportunity, but they decided to stop the discussions because the dinner ended up with an argument following a misunderstanding linked to cultural differences.

Section 4 Discussion

The main contribution of this chapter is to the literature on ecosystems, as it shows why and when actors evolving in a mature ecosystem as affiliation can decide to create a new ecosystem as structure. Players align for a new EAS, when there is a strong leadership of an actor who invests a lot to create inertia, impetus and adherence.

My key insight is that in mature industries, a new ecosystem can be a tool to allow strategic renewal provided that several antecedents are gathered and that balances are found.

Focusing on the antecedents to a new ecosystem helps positioning the ecosystem as structure concept towards the ecosystem as affiliation approach (Adner, 2017). Adopting the ecosystem as structure is necessary to set boundaries to an ecosystem, but the ecosystem as affiliation still has to be taken into account because the structure of a new ecosystem is strongly related to its antecedents. As stated by one of the interviewees,

> *"The aeronautical world is small, we have to learn to be customers, suppliers, partners, competitors of each other's" (Source I).*

In that context, antecedents are the bridge connecting ecosystem as a structure and ecosystem as affiliation.

The structure is the visible part of a new ecosystem that materializes through actors, who develop links, undertake activities and occupy positions (Adner, 2017) and I focused on the first steps of two new ecosystems that are insightful because they address the same issue with very different approaches. A key insight was brought because I conducted interviews with actors who are inside the ecosystem but do not necessarily play a leading role.

My results indicate that eight antecedents are to be taken into account and that they can be ranked in three categories, ranging from “essential”, to “important” and “nice to have”. Having a strong internal impetus and relying, at least partly, on past relations are the two essential basis to launch a new EAS in the context of a mature EAA. A strong internal momentum should allow a centralized leadership of the new ecosystem, while a motivation to invest based on an external momentum oriented new ecosystem would demand a shared leadership of the ecosystem. My results tend to show that a firm willing to start a new ecosystem should structure its project around an internal need, that can rapidly evolve to an internal and external need. When the project is only based on an external need, there is a high risk of failure during the creation phase, as it happened with Safran project. These results need to be confronted to other contexts to be generalized. This would need to be dug further in other articles focusing on different industries.

My approach needs to be continued to see how the intentions turn to reality or surprises and should then lead to new knowledge on the governance of such multi-partner relationships. As long as I have focused on the creation phase between April 2019 and January 2021, I knew at after that exploration phase that my study would become much more insightful a few years later, when both ecosystems have evolved in autonomous businesses. Some longitudinal observations were thus required, at least over two more years. The covid crisis has indeed frozen the pace of development of such innovation related projects. This is however what I went on and the object of Chapter 5.

Trust is strongly related to past relations but if one tries to link my results to how new ecosystems emerge, it might be interesting to dig further the link between trust at the individual level and at the firm level.

I showed that new ecosystems can emerge in the context of mature industries when powerful actors are aware of a long-term need to substantially shift their strategy.

Two other elements to dig further have to deal with collective investment and with the level of openness of the ecosystem. I showed that the two cases I studied were partly opened but it needs to be investigated further to what extent the level of openness has an impact on the value created.

My work helps understand better what is expected by each actor that gets involved in a new ecosystem but further research, on a more longitudinal timeframe would help assess more consistently to which level getting involved in an ecosystem helps strengthening competitive advantage for each partner (Clarysse & al, 2014).

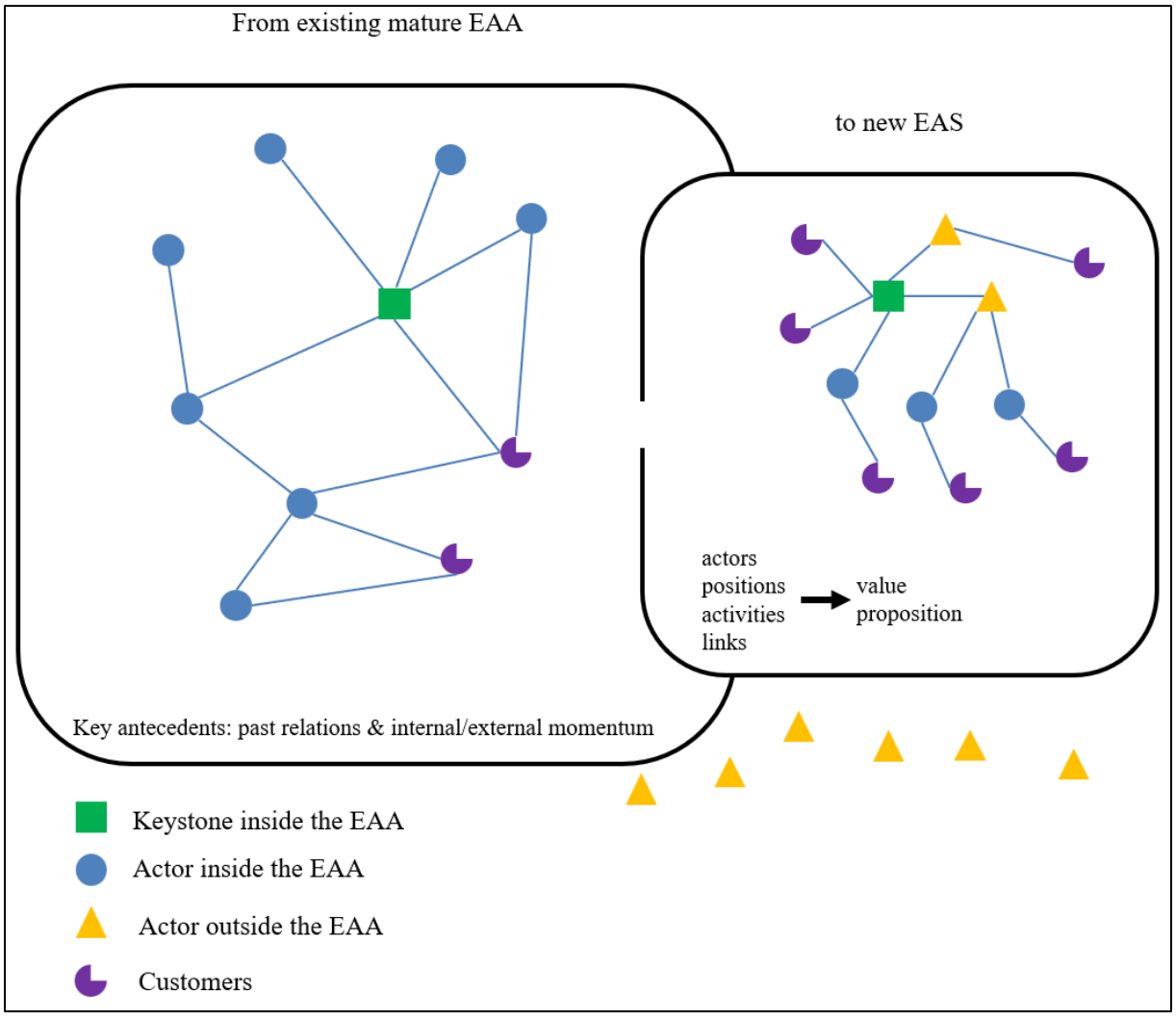
My literature review indicated that path dependence (Sydow & al, 2009) could hinder strategic renewal and on this point also, my study only brings partial answers because I need more time to assess the performance of those new ecosystems. I however showed that past relations were among the two most important antecedents and a leading firm to a new ecosystem can team up with some new actors but needs a majority of former partners in order to progress and deliver fast enough. Trust takes time to develop, and I showed that even when there was trust at the firm level because of former relationships or projects, there was also a need to create a dynamic and a fruitful relationship among individuals. Those elements hence tend to show that history is rather a strong asset rather than a potential threat on strategic renewal.

My study eventually shows that even two and four years after the start of the projects, there remains a high uncertainty on whether the investment will be fully covered and how much value will be created. This is one of the two main dimensions composing the blueprint concept (Dattée & al, 2018), the other one regarding the governance structure of the new ecosystem. On this last point, I showed that even if ecosystems display “non-hierarchically managed” subparts

because part of the structure is opened, there is a mitigation of uncertainty in the choice of a portfolio of heterogeneous relationships.

My results also show that shared leadership of a new ecosystem is really challenging and risky.

Figure 23 From mature EAA to new EAS



In this chapter, I had a strong focus on the antecedents during the birth phase of new ecosystems. Even if the concept of ecosystem has existed for more than thirty years, it has suffered a conceptual proliferation (Shipilov & Gawer, 2020; Cobben & al, 2022) that was partly solved with the distinction between ecosystems as affiliation (EAA) and ecosystems as structure (EAS) (Adner, 2017). Most of the studies have been on EAA, while the EAS concept is the one that

allows a better understanding of how value is co-created at the ecosystem level and how an alignment structure is developed. As illustrated in Figure 23, the new EAS is rooted in the existing EAA and it flourishes thanks to a commitment of various actors, including some that did not belong to the EAA. Those actors who were formerly outside the EAA bring new capabilities that allow the emergence of a new value proposition. It remains to be seen whether these new capabilities can be assimilated at the EAA level and allow strategic renewal. I will explore this point in the next chapter.

My findings show how two powerful firms invest on comparable ecosystems projects and allow a ranking of the antecedents to focus on.

I observed that the two cases I ended up choosing after an exploration phase were both linked to the exploitation of data and the broader context of digital transformation (Sebastian & al, 2017; Warner & Wäger, 2019). Furthermore, the need for strategic renewal when dealing with industrial actors tends to go through the development of services, that come to complement a product offer. This is why I will now include a complementary literature review section with a focus on digital transformation and on servitization, to ease the transition to Chapter 5.

Section 5 Digital transformation and servitization for ecosystem renewal

Before exploring further the steps after birth of a new ecosystem as structure, in the context of an ecosystem as affiliation, I need to explore the literature about digital transformation and servitization. The two cases studied in this chapter were chosen with an abductive approach, after questioning interviewees on collaboration and innovation dynamics inside their companies. Despite this randomness, both cases had to deal with digital transformation and with the development of new services inside two different big companies. Far from being a coincidence, some researchers even put forward that one can observe a proliferation of

ecosystem concepts, perspectives and applications because of the underlying phenomenon of digitalization (Thomas & Autio, 2020). It might mean that adopting an ecosystem approach goes along the adoption of a digital transformation journey.

I have an overall abductive approach, that will help me refocus my study for a second phase of explanatory case study. I did not explore digital transformation and servitization in my first literature review so I will now dig on those concepts and their links with ecosystems and strategic renewal, before developing a new chapter presenting my last case study.

Digital transformation of industries is an important empirical setting on which theoretical cross-fertilization with theory on ecosystems has to be developed. Digital technologies come along with many opportunities to transform industries but there should be tensions between new ecosystems and their exogenous environment. This needs to be explored (Hou & Shi, 2021).

Ecosystems represent a new way of considering the environment of the firm and they are developing very fast because digitalization is allowing to reconfigure activities. Business ecosystems have emerged in the tech world, but they are becoming common in all business sectors and in all business model settings, be that a business to business, business to government or business to customers context (Jacobides, 2022).

Digitalization, which is the use of digital technology to provide new value creating opportunities, has a disruptive effect on the competitive dynamics because incumbent companies can face competition from new entrants outside traditional industry boundaries (Sklyar & al, 2019). It needs to be studied to understand how it positions towards adopting an ecosystem strategy and the impact on competitive dynamics.

Digital transformation is a comprehensive and strategic overhaul of an organization's operations, business models, processes, and culture to leverage the full potential of digital technologies. It goes beyond mere digitalization and involves reimagining the entire business to create new value propositions, improve customer experiences, enhance agility, and respond

to evolving market dynamics. Digital transformation often involves adopting new technologies, rethinking business processes, and fostering a digital-first mindset across the organization (Fitzgerald & al, 2014). Digital transformation could thus be a ground for the development of new ecosystems.

Using digital transformation, industrial firms in the business-to-business (B2B) context have started adopting digital servitization. Literature defines this strategic choice as a large-scale transformation of processes, capabilities and offerings. This transformation needs to be done at an ecosystem level, with the target to use digital technologies to create new services, before selling them (Jovanovic & al, 2022).

5.1 Digital transformation

A growing digital disruption is spreading across many industries, traditional boundaries tend to blur, as well as long-standing interdependencies between firms and network positions (Sklyar & al, 2019). Firms like Nike shift from delivering shoes and sport clothes to selling services, based on customers communities, and even coffee companies tend to enlarge their offer with services sold around the coffee (Jacobides, 2022).

Technology is playing an important role in these changes, but research showed that firms willing to keep competing in a digital world need to find new strategic ways for value creation, while adapting their structure, processes and culture (Vial, 2019).

5.1.1 Digitalization and digital transformation

Digitalization refers to the process of converting analogue information into digital format, usually represented as binary code (0s and 1s). It involves the conversion of physical records, documents, images, and other data into digital form, making them accessible and editable using computers and digital devices (Laudon & Laudon, 2019). Digitalization is opening new

opportunities to reconfigure activities because the boundaries between previously well separated activities have disappeared. This has also opened new dimensions for competition (Jacobides, 2022).

Digitalization is the broader process of adopting digital technologies and integrating them into various aspects of an organization. It involves the use of digital tools and technologies to streamline processes, improve efficiency, and enhance overall operations (Westerman & al, 2014). It can be defined as using digital technologies, such as artificial intelligence, big data technology, cloud technology, Internet of Things and robotics to execute, control and improve every tangible and intangible activity that together comprise the value chain, create smart products and services and transform the business model (Szalavetz, 2022).

Digitalization implies the use of digital technologies in order to ignite opportunities of value creation, be that through products improvement or thanks to the development of new services (Sklyar & al, 2019), which is called servitization and that I will explore in the next section.

Digital transformation refers to the profound and strategic change that organizations undergo to leverage digital technologies to fundamentally alter their business models, processes, and operations. It involves reimagining the entire business ecosystem to meet evolving customer expectations, improve agility, and create new value propositions (Ross & al, 2019). Consumers are indeed increasingly embedding technology in their everyday activities and interactions, which consequently increases their level of expectations when they interact with firms, be that on the product or service side (Hanelt & al, 2021).

Digital transformation can be defined as

> *"a process that aims to improve an entity by triggering significant changes to its properties through combination of information, computing, communication, and connectivity technologies" (Vial, 2019: 121).*

Digital technologies are at the same time the fuel for a need to adopt digital transformation and what enables it. Those technologies are indeed available to all customers, who tend to increase their expectations. It can also change the competitive landscape and provide an easy access to many more data. Those three factors can trigger strategic responses from companies, who tend to adopt digital transformation strategies (Vial, 2019).

5.1.2 Disruption through complements

As showed in this chapter, threats for actors inside an ecosystem as affiliation can come from new ecosystems as structure, which need to base their development on past relations and on a balance between internal and external momentums. This might suppose that the biggest threats are actually inside an ecosystem as affiliation. However, the usual considered threats are from outside the ecosystem as affiliation, with innovations that can optimize customer experiences and allow complementary value creations (Warner & Wäger, 2019).

The threat can come from dominant players in the ecosystem as affiliation, who fear for their short-term performance and start competing with their partners. All mature keystones must struggle against the pressure exerted by growth imperative to cannibalize niches in the ecosystem for short-term objectives, but it can be done at the expense of long-term ecosystem growth and health (Iansiti & Levien, 2004). The threat can also come from other partners and most precisely complementors, who are needed to co-create value but at some point, might shift their impact on the competitiveness of incumbents from positive to negative (Adner & Lieberman, 2021).

Disruption can be defined by the introduction of a substitute product or service that gains a new market share and eventually becomes profitable, to the extent that it undermines the incumbent's position (Christensen & al, 2018).

As long as digitalization facilitates the reconfiguration of resources, this also has a disruptive effect on the competitive landscape in ecosystems and established incumbents face potential

competition from new entrants outside traditional industry boundaries, such as IT providers. If many very different industries develop that same kind of resources and digital technologies that they connect to physical goods simultaneously, it lowers the barriers between industries (Sklyar & al, 2019).

Threats can either come from within the boundaries of an established competitive industry or from outside the existing set of competitors (Adner & Lieberman, 2021). In the first case, there might be an internal dysfunction or competitive rivalry, threats from inside that might lead to a loss in market share. In the second case, the threats from outside can materialize as substitute products or services or as disruption through complements. Complementors usually play a supportive role, but they can eventually aim at changing their position with a strategic action leading to commoditization, adjacent entry, or value inversion (Adner & Lieberman, 2021). Commoditization happens when the "locus of differentiation" is driven from one position in the ecosystem to another (Jacobides & MacDuffie, 2013). Adjacent entry can be a chosen strategy by complementors to compete directly with their former partners. All actors try to strengthen their competitive advantage by raising competitive barriers. Complementors are far from common new entrants on a market because they are already part of the ecosystem. They thus already have incumbents' assets that lower the barriers to entry, such as relationships with suppliers and customers, brand or knowledge. Today's context of digital transformation brings many opportunities for adjacent entry (Adner & Lieberman, 2021). Value inversion can at last happen when complementors become too efficient. This is possible when after some time of synergy between the core actor and its complementor, the complement starts to provide so much value that it is more important than what the focal firm provides. This is what might currently be happening with smartphones and tablets which were complementing personal computers, up to a point where people now buy less computers (Adner & Lieberman, 2021).

5.1.3 Digital transformation for incumbent firms

Incumbent firms in traditional industries need to build dynamic capabilities for digital transformation (Warner & Wäger, 2019). Digital transformation seems to be a double-edged sword, which brings opportunities for all firms, be that a focal firm, its partners, complementors or other actors inside an ecosystem as affiliation, but also for other actors outside the business ecosystem. It requires substantial investment and brings uncertainty to the extent that some actors obviously perform better than others.

Digital technologies have significantly modified the way companies create value; even companies that produce physical goods are now under pressure to propose services and software as part of their core offerings (Vial, 2019). The imperative is to use the core products to generate data, that will then either be monetized or exchanged.

Digital transformation was defined as the use of a new digital technologies such as social media, mobile, analytics or embedded devices, artificial intelligence, cloud, blockchain and Internet of Things technologies (Fitzgerald & al, 2014). Digital transformation is a demanding journey but it is supposed to enable major business improvements that can range from better customer experience to more efficient operational infrastructures and new business models options (Warner & Wäger, 2019). Yet there is little research that explains how organizations build dynamic capabilities for digital transformation. Even if digital transformation is fundamentally not about technology but rather about strategy (Rogers, 2016), digital technologies are the tools that can have a disruptive impact on organizations. The tools need to be understood and taken into account by senior leadership who then need to find ways to capitalize on unexpected business model.

Wherever the threat might come from, it tends to illustrate that the worst move for an incumbent firm would be not to move. The digital transformation of big and mature companies has turned to be an imperative for executives and leaders who want to sustain their competitive advantage (Fitzgerald & al, 2014; Sebastian & al, 2017).

Using Agarwal & Helfat's (2009) strategic renewal perspective, Warner & Wäger (2019) show that incumbent firms can go through digital transformation to achieve their strategic renewal. They can use digital technologies to refresh their business models and they progressively replace their traditional operations with new collaborative approaches. People thus change the way they collaborate across business units but also with a broader ecosystem of external partners. Industrial actors who make the choice of belonging to a business ecosystem need to adjust their organization to become more agile and responsive than they used to be. This is particularly challenging for incumbent firms and non-digital natives because they usually have slower response times and more insular processes (Jacobides, 2022).

Digital transformation might, as well as the creation of new ecosystem as structure, allow strategic renewal of incumbent firms but I wonder if those two strategic actions are two independent options to choose or if the choice for a digital transformation journey opens new opportunities to start business ecosystems.

Digitalization has a direct impact on organizational change pace, which increases environmental uncertainty and complexity (Dattée & al, 2018). This is why mature companies have to take digital transformation into account for their strategic renewal.

In order to thrive in today's rapidly evolving digital environment, firms have to be agile, resilient and flexible to leverage ecosystem partnerships. They need to do this to gain access to advanced digital technologies that are necessary for them to develop dynamic service capabilities (Kolagar & al, 2022).

> *"Most leaders of big old companies believe their companies can retain leadership positions by taking advantage of both their existing strengths and the capabilities offered by digital technologies" (Sebastian & al, 2017: 198).*

Most of those companies are at an early stage of digital transformation; whatever the industry, those established companies still rely on traditional sources of revenue, even if they have started

investing a lot in digital initiatives. This can be a risked bet as long as more than 70 % of digital transformation projects fail and iconic industrial companies struggle to find a path (Danuso & al, 2021).

One of the most famous cases is the large industrial conglomerate General Electric, which started a journey in 2010 with the target to become a software giant. GE Digital was created, massive resources were invested, with over 2000 developers and expenses above $2 billion in 2018 but it ended up as a notorious failure for the company (Danuso & al, 2021). Most industrial players have the opportunity to leverage their strong market position, technology knowledge and limited competition but digital transformation is not an easy challenge.

Industrial players are embedded in ecosystems that are also fully part of a reorganization of actors and a potential new distribution of roles (Cennamo & al, 2020). Incumbents could be expected to have an advantage over new entrants in the ecosystem, yet global industrial players such as GE, Siemens, Honeywell or Bosch, have been struggling with the risk to see new entrants move fast and capture their loyal customers (Danuso & al, 2021). Size and structure do not guarantee success in the digital transformation process, notably because it is a journey without a fixed destination. In order to succeed in this journey, industrial actors need to have built digital capabilities before being able to connect products and services around new business models (Danuso & al, 2021).

New technologies such as artificial intelligence, blockchain, robotics, social, mobile, analytics, cloud and internet of things present at the same time game-changing opportunities and consistent threats for big old companies (Sebastian & al, 2017). Leaders of incumbent firms can start customer engagement digital strategies and seek to provide innovative, personalized and integrated customer experiences. This kind of strategy is possible if based on analytics of customer and products data.

Incumbent firms in traditional industries could be tempted to use digital transformation to launch new ecosystems. In order to be successful in this kind of journey, they can try to duplicate examples of other industries, such as the one of Amazon with Alexa smart home device ecosystem.

Amazon offers an interesting example of modern disruption based on the launch of a new ecosystem with its Alexa smart home device. The first stage of Alexa ecosystem was launched in 2014 with a strong focus on usage, not on revenue or marketing buzz (Adner, 2021). In a cloud-based world, usage is actually the hidden engine of progress because more usage generates more data, which is used to train algorithms, which results in better performance. Alexa is a platform and its outcome is enabled by an artificial intelligence which is enhanced by data. The number of Alexa's skills grew from 130 in 2015, to 5 000 in 2016, to 25 000 in 2017, to more than 80 000 in 2021. Once the dynamic is started, increasingly more developers are willing to join the platform and customers are also eager to buy the product. Alexa is a success for Amazon because a point was reached where other companies and developers contribute to spread adoption of Alexa. This example shows that becoming a platform is not a starting point, but a destination, which was started by Amazon as early as 2010, when they applied for patents covering virtual displays offering services in response to movements and voice commands (Adner, 2021). Amazon won the race with Apple, Google, Microsoft and Samsung on the smart home market. Amazon had a 53% share of the market in 2020, followed by Google with 28% and Apple with 4%. Yet this example is taken from a global giant that develops products in business to customer (B2C) context and there might be very little possible transposition to B2B context. What can apply to all cases of digital transformation is that the basis for value lies with the collection of data and there must be enough data to train algorithms and improve product performance.

Table 18 Section 5.1 Synthesis of extent knowledge and gaps to be explored

Chapter 4 Section 5.1 Digital transformation
Digitalization: use of digital technologies to create new product & services or transform the business model (Szalavetz, 2022) Digitalization brings new threats / lowers entry barriers even if biggest threats might come from inside the EAA: complementors producing substitutes (Adner & Lieberman, 2021) +trigger commoditization (Jacobides & MacDuffie, 2013) Incumbent firms in traditional industries need dynamic capabilities for digital transformation (Warner & Wäger, 2019). Use core business to generate data, before being able to monetize it (Vial, 2019) 70% of digital transformation projects fail / iconic industrial companies struggle to find a path (Danuso & al, 2021) In a cloud-based world, usage is the engine of progress and generates data, used to improve performance (Adner, 2021) B2B context, industrial firms can achieve complete digital transformation resorting to new collaborations with customers and complementors (Jovanovic & al, 2022)
What is still to be explored
Little research shows how organizations build dynamic capabilities for digital transformation (Warner & Wäger, 2019) Under which conditions are there threats coming from inside the EAA (Adner & Lieberman, 2021) or outside (Warner & Wäger, 2019)? Are digital transformation and the creation of new business ecosystems two alternatives to foster strategic renewal or does digital transformation allow the emergence of new business ecosystems?

To reach the full potential of digital transformation, industrial firms can develop digital platforms, and this might go along an ecosystem approach. In the B2B context, this usually unfolds following new collaborations among a leading firm, its customers and complementors (Jovanovic & al, 2022). Digital transformation entails boundary-spanning activities that come along with an increase in collaboration with external actors. A new balance has to be found between internal and external focuses (Tronvoll & al, 2020). There might actually be a need to share the required investments among several actors and also to adopt an ecosystem approach to generate enough data.

The interplay between digitalization and servitization is very strong. These are two different processes, but they are intertwined and interdependent (Sklyar & al, 2019).

Table 18 synthesizes that digital transformation seems to be a mandatory journey for industrial actors evolving in mature industries if they want to sustain or improve their competitive advantage. Digital technologies modify the competitive landscapes and allow new opportunities, but several aspects of this strategic choice remain unclear. As long as most digital transformation projects fail, there is a need to explore further which dynamic capabilities have to be developed to reduce the risk of failure. There is also a need to shed light on the value prospects of such a transformation. One of the revenue streams might come from the development of new services.

5.2 Ecosystem transformation through servitization

The digital wave that includes artificial intelligence, big data, machine learning, internet of things and cloud computing platforms, has deeply impacted manufacturing firms on how they produce internally, how they are structured and how they collaborate and think (Tronvoll & al, 2020). This major shift and new mindset can lead to digital servitization, when the use of digital technologies enables a transformation from product-centric to service-centric business models (Tian & al, 2021). Acquiring digital technologies or developing digital capabilities is only the first step of a digitalization, which will only become successful when a company innovates its business model including these changes (Sjödin & al, 2022).

5.2.1 Servitization and digital servitization

Servitization happens when firms base their competitive strategies on services. It has been going on for a long time. It refers to how manufacturing companies change their business models to include service-based strategies.

The first step for those firms is to increase the share of services in their overall offers and sales. The following step is to deliver integrated product and services offers, where services are not only added to the product but allow a value delivery each time the product is used (Szalavetz,

2022). Servitization has been intensified by digitalization, which enables the development of digital services (Vandermerwe & Rada, 1988; Coreynen & al, 2017). It brings more opportunities but also new challenges because services require local presence and a higher degree of customer interaction than the usual product-based business (Tronvoll & al, 2020).

Digital servitization describes the convergence of servitization and digitalization (Gebauer & al, 2021) and can be defined as the transition toward smart product-service-software systems that enable value creation and capture through monitoring, control, optimization and autonomous function. Firms opt for digital servitization when they use digital tools to switch their business models from product-centric to service-centric (Sklyar & al, 2019).
The implementation of digital servitization and the related technologies, routines and business models adds complexity and creates challenges (Kohtamäki & al, 2019). However, if this strategic move is totally enforced, it can lead to new revenue streams and extend beyond the boundaries of a single firm.

Servitization is a strategy that can be used by manufacturers who choose to base their competitive approach on services. This is a transformation where manufacturers offer more services that are tightly linked to their already sold products. This strategy can strengthen customer relationships, create new and long-term revenue streams but also generate new barriers for competitors (Baines & Lightfoot, 2014). There is a need to develop some specific capabilities, to be able to change one's business model and start selling services. Many manufacturing firms have tested this approach to include services in their offers and changed their focus from only delivering industrial products to selling a combination of services and products (Cenamor & al, 2017). They do that because they need to renew their offerings and see some opportunities to exploit scale economies from high-volume production.

This approach brings a lot of opportunities and threats. So far, there is little research showing to what extent such a strategy can yield financial rewards (Tronvoll & al, 2020). Services can bring additional revenues or value but it can also require a significant adjustment of the firm's operational capabilities. For example, services usually demand a 24-7 mindset and human resources who are skilled for customer interface (Baines & Lightfoot, 2014). When a company is used to selling industrial products, this can demand a major shift and consequent investments. Switching to digital servitization requires to adopt several organizing activities that come along with increased embeddedness, centralization and integration (Sklyar & al, 2019). There is a need to foster a close collaboration with internal and external parties for digital servitization, because this is a complex process. It needs to be adopted by the people inside the company so there is also a need to formulate and communicate a comprehensive vision to prepare everyone for change. Furthermore, critical IT skills and capabilities need to be available and centralized. On the value side, servitized manufacturers gain significant value from knowing how their products are used by their customers. This can be useful for contract monitoring, to enhance reliability and to accelerate the design process of future products (Baines & Lightfoot, 2014).
If digital servitization is well prepared and done, it should yield new revenue streams and internal process innovations (Sklyar & al, 2019).
On the threat side, the balance between product and service centricity inside the focal firm is at stake, as long as this balance might be modified. This is why collaboration between product and services units have to be strengthened and those efforts are to be undergone in the long-run (Sklyar & al, 2019).

It can be wondered how the new services are positioned in comparison to traditional business within the company. It can be a strategic move for long-term survival, yet the current business has to go on. How do manufacturers deal with this need for new capabilities and how do they

spread their investments? There is also a question for competition: if they develop services, they might face new competitors. Are there any pure service players on their slot? Can they compete with them? Does that change the current relationships they have inside their ecosystem as affiliation?

Manufacturers need to configure their operations and to improve their practices and technologies so that they may be able to deliver advanced services that will yield additional benefits (Baines & Lightfoot, 2014). Those advanced services can be defined as a capability delivered through product performance, but it also encompasses a relationship over extended life-cycle and extended responsibilities. Manufacturing firms thus claim a legitimacy to keep the products they created and sold operational because they have the capabilities to develop the products. It makes sense but it also increases the power of the manufacturing firm over its customers. This also entails an important question about the value creation and sharing: if those services are helping to manage the performance of products, they should maybe already be included in the basic offer of the manufacturing firm.

Servitized manufacturers have a strong challenge to face because they need to coordinate their research and development units, which can be called the back-end, and their market and sales units, that can be called the front-end. There lies a key aspect in implementing services (Cenamor & al, 2017). All units need to integrate or develop new kinds of skills, starting with data scientists in the back-end functions. It is also a critical point for front-end units, who definitely cannot sell services as they were used to sell products. Extensive training programs for front-end units can help building operational competences. More technical skills allowing to connect cloud-servers, or developing software, applications and analytical tools can also be required to make the most of servitization efforts (Cenamor & al, 2017).

Keystones tend to become commodities over time, in the sense that the problems they solve are increasingly well understood by a wide audience. Each ecosystem has its own dynamic and faces new challenges and opportunities. A solution for mature players might be to give up the lower levels of their platform. It can mean leaving profitable and easy business to new players, but this is also a way to avoid staying too long in a comfort zone (Iansiti & Levien, 2004). Different parts of the platform unequally contribute to its overall value and keystone should aim at retaining control of the locus with the highest value.

As showed with the example of GE Predix[14] (Adner, 2021; Jacobides, 2022), adjusting to the fast-moving environment might require creating industry-transforming ecosystems. GE expanded its services successfully and is seen as a pioneer in the servitization process (Gebauer & al, 2021), but achieving a servitization process does not necessarily implies achieving a digital servitization process. In 1995, services already generated 22% of General Electric's revenue and it rose to 36% in 2005. In 2015, they decided to look for new growth opportunities through digitalization. They managed to raise those digital revenues from 2,9% with $ 3,1 billion in 2015, to 3,2% with $ 3,2 billion in 2018. This shows that altering its core business activities can be a risky bet, which in that case trapped GE in a difficult financial situation (Gebauer & al, 2021).

Focusing on Microsoft can also help understand what it takes for big old companies to keep strong positions. At the time of Bill Gates, they managed to be part of the winning ecosystem with IBM and Intel and then to outperform IBM because over time, new companies built compatible machines with their software. They have integrated that everything gets

[14] See Chapter 1, Section 3.2

commoditized eventually. Steve Ballmer was Microsoft CEO between 2000 and 2014. In 2013, he announced a new strategy focusing on a broader goal of value creation:

> *"our strategy will focus on creating a family of devices and services that empower people around the globe, for the activities they value most"*[15]

Ballmer was replaced by Satya Nadella who issued the following mission statement in 2015:

> *"our mission is to empower every person and every organization on the planet to achieve more" (Microsoft website).*

The two statements are very similar except that Nadella does not specify which products or services will allow the achievement of the company's goal. He thus broke with longstanding Microsoft taboos, embracing open-source software trend and opening up interfaces and integration with competing platforms (Adner, 2021).

What applies to Microsoft might however not apply to other kind of actors, such as industrial firms, whose traditional business is far from digital technologies.

Platforms and standards used to serve as the connecting fabric of an ecosystem. They drew the boundaries and defined the relationships among its members (Iansiti & Levien, 2004). Now, Microsoft is no longer limiting its development to the platform but could also replace its complementors. Iansiti & Levien also stressed that companies always needed to assess new options offered by technology and IT providers, to select the most promising ones and then implement their solutions to evolve their ongoing operations (2004). Servitization can indeed bring new opportunities, but on the threat side, there is now a need to seriously consider technology providers as potential direct competitors. Industries that are technologically mature and have always seen incremental evolutions, can become exposed to radical changes because

[15] www.independent.co.uk/tech/microsoft-announces-reshuffle-one-strategy-one-microsoft-8703772.html

of new technologies. This is the case for the automotive industry (Adner & Lieberman, 2021) and there might be comparable threats transferred to the aviation industry, or other industrial sectors.

5.2.2 The example of the automotive industry, a mature ecosystem disrupted through digital transformation

The automotive industry and the aerospace industry belong to the broader mobility ecosystem, in which four technologies contribute to reshape the structure of the industrial landscape: cars going electric, autonomous driving, mobility platforms for shared uses and data connectivity. Incumbent global car makers are usually called original equipment manufacturers (OEMs), as well as Airbus or Boeing are called OEMs in the aircraft industry. OEMs in the car industry have progressively strengthened their position as “system integrators”, thus occupying the key bottleneck, with a strong control on the suppliers, complementors, overseeing brand and marketing and keeping the overall responsibility for product quality and liability (Jacobides & al, 2016).

Tesla case exemplifies how a new actor disrupts an existing mature ecosystem. They took a strong stance because they have developed solid capabilities in several of the new technologies renewing the car industry: they have the capabilities to produce electric cars, they made the choice to prepare for autonomous vehicles and the use of big data (Adner & Lieberman, 2021). Data has become a critical asset because of its fungibility; the use of today is not necessarily the use of tomorrow and it can be reused with no limit. Tesla is a prominent example of an industrial actor that manages to disrupt a mature industry through complements. Commoditization, adjacent entry and value inversion are three pathways that threaten incumbent firms and blur the lines between actors, potentially turning “friends” into “foes” (Adner & Lieberman, 2021). For the car industry, it was shown that historical industrial actors face four technological challenges, linked to breakthrough technologies and the use of data, that

will displace the locus of value creation from industrial production to services. I will try to understand how this pattern might unfold regarding the aerospace industry. One key question is to wonder if and how services are developing in this ecosystem as affiliation. In a world of ecosystems, being early often means waiting for other elements and partners to arrive before the real race starts (Adner, 2021). When there is a lot of uncertainty, incumbent firms might have to make strategic choices of investments, with a risk to be either too early or too late.

Servitization can be done internally or externally. Internally, this strategy can be based on developing dynamic capabilities and learning but it can also rely on new ways of collaborating with partners. It can start with M&A and new forms of IOR, in order to integrate new capabilities faster.

Doing servitization with an external focus should go through partnering with actors that are inside or outside the ecosystem as affiliation of a focal firm. The focus for innovation leaders should be on understanding the overall health of their business ecosystem and on responding to and influencing their ecosystem's evolution (Iansiti & Levien, 2004).

When new activities depend on crossing traditional ecosystem boundaries, there is a strong need to create new structures of collaboration and to establish some kind of leadership outside a legitimate domain (Adner, 2021). The leaders in place have to adopt an alignment mindset, which goes along with the humility to accept that potential partners have their own expectations and need to be convinced.

Recent research on the design of ecosystems in the context of digital services showed the importance of substantive uncertainty, which can be weak or strong, on the overall performance of the ecosystem (Lingens & al, 2021). It showed that when the uncertainty is weak, the actors tend to be more intensively linked with one another. They have many connections and can take part in several flows of activities. When this uncertainty is strong, actors are less tightly connected to each other and tend to only adjust their respective modules with very few partners.

Ecosystems where uncertainty is high favour simple designs with few actors and activities to coordinate.

5.2.3 Digital servitization and business model adaptation or innovation

Manufacturers who have no strong experience as provider of digital technology face a vital need for filling this technology and resource gaps. They realize that succeeding with digital servitization might be an imperative and that it comes along with a direct access to new digital resources and technologies, such as skills and competencies in operating analytics, connectivity and sensors (Tian & al, 2021; Kolagar & al, 2022).

Manufacturers who intend to transform their ecosystems must introduce some basis related to their culture, business model and capabilities to lower the implementation obstacles that could interfere (Tronvoll & al, 2020). The organizational culture is most importantly shaped by transparency, openness, accountability and trust, which have to be encouraged by transparent data and knowledge sharing (Gebauer & al, 2021; Kolagar & al, 2022). The trust among partners within the ecosystem allows a continuous improvement and self-reinforcing mechanisms that are key to facilitate new transformations or commit to new orientations, be that at the firm level or at the ecosystem level (Kohtamäki & al, 2019; Sklyar & al, 2019).

An under-researched topic is the question whether ecosystems have one or several orchestrators (Lingens & al, 2021). Research however showed that digital servitization is entangled in the ecosystem and that it is facilitated by centralization and integration (Sklyar & al, 2019), which indicates that one orchestrator needs to take the lead. This theoretical input is consistent with the empirical results developed in this chapter, where my empirical results showed that the creation of a new EAS is doomed to fail if the leadership is shared among several actors.

5.2.4 Business model innovation for servitization

The business model is one of the main factors to focus on when ecosystem transformation occurs. It represents the structure of a firm, which operates to create, deliver and capture value for survival and growth in a volatile environment (Kolagar & al, 2022). Manufacturing firms need to constantly assess and rate the business model components so as to identify potential needs and opportunities of ecosystem transformation. It can for example be a smart move to help customers in a business-to-business context to ensure the value delivery of complex digital services (Sjödin & al, 2022).

The transformation of the value proposition, with a shift from products to digitally based services, requires an investment from the focal firms to develop digital resources and capabilities. However, single firms hardly possess all the specialized knowledge to tackle at the same time their usual manufacturing challenges and close the capability gaps that are necessary to make the most of identified opportunities of digital transformation (Szalavetz, 2022). Manufacturers can fail to exploit the benefits of servitization, unless they decentralize a service organization with profit-and-loss responsibility and foster a culture that strengthens between manufacturing and service-oriented values (Tronvoll & al, 2020).

Internal capability building is always possible but time to market is a key dimension and established manufacturing firms need to complement their internal resource accumulation efforts with external resources. Integrating new knowledge and technological solutions from external providers can be the best solution to address identified resource and capability gaps (Szalavetz, 2022).

Digital platforms are technological architectures that can be intra-firm focused or inter-firm focused (Tian & al, 2021). Platforms can be

> *"products, services, or technologies that act as a foundation upon which external innovators, organized as an innovative business ecosystem, can develop their complementary products, technologies, or services" (Gawer & Cusumano, 2014: 417).*

When platforms are intra-firm, they are inside the company and enable companies to improve customization and operational efficiency (Cenamor & al, 2017). Platforms can also be inter-firm platforms and in this case, their purpose is to enable management and orchestration of complex relationships with customers, suppliers (Tian & al, 2021). Industrial companies that opt for digital servitization use technology to align their internal and external core capabilities. They use digital platforms to coordinate back-end industrial production and front-end service delivery processes (Tian & al, 2021). A choice between intra-firm or inter-firm focus seems to be required, because their purposes are too different to be achieved at the same time. The empirical study led in the chapter however showed that Airbus Skywise ecosystem relied on a key antecedent to strike a balance between an internal and an external momentum. It can thus be insightful to explore further how this new ecosystem as structure develops its digital platform.

Uber and Airbnb are platform business models because they provide a foundation upon which external actors can connect and develop complementary products or services (Gawer & Cusumano, 2014). The situation is totally different for firms that want to engage in digital servitization and need to create new business model configurations, which take into account other firms within an ecosystem. Different companies have different histories and processes that define their capabilities regarding business model definition. It ranges from technologies, routines, value propositions or pricing logics and they need to build on those business models to collaborate with other companies and allow digital servitization (Kohtamäki & al, 2019).
Most studies of servitization are firm centric and there is a need for more research adopting an ecosystem and value system approach (Forkmann & al, 2017).

Tronvoll & al (2020) lead a single-case study of digital servitization undergone by a maritime industry player, Navarch, during nine years. Many aspects are comparable to Airbus case with Skywise. Navarch enforced the strategic decision to install a hardware underpinning digital services on boats that were under construction. They did not wait to have sold any kind of services or signed any dedicated contracts before offering digital services for free to all customers (Tronvoll & al, 2020). They however faced some issues and challenges when they realized that the software did not scale as much as it does in the consumer industry. In industrial business, major stakeholders might have unrealistic expectations about pure revenue growth from digital solutions. A parallel can be drawn with GE Predix case and might probably resonate with Airbus case. With Predix, GE aimed at taking position in the industrial Internet of Things (IoT) market. Predix was an advanced analytics platform, supposed to make the most of data and engineering solutions (Jacobides, 2022). At the launch of the platform in 2015, the ambition was to become a world leading software company and sales of $15 billion by 2020 were predicted. GE was at that time already successful to operate its platform internally with remote diagnostics for its jet engines. They were convinced of the market potential; they had the technical solution, and they were ready to invest what was needed to spread their solutions. Predix was probably a good technical tool, that could have helped customers to connect, monitor and manage their machines generating more insight and increase predictability. It was however a failure because of a lack of partners to become a real ecosystem (Adner, 2021). This shows that the potential of digital servitization should not be overestimated, at least on a value creation perspective. Following this failure, there is a need to wonder how industrial actors can decide on the best commitment to have towards digital servitization. This transformational choice requires closer collaboration with customers and to build partnerships with various external firms (Tronvoll & al, 2020). It yet still remains to be shown how it can be done.

Table 19 Section 5.2 Synthesis of extent knowledge and gaps to be explored

Chapter 4 Section 5.2 Servitization
Servitization intensified by digitalization (Coreynen & al, 2017). Opportunities and challenges / requires more customer focus than usual product-based business (Tronvoll & al, 2020) Digital servitization: convergence of servitization and digitalization (Gebauer & al, 2021) Servitization helps manufacturers know their products better + optimize processes (Baines & Lightfoot, 2014) Ecosystems with high uncertainty go for simple designs = few actors / activities to coordinate (Lingens & al, 2021) Successful giants in servitization in B2C context lead to overestimate the potential of servitization. Technical tools development ≠ successful servitization, need ecosystems with partners to avoid failure (Adner, 2021), especially in B2B contexts Customers + complementors need to be convinced to commit a new ecosystem for servitization (Jacobides,
What is still to be explored
Can servitization for industrial players bring financial performance (Tronvoll & al, 2020)? Spread of investment between the core business and new services development for manufacturers? Moving to product & services orientation impacts the competitive landscape. Any change in the EAA landscape? Servitization are firm centric, need for new research with ecosystem and value approach (Forkmann & al, 2017)

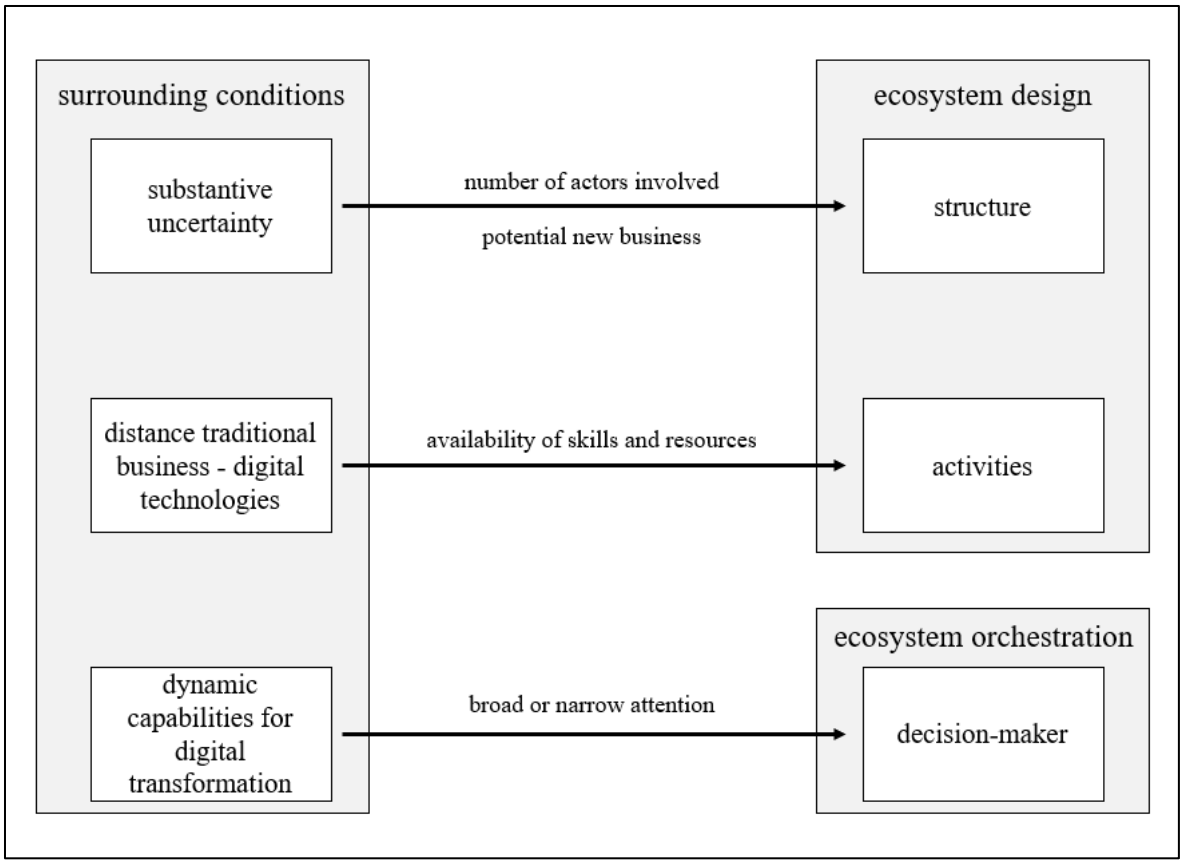
Table 19 gathers the main outcomes of research on the topic of servitization and three main aspects that need to be explored further regarding the fit of servitization with manufacturing firms' capabilities. Those aspects will be tackled in the following chapter.

5.3 Developing competitive ecosystems in the context of digitalization

Digitalization brings opportunities for incumbent firms to renew their models and develop new ecosystems as structure (Adner, 2017) but prior success might be a trap because these opportunities demand a new kind of focus. Firms need to set some targets, to define a blueprint that includes a scope, a market position and a thinking that goes beyond the firm level. Customers and complementors need to be convinced to engage with the new entity (Jacobides, 2022). Even when the value proposition takes into account the needs of the final customer and includes potential complementors participation, implementation can turn to be the most difficult part to achieve (Jacobides, 2022).

Figure 24 synthesizes what it may take for a focal firm to develop a new ecosystem as structure resorting to a digital transformation journey. The surrounding conditions represent the starting point and conditions that need to be acknowledged before starting a new ecosystem.

Figure 24 From digital transformation to ecosystem design (adapted from Lingens & al, 2021)



If substantive uncertainty is high, the focal firm will need to define a simple structure, with a minimum number of partners and a straightforward governance structure. If the distance between traditional business and digital technologies is long, there will be less available skills and resources inside the company to develop new activities inside the ecosystem. This will notably have an impact on the ability of the ecosystem to develop services and digital services. The last point has to deal with available dynamic capabilities for digital transformation and has a direct impact on the decision-maker resources to devote to the orchestration of the ecosystem.

Considering digital transformation with an ecosystem perspective requires to have an overall basic level in digital capabilities, for all actors involved in the ecosystem. Leading manufacturers thus need to play an active role to develop the digital capabilities of other ecosystem actors, be they distributors, complementors, suppliers or customers (Sjödin & al, 2022). There are already some identified key activities that can help build digital capabilities inside the ecosystem, such as building skills in the advanced analysis of customer usage data in front-end units and automating basic data analysis for service delivery (Sjödin & al, 2022). Several aspects need to be addressed on this dimension of capabilities development at the ecosystem level and it would be important to study how an ecosystem leader behaves to embark its partners on the digital transformation journey. At some point, it must even be a question to wonder whether there is a business case to do so.

Chapter 5 Expanding an EAS in a mature EAA to support digital transformation

In Chapter 4, the focus was on the key antecedents allowing the launch of a new ecosystem as structure (EAS) in the context of a mature industry. I compared two emerging new ecosystems as structure, one lead by Safran and one lead by Airbus. Both of them were launched to generate business with partners thanks to the exploitation of data. Four years after my first interviews on this topic, only one of the two initiatives is still alive. The literature review and the interviews conducted helped me identify a few key antecedents that needed to be gathered so that a business ecosystem may be successful, or at least managed to survive after its launch. I showed how partners can be selected inside or outside the existing EAA and that a blend is necessary to launch a new thriving EAS. Some past relations are necessary to build on strong basis and new partners can bring essential complementary capabilities. A new EAS is however an uncertain journey, in which actors can commit without collecting the expected results. Some dimensions studied in Chapter 4 thus need to be reassessed with a longitudinal approach, to see if the blueprint (Dattée & al, 2018), presented to attract partners has come to reality after a few years. Aspects like the unfolding of dynamic capabilities (Teece, 2007; Agarwal & Helfat, 2009) or the impact of EAS creation on competition at the EAA level also needed further study that go beyond the creation of a new EAS. While Chapter 4 was more focused on the ingredients taken from the existing EAA and external environment to enable the creation of a new EAS, Chapter 5 will rather focus on the development of this EAS and the impact it can have on the existing EAA in return. Transformation of a mature EAA (Cozzolino & Rothaermel, 2017; Onufrey & Bergek, 2020) only happens if actors manage to innovate to develop new value, without underinvesting their core business (Lingens & al, 2021).

Digital transformation starts from the organisation level but goes much beyond, to the extent that future studies on ecosystems should investigate the area of digital affordances (Cobben & al, 2022), which are the tools and capabilities that firms involved in ecosystems leverage during the process of digital transformation.

The exploratory study conducted in Chapter 4 sheds light on how two ecosystems as structure are foreseen and prepared, but this is only a first step, and there are many uncertainties at this point. It is necessary to adopt a longitudinal approach and come back on the case that is still ongoing to see how it evolved.

It is moreover recommended that practitioners focusing on ecosystems do look beyond the internal ecosystem as structure and focus on the ecosystem's external environment, the business ecosystem, or ecosystem as affiliation. It could also include other potential competitors (Cobben & al, 2022). This is why I will focus more on this competitive environment in Chapter 5 than I did in Chapter 4. The creation of a new ecosystem is a long process. There might be a difference between theory where an ecosystem as structure is presented as organized around a new value creation and reality where the ecosystem business case and associated value creation and sharing can take a long time before materializing. I will thus explore further what the actors involved in the new ecosystem development consider as value creation. It does not necessarily mean revenue growth. This chapter will explore further the development of a new EAS in the context of a mature EAA and shed light on how value is created (Tronvoll & al, 2020; Vial, 2019) and how dynamic capabilities for digital transformation are developed (Warner & Wäger, 2019). In the line of Chapter 4, this new chapter will focus on the balance to find between internal and external focus.

Strategic renewal (Agarwal & Helfat, 2009) is an imperative for incumbent firms that evolve in mature industries. They are part of business ecosystems (Moore, 1993), or ecosystems as affiliation (Adner, 2017), in which they have longstanding ties with other firms that can in turn be their partners, customers, complementors, suppliers or competitors (Brandenburger & Nalebuff, 1996). Firms need to innovate, for growth or at least to sustain their competitive advantage, in a fast-moving environment. The rise of digital technologies has urged manufacturing firms to adjust their processes and lower the entry barriers for potential new competitors. Digital transformation is an imperative for incumbent firms, who need to increase their operational efficiency and organizational performance (Vial, 2019) because their customers become more demanding and because new actors arise with new threats. Digitalization also encompasses opportunities to innovate product, services, processes or business models (Sklyar & al, 2019). These changes however demand high investments and collaboration through ecosystems as structure (Adner, 2017) can be an effective approach to achieve strategic renewal.

Through a longitudinal, qualitative case study of an ecosystem as structure, I address the following question:

How can industrial firms use digital transformation and ecosystem to foster strategic renewal?

In this chapter, I claim the following contributions to the literature. First, I show that ecosystems as structure do have an impact on the competitive dynamics at the ecosystem as affiliation level. Adopting an ecosystem approach helps historical industrial actors to move their strategic positioning and strengthen their positions towards their partners. Second, I contribute to the understanding how digital transformation and servitization for industrial actors goes along this

ecosystem approach, with a focus on B2B context and the development of dynamic capabilities, at the ecosystem level. Third, my findings challenge the potential of digital servitization for industrial actors.

Overall, I will bring contributions to the literatures on ecosystems, dynamic capabilities, strategic renewal and digital transformation.

Section 1 Digital transformation for value creation at the ecosystem level

Digital transformation and servitization allow the use of digital technologies to reshape the strategic positioning of companies, be that at the firm level or at the ecosystem level (Coreynen & al, 2017; Baines & Lightfoot, 2014).

If digital transformation brings new opportunities for incumbent actors, it also brings new threats, be that from inside the ecosystem as affiliation, for example with complementors who could be competitors in different ecosystems as structure, or from outside the ecosystem, with new actors who could step in. How does the competition landscape evolve? These aspects will be studied in this chapter.

Research in strategy started focusing on ecosystems but the coverage of their actual designs and the impact they can have on the ability for firms to adapt to change in an appropriate and timely manner remains superficial (Vial, 2019). Historical industrial actors are subjected to surrounding conditions that will determine what they can reasonably foresee as a potential ecosystem development. Depending on the substantive uncertainty (Lingens & al, 2021), on the distance between their traditional business and digital technologies, they will need to opt for a more or less complex ecosystem design.

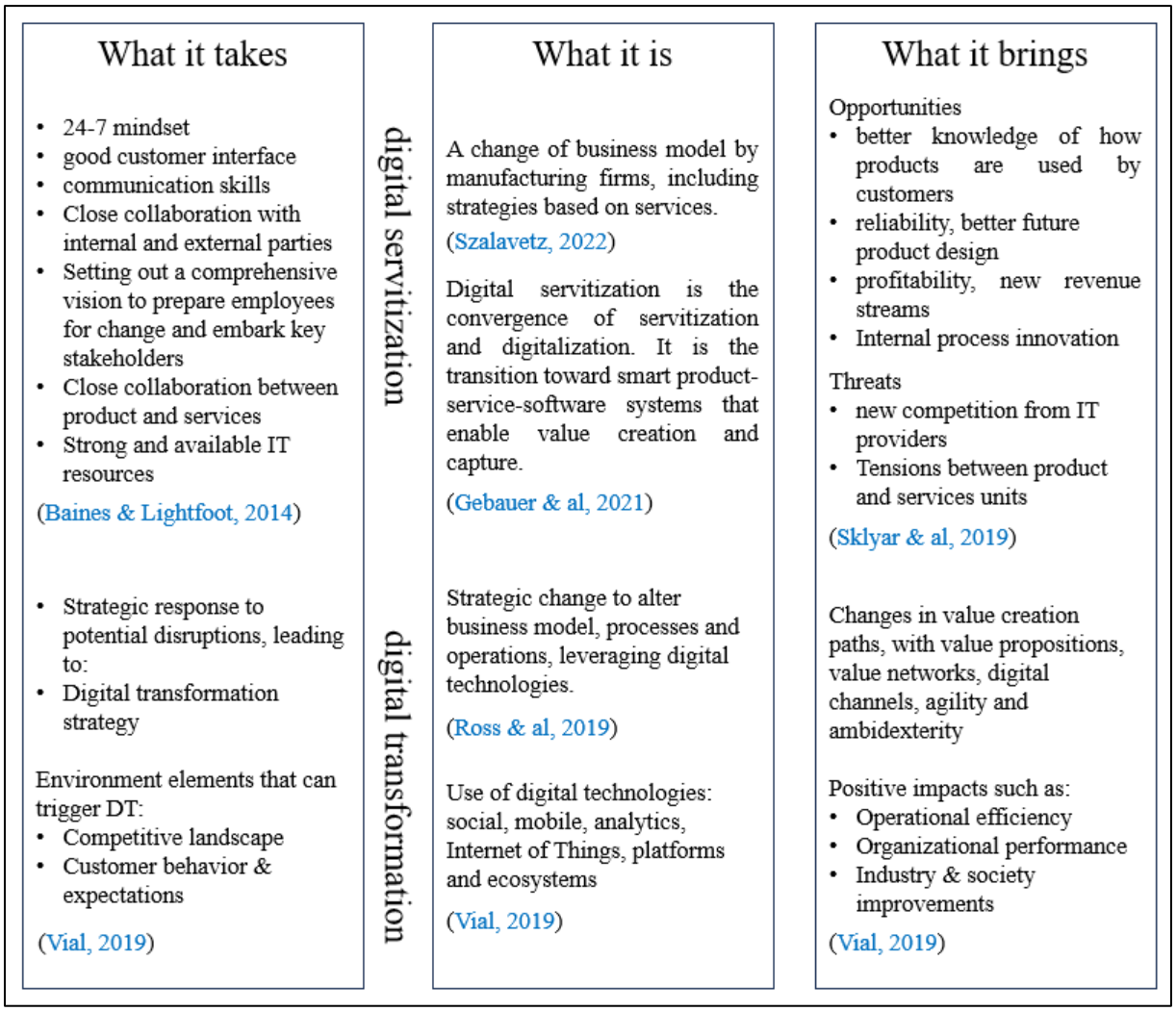
Manufacturing firms increasingly tend to rely on digitalization and digital servitization but generating value requires to form ecosystem partnerships (Kolagar & al, 2022). Several areas have been underexplored so far and future research should investigate the following points:

- Understanding the influence of new entrants in digital servitization (how can digitally oriented new entrants collaborate and compete with established firms in shaping the ecosystem for digital transformation?),
- Investigating the impact of new digital technologies on different industries and on the ecosystem transformation process (How can the emergence of AI, IoT, blockchain, and big data analytics impact the process of ecosystem transformation for digital servitization?),
- Understanding the impact of Business Model Innovation on ecosystem relationships (How can activities related to value creation & capture evolve to integrate an ecosystem perspective?),
- Understanding the requirements to undertake new effective partnerships (How can manufacturers attract new actors or sign new kinds of partnerships with the aim of offering digital services?).

Figure 25 synthesizes the main characteristics of digital transformation and digital servitization. It shows that both processes can bring a lot, in terms of strategic renewal through capabilities development and new potential revenue streams. It also shows that even if it remains a choice by a company, there are also some pressures from the environment, because digital technologies enable the development of new capabilities and focusing on the traditional core business might no longer be sufficient to satisfy customers expectations.

It eventually shows that those two strategic choices are demanding and require to dedicate time, finances and resources to develop and strengthen relationships with existing and with new partners or customers.

Figure 25 Digital transformation & servitization: what it takes, is, brings



The servitization literature stresses the need for empirical studies investigating how industrial companies engage in transitions processes in order to renew their business models, thanks to the use of platforms to provide services to their customers (Kohtamäki & al, 2019).

Research on servitization has also explored the impact it can have on firm performance and the results show that it can improve profitability, customer satisfaction, organizational operation

efficiency, internal processes and innovation of the firm. Those positive outcomes are however not to be taken for granted and future research should explore why some manufacturing companies do not succeed with servitization (Feng & al, 2021).

Most manufacturing firms face difficulties when they want to transit from product innovation to product and services innovation because this switch demands a totally new organization and transformation of how they want to create, deliver and capture customer value (Cenamor & al, 2017).

There seems to be several contingent requirements while launching a new ecosystem as structure and choosing to start a digital transformation journey, mostly because it requires to adopt a focus on the external environment, to create value at the ecosystem level, after having developed capabilities at this level. This section about digital transformation and servitization however shed some light on the fact that value creation should not be the only target of such a journey, or at least not in the short run. It is actually a long and uncertain move. Value is also not necessarily assessed by a rise in turnover, but this point needs to be explored and I will focus on that in the next empirical section. Following the research on servitization, there is a need for further investigation with a focus on companies' strategic triggers and measures the impact of digital servitization on the firms' performance, with criteria such as enhancement of customer retention or revenue increase (Tian & al, 2021).

My two other main focuses will be on dynamic capabilities development and on the impact of digital transformation at the ecosystem level on the competitive landscape. If industrial companies want to lead product-service innovation, they need to develop agile capabilities (Sjödin & al, 2022) and I will explore how such capabilities are developed and how they can serve internal or external focuses.

The reasons why ecosystems are unique organisations of collaborative actions to create ecosystem-level outputs have been extensively documented but the competition dimension of

ecosystems is almost never discussed in the existing research (Thomas & Autio, 2020). I already showed how it was taken into account at the EAA level before creating a new EAS, I will now focus on the development of the EAS with a focus on how it can change the dynamic at the EAA level.

I will eventually go on exploring how incumbent firms cope with internal and external dynamics when it comes to digital transformation and servitization.

Having an external focus also means dedicating resources to ecosystem orchestration and this strategy requires leading industrial firms to create new roles for the coordination of new activities (Sjödin & al, 2022). I will also study how they share their time between internal and external focuses.

Research on digital servitization and especially in business-to-business markets is still at an early stage (Gebauer & al, 2021). There is a need to extend the scope of research from a single firm to an ecosystem approach. It was shown that digital servitization can bring revenue growth as well as reducing costs through deploying digital technologies for manufacturing processes (Gebauer & al, 2021). It was also written that digital servitization demands a lot of investment and change management because it affects the balance between product and service focus. It could thus be interesting to focus on industrial companies and see how they lead their digital transformation and servitization.

Past research on business and innovation ecosystems gives few recommendations for manufacturers and industrial companies who would like to innovate their business models using digital technologies (Sjödin & al, 2022). As long as I wonder to what extent industrial companies evolving in mature ecosystems can create new ecosystems as structure to foster strategic renewal, it makes sense to dig further how this ecosystem creation relies on digital technologies. It will also advance the research to check whether industrial actors can easily deploy servitization and digital servitization.

Section 2 Methods

Digital servitization research is at an early stage, thus a single case study approach is appropriate to advance theoretical understanding (Tronvoll & al, 2020). Single-case research exploits unusual opportunities to explore a significant phenomenon under rare or extreme circumstances or because they offer opportunities for unusual research access (Yin, 1994; De Massis & Kotlar, 2014). I chose this approach for this Skywise case because I consider it is a unique set-up that allows to observe the unfolding of a new business ecosystem in a context of digital transformation of a mature industry. I decided to go on with the single case of Airbus Skywise because it was the necessary following step after an exploration phase to richly describe a phenomenon (Siggelkow, 2007). I looked for comparisons in my study and included interviews from people outside the focal organisation, either from competitors, from complementors and from advisors. I selected respondents by snowball sampling (Biernacki & Waldorf, 1981). I designed a semi-structured interview guide to acquire a comprehensive understanding of the impact of digital servitization within Airbus.

2.1 Data collection

Data were collected through individual, in-depth interviews with participants from Airbus, from partners who were involved in the ecosystem as structure and from external observers who are members of the broader ecosystem as affiliation of Airbus.

The informants were selected because they were actively involved in the development of Skywise ecosystem or because they were operationally involved in similar activities in a comparable context. My overall focus was on respondent's experiences of the transformation process, their everyday tasks and perception of the changes occurring, both within their company and across the ecosystem. I made sure to have several informants that covered all the

development stages of the ecosystem since its first steps and to have several informants for each step, in order to be able to bring validity to what they said. Key informants were asked to recommend people with experience and insight on digital transformation, the development of services and Skywise platform, be that with an internal or external to Airbus focus.

I interviewed different participants who exercised various organisational functions to capture a multifaceted view of the processes. The interviewees included roles such as digital business manager, business development manager, Service strategy director, Head of Skywise for Airbus and supply chain, Head of Skywise for airlines and ecosystem, Skywise Solution Training Engineer, Head of Skywise Product and service line, Head of Digital solutions and marketing. Table 9 provides an overview of all interviews[16] I conducted from August to December 2022.

The respondents were asked open-ended questions with the support of an interview guide. This guide was developed from themes on enablers and practices relating to ecosystems development, servitization and digital transformation, with a strong focus on the balance between internal and external focus of the firm. For example, respondents were asked to consider questions relating to broad themes such as: Can you explain what your role consists of? Do you think Skywise development helped to change the practices inside Airbus? Was there a will from the start to develop the new ecosystem to address both internal and external aspects? How do you assess the value creation linked to the new ecosystem? How do you involve new partners in the ecosystem? What are the main KPIs (Key Performance Indicators) to assess the performance of Skywise? Which capabilities did you need to develop internally to support the development of this transformation? How do you involve and exchange with partners in the ecosystem and how are they incentivised? From what has been done in the past years, can you

[16] See Chapter 2 Section 2.2

describe what was successful and what should or could have been done differently? Do you consider Skywise to be a success?

I systematically sent the interview guide to the informant at least three days before the interview. Follow-up questions were used to clarify points and obtain further details, which helped me to explore further relevant aspects. I recorded all interviews and transcribed them in the following days. I then sent them back for validation by the interviewees, before using them for my data analysis. If some points were still unclear during transcription, I followed up with complementary shorts exchanges on the phone or via visio call. The detailed record of interview guide is available in the Annexes.

2.2 Data analysis

I followed a thematic approach to data analysis (Braun & Clark, 2006). My first step in my data analysis was to examine the raw data in-depth for each interview. This analysis consisted of reading each interview several times and highlighting sentences, key words and parts that were related to the overall purpose of my research, which consists of understanding how a dominant firm in its industry changes its usual interorganisational relationships to opt for the launch of a new ecosystem as structure and does it in the particular context of digital transformation and the development of digital services. I followed the approach developed by Gioia (Corley & Gioia, 2011) to build a data structure. By coding the common words, sentences, ideas mentioned by interviewees, I identified first-order categories of codes that reflect their opinions with their own words. The second step of my analysis consisted in going further with the examination of the first-order categories across interviews and contexts to identify connections and patterns among them. At this stage, I tried to combine insights from the literature and data collected in an iterative process (Miles & Huberman, 1994), which yielded second-order themes. Those themes represent new concepts that correspond to combinations of first-order categories. They

relate to key ecosystem development and dynamic capabilities for digital transformation development, with some elements related to business model innovation. Then I had a first draft of data structure. During the following step, I built aggregate dimensions in order to achieve a broader level of abstraction in my coding. This is how aggregate dimensions are created on second-order themes and on first-order categories to display a practically and theoretically grounded data structure.

I used tables in the next part to gather the most insightful quotes that I collected from my interviews and from which I elaborated my whole data structure with key first-order findings, second-order themes and aggregate dimensions. Qualitative researchers have been repeatedly encouraged to "show" rather than "tell" readers about their data (Pratt & al, 2020) so I used tables gathering "power quotes" or "proof quotes" (Pratt, 2008) that help understand how I structured my whole first-order findings. Tables in qualitative research have three main uses, organizing, analyzing and displaying (Cloutier & Ravasi, 2021) that I tried to combine.

Tables are good tools to transform data into findings (Patton, 2002) and this process unfolds in the iterative process of choosing, summarizing, and displaying the data. I used these tables as a complement to the overall data structure and explanations I wrote aside (Cloutier & Ravasi, 2021).

Section 3 Findings

Airbus servitization and Skywise ecosystem development for strategic renewal

Four years after the beginning of my empirical work, my focus is still on Skywise, which is a new ecosystem as structure developed by Airbus. This second phase of empirical work was still aiming at shedding light on strategic renewal of industrial actors evolving in mature industries, when they adopt an ecosystem strategy but with a special focus on digital transformation and

servitization. After phase 1, lead between April 2019 and January 2021, phase 2 took place between August and December 2022. During this phase, I focused on four key dimensions for research on ecosystems that are somehow intertwined:

1) Development of dynamic capabilities at the firm and at the ecosystem level
2) Balance between internal and external focus, including the required activities to embark partners (motivation, contracts)
3) Value creation or expected outcome through new ecosystem development
4) Impact on competition at the EAA level following the development of EAS

Having a longitudinal approach gave a lot of perspective to my past results. For example, I had no idea whether one case would be more successful than the other because both choices seemed to have their own strategic advantages and risks. Four years later, it is easier to say that

> *"Safran project was a failure because it was too ambitious to aim at two targets at the same time: creating a shared capitalistic structure and a new business ecosystem with real services" (Source 6).*

Both cases I focused on had to deal with the use of big data to create new services for airlines and creating new ecosystems as structure. To have a scientific contribution on this topic, I now want to explore further the link or contingency between strategic renewal of mature industries, the creation of new ecosystems as structure and the broader context of digital transformation and services development for an industrial company. Developing services is a key performance factor for most industrial companies and new opportunities have emerged with the rise of artificial intelligence. To make headway on this topic, I needed to understand how the market of services is structured for the aeronautical industry, see where the competition for Airbus exists and understand which opportunities could be addressed. This is why I start by questioning the rivalry with Boeing, on the service side, before focusing on other potential competitors, who can be incumbent members of the broad global aerospace ecosystem as affiliation, or pure service providers.

3.1 Overall data structure

The following overall data structure synthesises the results of my investigations. The four dimensions that materialize confirm the embeddedness of several key concepts. Digital transformation is intimately connected to the development of Skywise ecosystem as structure and this association enables strategic renewal.

Figure 26 Data structure 2

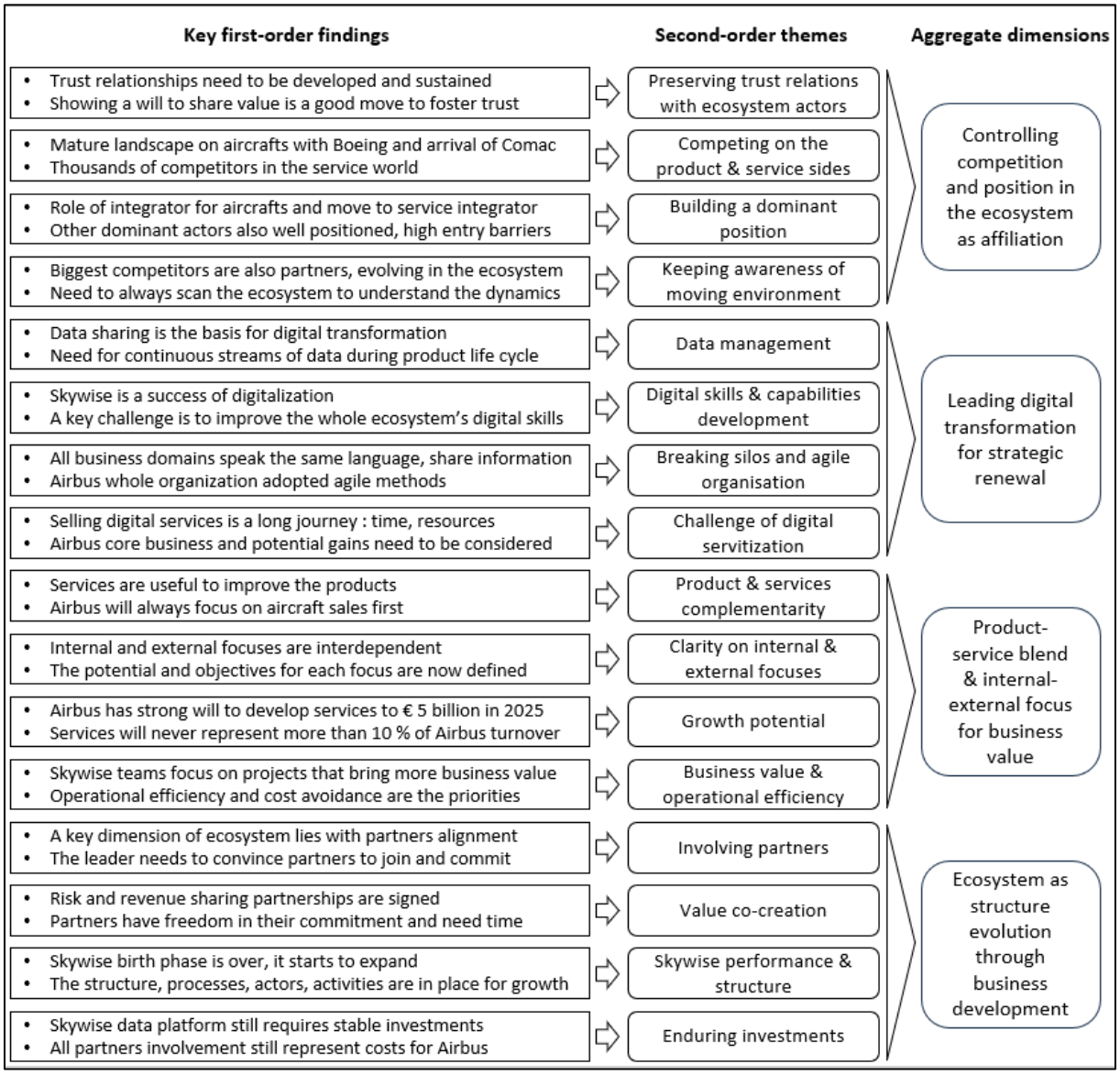


Table 21 is also a synthesis table of archival data that gathers elements from the interviews and secondary data, which gives some context on the overall servitization dynamic that unfolds in the aeronautics, globally. This table illustrates how Skywise is positioned inside Airbus, but also how Airbus can compare to a pure player actor for digital services.

Table 21 Servitization in the global aerospace market

	Openairlines	**Airbus services**			**Skywise**
		Navblue	Satair	Other services	
Creation date	2007	2016	1957		2017
Human resources	60 employees	400	1300	?	550
Turnover (M €)	6	100	2000	1400	
Core offer	SkyBreathe, big data software for fuel efficiency	flight operations digital services; use of aerodata	Spare parts	major repairs, air trafic management, pilots training, cabins modifications, maintenance	ecosystem with a data lake to share data and use Palantir algorithms to do analytics ; app editor
Key steps of development	CleanSky European call for tender and R&D from 2009 - 2013	merger of 3 entities in 2016, then focus on improving the large offer	Danish subsidiary acquired in 2011 for $ 500 M	Since 2017, trend to replace historical products using Skywise to modernize. Skywise Health Monitoring replacing Airman-Web	DTO office with full powers until 2020, then product & service line inside IT
Addressable market (M €)	1 000	18 000 to 20 000			maxi 1 000
Main competitors	Honeywell, Boeing, GE	Jeppesen (Boeing)	Boeing	Lufthansa Technik, Collins, Thales, GE Aviation, Honeywell, Akka	Lufthansa Technik Aviatar, GE Digital
Key partnerships	consortium with airlines at the beginning; Navblue for sales	Thales, GE, 100 partners for all portfolio			Palantir; 6 partners; third party agreements to develop applications with Honeywell, Collins
Customer base	52 airlines, presence in 36 countries	airlines	airlines	Airman-Web had 150 airlines customers in the world, SHM has more than 50	140 customer airlines connected to Skywise and sharing data
Business model	SaaS subscription; customers pay depending on their fleet size			contracts for several years and number of aircrafts	freemium model + SaaS subscriptions

This table also needs to be read in comparison to Table 14 that collects key figures for products and services markets for Airbus and for Boeing. It shows that Airbus is late in comparison to Boeing for the development of its services but that they are catching up, through M&A (acquisition of Satair and Navblue) and digital transformation, with the launch of Skywise. It also shows that Skywise first purpose is not to generate financial large revenues because the potential will remain below 2 % of Airbus turnover. The ecosystem is rather a tool to improve all other activities inside Airbus, be that on the product or service side.

4 aggregate dimensions emerged from my data structure: controlling competition and position in the EAS (3.2), leading digital transformation for strategic renewal (3.3), product/service blend and internal/external focus for business value (3.4), and EAS evolution through business development (3.5).

3.2 Controlling competition and position in the ecosystem as affiliation

Mature industries are characterized by historical ties among actors and this has an impact on the strategic decisions that can be made for changes at the firm level. Adopting the ecosystem lens was initially a way to suggest that competition was dead, or rather that competition cannot be considered at the firm-level without taking a broader ecosystem into account. This environment is always moving, all actors are aware of the competitive landscape.

This ecosystem as affiliation is the large environment in which firms evolve and they always take it into account before making strategic choices. My interviews showed how much Airbus was cautious with its partners and strived to gain their trust. Airbus employees who are in touch with suppliers, customers or complementors are aware that Airbus managed to become a world leading OEM with the help of many partners and sometimes at the expense of their profitability. Even if Skywise members consider a potential value to create, they never consider it as a priority and they insist on the value to bring to the ecosystem members. Airbus is seen as the dominant

actor in the EAA and they try to have a keystone approach, helping their customers to develop capabilities and becoming more efficient.

An actor like Airbus is highly subjected to path dependence (Sydow & al, 2009) to the extent that past relationships have a strong influence on future interactions. Airlines can be reluctant to participate in new collaboration projects with Airbus because they are already in a weak position towards the aircraft manufacturer. Consequently, Airbus needs to convince them that they will get value.

3.2.1 Preserving trust relations with ecosystem actors

Airbus suppliers are aware that they could become more efficient using the platform but they fear Airbus would use these data to negotiate the future agreements. This is how past relations have an impact on future developments and how historical business partners know that they need to pay attention to their long-term business interests:

> *"I spent two years working on how to reduce Airbus costs on the A380. We start doing things well before talking money, but once we know our suppliers' real expenses, we send purchasers to cut the prices. This is how the whole system works" (Source 10).*

Quotes	First-order concepts
"Skywise also entails a confidentiality issue. There is so much data that suppliers can access their competitors components prices" (Source 14)	issues / limits to Skywise / partners trust issue
"The most important point to sell digital services is to have developed a trust relation with the airlines, airports or other aerospace actors" (Source 6)	EAA / customer knowledge / servitization
"I met airlines who clearly stated that they never would go on Skywise because they lack trust and do not want to share their data with Airbus" (Source 6)	data management / data sharing / value creation / trust
"Sopra tried to help Airbus deploy Skywise with its suppliers because it is a real challenge for Airbus to know its suppliers better. Suppliers like Liebherr or Thales are not very eager to share their data with Airbus" (Source 8)	EAA relations / data management / data sharing / competitive advantage
"Data sharing by airlines, it can also imbalance the negotiation power when Airbus has too much information for future aircraft sales (Source 2)"	data management / Skywise weakness
"As soon as the platform is owned by an actor, the others would rather see it managed by a consortium" (Source 8)	collaboration & competition / competitive advantage / data sharing
"Airlines cannot fully come and participate on Skywise platform and this is not only an issue of IP" (Source 6)	growth potential / addressable market / path dependency / EAA
"We have business cases for logistics improvement projects without asking our suppliers for any money. It is much simpler this way and analysing useful data for supply chain improvement can enhance our trust relationship" (Source 10)	value without money / trust relationships / EAA
"In the digital realm, Airbus cannot be considered a direct competitor to Lufthansa Technik or Air France Industries. We have some products that compete in some markets like predictive maintenance, but Lufthansa Technik is primarily a maintenance provider, closely associated with an airline, which is our customer" (Source 15)	competition / EAA
"We do not seek to engage in a competition battle as our primary objective is to improve aircrafts operations, which has the most value for us. The significant market for Airbus is not digital services" (Source 15)	competition / value creation / digital servitization

3.2.2 Competing on the product & service sides

My main focus is on a new ecosystem as structure, which boundaries entail the actors that contribute to a specific value proposition. It is however not possible to understand the ecosystem as structure features without taking the ecosystem as affiliation competitive dynamics into account. The aeronautic industry has been structured by a strong product focus on aircrafts and the competition has started including a services' dimension for twenty years.

Quotes	First-order concepts
"All engine makers also propose their own system for maintenance, they propose free offers that they need to collect data and improve their products and then they propose paying offers" (Source 14)	competition on services / competitive environment
"Today we face a real challenge to reduce our costs because the Chinese will put strong pressure on the market with their C919. 850 have already been ordered and they will flood the market" (Source 14)	competition
"Navblue is a subsidiary of Airbus, fully dedicated to flight op erations services" (Source 2)	digital services
"Regarding services, the biggest share of sales lies with spare parts, sold by Satair, a German subsidiary of Airbus" (Source 2)	services
"Flight operations represent a small part of services for Airbus, with € 100 M, made by 400 employees" (Source 2)	services turnover share
"Navblue was born in 2016 and gathered 3 parts: Navtech, a British firm that made flight planning solutions and was bought, Airbus flight operations solutions that were already made inside Airbus and the part dedicated to air traffic management" (Source 2)	digital services
"Jeppesen is the historical actor on aerodata, the data used with computers inside the aircraft and that are necessary to make them fly. Jeppesen belongs to Boeing and they make a lot of money. They are supplied with data thanks to their military branch. Pilots love Jeppesen and their maps" (Source 2)	Jeppesen, historical actor on aerodata belongs to Boeing
"Navblue portfolio of services is very large but with small marketshares" (Source 2)	services competition
"Lufthansa Lido Flight 4D is the best flight planning solution on the market" (Source 2)	competition services
"Our main competitor on fuel efficiency is Openairlines" (Source 2)	competition on digital services
"The service world is very different from the aircraft world, this is not a duopoly because we face thousands of competitors" (Source 4)	competition on services / competitive environment
"Aviatar is a direct competitor to Skywise Health Monitoring. Other competitors are also big data tools that are not necessarily specific to the aerospace industry" (Source 11)	competition
"Aviatar from Lufthansa Technik is considered a major competitor because they have both digital expertise and maintenance capabilities" (Source 12)	competition / dynamic capabilities / competitive advantage
"Skywise starts facing a large competition with GE Predix, Air France, Honeywell with the Forge platform, Lufthansa with Aviator. All the big players are present, including Rolls Royce, which understood from the start that there was a lot of business to do with data and services" (Source 2)	competition on digital services

3.2.3 Building a dominant position 1/2

Airbus as well as Boeing have progressively increased their leadership while shifting their role from production to integration. They understood that their added value was higher if they focused on the relationship with customers and focused on the integration bottleneck, while sourcing enough suppliers to have enough bargaining power.

Quotes	First-order concepts
"Airbus has progressively built a role of integrator in the value chain; we have longstanding partnerships with suppliers and we install their components" (Source 4)	business model / competitive advantage
"Boeing generates a significant portion of its revenues from military contracts and they started their mergers and acquisitions strategy twenty years ago. Boeing digital services' revenue is around $ 1,2 billion, a significant amount, with $ 800 million from the civil sector. This mostly comes from Jeppesen, the largest player in navigation and mapping" (Source 15)	competition / servitization
"Navblue strategic position is tough because we try to cut costs so we offshore in India, we have facilities in Canada that are strong but face competition from GAFAs to keep our workforce" (Source 2)	competition / strategic development
"We wish to have the same position with services as we have with aircraft, with a role of integrator" (Source 4)	competitive advantage / business model
"Currently we do not have potential competitors due to the required financing and investment capacity. To have a real impact in the digital space, it requires tens of millions of investments" (Source 15)	competition / digital servitization / digital transformation / competitive advantage
"We look for solutions to develop depending on our capabilities and assets inside Airbus. We can also look on the market for complementary elements that exist and that we do not have inside Airbus. We can opt for partnerships or acquisitions" (Source 4)	Capabilities acquisition / servitization / partner relations
"Engine manufacturers were willing to collaborate but only if we agreed to export our customers' data on their platforms, so that they may develop algorithms with their own tools" (Source 7)	data management / collaboration / value creation / business model innovation / EAA
"Rolls Royce keeps control over its data, this is an issue for Airbus and for airlines, who have to pay" (Source 2)	data management / engine manufacturer strong position

Engine makers also have a dominant position in the industry because they produce the highest value part. Services appear to be a potential disruption asset in a very stable market.

3.2.4 Building a dominant position 2/2

"Boeing can seem to have some advance because they set a target of $ 50 billion turnover on services but this includes a broader perimeter and their fleet is much older than ours" (Source 4)	competition / servitization / performance / business model
"We have a duopoly, heavy regulations and a highly segmented industry. The only way to achieve rapid growth is through mergers and acquisitions" (Source 15)	competition / growth potential
"We are not a digital player but we have a certain advantage at our level, in an industrial world" (Source 9)	competition / dynamic capabilities / competitive advantage
"We have an action plan for the supply chain but it is difficult to sell access to the platform to our suppliers and they are concerned about the consequences of giving us access to their data" (Source 10)	data management / EAA / organizational complexity
"Airbus sells around € 3,5 billion in services, including 2 from Satair, which employs 1300 people. This includes pilots' training that needs to be done by the OEM" (Source 2)	services turnover share / high barriers to entry / dominant position
"External players like Google or Microsoft are not interested because we are a niche and highly regulated market. They prefer to invest in retail, healthcare, or sectors where the potential return on investment is much higher" (Source 15)	competition
"We want to be proactive with the engine manufacturers because we need to address issues together. The more we know about what is happening around the engine, the more we can customize maintenance" (Source 10)	ecosystem development / ecosystem as affiliation
"We are convinced that we are moving in the right direction because no player can do what we do in our industry. It is a great success, even if we now need to generate revenue" (Source 15)	ecosystem performance / digital transformation

3.2.5 Keeping awareness of moving environment

Quotes	First-order concepts
"My first job in 2016 was to map all companies with which Navblue was working and it represented more than 100 actors, from 1 person to big OEMs like Thales or GE" (Source 2)	partners relations
"Amazon is also a serious competitor because they are a cargo airline, they have a lot of aircrafts and they have their cloud. They started working on a flight planning tool" (Source 5)	competition on digital services New threats from outside EAA
"We can have partnerships projects but rather with small actors. It is complicated to work with big companies that are already your customer, your competitor and supplier on different projects" (Source 2)	path dependency / competition / ecosystem as affiliation / partner relations
"Our main competitors are Lufthansa Technik, all our suppliers like Collins, Thales, GE Aviation and other engine makers, Honeywell, or actors like Akka, who can do cabin modifications" (Source 4)	competition / ecosystem as affiliation
"We do a lot of market monitoring to understand what digital players, especially small companies like Openairlines, are doing" (Source 15)	competition / market analysis

Airbus keeps a focus to understand to ecosystem as affiliation evolution, to see if historical actors have some new development projects or if new actors come up with new services, with a specific focus on start-ups and digital offers. All traditional actors have projects around big data but it is difficult to launch an initiative at the ecosystem as affiliation level. Big old companies all have heavy legal and procurement departments that are almost impossible to align. Partnerships projects are rather foreseen with small players, who have more complementarities to bring.

3.3 Leading digital transformation for strategic renewal

Industrial players and manufacturers face high stakes to become commoditized as their core activity becomes easier to replicate when lower cost countries produce cheaper substitutes. Digital technologies represent at one and the same time the issue and the solution. It might be an issue because it significantly lowers entry barriers for pure digital players and the opportunity for traditional actors who can renew their business and processes. My findings exhibit that Skywise is the "fundamental brick" of digital transformation inside Airbus, in and around which people keep on increasing their digital skills and their agile approach. The whole firm culture has changed, all departments are better connected so that data may circulate and be shared. Digital transformation is a challenge and a success for Airbus, which has brought the basis for a deep strategic renewal. Digital servitization is however at another level of transformation, notably because it requires to upskill the entire ecosystem of partners and customers.

3.3.1 Data management

Digital transformation starts with data collection and management, in the long-run, which brings digital continuity. This poses numerous challenges of confidentiality, compatibility, validity, trust. This is true for data that come from outside the firm as well as for data from inside the firm.

Quotes	First-order concepts
"Data sharing can be seen as a blocker by airlines but they trust Airbus which is a reference for data protection and cybersecurity" (Source 10)	data sharing can be a blocker
"There are 3 steps in Skywise: data integration, data processing and analytics, and data visualization through applications or dashboards. The first part of data integration is the most complex one because there are several pipes of data" (Source 13)	data access / core value development / digitalization
"Data is the gold of tomorrow and we had too many analytics tools and it cost too much" (Source 14)	data management
"Rules are very strict for digital solutions: data are protected and are hosted inside the airline" (Source 2)	data management
"Pilots need to give their agreement so that their data can be shared, so we need to reassure the unions" (Source 2)	data management
"On the big DDMS programme, manufacturing and services have been involved from the start. We want a continuous stream of data during the whole product life cycle" (Source 10)	servitization / Data management

It was also a necessary step in the development of Skywise platform. Before being able to sell services, there was a target to gather enough data to then be able to demonstrate value to new customers:

> *"We wanted to open the market and we targeted some airlines on specific criteria because it costs a lot for each new airline. Each year, the aircraft marketing department gave us a list of airlines to onboard on Skywise. It was either for key cases or for sizes of fleet. Our target was to have 50 % of Airbus fleet in the programme, to have enough data. After 5 years of gathering, we now have enough data to switch to a paying offer" (Source 11).*

3.3.2 Digital skills & capabilities development

Airbus managed to introduce a real revolution with Skywise and created a digital culture, which was not taken for granted for a very engineering-driven company. Despite a tradition of process driven logic, Airbus employees have understood the importance and use of dealing with data and building analytics. It has been a success inside Airbus and after the launch by the DTO, Digital Transformation Office, Skywise was integrated in the IT department, which is a way to show that the most demanding move is done. This is a success inside Airbus and it contributes to the firm's strategic renewal because digital capabilities are dynamic capabilities, which will help the company develop new business or modernize its core business. In comparison to

Boeing, the turnover on services is still much lower because Boeing started a merger and acquisition strategy twenty years ago and they sell services as they sell products. Airbus has however invested to sustainably develop its employees' skills.

Inside Airbus, for operational purposes, there has been a real switch to the use of digital tools and platforms, with the main target to improve efficiency and help the workers with their daily tasks. This is purely internal transformation but in 2017 Airbus started contracting with digital platforms such as Workday, ServiceNow, Cornerstone or Knowmore. Those tools help understand the needs of workers to then provide guiding tools in their everyday work. The tools would be nothing without the workers who are in charge of explaining how and why those tools work, what they can offer. Workday is a platform that includes all human resources business processes. Those instructions were only read by 250 people on Cornerstone during the first year. This is why Airbus worked with Knowmore, to ease the understanding and use of those processes. The guidance provided by Knowmore were consulted 50 000 times (Source 1). Airbus adopts an agile approach to use those tools and partners. Workday is a global actor that has no financial interest in adjusting its products to Airbus needs. Knowmore is a small French player, which does co-innovation with Airbus. This software editor was created twenty years ago, gathers thirty employees and sells a digital adoption platform or DAP (Source 3). Airbus allows Knowmore to access all data generated by the users, so that Knowmore can improve its solutions. Those solutions can then be sold to other customers of Workday, who are based all over the world. This situation is interesting even if there is almost no link with Skywise business ecosystem, but the parallel is instructive. In this situation, Airbus is the actor generating and sharing the data. It creates value for Knowmore, which in return reduces its prices for Airbus (Source 1; Source 3):

> *"With Knowmore, we divided the prices of our licences by two because they are aware that we help them develop their business" (Source 1).*

They take part into the nascent digital adoption market. The core of Knowmore solution is the use of a GPS (Global Positioning System) that observes how the workers use the digital applications to offer explanations when difficulties are met. They co-innovate with Airbus and manage to agree on a value creation and sharing model. Airbus voiced a need for a new module that leads to a reuse of data collected into business intelligence tools. This module was not part of the development roadmap of Knowmore, yet they acknowledged that this need might be shared with other customers. The software editor assessed it would need 100 days of development, Airbus paid for 50 days, Knowmore kept the intellectual property, and the aircraft manufacturer is granted a free use of the module in the long run (source 3). This is an example of how Airbus has been leading its digital transformation internally over the last five years, with a business ecosystem mindset, where a supplier can become a partner. The contractual agreement is still a customer to supplier contract because it would take too much time to define a real risk and revenue sharing contract. This kind of organizational shift is very hard to observe because the financial impact for Airbus is tiny. The contract between Airbus and Workday is of several millions a year, while Knowmore targeted a yearly turnover of € 2.5 million in 2022 (source 3).

Quotes	First-order concepts
"Boeing is clearly outrun by Airbus on digital topics. They do more turnover with services because they acquired several subsidiaries like Jeppesen and other technical products that they sell to airlines but they show no will to partner with customers on digital topics" (Source 6)	competition / digital capabilities / competitive advantage
"We try to have a backbone allowing digital continuity" (Source 14)	digital continuity / digital transformation
"In Skywise solution teams, we mostly work with suppliers, with an average ratio Airbus-subcontractors of 20/80. If we consider Airbus India as an internal resource, the ratio is more like 50/50. We have great team loyalty in India because we helped them build new skills" (Source 9)	human resources allocation / suppliers involvement / digital capabilities / competitive advantage
"Working with Palantir allowed a new awareness and enhanced the IT department's skills" (Source 7)	digital capabilities / ecosystem performance
"Our customers, the airlines are focused on revenue per available seat kilometer (RASK). They choose lines, sell flights and do yield management. Operations or maintenance are secondary activities for them. We should help them operate their assets" (Source 4)	customer knowledge / capabilities for growth / dynamic capabilities
"Skywise Core X allows customers to develop more things with the tools we provide. Airlines can customize their parameters. This offer is more about boosting adoption than generating high revenues. The value for us is more internal than external. It is a monthly subscription that can be stopped at any time. There are 3 levels of services, starting at $ 17 000, then $ 25 000 and ending at $ 45 000" (Source 15)	value creation / digital skills development for customers / digital transformation
"There are over 1000 people developing on the platform, we train them but cannot measure all the value generated" (Source 10)	value creation / digital capabilities / upskilling
"Skywise solution includes everyone involved in developing the products. Around 80% of the teams are developers. The business units provide imputs and we propose innovative ideas. We contribute to transforming the company's way of thinking" (Source 9)	digital skills / digital transformation / strategic renewal

One of my findings is that there was an awareness that digital transformation needed to include an ecosystem approach to skills development, at least at the customer level.

Quotes	First-order concepts
"We leave our customers a bit too alone and forget that they do not have 140 000 employees. In the best of cases an airline has 20 analysts and it is not interesting for them to develop applications from scratch. We could have capitalized better on applications developed for internal needs" (Source 7)	digital servitization / internal-external focus / customer centricity
We thought it would be easy to share data with our customers and that they would be able to do analytics with Palantir tools in the cloud. It was a mistake. We had not understood that our customers were very far from this business.	customer knowledge / digital capabilities / business development
"We take care of digitalization" (Source 14)	teams operationaly involved in digitalization
We use 3D experience, the tool of Dassault Systemes; our ERP is under SAP, on which we do logistics and finance" (Source 14)	tools for digital transformation / data management
The real success of Skywise is linked to "low code, no code". It allowed a real transformation with all employees accessing data sets and being able to do reports very easily" (Source 14)	Skywise forces / digital transformation / digital skills
"In each unit, Skywise champions can help data scientists. It helps our digital transformation" (Source 14)	internal organisation / Digital transformation
"Skywise was a success because we introduced a revolution. There is now a real digital culture inside Airbus" (Source 4)	Skywise strength / internal impact / digital transformation
"We missed the step of helping our customers in their digital transformation. They do not know how to do analytics, this function does not exist for airlines" (Source 4)	digital transformation / digital capabilities
"Airbus is a process driven firm, based on engineers. It is complicated to move from process to data driven. I see a real transformation in the way Airbus people deal with data and build analytics" (Source 8)	digital transformation / digital capabilities
"Skywise is the best platform to help us with our digital transformation" (Source 7)	digital transformation / platform performance
"I was among the five first members of Skywise and our focus was on the use of Skywise within Airbus: how we create value, drive transformation, solve problems and change the way we work. We started with the DTO and have been fully integrated into IT since 2020" (Source 10)	digital transformation, value creation, strategic renewal
"We have a training academy for internal users and airlines, called Skywise Academy" (Source 12)	digitalization / digital capabilities / skills development
"It also gives us a real competitive advantage. The service offerings are now packaged with aircraft sales. We want to offer this digital transformation to airlines" (Source 12)	digital transformation for customers / competitive advantage / digital capabilities

The first step goes with digital transformation and the acquisition of digital capabilities and skills inside the focal firm. Through Skywise, Airbus employees have been able to work directly with Palantir teams and upgrade their skills. The second step is about access to the data (Source 7).

3.3.3 Breaking silos and agile organisation

Skywise platform development started with a revolutionary organisation for an industrial actor, which has been operational since January 2018. They drew from IT companies and adopted the agile at scale framework, which allows the adoption of agile methodologies for an industrial company. Instead of the usual five years' timeframe that corresponds to an aircraft development cycle, they use fail fast principles and reassess their objectives and results every two weeks. All departments share much more information, use the same tools and allow to consider strong disruptive ideas.

Skywise has been a strong tool to change the culture inside Airbus, to shift from an industrial mindset to a more customer focused company that seeks opportunities to renew its business model, pool of partners and ways of doing business:

> *"The strength we had was to start a revolution with a technological innovation that was deployed throughout the group. People used to speak about IT and our processes were very SAP driven. Now there is a real digital culture in the whole organisation" (Source 4).*

Some mistakes were made, mostly because some difficulties were not anticipated. It was notably overly ambitious to think that airlines and other actors in the ecosystem would openly share their data.

There are SAFe [Scaled Agile Framework] organisations in which we usually gather a hundred people for three months cycles. The employees who are not directly involved do not really know what is done, how the trains are organised.

> *"There was a lack of communication and we set the objective how the Skywise platform should be used by managers inside Airbus and who has to use it" (Source 8).*

Skywise teams also overestimated the skills and availability of their customers to adopt digital solutions:

“We thought that our customers would have the capabilities to do their own analytics in the cloud with Palantir tools. But we had not understood that our clients were very far from this business. Their job is to fly aircrafts and to sell tickets. We have not been able to back them in this digital transformation” (Source 4).

Quotes	First-order concepts
"Since the DTO no longer exists, we work in MFT, multi functional teams. I am in IT and work with people from customer services and marketing" (Source 11)	no silos / agility / digital transformation
"We also have a backbone for the work environment. Google Workspace is used by more than 200 000 people" (Source 14)	breaking silos / circulation of information
"Operators are equiped with phones, which allows to close operations faster and to know in real time where we are in the production plan" (Source 14)	operational efficiency / digital transformation / tools
"We have worked on moving from a product to customer centric approach" (Source 4)	renewal
"We now have access to all production non-conformities. Skywise is the best platform to connect datasets from all departments. The true value of Skywise lies in the ability to cross datasets" (Source 7)	digital transformation / breaking silos
"We work in the agile at scale framework to apply agile methodologies to an industrial company. The goal is to align 3000 people" (Source 9)	strategic renewal / agile organisation / operational efficiency
"The first PI (Product Increment) planning was done in January 2018 with 6 teams, totaling 60 people. We increased the workforce until 2020, when we had 500 people, 5 trains and 50 teams, including staff from France, Germany, Spain, India and Vietnam" (Source 9)	agile organisation / strategic renewal
"Epic are big projects that last from 6 to 18 months and enter Skywise Solution with a business case, benefit assumptions and key indicators. Business value is assessed, this is what it brings to the business, but real costs are very complicated to identify" (Source 9)	value for business / strategic renewal / costs of digitalization
"In comparison to the usual 5 years aircraft development cycle, we now have measured risk taking thanks to an agile organization, with fail-fast principle, 2 weeks iterations. We manage uncertainty through our flexibility" (Source 9)	uncertainty management / agile organization / strategic renewal
"We prefer to have a dynamic portfolio of ideas that allow for strong disruptions, with high potential gains and high levels of risk" (Source 10)	value creation / agility
"Skywise is restructuring how we handle information. The business domains and their IT tools were very siloed. DDMS wants an end to end approach with integrated processes. We are starting to speak the same language within the business and IT" (Source 12)	breaking silos / strategic renewal / digitalization
"The departments who pay must accept that their budget will go into a machine that will produce solutions to Airbus' firm priorities, which may not exactly align with their own priorities" (Source 9)	development priorities / silos cutting / firm level decisions

There are three people who are in charge of coordination and aligning the whole Skywise SAFe solution: a solution train engineer (STE), a solution manager and a solution architect. SAFe means Scaled Agile Framework and it is a framework that helps industrial company to use agile

methodologies at scale, to align up to 3000 people (Source 9). This approach entails a real change of mindset and processes because the whole Skywise solution is challenged every ten weeks during a PI (Program Increment) planning. Following the Agile Manifesto,

> *"the most efficient and effective method of conveying information to and within a development team is a face-to-face conversation" (agilemanifesto.org).*

SAFe goes further with PI planning, which is a physical event that gathers all teams and shareholders to align on a vision and shared mission (scaledagileframework.com). Skywise lead its first PI planning in January 2018, with 60 people split in six teams. This represented one train, which is a gathering of agile teams (Source 9). Airbus made a big switch from an industrial world where an aircraft's lifecycle lasted 5 years to digital deliverables every two weeks. Skywise teams became bigger until 2020 and the covid 19 crisis, when there were 500 workers, spread in 5 trains and 50 teams, with an international footprint with people in France, Germany, Spain, India and Vietnam. In one month, they downsized from 500 to 250. It then progressively grew again up to 400 workers because part of the activities left Skywise to be fully integrated into Airbus. Skywise teams are composed of suppliers for a half and of Airbus employees for the other half. Among those latter, half are based in India, mostly in Bangalore. Part of the big strategic change within Airbus has been to enable the upskilling of employees in India:

> *"A few years ago, Airbus India employees mostly did ticketing and tasks that the teams in France did not want to achieve. We have trained them and now they can innovate, make decisions and take responsibilities. This is a key achievement in India and a competitive advantage. Despite a very dynamic job market on those skills, we have a low turnover because our jobs are more interesting than others (Source 9)".*

Those teams are composed of 80 % of developers.

Among the main developments that were achieved during the last few years there are some products that are developed for internal needs, some for external needs but also some major

improvements of already existing solutions. One solution is named Skywise Health Monitoring (SHM). It is progressively replacing Airman-Web, a former successful service that was sold by Airbus customer services department. This is a tool that helps for aircraft health monitoring, in order to minimize the time an aircraft needs to spend on the ground between two flights. Airman-Web was sold to 150 airlines, SHM had been sold to 50 airlines in December 2022 and the target was to reach 200 customers. In comparison to the former solution, SHM offers less options, but it was quickly developed, it is reliable, and the development costs were much lower (Source 9). One of the big evolutions brought by Skywise is that SHM is available on the cloud, and it can be deployed three times a day, when Airman Web was deployed twice a year. This can play an important role during the negotiations for aircraft sales with airlines (Source 9). Other solutions are based on the Skywise platform, for predictive maintenance (Skywise Predictive Maintenance, SPM) and for reliability. Among the five trains composing Skywise solution, the biggest one gathers 110 employees and is named the Airline train. This train is dedicated to all services that are sold to the airlines or used inside Airbus for other services that are then sold to the airlines. Airbus invests a lot on this train because this is also the one that brings more value and revenue (Source 9).

Skywise Solution entails a new mindset and agile organisation that allows to take measured risks:

> *"We have a fail fast principle, based on 2 weeks iterations. If there was a misunderstanding between business owners and developers, it would take 10 weeks to understand in the worst of cases. The principle of an epic is to produce a minimum viable product (MVP) without looking behind. We then either stop or go on with investments if the potential value is acknowledged" (Source 9).*

Skywise Solution is considered as an innovation accelerator:

> *"When we run 5 sprints of 2 weeks, the last one is dedicated to innovation. We prepare the planning for what comes next and we think about possible evolutions. The teams always commit on contents for 4 iterations but keep the last iteration free. There is one week for PI planning preparation and one week that can be used to develop new tools or start working on new business cases" (Source 9).*

3.3.4 Challenge of digital servitization

The use of digital technologies enables digital transformation that is supposed to open new business development perspectives.

Quotes	First-order concepts
"Some initial projections planned € 2 billions thanks to Skywise and many apps that could be sold" (Source 2)	servitization growth potential / value creation
"The potential of turnover development with Skywise is probably of a few hundreds millions euros but this is not pure creation. Old applications were modernized thanks to Skywise" (Source 2)	value creation / digital servitization / renewal
"Digital services are not Airbus core business and we underestimated the difficulty to create and sell such apps" (Source 2)	digital servitization / difficulties
"The true issue inside Airbus is that we do not know how to create applications. We have increasingly more digital profesionnals, but we still have too many engineers who lack the required agile skills for digital services" (Source 2)	digital servitization / digital skills
"There are several thousands of internal use cases. The big dashboards are robust enough to be classified as real apps. They cost several millions of euros" (Source 7)	digital transformation costs
"For digital solutions, it takes time to sell new solutions because we need to demonstrate the potential value creation, which is often a reduction of costs for the customer. It can take 2 years to sell new services" (Source 2)	digital servitization / difficulties
"Skywise is a B2B business model, it is hard to attract enough airlines to have enough data and it is hard to value interesting services" (Source 6)	B2B context for servitization / value creation
"Skywise has almost no weight in the services portfolio of Airbus. We mostly sell applications that have existed for 20 years" (Source 7)	services innovation

When Skywise project was launched in 2017, high perspectives of revenue generation were anticipated, with figures ranging from € 500 million to 2 billion. My finding with this round of interviews, in comparison to the one started four years ago, is that the position inside Airbus has changed on the revenue generation potential of digital services. They understood that the market had been overestimated by the consulting companies and that digital services were too far away from Airbus core business.

3.4 Product-service blend & internal-external focus for business value

In Chapter 4, the focus was on key antecedents to ecosystems creation in the context of mature industries and I showed that Skywise ecosystem had been created notably because there were both an internal and an external need to adopt such a complex structure as an ecosystem. Once the ecosystem has been created and is in its expansion phase, I wanted to dig how the balance evolved. My findings also show that product and service focuses are highly complementary. Furthermore, I showed that digital transformation can lead to strategic renewal, which is rather a long-term objective. If we zoom in to see how this renewal is assessed inside the firm, in the everyday business, I show that the success of the ecosystem relies on business value.

3.4.1 Product and services complementarity

The core business of Airbus is to sell aircrafts and there is a strong will inside the company to develop services but both aspects are complementary. Aircraft services are sold on top of the aircraft and can contribute to increase the product value for the customer. Selling more services means knowing the products better and being able to sell more aircrafts later.

Quotes	First-order concepts
"SHM can play an important role in negotiations with airlines to secure aircraft sales. Health Monitoring is a service component, such as Predictive Maintenance and Skywise reliability. The Skywise ecosystem allows us to deploy complex services" (Source 9)	competitive advantage / ecosystem added-value
"Before the covid crisis we had the target to better balance our aircraft and services activities. We now want to build our services offer further to have more influence on our customers' choice" (Source 4)	product-service balance or focus
"90% of our services revenues come from airlines but we also sell to training or maintenance centers" (Source 4)	customers / business model
"Airbus services portfolio is rather large with cabin modifications, maintenance digital services, spare parts, major repairs" (Source 4)	servitization
"Airbus has a strategy to develop services but it is easier to say than do" (Source 2)	servitization
"Airbus delivers supports to its customers, that is included in the contracts. Then they sell additional services" (Source 2)	services
"We do 75 % of our services turnover with maintenance and spare parts, then we have flight ops that account for 100 millions, then we have major repairs and other elements linked to digital" (Source 4)	servitization / business model / value creation
"We also counted on an organic growth of our services linked to the growth of our fleet. The more Airbus aircrafts fly, the more services revenues are generated" (Source 4)	business model / servitization
"Skywise is probably not a success if we focus on turnover but in terms of usage and knowing how aircraft fleets are operated, this is a real success" (Source 8)	competitive advantage / customer centricity / better product knowledge
"Skywise services will never cannibalize aircraft sales" (Source 6)	servitization
"Skywise invested at least € 2 billion to develop the platform since the beginning. At Oliver Wyman, we consider the addressable market should reach between 20 and 30 billion in 2030, in the best of cases, and this includes maintenance, flight operations, training" (Source 6)	digital transformation costs / business development / product - services balance / servitization
"It is challenging to sell digital services on top of everything else. An Airbus aircraft is cheaper to operate with Skywise, it has more value. We can sell it at a higher price and sell more but we should not try to achieve 2 billion euros in digital services" (Source 10)	digital servitization
"We can better sell flight hour services or other services but we should not only focus on selling digital services, we are not an IT company" (Source 10)	digital servitization vs servitization
"We do not engage with airlines individually because there may be ongoing negotiations for aircraft sales. Digital sales align with aircraft sales" (Source 11)	digital servitization / product-service priority / core business focus
"The market for digital solutions for airlines represents approximately € 1 billion. It is a very fragmented market, the stakes of a platform like Skywise are not on revenue generation and even if we had 100 % market share, it would account for only 2 % of our Airbus activities. It is very marginal" (Source 13)	digital servitization / value creation / product-services balance
"If we want to produce 75 single-aisle aircraft per month in the future, we need to have the right industrial capacity in all factories and FALs. If we can increase the deliveries of 10 more aircrafts per year, this is € 1 billion in revenues" (Source 13)	value creation / operational efficiency / business value
"We are mostly focused on aircraft sales rather than selling digital solutions. Out of € 60 billion in revenue, 80% comes for aircraft sales and we aim for € 4 billion in services, which is a mere 8%" (Source 15)	product-services spread / business model

Servitization, which consists in selling more services when a firm has core manufacturing or industrial activities, can increase revenues. It will however never be the development priority for Airbus, which knows that services will never account for more than 10% of its revenues.

3.4.2 Clarity on internal & external focuses

Internal and external aspects were to be taken into account from the start to justify the consequent investment required to develop such an ecosystem. Starting a new ecosystem however goes hand in hand with a high level of uncertainty. How many people would adopt the platform, be that inside or outside Airbus? After five years and a covid crisis, figures are around 30 000 connections per month, 70 % of which are inside Airbus. On the external side, it was necessary to attract the users, to have airlines who accept to share their data so that they may do analytics on Skywise and improve their operations or revenues. There is however a digital continuity between external and internal that looks like a virtuous cycle, in which data from airlines needs to help accelerate products development and improve support and services.

A result from my first round of interviews was that having a balance between an internal and an external focus when developing a new business ecosystem could help keeping the necessary investment long enough, so that the project would come to life. From the start of Skywise project, there was a full consciousness that internal and external needs went together (Source 10). If the focus is only on an external need, the level of uncertainty is much higher because a company cannot control its partners' commitment and priorities management. This is what happened with Safran project and it just might be too complex to create a shared capitalistic structure to build a new value proposition (Source 6). I showed that Airbus had started its Skywise project to address a strategic renewal need with a focus on the internal need to manage its supply chain. However, the Digital Transformation Office, or DTO, decided almost from the start to open the new ecosystem to partners and customers, so that they may use the applications

created and share their data to bring more value to the whole ecosystem. Even before the launch of Skywise, there were some initiatives to generate business out of data for and with the airlines:

> *"Before DTO was created, I was in charge of the ancestor of our external part. I had launched a platform for airlines, with IBM. We worked on the project during three years and we managed to show that it was possible to make money. The tool was however too limited to enable developments at the level of ambition required by Airbus. We could not compete with Boeing, Aviatar (Lufthansa Technik solution) or GE with this platform" (Source 10).*

The first reason why Airbus focused on internal and external needs was to share the initial investment. The first need inside Airbus was to break data silos:

> *"In service data are extremely valuable for engineers, for the quality people. We used to have different data platforms for flight testing, for operations and for customer services" (Source 10).*

After five years of Skywise existence, it seems that Airbus has decided to focus more on the internal need with a will to explain better how it works, inside the company:

> *"We tried to focus on the internal use of Skywise inside Airbus" (Source 10).*

Internal topics are prioritized towards external opportunities because this is where there is more value:

> *"We do portfolio management to aim at developments that bring more value. We take into account the cost of delay and difficulty to acquire. Most of internal subjects are more interesting than external subjects. We however still have a lot of people working on Skywise outside Airbus, to build partnerships or get commitment with companies like Eurocontrol. We sustain the surface of an ecosystem more than try to create a lot of value" (Source 10).*

Quotes	First-order concepts
"Last year we worked, Sopra and Skywise team to redefine the objectives for the platform, with the will to focus on the internal use" (Source 8)	ecosystem development / internal focus
"We want Skywise to become the reference platform to gather operational data and help us improve engineering and aircraft design" (Source 4)	internal - external focus / product - service focus
"Each project on Skywise is linked to a function, be that aircraft, quality, procurement, operations, customer services. Depending on the number of applications and on the memory used, there is a price that is charged back" (Source 8)	internal costs management
"Skywise is wonderful tool for Airbus that allows to master its end to end life-cycle. This is about digital continuity and digital twin. 70% of connections to the platform are inside Airbus" (Source 6)	digital transformation / operational efficiency / internal-external focus
"The team in charge of relations with the airlines is not connected enough to our internal use cases in order to learn from it and really improve the service offer" (Source 7)	servitization / internal-external focus
"There are many opportunities for development of Skywise platform outside Airbus but our internal use sometimes makes it more difficult to access the data. We created a lot of dashboards that are not useful for airlines needs. They have a more simple organisation" (Source 7)	internal-external focus / opportunity to share development costs / servitization
"If we consider the external aspects and the airlines, there is a flagship product called SHM, Skywise Health Monitoring. This is a customer services product, used for monitoring the health of aircrafts in flight. It replaced an historic product and now is a full-cloud solution with AWS" (Source 9)	digital servitization / internal-external focus
"We knew from the start that internal and external aspects were inseparable. The main reason is that this type of system is extremely costly. It was essential to break down data silos because service data is extremely important for engineers" (Source 10)	internal & external aspects / product-service innovation / breaking silos / digital transformation
"We do not differentitate between internal and external aspects, we focus on solving problems. We create value for the airline and then wonder if we should charge or simply rely on selling more aircrafts" (Source 10)	value creation / services to help sell more aircrafts
"We selected the airlines we on-boarded on Skywise following recommandations from the marketing department. Our goal was to have 50% of the Airbus fleet in the program to have enough data and representativeness of our use cases. It was a good strategy to kick-start but after 6 years we reached a milestone and can give up the freemium offer" (Source 11)	data for product improvement / services after product improvement / external focus for business value
"My job is oriented towards the external for 80 % and internal for 20 %" (Source 11)	internal-external focus
"We collaborate with various departments at Airbus to develop products and services, based on Skywise platform, either for internal use or for airlines" (Source 12)	internal-external focus
"External solutions are initiatives that originate from Airbus to commercialize digital solutions and generate revenue. The internal aspect relates to Airbus' industrial performance. Within the Skywise solution scope, it is about a 50/50 split between internal and external focus" (Source 12)	internal-external focus / digital servitization / industrial performance
"75% of Skywise platform users are inside Airbus and we have 30 000 unique users every months. The goal of Skywise is not to have everyone working on it" (Source 13)	internal-external focus
"We made an effort on the airline side, to attract enough users, because there was a significant need to better understand the life of our aircrafts in service. Before that, we were blind. Another challenge was to recycle value internally to accelerate product development, validate design models, improve support and have leverage on the suplly side" (Source 13)	digitalization / effort to attract partners on the platform / data acquisition

At the beginning of Skywise, the project was to move quite fast from the internal need to address a much broader need outside Airbus. The internal need and potential was however underestimated, while the external potential was probably overestimated, or at least the time to reach it was underestimated:

> *"Skywise has a much more internal role than what was initially forecasted. The platform has become one of the most important enabler for digital transformation (Source 6)".*

Customer services is the main division within Airbus that has an external focus. Some targets had been set in terms of turnover, but this was not the most important performance indicator because Airbus main business is still to sell aircrafts. Developing Skywise helped accessing enough data to have a better understanding of how the products they sell are used and evolve:

> *"Skywise has not necessarily been a success regarding turnover generated but it is one in terms of use by our customers. It helped us learn to know the fleets in operation" (Source 8).*

3.4.3 Growth potential

Quotes	First-order concepts
"Airbus has a strong strategy to develop services but the target of € 10 billion for 2025, was reduced to 5 after covid" (Source 2)	servitization
"The overall market for aeronautics service represents $ 95 billion, from which Airbus can address from 18 to 20 billion. We have approximately $ 4 billion turnover in 2022" (Source 4)	business model / value creation / market share / growth potential / servitization
"Before the covid crisis there was actually a target to achieve € 10 billion in 2025 but it included non-organic growth with acquisitions that we gave up with the pandemic. The target was modified to $ 5 billion, which would still represent a growth of 80 % in 7 years" (Source 4)	business development / growth potential / value creation / servitization
"Services will never represent more than 10% of Airbus turnover, they offer services to airlines, not MRO. The maintenance, repair and operations represent between $ 90 and 100 billion per year" (Source 6)	growth potential / addressable market / product-services balance

Airbus still aims at strongly developing its services and targets an increase in 80% between 2019 and 2025, which remains ambitious if one takes into account the covid crisis.

3.4.4 Business value & operational efficiency

Value creation is usually considered through the scope of revenue generation but for Skywise and Airbus dynamic with digital transformation dynamic, the focus is on three dimensions: revenue generation, operational efficiency, cost avoidance.

Quotes	First-order concepts
"One of our jobs inside the COO, the Operations departement, is to assess the value" (Source 14)	operational reality / organization / value creation and control
"I work on an internal project, Xbom, or cross bill of materials, launched 5 years ago. We started collecting data during 3 years and we use data analytics. We started using Skywise, then left to another technology because there was too much data and the costs were too high. We then came back to Skywise because the platform has been improved" (Source 8)	ecosystem development / ecosystem improvement / operational efficiency / digital transformation costs
"One of the most critical apps for Airbus is called Tandem and is used to plan all operations, including the final assembly lines" (Source 8)	operational efficiency
"The largest train in Skywise solution is the Airlines train that refers to services sold directly or indirectly to airlines, like SHM. This is where we have the most value and revenues so we invest heavily in it" (Source 9)	servitization / internal-external focus / business value
"Revenues linked to SHM are hard to assess because it can be part of an aircraft sale negotiations" (Source 9)	value creation / service to add value to products / competitive advantage
"When we stopped the A380 programme, we needed to anticipate the need for spare parts over 40 years, to produce the necessary stock. Using Skywise resulted in cost savings in the hundreds of millions of euros" (Source 10)	cost avoidance / business value / digitalization
"The high-value projects are classified in 5 categories. We focus on big applications that can break bottlenecks, such as producing three more planes per year. Digitalization plays a fundamental role. Key projects aim to achieve ramp up with the same resources, help negotiate with raw materials suppliers and generate hundreds of millions of euros in savings" (Source 10)	digitalization / value creation / cost avoidance
"We use the SAFe (Scaled Agile Framework) framework to prioritize our investments in Skywise. We have portfolios and strategic directions. We look at the potential, business case, the value it can bring to Airbus based on our company's priorities. We consider factors such as effort, residual value of the initiative, risks and opportunities. Our goal is to deliver maximum value in the shortest time with minimum effort" (Source 12)	strategic choices / performance assessment / business development / investment choices
"Prometheus is an intelligent system to identify high-risk parts based on their nature and feedback from aircrafts in service. After A380, it is being expanded to other programs to optimize real-time spare parts stocks" (Source 12)	cost avoidances / internal need / operational efficiency / digitalization
"Value creation can be of three types: revenue generation, operational efficiency or cost avoidance. For us, the most important stakes lie in the last two points. The revenue aspect is marginal on our scale" (Source 13)	value creation / digitalization strategy / operational efficiency / cost avoidance

Out of those three components, the last two bring the highest value for business. When the price of an aircraft is around € 100 million and operational efficiency helps produce ten more aircraft in a year, this a net margin of € 1 billion. The Scaled Agile Framework used to run Skywise platform is key tool to assess the value of projects and prioritize the investments.

When it comes to Skywise solution, the development is at a point when teams say that most of the value created has been for inside Airbus. This value hardly corresponds to increase in turnover, it can sometimes allow better sales or better competitive advantage, but quite surprisingly the biggest value assessed might come with cost avoidances:

> *"When an aircraft reduces its fuel consumption thanks to digital, this is a benefit for the airline. We could wonder if we should make them pay for this value created or if this is enough to sell more aircrafts" (Source 10).*

An example of cost avoidance goes with the A380 programme interruption. Airbus decided to stop the production, but an aircraft has a lifetime of 40 years, during which the aircraft manufacturer needs to provide spare parts for maintenance. Thanks to Skywise, Airbus managed to model all parameters in order to produce in advance all parts that will be needed in the coming four decades. The savings are assessed to be of several hundred million euros (Source 10).

In 2020, Airbus considered making a spin-off with Skywise and they ran a value assessment to make their decision. There are between 500 and 800 applications running on the platform but only a few of them are big enough to potentially generate some hundreds million euros. This can be for example an app that would make it possible to produce three more aircrafts per year (Source 10). The value is always assessed, and the big value topics are categorized in five categories. Even if those projects represent a lot of value, that can be assessed, there is no business case because it would mean adding the work of marketing and communication. It might come later but not in the short run.

Skywise platform might be turning to a new development phase with a mature offer to put on the market, to attract more customers with packaged services. Some airlines that have no Airbus aircrafts start discussing with Airbus because they see that Skywise brings a strong added value:

> *"They see the difference with Boeing aircrafts that are delivered with accessible documentation on internet. Skywise is a community that shares information, where the whole ecosystem uses aircraft information for the benefit of the airlines" (Source 10).*

Apart from internal value benefits and contributing to add value to Airbus sold aircrafts, Skywise also unfolds as a business ecosystem, which is characterized by organizations that interact without a strict hierarchical management and invest together to create value (Jacobides & al, 2018). Airbus encourages other actors to interact directly, without interfering. If I go on with the example of Australia, Airbus targeted potential app editors because they knew that some Australian airlines would be interested to develop business, using Skywise:

> *"Qantas is a dynamic airline on Skywise. The Australian ecosystem is interesting because they experiment things together. There is a value proposition with the app. The airlines directly buy to the partner and let them do their business. They do the go to market, the contracts, and the sales" (Source 11).*

Moore focused on the four distinct stages of business ecosystems development that are birth, expansion, leadership and self-renewal or death (Moore, 1996). Following those stages, I suggest that Skywise has finished its birth stage and started the expansion phase. Operational teams are working, processes have been developed but it takes a lot of time before starting to create value. End of 2022, 24 applications had been created on Skywise Store, most of them by Airbus but also some by LTTS, Palantir and FPT:

> *"We are still starting our development. We realized that the process was very long. Between contacting a potential app editor and signing a contract, there is approximately one year. Once they are onboarded on Skywise platform, it takes some more months before they issue their application" (Source 11).*

Airbus teams have also needed time to increase their knowledge and capabilities on a business that was far from engineering. They learnt how to develop a new business model, based on a revenue sharing model:

> *"We are in the standards of stores with one third of revenues for Airbus and two thirds for the app editor. The app editors have a fixed fee to pay to join the partnership programme. This fee is much lower than the one paid by certified partners" (Source 11).*

App editors are smaller companies than certified partners and they still have little visibility on the real potential business. This is why Airbus tries to propose attractive models.

Next to this approach, which is centred on partners, Airbus has also gained experience on its direct value creation process with airlines. A company that wants to sell services based on artificial intelligence needs a lot of data. It was probably too ambitious to focus at one and the same time on gathering enough data to be able to create valuable dashboards or applications, and to focus on selling services. It takes time to build an offer that will answer a market need. Skywise started with a freemium model to generate traffic on the platform, until it unveiled a new strategy in November 2022, during a big show that took place in Istanbul. The freemium access is no longer an option for airlines who would like to join the platform:

> *"New customers who would like to join the platform have to pay to be onboarded and then have to pay a monthly subscription" (Source 11).*

Skywise performance is assessed internally at the levels of the epics. In the SAFe, an Epic is a significant solution development initiative. Those big projects can last between 6 and 18 months, have an associated business case because they rely on big investments. Each epic entails benefits expectations and key indicators to control (Source 9).

The number of aircrafts connected to the platform is still a controlled performance indicator, as well as the number of active users, who connected at least once during the month. Around two

thirds of the aircrafts in the world are connected to the platform and around 15 000 used log every month (Source 9). These are however rather quantitative indicators because the real value is linked to how the platform is used:

> *"There can be 20 users of a Skywise dashboard, who keep it opened all day but do not use Skywise for what it can really bring. Should we consider those users as well as we consider the five geeks of the airline who discover for the first time some hidden relationships using analytics and spending two or three hours per day on the platform? (Source 7)".*

The five are fewer and apparently spend less time on the platform than the twenty, yet they are those who help the platform grow.

For the teams who coordinate the Skywise Solution, the most important performance indicator is business value. At the end of each PI planning, the Skywise team presents its objectives for the next ten weeks to business owners, who then assess and rank those objectives. This ranking is based on business value, which is the potential value for business for Airbus. Each objective is ranked on a 10 points grid:

> *"We can score 10/10 for an objective that will allow a new contract with an airline if this airline is, for example, Emirates" (Source 9).*

The business owners score the objectives and they come back at the end of the PI planning to assess the final value. For each train, there are between 4 and 6 business owners, who do not belong to the Skywise solution teams:

> *"Their job is for example to be in charge of SHM (Skywise Health Monitoring) support. They are in touch with customers on an everyday basis and know exactly what they expect" (Source 9).*

The assessments of the results are always done in front of the developers, so that they can have direct feedback.

3.5 Ecosystem as structure evolution through business development

The ecosystem as structure is defined by its actors, activities, links and positions that allow the emergence of a joint value proposition. At birth stage, most of the ecosystem was invisible so I needed to focus on the blueprint or projection of what would come up. After more than five years, the ecosystem has evolved, partners commit, sometimes still with a strong influence or incentive from Airbus. The structure of the ecosystem evolves and becomes more visible from the outside, with a clearer value proposition that is co-created.

3.5.1 Involving partners

Palantir remains a special case, which has no risk and revenue sharing position:

> *"I wonder if Palantir is really a partner, or if it is rather a supplier that found a fruitful business" (Source 2).*

Palantir brings a lot of value to Airbus and Skywise, but the relationships tend to be balanced and there might be a point when Airbus will no longer rely on Palantir:

> *"They are very strong. We need them, as well as they need us. Today, they are still key, but we also start offering products that are directly on AWS (Amazon Web Services)" (Source 9).*

Palantir offers its Foundry solution, which is a great tool for those who have no basis in coding, but the more workers are skilled with digital capabilities, the less Palantir will have added value (Source 7).

Six other actors have partnership agreements with Airbus that set how they can co-create opportunities and business inside Skywise:

> *"They have no shareholding in Skywise. They trained their teams but their investment does not go much further" (Source 2).*

This is called Skywise Partnership and it entails two different partnerships. 6 IT companies are Certified Partners of Airbus. They have a global footprint with two companies based in India,

one in Vietnam and the others in Europe. Those companies are FPT, Infosys, Capgemini, Sopra Steria and Accenture:

> *"The aim of those companies is to support airlines when they want to do big data and analytics using Skywise by themselves" (Source 11).*

The second kind of partnership is the Skywise App Editor Programme, which was created to enrich Skywise app store. Partners have access to the data available on Skywise and they are allowed to create applications. This programme started at the beginning of 2022 and one year after its launch, 10 partners had signed contracts with Airbus, while 70 companies had been contacted to join the programme:

> *"We rather target companies that already have some business in aeronautics, because we need to find use cases that have value. We target start-ups, but that are big enough to provide support and maintain their apps. This is why we target companies that have a minimum of 5 employees" (Source 11).*

Airbus is aiming at small companies but aims at having a global footprint. There is a Skywise for airlines and ecosystem team, that gathers 10 employees. They are mainly based in Europe, but one person is based in Japan to cover the whole Asia Pacific area, while another team member is based in Australia. This presence helped starting a global network, with two app editors who are Australian start-ups: Forloop and Lex (Source 11).

There is a clear difference between suppliers and partners, even if suppliers are sometimes also partners. Suppliers commit to delivering and are paid to be involved in Skywise development teams (Source 9). They are big actors such as Capgemini, Sopra Steria or Alten. Partners have an agreement with Airbus to use the platforms for themselves and sell services. This side of Skywise is still at a very early stage, because Covid crisis happened when it was launched and because the actors, such as LTTS, Capgemini and Infosys strive to find their business model (Source 9).

Quotes	First-order concepts
"With Skywise, we could target other players such as airports, lessors, maintenance centers or even end users" (Source 9)	growth perspectives / value creation / Skywise performance
"Sopra and Capgemini are the two biggest partners of Skywise, Sopra being first. They have not made much financial results, but they learn and they have a limited investment in the project" (Source 6)	risk sharing / partners involvement / ecosystem structure
"We have a mutual dependency with Palantir, as it is true for all technological backbones we use, such as SAP for ERP, PTC for PLM and Dassault Systemes. We are committed with Palantir until 2025. It was an inital 5 years contract, renewed for 5 more years" (Source 12)	interdependencies / complementarities management
We have 6 certified partners who sell integration services, including FPT, Sopra, Capgemini and Infosys" (Source 2)	servitization / ecosystem value creation
"One of the main difficulties for Skywise goes with contract management because this is Airbus contract structure. It took 2 years to define and sign the app editor agreement" (Source 2)	Skywise difficulties / app editor agreement on track
"Sopra is still involved in two partnerships with Airbus: Skywise Partner and CSE, Cloud Software Engineering. CSE is based on call for tenders and we work on Airbus needs. With Skywise Partner we try to become partner of customers or suppliers of Airbus and to sell Skywise licences. This demands more commercial effort" (Source 8)	business development / ecosystem as structure partners / contracts
"Skywise partnership includes two types of partnerships: Skywise Certified Partners is a network of 6 IT companies with FPT, Infosys, LTTS, Capgemini, Sopra and Accenture to support airlines when the want to do big data and analytics with Skywise on their own. The other model is the Skywise App Editor Program that was created to feed our store. LTTS and FPT are in both programs" (Source 11)	Ecosystem structure / partners involved
"We have a revenue-sharing model with app editors, following the standards of stores, with around one third for Airbus and two thirds for the editor. They also have an entry fee to join the program, which is much less than for the Certified Partners. They are small actors, they need to find their business case" (Source 11)	revenue-sharing / value co-creation
"The strategy now is to capitalize on the airlines, explore MRO, lessors, and interoperability to have a broader positioning" (Source 11)	business development / new services development / new customers acquisition
"Leading airlines like Delta, Easyjet, Cathay and Qantas are now in the same dynamic as us" (Source 12)	customer alignement
"Our initial vision regarding partners' work sharing was that we are not an IT company and we wanted to grant the airlines the autonomy to work with the IT actors of their choice to help them develop workflows. We did not want to be the prime contractor because we had no addded value in that model. It however required commercial investment on the partners' side" (Source 13)	ecosystem development / non-hierarchical management / business development
"Our next step is to prioritize whether we should first get closer to MROs or address a new vertical such as fuel savings, or develop new solutions in particular" (Source 15)	business development

I just wrote about the suppliers of consulting who get involved in Skywise Solution, but Airbus is first and foremost an aircraft integrator, it relies on several hundreds of industrial suppliers,

who produce parts that are eventually assembled by Airbus. This supply chain has also been targeted as a potential customer for Skywise platform:

> *"We observed a strong go to market from the airlines on Skywise platform, so we tried to ignite the same adoption with our supply chain. We wanted to grant them access to the platform in exchange of their data. It is however difficult for our purchasing department to change the contracts and our suppliers are reluctant to share their data with us" (Source 10).*

A key dimension of the ecosystem concept stands with the fact that the actors are at least partially connected thanks to non-hierarchical ties (Jacobides & al, 2018). This is an appealing dimension because it entails a freedom margin for partners and an openness of the collaboration structure. It however also means a space of uncertainty for the leading firm in the ecosystem, which needs to rely on its partners because their contributions and capabilities are necessary for the joint value proposition to materialize. My findings bring some more understanding of how this partially opened structure can work. It is far from a fully opened structure in which any partner could decide to join and propose to create value. Airbus selects partners, who are allowed to pay a fee, to start creating offers and collaborating with the other actors involved in the ecosystem. Value is thus co-created, notably through risk and revenue sharing agreements, on the App Editor Program. This part of the ecosystem suffered from the covid pandemic and really started at the beginning of 2022.

3.5.2 Value co-creation

Partners in an ecosystem keep strengthening their ties because they share joint investments that are difficult to redeploy. As an ecosystem leader, Airbus is responsible for creating the appropriate structure and incentives that will encourage partners to create value. In Skywise, this is mostly done through the two main partnership agreements that were signed: Skywise Partner and Skywise App Editor. In those two agreements, partners are allowed to develop business with a virtuous mechanism for the ecosystem. They can use the structure and tools

provided by Airbus and if they generate revenue, they redistribute part of their revenue to Airbus.

Airbus is at the crossroad between suppliers and airlines. It was part of the Skywise Partnership agreement, that partners such as Sopra Steria would help Airbus get airlines and suppliers to use Skywise platform.

> *"It is a strong stake for Airbus to know its suppliers better so that they may improve their products. On their side, suppliers like Thales or Liebherr do not necessarily want to share their data with Airbus" (Source 8).*

Skywise partners are still granted an access to the platform with anonymized data, so that they can use it as a sandbox. This is part of the agreement and one of the elements that make Skywise an ecosystem as structure because partners can use the generated data to create value and sell applications to Airbus customers. It takes however time to create business cases and there seems to be a gap, or at least a learning curve to travel, between the expected value to create and the one which is actually created.

> *"The difficulty for actors such as Sopra Steria is that we do not know MRO companies and airlines very well. Those Airbus customers are really focused on their aircrafts operations and have little interest in data from a whole fleet" (Source 8).*

Sopra Steria explored the opportunity to develop its business thanks to Skywise, with a dedicated team and they tried to build scenarios, for example on the sustainable development dimension. This is interesting because it is exactly the position chosen by OpenAirlines and so far, there is a real difference in performance between the two cases (Source 5; Source 8). The main difference between the two cases goes with complexity. The ingredients seem quite comparable with data gathered from airlines, strong skilled technical teams, a big data platform and applications to generate insight, good connections with airlines. It is also certainly too early to assess Skywise performance from a turnover angle.

> *"Skywise started 5 years ago so it is still very young to offer valuable services that base their solutions on analysing the past. This is however a necessary investment" (Source 8).*

Apart from complexity, there might also be an issue of contradictory motivations and lack of strategic decision-making, be that on Airbus side or on partners' side. On Airbus side, time and money were spent to increase the use of Skywise and it sometimes went with waste:

> *"Instead of creating several times the same applications or dashboards inside Airbus and without the help of Palantir, we could have done it with them and after having checked that everything can then use those tools. If everything is developed five times, there is no positive business case (Source 7)".*

On the partners' side, the conflict might come from the conflicting roles they can play, as providers on the one hand and business developers on the other.

> *"Partners such as Capgemini and Sopra Steria have no interest in helping us reduce the number of use cases and they take Airbus for a cash cow. They are paid to help Airbus teams develop similar dashboards that cost one or two million euros each and that we then need to maintain (Source 7)".*

Consulting companies are also facing difficulties to switch roles and focus as well on Airbus internal needs as on external needs.

> *"Skywise allowed a real digital transformation for Airbus in the way employees deal with data. Plenty of employees now code and build analysis; they manage to develop very useful applications for their everyday job" (Source 8).*

There are still two main kinds of partnerships that link Airbus to its partners in Skywise business ecosystem, with Skywise partner agreement et Cloud Software Engineering agreement, or CSE. CSE is a call for tender and dates back to December 2019 with Sopra Steria (Source 8). CSE is a more classical kind of contract between Airbus and suppliers for its own needs.

Quotes	First-order concepts
"We worked a lot on committing the ecosystem for the business model so that this ecosystem could develop applications that have value for our customers operations" (Source 4)	value creation / ecosystem development / committing partners
"Applications can be developed inside Airbus or by third party developers such as Honeywell or Collins, with whom we have partnerships for the development of applications on Skywise platform" (Source 4)	partners relationships / ecosystem development
"FPT is doing well because they do some training for Skywise. Palantir remains the best partner to bring new customers to the platform. They are good at demonstrating the value with use cases" (Source 8)	value creation / partners inside the ecosystem
"Skywise is really open and partners have a direct access to the core data and all applications. They can try to develop applications" (Source 6)	EAS / data management / value creation / partners involvement
"Skywise App Editor started in 2021. We have signed 10 partnerships and have a pipeline of 70 companies that we contacted this year. We are mainly looking for companies in the aviation industry in order to have valuable use cases. We signed Forloop and Lex, two Australian start-ups" (Source 11)	value co-creation / digital capabilities
"We often select app editor that have connections with an airline. They sometimes have a product line that they will adapt and develop on Skywise" (Source 11)	value co-creation / ecosystem links / business development
"At Sopra we worked on Skywise, to build appealing scenarios and to attract new customers on Skywise. The difficulty for an actor like Sopra is that we do not know very well actors who do MRO and airlines" (Source 8)	ecosystem partners choice / dynamic capabilities / business development
"Capgemini, Sopra Steria, Alten commit to deliverables and are part of the development teams. Partners are there to use the platform and sell their own services. Suppliers can be partners but there are also companies like LTTS. Partners have had a hard time finding a model, and we have too" (Source 9)	partner, suppliers relationships / ecosystem structure / non-hierarchical management
"The partners who try to do business using Skywise are at least LTTS, Capgemini and Infosys but they were silent partners during two years of covid" (Source 9)	ecosystem partners / business development
"The process is very long between the moment we contact the company and the moment we sign the contract, it takes almost one year. Then they need to develop their app" (Source 11)	time to market / time for ecosystem development / contracts
"Palantir displays our core technology for data acquisition and processing. We have an Amazon infrastructure to complement Palantir's platform capabilities" (Source 12)	complementors / ecosystem roles for structure
"We are increasingly opening up Palantir's platform to other tools so that the data can be reused in new environments" (Source 12)	opening the ecosystem / ecosystem development / reuse of data / value creation
"We have a revenue-sharing model with partners to develop the Store. This is quite marginal but it covers part of our costs and it gives an incentive to our teams to develop" (Source 13)	revenue-sharing / value co-creation / incentive for business development

When companies are committed in the Skywise Partner, they contract to become partners of customers or suppliers of Airbus and they try to sell Skywise licences (Source 8). After more than 3 years, this partnership still brings little results.

Among other partners of Airbus for Skywise, FPT and Palantir can be seen as the best business getters:

> *"FPT is doing well because they are also doing a lot of training. They are just behind Palantir, which remains the best partner to open new accounts. Sopra has a good complementarity with Palantir because they show the value on a use case and then, there is a need to industrialize" (Source 8).*

Sopra Steria achieved an annual turnover of around € 8 million on the CSE agreement, which is an IT contract. This is only a share of what Airbus pays to Sopra Steria in relationship to the use of Skywise platform. For this action, around 100 Sopra Steria employees work on the development of Skywise, half in Toulouse and half in India (Source 8).

3.5.3 Skywise performance & structure

Several terms were given to describe how Skywise, the ecosystem as structure, was the flagship thanks to which Airbus was unrolling its digital transformation and changing the culture of the company: "war machine", "fundamental brick" or ecosystem among others and it is either named Skywise Solution or Skywise Platform. 550 people develop Skywise products with business value targets in order to improve operational efficiency, reduce costs or provide additional revenues. The whole organisation is made to serve both Airbus direct production interests and the whole life cycle of aircrafts, which comes to providing solutions for their customers, the airlines. My findings show that the ecosystem went out of its birth phase, to join its expansion phase, notably because a critical mass of data has been secured. More than 160 airlines are connected to Skywise, which represents approximately 50% of the Airbus aircrafts in service. Achieving this development milestone allows Airbus to now focus on future

development that come along with monetizing the platform and opening it further, to new partners.

"I know there is a big gap between the anticipated turnover thanks to Skywise and what is really sold" (Source 14)	clearer view on potential revenues
"Skywise lead to some efficiency issues because some employees were on Skywise doing reporting all day instead of doing their job" (Source 14)	operational efficiency / launch adjustments / ecosystem evolution
"We now have more than 160 customers connected to Skywise, who share their data on the platform" (Source 4)	data sharing / fuel for digital servitization / value creation / operational efficiency
"Skywise performance cannot really be assessed with the services they sell. Delivering valuable services demands a consequent history and Skywise only started 5 years ago. It is still very young to deliver services based on analytics" (Source 8)	servitization / ecosystem maturity / business model evolution
"Palantir chose an architecture that relies on data duplication. Calculations could be performed where the data resides. Data duplication represents a significant expense" (Source 7)	ecosystem structure / value proposition / strategic choices / digital platform costs
"It is very difficult to discuss Skywise business model because it is a platform to develop solutions, sometimes with cost models, sometimes cost savings without revenue" (Source 9)	ecosystem business model / ecosystem performance
"Skywise is no longer a P&L holder, they became an IT service line" (Source 2)	ecosystem structure / ecosystem phase
"Skywise is a platform that allows to share data, on which applications can be created and sold. Skywise is an ecosystem" (Source 4)	ecosystem structure / data sharing and data management
"Skywise is an ecosystem with a data collection part, a hosting part, a part for applications development. This is more than a tool, this is the fundamental brick" (Source 4)	ecosystem development / platform
"The airlines buy directly from the partner. The app editor directly handles the go to market, contracts and sales" (Source 11)	complementor / non-hierarchical management / ecosystem structure
"550 people develop Skywise products, without those who sell and those who provide support" (Source 9)	human resources / ecosystem structure
"We adopted a standard model for platforms, where after building a customer base and reaching critical mass, you can find ways to monetize it" (Source 15)	value creation / business model evolution / ecosystem development

"The Skywise solution is a kind of war machine that incorporates the best practices in IT project management" (Source 10)	digital capabilities / competitive advantage / strategic asset
"Skywise remains the official platform after the closure of DTO but the departments have to pay for their use; which was not the case at the beginning" (Source 14)	Skywise platform is broadly used inside Airbus
"There is no freemium option for new customers. They can now choose between 3 packages Core X, Core X^2 and Core X^3" (Source 11)	value creation / platform monetizing
"We transitioned from a software as a service to platform as a service model" (Source 15)	digital servitization / ecosystem evolution
"We have set achievable sales targets for services, we now have a pricing in mind. When I arrived, I was told that we needed to make € 11 million per year but we were selling products for € 5000. Now, the first subscription is over € 5000 per month" (Source 11)	business model / value creation / sales targets
"There was a period of uncertainty during the covid crisis but we modified our Skywise Core technological offering. It was too fragmented and technology focused, the airlines did not understand our offer. It is now packaged, more transparent and easier to sell. It is easier to position a service offering when there are aircraft financial deals, rather than offering individual services afterwards" (Source 12)	ecosystem development / building an appealing service offer / customer centricity
"Regarding connected airlines, we have reached a critical mass. This is why we stopped the freemium offer and introduced commercial offers, so as to onboard new airlines who may want to access more powerful technical capabilities" (Source 13)	critical mass of airlines connected / business model innovation
"I am in favor of developing partnerships that are based on extracting data from Skywise. That is probably the next step in the development of Skywise" (Source 15)	data management / ecosystem evolution
"Portfolio management helps determine which subjects deserve attention on Skywise because the platform is the appropriate tool and the cost is reasonable compared to the expected benefits" (Source 10)	business case / platform efficiency / cost control
"The project has become clearer in the past two years. Covid brought uncertainty, we lost contact with the airlines. We now have objectives for 2027, to grow the ecosystem of partners and apps on the store. Revenue is not the most important thing, we need to have high-quality data that brings value to the airlines" (Source 11)	ecosystem development / performance indicators
"We would like to reach 15 to 25 % of the airlines on the platform that contribute financially to the development of Skywise by 2025" (Source 15)	business development / monetization / financial targets

3.5.4 Enduring investments

The literature tends to focus on potential additional revenues, value creation or cost avoidance that digital transformation as well as ecosystem can provide but these changes also require huge investments, in a very uncertain context. This is why most business ecosystem fail. Skywise is a success because it reached that milestone of becoming a real component of business as usual inside Airbus. The ecosystem is just at the beginning of its expansion phase but there is more

confidence on the added value of the ecosystem. In order to reach this phase, huge investments had to be made, especially on the partner side.

Quotes	First-order concepts
"Sopra charges around 8 M€ to Skywise for one year of CSE, which is an IT contract. We have around 50 people working in Toulouse and around the same in India" (Source 8)	ecosystems costs / contracts with ecosystem partners / enduring investments
"Inside Airbus, we have 400 people working on 5 trains to develop digital solutions, we go on investing a lot on Skywise" (Source 2)	investment on digital servitization
"A limit of Skywise is that it is a data lake where data is "cold". It is duplicated data. Thousands of data are duplicated every day but this represents a cost" (Source 14)	issues / limits to Skywise / digitalization costs
"Palantir is in charge of on boarding new customers but it costs a lot. They trained our teams but there is no risk and revenue sharing" (Source 2)	partners relations / governance sharing of the ecosystem
"We went through the natural phases of developing a service as disruptive as Skywise. We had to explore all possibilities before rationalizing, keeping the same level of investment but setting priorities" (Source 15)	ecosystem development / investment
"The overall cost of Skywise was of around € 10 million per quarter but it is now a little less" (Source 8)	digital platform cost

During the launch of Skywise, there was a strong push to increase adoption of the platform and all employees were encouraged to create applications. It led to huge costs and sometimes poor consequences when the time spent on the platform was used at the expense of professional efficiency. Skywise is not at a maturity level yet and sometimes there was a need to stop using the platform, to come back to the use of other tools, to really realize that Skywise was bringing a lot, even if there was a need for some adjustments. This is what happened with the product cross bill of materials, or Xbom. There is a constant need to analyse the aircraft structure, with data that come from all services, from engineering, manufacturing, to customer services. After a few years using Skywise data lake, uploading the data and using the platform, it was concluded that Skywise was too heavy. There were too many data in the platform, so they switched to another technology called MarkLogic, which is a datahub instead of a data lake.

They eventually decided to come back to Skywise, provided that they managed to simplify the data streams in the platform (Source 8). The cost dimension was a key parameter to ease this transition to a next phase in the maturity of the platform:

> *"Huge amounts of money had been spent so there was at a point a will to spread theses expenses in the functions inside Airbus, such as aircraft programmes, quality, procurement, operations, or customer services. Variable costs depending on the number of applications and the memory space used were impacted on the functions, even if the fixed costs are still paid by the IT department" (Source 8).*

This was a necessary second phase in the development of Skywise to lead all users to assess the cost-effectiveness of their use.

> *"Palantir used to cost around € 10 million per quarter to Airbus when there was a lot of development costs. It is now less than this amount" (Source 8).*

Some parts of Skywise are now critical for Airbus, such as the application Tandem, which enables the production planification and operational control of all final assembly lines. The other applications are now included in services that are delivered as part of contractual agreements with Airbus customers. Those applications are carried by customer services (Source 8).

Section 4 Discussion

This empirical research brings new insight on the unfolding of ecosystems and advances the knowledge on dynamic capabilities, competition and servitization at the ecosystem level.

Digital transformation is an imperative and an opportunity for incumbent firms evolving in mature business ecosystems, who can create new ecosystems as structure to renew their strategic position.

In Airbus case, the choice was made to tackle digital transformation and to develop an internal digital platform. This was the first focus, but it also triggered the choice to invest of having a dual approach with a concurrent focus on developing this platform for the external environment.

The topic of business model renewal through the use of platforms to provide services to the customers' needs new research (Kohtamäki & al, 2019) and this case shows that it is rather limited. This is not the first focus for value creation inside Airbus but the first focus of the platform was not to sell new services to customers.

Servitization is often a costly bet for manufacturing companies (Feng & al, 2021) because this approach requires a lot of efforts in the long-run and a real focus on the external environment. The financial reward is also light, at least in the short run. It is however part of the strategic renewal of the firm and the value has to be assessed with different criteria as mere increase in turnover. My study shows that Airbus reassessed its strategic position towards servitization after a few years, because they understood that it was too far away from their core business. They are still targeting a development of their services, but they stopped considering they could make a major strategic shift thanks to the development of digital services.

Airbus is an aircraft manufacturer, and its first target is to sell aircrafts. It took them fifty years to become a challenger in a market driven by two main actors and they even managed to become the leader in this market. The first objective of Skywise platform was to break silos inside Airbus, to avoid costs and to improve the knowledge of sold aircrafts to improve their products. The target was to access data for at least 50 % of the flying or in-service Airbus aircrafts and it was achieved in 2022, 5 years after the launch of Skywise. On this ground, it has been a success. They are still lagging behind in terms of services revenue but their digital transformation and ecosystem as structure development put them in a strong position for the future. The ecosystem as structure creation helped Airbus know its product better and increase the value of their

products for their customers. The average price of an Airbus aircraft is around € 100 million, and they make a € 3,5 billion turnover with services that represents approximately 5 % of the overall turnover. As shown in Table 22, the addressable market for Skywise is of € 1 billion and they are today far from achieving it. This would be the target for a successful digital servitization, but it would demand much more investment and it would put a higher risk on the company's core business, for less than 2 % of its turnover. My study confirms the value of digital servitization in business-to-business market lies in cost reduction more than in revenue growth (Gebauer & al, 2021).

The most important dimension of my study lies at the dynamic capabilities level because it shows that they need to be developed at the firm level and ecosystem level. Dynamic capabilities are meant to adapt to the external environment and changing context, to sense changes in customer preferences and to explore new ideas (Schilke & al, 2018). Skywise ecosystem development exemplifies how a leading firm can attract partners with dedicated capabilities and make them work inside mixed teams to develop the skills of the whole ecosystem as structure, which will have an impact on the ecosystem as affiliation in the middle term. To start with the EAS level, the whole Skywise solution has been an agile team of up to five hundred people, who work on two months cycles with an agile approach to find new solutions, be that for internal or external needs. The ecosystem structure also evolved to embark partners, who need to dedicate resources to the project if they want to sell new services.

It starts with agile capabilities that are required to lead product-service innovation (Sjödin & al, 2022). Skywise ecosystem is a perfect example of how to increase the internal capabilities and develop the skills of external partners, so as to improve the overall health of the broader ecosystem as affiliation.

This role inside the EAA has an impact on the competitive dynamics, because Airbus needs to convince partners to commit to the ecosystem. It has sometimes been a real challenge because

they have been seen as a dominator by most of the actors evolving the same EAA. They need to show to their customers and suppliers that they are really aiming at becoming a keystone (Iansiti & Levien, 2004).

Figure 27 Emergent model of EAA strategic renewal by EAS creation

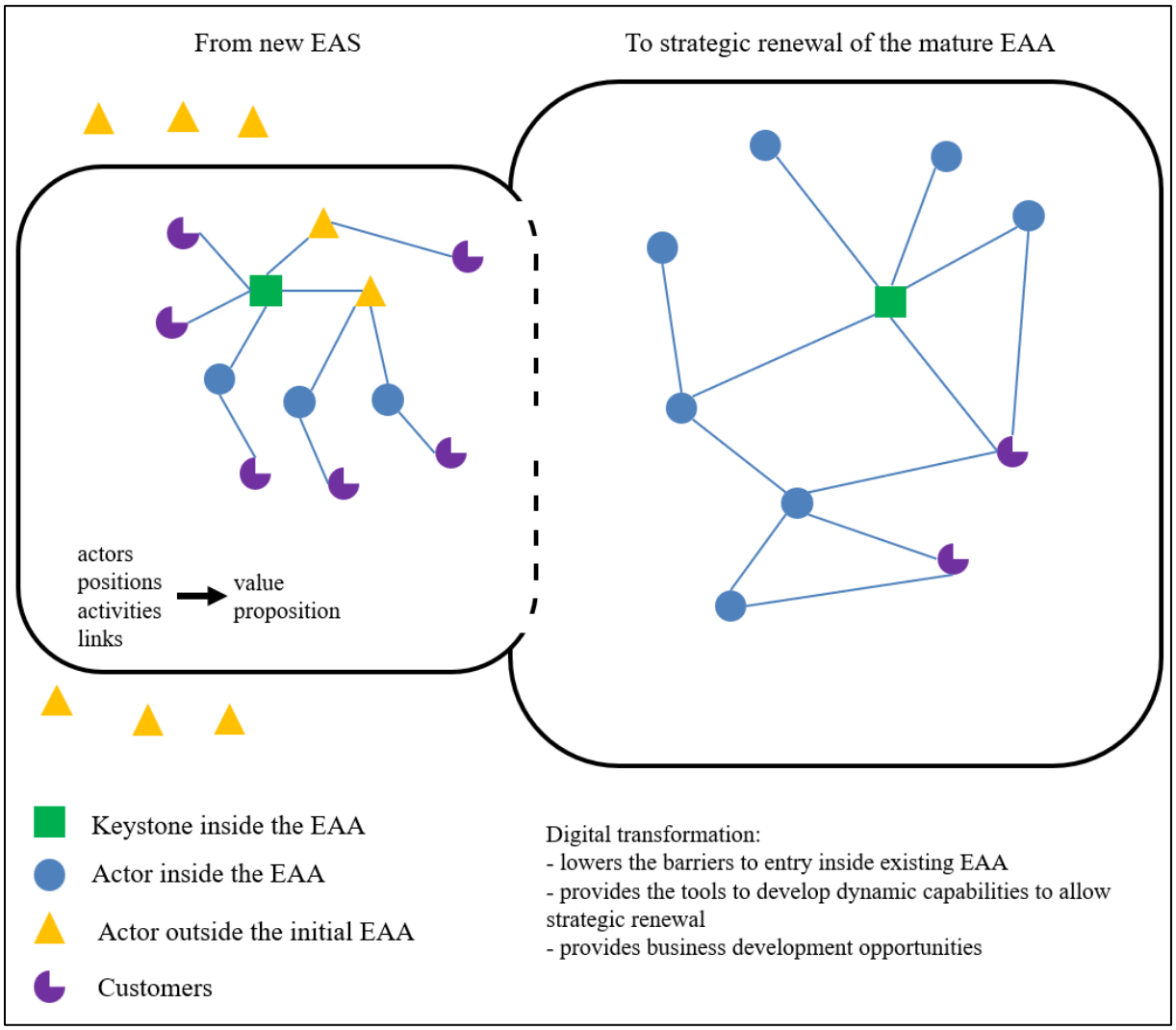


Figure 27 illustrates how the new EAS can be progressively integrated into the existing mature EAA and allow its strategic renewal. As showed in Chapter 4, actors need to be attracted from outside the existing EAA to incorporate adding value capabilities to a new value proposition. The leader of the new ecosystem as structure (EAS) has to be a leading company in the existing

ecosystem as affiliation (EAA). His historical position goes along with key assets but also potential barriers to innovation and renewal. On the positive side, a mature EAA is an environment of surviving companies, that have known one another for years. They are used to partnering and contracting together. They have longstanding trust relationships. A leading actor in the EAA has the power and responsibility to foster the renewal of its environment. Leading firms can be keystones or dominators (Iansiti & Levien, 2004) and their whole challenge to keep a sustainable performance is to make sure that they help the other actors evolving in the same EAA to keep performing. On the negative side, a leading firm is always considered as a potential threat by the other actors of the EAA. Those relatively smaller and less powerful actors have struggled for years to keep performing but never being in a dominant position. When an ecosystem tends to mature, concentration is high and past complementors can be good targets to achieve short-term growth objectives. This is why keystones need to reassure their partners on their will to remain keystones. My research shows that business ecosystems are an efficient way to achieve long-term strategic renewal, through the development of dynamic capabilities at the ecosystem level. The keystone firm invests to define a new value proposition, jointly created with other actors. The new EAS can in a second step be progressively integrated to the EAA and benefit to other actors evolving in the same environment. Competition has not disappeared, companies face inter-ecosystem and intra-ecosystem competitions (Gueler & Schneider, 2021). Strategic renewal is achieved when keystones manage to launch new EAS that end-up benefiting the other actors inside the EAA. This performance can be measured when the renewed capabilities basis inside the EAA allows the actors to be more competitive outside their EAA.

Chapter 6 Synthesis and research prospects

At the beginning of this thesis journey, I set out to explore how firms evolving in mature environments can adopt an ecosystem approach to renew their business models and strategic position. While most business ecosystems' studies have adopted an ecosystem as affiliation overall approach with a strong focus on actors (Tsvetkova & al, 2021; Hou & Shi, 2021), I adopted a dynamic approach and combined this lens of inquiry with a focus on the activities that actors jointly run to create value (Adner, 2007). My study goes back and forth from ecosystem as affiliation (EAA) to ecosystem as structure (EAS). This allows me to fill the theoretical gap that starts from a new value proposition, built by an incumbent industrial actor, who aims at impacting its longstanding competitive landscape. Leading actors evolving in mature ecosystems as affiliation can foster strategic renewal (Agarwal & Helfat, 2009; Teece, 2018) of their environment while creating new ecosystems as structure, making the most of digital transformation (Sebastian & al, 2017; Warner & Wäger, 2019) to develop dynamic capabilities (Teece & al, 1997; Teece, 2007).

Through a qualitative case study based on an abductive overall approach, I found that business ecosystems can help mature industrial actors renew their capabilities basis and strengthen their position in their ecosystem as affiliation. In mature industries, launching a new ecosystem as structure can be a tool to allow strategic renewal, provided that several antecedents are gathered and that balances are struck (Chapter 4). By understanding and leveraging the dynamics of their ecosystem, organizations can drive strategic renewal, embrace digital transformation, but also create and appropriate value effectively (Chapter 5).

In the following section, I will detail my contributions; I will then discuss the transferability of my findings. I will then highlight the managerial contribution and eventually conclude with the limitations and research avenues.

Section 1 Contributions

My longitudinal approach allowed to see how a new ecosystem as structure has unfolded over 6 years, from 2017 to 2023, and to underline the difference between what was projected and what really happened. The core of my contribution is to focus on business ecosystems in the context of mature industrial companies and to explore the interplay of ecosystem as affiliation and ecosystem as structure constructs (Adner, 2017). The concepts of business ecosystem, strategic renewal, digital transformation, value creation, and value appropriation are interconnected (Jacobides & al, 2006) and crucial in the context of the European aerospace industry, represented by Airbus' initiatives like the Skywise platform.

Starting a new ecosystem can be a risky and highly uncertain bet. In the two cases I studied in Chapter 4, Safran project was given up after a few years of inception, while Airbus Skywise project survived and can be regarded as a successful new ecosystem as structure. The whole blueprint however did not exactly come to reality. As for most innovation and digital servitization projects, Skywise project was too optimistic on several dimensions (Tronvoll & al, 2020; Jacobides, 2022). The biggest difference with what had been forecasted was on the anticipated revenue generation with digital servitization, in the case of Skywise platform for Airbus. The two nascent ecosystems I picked are insightful because they bring light on the dynamics of business ecosystems formation and evolution (Hou & Shi, 2021). The formation of a new EAS is a component of the evolution of an existing EAA. The EAS is formed by actors who aim at creating value together. Past research has underlined the need for a closer attention to value cocreation in ecosystems, as an outcome of coevolution (Tsvetkova & al, 2021), which poses several challenges in the context of mature industries.

1.1 Gathering the approaches on EAA and EAS studies

Research on business ecosystems underlines a lack of clarity on the definition and boundaries but also a need for dynamic perspective to study the constitutive characteristic of coevolution (Moore, 1996; Tsvetkova & al, 2021; Hou & Shi, 2021). My study contributes to a better understanding of those dimensions and underlines the need to start with a focus on the EAA level before studying the EAS level and coming back to the EAA level.

A longstanding business ecosystem or EAA is a landscape of many ties among actors, who have been partners, complementors, competitors, suppliers in different situations but mostly have learnt to live next to one another. A mature ecosystem is also an environment of survivors, who have gone on growing and improving their efficiency and developed renewal mechanisms. They fear the moment when a technological discontinuity (Cozzolino & Rothaermel, 2017; Christensen & al, 2018) will prevent them from satisfying their customers. To postpone the moment when they would be exposed to commoditization (Adner & Lieberman, 2021; Cozzolino & Verona, 2022), they need to renew their capabilities portfolio and to play a leading role inside their EAA. Past relationships can bring trust as well as awareness or prudence. Actors need to attract participants and to develop governance mechanisms for new EAS (Kretschmer & al, 2020; Jacobides & al, 2024). Those governance mechanisms need to be at least partially non-hierarchical (Jacobides & al, 2018), and I show with my study that it cannot be fully non-hierarchical. There is a need to involve suppliers on a new EAS, with classical provider or supplier relations, in order to at least partially control the uncertainty of a new value proposition development. A balance has to be found among historical partners and new partners from outside the EAA. Historical partners bring consistency to the project and can easily be onboarded thanks to the common experience that is shared, while new partners bring new capabilities but demand more time and human resources involvement to develop joint collaboration skills.

The study of two new ecosystems as structure in Chapter 4 confirmed that development times were underestimated and that potential partners can give up such a new project because it is a long and uncertain journey. This research also contributes to the literature on ecosystem governance and brings answers to the issue of potential number of orchestrators of ecosystems that has been under researched so far (Lingens & al, 2021). The launch of a new EAS requires a strong leadership from one company (Chapter 4), which takes the responsibility to finance the biggest part of ignition investments. During the blueprint definition phase (Dattée & al, 2018), non-leading actors involved in the new ecosystem need to find short-term incentive in order to commit and sustain their involvement. This has been the case for Palantir in Skywise ecosystem. Palantir is a big data company that has been contracted by Airbus to develop its data lake and AI platform. Palantir experts played a key role to launch the new ecosystem as structure. They were outside the broader aerospace ecosystem as affiliation. This initial distance came along with a high entry barrier for collaboration with Airbus. The barrier to commit to this new EAS has been lower for Airbus historical partners who can be complementors with less investments than demanded for other partners at the EAS level, who are not already part of the historical EAA. Even if the uncertainty is very high and there is no clear business case from the start, historical partners are willing to be onboarded for a new project because the leading company has provided them with business in the past; they still have ongoing projects together. Actors who already belong to the same EAS have developed trust and capabilities for collaboration with one another. All actors get involved for the prospect of potential new business development. Complementors of leading companies in the EAA bring a lot of confidence to the ecosystem leader because they represent no potential threat. Their mutual interests are fully aligned. Skywise mostly relies on three kinds of actors (see Figure 21): Airbus internal teams, certified partners such as Capgemini, Sopra Steria, Infosys, FPT and technology suppliers, with Palantir that occupies the strongest position. Certified partners have already a position inside

the EAA, but this is part of their identity to evolve in several industries and longstanding EAA. They are complementary to Airbus but also to Palantir. Palantir is at the core of the EAS value creation process because they provide deployment strategists (see Chapter 4, Section 3.4 for details), who are experts that have very seldom and precious hybrid skills. They can find value for their customers because they dispose of technical and business skills at the same time. This however comes with a cost and scarcity that has been balanced by Airbus while resorting to certified partners. Those actors are fully skilled to scale up developments initiated by Palantir. This complex set-up is the basis for development of a partially non-hierarchically led ecosystem. Certified partners are empowered to develop business for the ecosystem. Chapter 5 also shows how new partners are attracted to develop new applications (Section 3.4). The EAA history, or path dependence (Sydow & al, 2009) allows the creation of an alignment structure by different actors, led by a focal firm. This keystone company manages the development of dynamic capabilities (Teece, 2007) among actors, to allow value cocreation (Lingens, 2021) and strategic renewal (Agarwal & Helfat, 2009). The partially non-hierarchical management of the new EAS (Jacobides & al, 2018) is possible because the keystone selects partners for their potential interdependencies and complementarities (Kapoor, 2018).

In Chapter 4, I focused on the creation of new ecosystems as structure in the context of mature industries. I focused on how new ecosystems as structure (or EAS) can emerge in the context of existing ecosystems as affiliation (or EAA) and defined a ranking of key antecedents that need to be taken into account so that the new EAS might thrive.

Some actors need to be chosen outside the existing EAA, so that they may bring new complementary capabilities and new development opportunities (Padula, 2008; Dyer & al, 2018). A mature EAA tends to become less wealthy, actors tend to have less change margins to innovate. They focus on efficiency more than on growth (Binns & al, 2013). The ecosystem concept is useful to understand that maturity inside an ecosystem goes along with the

disappearance of some species and a potential lack of renewal. All actors know each other and evolve in an environment in which the most resistant have gone on developing while incorporating some of their partners, either through mergers and acquisitions, or because of competition. They rely on one another but also know that partners could be fierce competitors. Threats exist inside as well as outside the EAA (Gueler & Schneider, 2021). With time, opportunities no longer exist inside the EAA and push the strongest actors to look for new options outside the EAA. Those actors however need to embark some of their historical partners so that new value might be created inside the EAA. The selection of partners, from inside and outside the EAA is a time-consuming and challenging task for firms willing to launch a new EAS. They need to find complementors (Kapoor & Lee, 2013) who will be able to catalyse new capabilities development. As shown in Chapter 4, incumbent industrial actors are highly experienced in partnering and know which complementary dimensions to focus on. This completes the extant literature on ecosystem development, showing how actors are selected and attracted to be part of the blueprint (Dattée & al, 2018) and Minimum Viable Ecosystem (Adner, 2021).

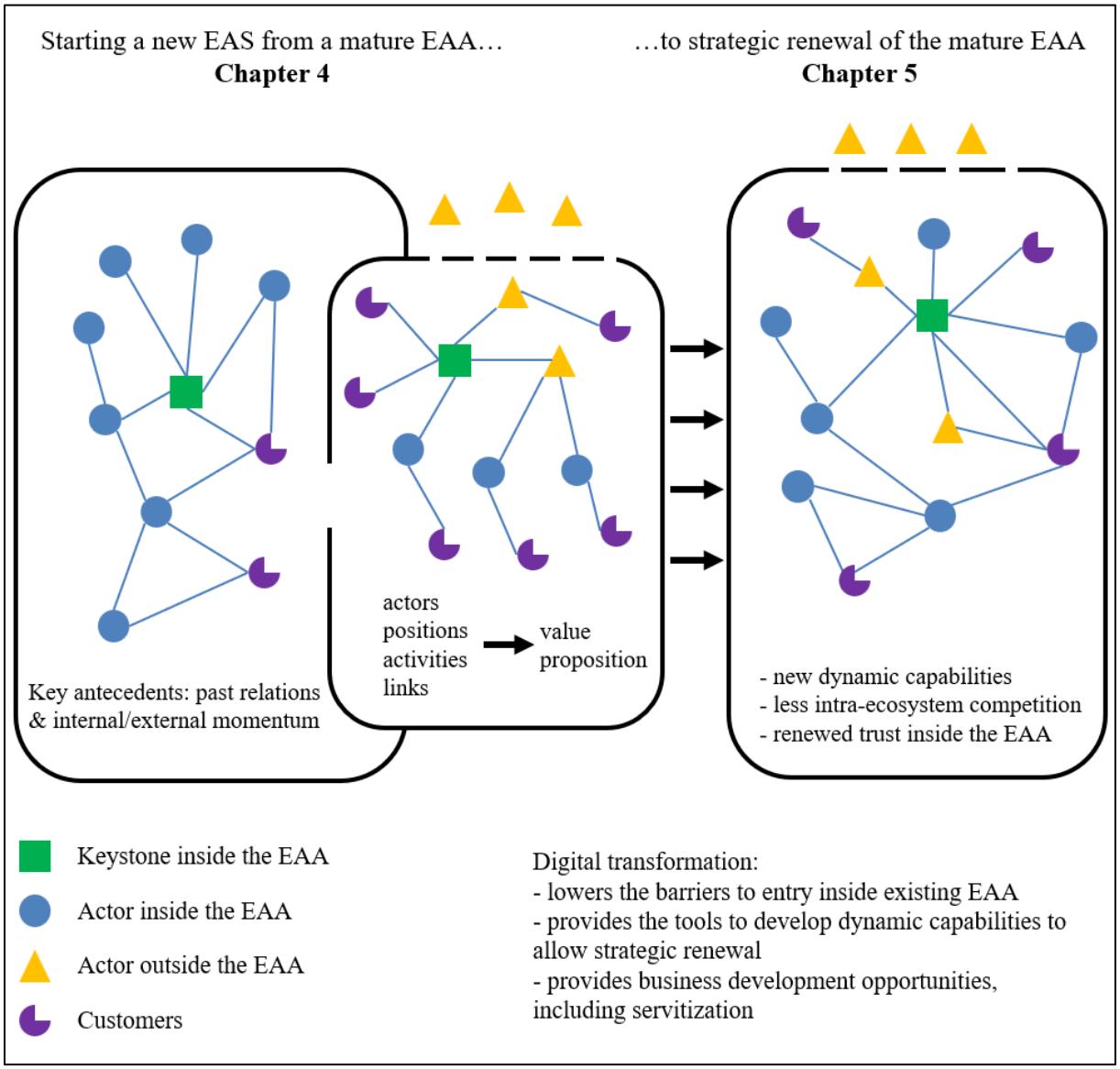
With a focus on business ecosystem formation (Hou & Shi, 2021), the study in Chapter 4 shows that competition at EAA level is not a strong antecedent to new EAS creation. Companies that start an ecosystem journey need to scan their current EAA to be fully aware of the landscape and dynamics, but they speak to every actor and consider them as potential partners for a new EAS development. They place more focus on what is outside the EAA, be that for opportunities or for threats because this is where the highest uncertainty lies. Competition can exist inside the ecosystem as well as outside the ecosystem (Gueler & Schneider, 2021). Adopting a dynamic analysis of business ecosystems shows why this competition dimension is not among the most important antecedents to be taken into account when creating a new EAS. All actors are

subjected to path dependence (Sydow & al, 2009) and when they have evolved in longstanding EAA, they cannot make important strategic moves without risking disturbing the whole ecosystem equilibrium.

Figure 28 is a synthesis of the outcomes produced in Chapter 4 and in Chapter 5. It shows how the development of a new EAS with roots inside an existing mature EAA can lead to strategic renewal of the EAA. With maturity of the EAA, the keystone actor risks becoming a dominator (Iansiti & Levien, 2004; Cobben & al, 2022). Surviving actors go on sustaining their competitive advantage but business development margins become scarce to a point when they threaten the equilibrium of their ecosystem. My study helps understanding how the new EAS development eventually impacts the whole EAA. Chapter 5 complements Chapter 4 and shows the differences between what was expected on the keystone side and what really happened after a few years. Airbus hoped to attract its whole EAA on its digital platform journey and realised that most historical suppliers were afraid of committing further.

Airbus became a keystone twenty-five years ago (See Chapter 3, Section 3 for details on Airbus strong development since 1973) and managed through time to strengthen its central position inside the EAA. They became an aircraft integrator and occupied the unique position between customers and hundreds of suppliers. They decided to start a digital transformation journey in 2017, to become more efficient. They saw an opportunity to share their investment for internal needs with external needs. Launching a big data platform was a costly investment, that could also be monetized. The study shows that actors inside the EAA who have no other EAA footprint are very cautious towards new EAS creation. They need to be convinced in the long run that they will benefit from this new activity. New value for the keystone inside the EAA has to come from outside the existing EAA.

Figure 28 Strategic renewal of mature EAA through EAS creation



The keystone has to create the new EAS and take the responsibility to bring value creation opportunities for existing EAA members. The focus on both internal and external momentums in the EAS creation process is mandatory to justify the required investment in the long run. The focus on external needs helps designing a new EAS that can bring value for the other EAA actors, but the leader of the new ecosystem should not expect financial return on investment in the short run. This relates to the extant literature on mature industries that are under heavy pressure to transform and tend to put a strong emphasis on efficiency (Cozzolino & Rothaermel,

2017; Onufrey & Bergek, 2020). This kind of context is a perfect ground for battles between new entrants and incumbents, where the latter can be seen as threats from other actors evolving in the same EAA (Kretschmer & al, 2020). My study confirms that potential complementors can easily give up their commitment to a new project if they fear that the keystone might become a dominant firm.

Strategic renewal (Agarwal & Helfat, 2009) of the existing EAA is happening through the incorporation of new dynamic capabilities (Chapter 5), ranging from new ways of working to improved customer centricity[17]. The new EAS thus brings new resources to the existing EAA and, in the long-run, business development opportunities that come along with new actors attracted inside the EAA, as shown in Figure 28. Digital transformation goes along potential technological discontinuities, and it happens outside as well as inside the EAA. A mature EAA is characterized by longstanding entry barriers that start to decrease. The traditional business done inside the EAA can become less competitive from the customers' standpoint. This is the threat for most industrial actors who can see their customers value more the use of the products than the products themselves. The creation of new EAS that is progressively fully integrated to the EAA enables the revitalization of the EAA. The risk of being commoditized (Adner & Lieberman, 2021; Cozzolino & Verona, 2022) can be significantly lowered by ecosystem leaders. This study brings new light on how to renew a leading position inside an existing mature EAA. New value can be created inside the ecosystem and barriers to entry can also be revigorated.

[17] Customer centricity is the ability of people in an organization to understand customers' situations, perceptions, and expectations (Gartner)

1.2 Business ecosystems to develop new dynamic capabilities for strategic renewal

In Chapter 5, I mostly focused on business ecosystem evolution and showed how a leading firm understands better where the value gains are. Cost avoidance and operational efficiency are the two most valuable outcomes, far away from new financial outcome generation. Servitization (Vandermerwe & Rada, 1988; Jovanovic & al, 2022) and digital servitization (Sklyar & al, 2019; Gebauer & al, 2021) are enabled by the creation of new EAS that exploit a big data platform. Services can be developed by manufacturing firms who collect and analyse data with a long-term perspective, but the business generated will never be as profitable as the core business of most industrial companies. All longstanding industrial actors fear losing their added value because of technological discontinuities (Cozzolino & Rothaermel, 2017; Onufrey & Bergek, 2020). When they evolve in a mature ecosystem as affiliation, the threats can come from inside and outside. New technologies lower the barrier to entry, new competitors can take market shares and customers become more demanding. Dynamic capabilities are needed to sense changes in customer preferences (Teece, 2007; Schilke & al, 2018). Developing services becomes an imperative to balance the business model but mostly to have a better knowledge of what the customers need and expect. Digital transformation has become an imperative for industrial companies (Warner & Wäger, 2019) and they need to start with a use of digital tools to improve their processes. I showed in Chapter 5 that dynamic capabilities are developed both at firm and ecosystem levels, to the extent that the development at the EAS level necessarily implies a development of those capabilities at the EAA level.

Digital transformation cannot be done at firm level (Jovanovic & al, 2022; Jacobides, 2022). This is a contribution of my study to show how the choice to engage in digital transformation goes along the development of a new ecosystem as structure. This strategic shift obliges a keystone actor to have a more positive impact on its surrounding environment. The basic concept of Skywise was to convince customers to share their data so that Skywise data platform

may start producing insightful analytics. It obliged Airbus to develop new skills to understand their customers. A contribution of my study lies in the longitudinal inquiry, and the understanding from Airbus team that digital servitization was hard to achieve. They wanted to sell affordable services and thought it would be easy to convince their customers to pay for the use of their data analytics platform. In Chapter 5, the findings show how Skywise teams realized that a great tool was nothing without capabilities to use it. Starting a new EAS thus allows the development of dynamic capabilities, that can be brought back into the EAA and rejuvenate the overall ecosystem. Skywise Solution is a whole agile big team, where five hundred people adopt agile methods to be more efficient and renew their operational skills.

Airbus' endeavour to embrace digital transformation led them to renew their customer focus and understand how they were perceived by other actors around them. They understood that they needed to help their partners at the EAA level, notably all their supply chain, so that they may make the most of their own capabilities' development.

They build dynamic capabilities for digital transformation starting a new EAS. This structure allows a lot of collaboration among people from different companies. The boundaries among companies even disappear because they work in integrated teams. In four years, many employees inside Airbus have upgraded their digital skills, even if they work in engineering and do not directly need those skills for their everyday job. This is an important outcome of the study, to see how Airbus spent a lot to encourage all employees to use Skywise platform to share data and try to create applications. The interviews made before Chapter 5 also show that some employees felt it was a waste to some extent but there was a need to embark everyone on the journey and it brought valuable ideas. This transformation allowed to break silos. The new EAS helps all employees inside the company to adopt a broader view and this also applies beyond the firm borders. This study displays concrete actions that can be led by industrial incumbents who are non-digital natives (Jacobides, 2022) and want to start a digital

transformation journey (Warner & Wäger, 2019), to advance their strategic renewal (Agarwal & Helfat, 2009). The adoption of new methods and procedures based on the use of digital technologies goes along the development of new dynamic capabilities (Teece, 2007).

1.3 Going beyond the internal & external focus for value creation

Chapter 4 showed that one of the two critical antecedents to launch a new ecosystem as structure (EAS) in a longstanding ecosystem as affiliation (EAA) was to make sure that there was internal and external impetus to start a new EAS. Safran data project was purely aimed at answering an external need. They knew that for established firms, the opportunity to anchor a new initiative with an internal customer is a "double-edged sword" (Adner, 2021). Longstanding actors that have kept growing, risk focusing too much on what happens inside their company. That is why digital transformation is an imperative, so that they may break the internal silos and connect better to their environment, be that inside or outside their EAA. The failure of Safran project however shows that an internal need is also mandatory to keep receiving the necessary funding for such an uncertain project.

Considering an external impetus is furthermore necessary to develop the required dynamic capabilities to create a successful new ecosystem, but it does not necessarily mean selling new products or services to customers. My study shows that servitization (Jovanovic & al, 2022) plays a key role in the connection between internal and external focuses; it can bring financial performance but focusing on this objective could even be counterproductive in the short run. There is still uncertainty on this point, because financial value means that many people are ready to pay little money. This is hardly applicable in a B2B industrial market where customers are not numerous. It could however bring some opportunities in the long run, if value is created in a B2B2C dimension. Airlines who are the main customers of Airbus, develop their dynamic capabilities when they agree to take part to Skywise ecosystem. They improve their operations

and thanks to those skills, they develop new offers for their own customers. It is highly uncertain, and it will take time, but this is the only way for Airbus to consider financial value creation.

Most studies of servitization are firm centric and there was a need to adopt an ecosystem and value system approach (Forkmann & al, 2017). This focus on the ecosystem level requires to start with an understanding of what value can be. If one only considers profit generation, it necessarily leads to competition among companies. The ecosystem approach revolves around joint value creation. I showed that revenue generation was only one component of value creation, the two others being operational efficiency and cost avoidance. This new value is the outcome of a new common commitment from actors that were not necessarily partners in other configurations in the past. A keystone company has to take the lead and find a way to combine its internal and external needs for development. This combination is necessary to sustain the required investment in the long run. Servitization is thus a component of strategic renewal for mature industrial actors and my study shows how servitization needs to be studied with an ecosystem approach. The development of services is an outcome. Incumbent industrial actors need strategic renewal, they adopt a digital transformation journey, start a new EAS, develop new dynamic capabilities. All these steps empower them to upgrade their processes and become better at their core product-centric business. Following the better connections they have with the other actors in their EAS as well as EAA, they can in a second step develop new services and potentially generate new revenues. This study can help understand why some manufacturing companies do not succeed with servitization (Feng& al, 2021). Instead of switching the focus from product to services innovation, industrial firms should focus on creating and delivering new value for their customers (Cenamor & al, 2017).

A digital transformation journey can result in the creation of a digital platform that can either be intra-firm or inter-firm focused (Cenamor & al, 2017; Tian & al, 2021). Chapter 5 shows

that there is a way to develop a platform that can serve internal and external needs at the same time. The first focus is on internal needs because the uncertainty is too high on potential revenues generation with a focus on external needs. This approach however drastically reduces the cost of adjusting the platform to address potential external opportunities.

The study of Safran project in Chapter 4 showed how they based their development on a stronger focus on external dynamics, be that for outcomes of the ecosystem but also for the governance of the ecosystem, in comparison to Skywise project. It is shown in Chapter 4 that they wanted it to be shared among three or four leading actors, which eventually turned out to be too complicated. My study does not show any sign of potential shared leadership for a new ecosystem creation. Safran executives felt Skywise project was too Airbus-centric and that it would deter potential partners from getting involved. Airbus is however on its way to have providers, partners, app designers who use the platform without their help, which is strengthening their leadership as keystone inside the existing EAA. This is a clear contribution to the topic of ecosystem governance (Adner, 2017; Kretschmer & al, 2020) and governance structure (Lingens, 2021). Partners need to be attracted to commit to the new alignment structure but an ecosystem is more than a collection of risk and revenue sharing agreements.

Another contribution of my study is to bring a clearer view on how to separate core business investments from new business based on services. Skywise new EAS started focusing on internal needs before addressing external needs and aimed at improving the core business. The first expected outcome was towards operational efficiency and cost avoidance. In order to achieve a minimum level of data continuity, Airbus needed to collect the data of around 50 % of the flying Airbus aircrafts. After a birth phase that required high expenses, mostly to pay partners' commitment, investments have been rationalized after four years. Even if it still costs a lot, it was a learning phase. Skills were developed and Skywise platform development has been operational since January 2018 (see Chapter 5, Section 3.3.3). The ecosystem as structure

is starting its growth phase with a strong structure that allows to assess incoming new projects, on the value they generate. Those projects can have an external or an internal focus and the teams, as well as the platform are dimensioned to handle them all.

The last contribution of my study has been on the methodological aspect because I chose to overcome the single party blindspot (Lumineau & Oliveira, 2018) and looked from the start to get in touch with actors of the ecosystem that had external and potential contradictory perspectives. Ideas from interviews of partners, customers, competitors and advisors, as well as with people directly involved on Skywise ecosystem tend to merge with time. That shows that uncertainty is fading. Airbus has led a successful digital transformation and wondered to what extent they could improve operational efficiency, reduce costs and generate new revenues. They understood that revenue generation would be very limited, in comparison to their core business of selling aircrafts, and could hurt their whole ecosystem as affiliation health. Airbus has kept on strengthening its leading position over the last fifty years and they have partners, such as airlines, who strive with much more unstable situations. An airline that is struggling not to go bankrupt will not hire artificial intelligence experts to analyse data with Skywise platform. Airbus wanted to understand its sold products better, in order to sell more products and sell new services. Instead, their digital transformation journey led them to know their customers better, but also to help them cut costs and improve their operational efficiency.

Overall, the findings of this thesis contribute to enhancing extant knowledge of business ecosystems, thanks to a dynamic adoption of two complementary lenses: ecosystem as affiliation and ecosystem as structure. Longstanding industrial firms need to start digital transformation journeys and launch new ecosystems as structure so that they may bring more business development opportunities inside their ecosystem as affiliation and displace competitive threats outside their EAA. My study however goes beyond the development of

theory on business ecosystems because this concept is intertwined with several other constructs, at the intersection of inter-organisational relationships and competitive dynamics.

Section 2 Transferability

My study tackles a lot of topics that combine with the concept of business ecosystems and help getting a broader understanding of strategic renewal and competitive dynamics.

Chapter 4 focuses on the first steps of a new EAS creation, when two successful companies scan their environment to decide which activities and which partners they need to attract for their new project. This position towards competition can be transferred to any business and size of companies. There must always be development and innovation teams that spend part of their time meeting actors evolving in the same ecosystem as affiliation. Innovation can start from that openness. Business developers should always take time to think beyond their current daily business and wonder what business opportunities can be initiated, with one or with several other actors. Discussions can be started about business prospects, complementarities, current strengths and weaknesses, so that new opportunities may emerge.

This open approach to coopetition (Brandenburger & Nalebuff, 1996; Shu & al, 2017) needs to be balanced with the focus to keep enough investment on a firm's core business. My study led me to observe how Airbus launched its big data analytics platform and to observe how some executives inside the digital transformation office considered that the shift to digital servitization should even be stronger than it was. It was in Chapter 4 and the view had evolved three years later (interviews used for Chapter 5), when the teams had understood which new business development would be possible and at what cost. The cost is not only about financial investment but mostly about what skills portfolio has to be available. Every business has a **core business** that generates most of the value, requires most of the internal focus and for which the

company is known. Trying to adjust this core is always a bet. Digital transformation brings opportunities for new business development, but it can require significant adjustments of a firm's operational capabilities. Servitization for example usually demands a 24-7 availability and to improve customer interface for industrial actors (Baines & Lightfoot, 2014). Adopting an ecosystem approach can be a low-risk approach to develop new skills and test the market before adopting broader strategic shifts.

This study is also insightful on the **blueprint definition** (Dattée & al, 2018; Lingens & al, 2021) and **dynamic capabilities** dimensions, that can be useful to any business. Individuals inside a company are seldom consulted when it comes to question new potential value propositions and associated structures of governance. Chapter 5 shows how the new ecosystem is structuring its development and how new capabilities are developed around the Skywise Solution. Companies need to question their strategic positioning in order to renew their models. It can often be done with an agile approach. Uncertainty exists and cannot be reduced without making mistakes and taking risks. Those downsides can however be limited with flexibility. Skywise Solution started in January 2018 as a team of 60 people split in 6 teams that needed to deliver outcomes every two weeks. In two years, they grew from 60 to 500 and when covid crisis burst, they downsized to 250. Part of this flexibility is possible because the teams mix Airbus employees and suppliers' employees. This "fail fast" approach is also achievable for most businesses. It can even be an effective set-up to break the daily routine, bring workers from different units to work together and get them to understand better the long-term strategy of their company.

Another transferable outcome is about **customer centricity** to favour the overall health of an ecosystem as affiliation, especially in a B2B context. Customers need to be taken into account because they are the users of sold products and services. Digital technologies allow the collection of large amounts of data and companies that do business with other companies need to wonder how they can help their customers do better with their own customers. In the short

run, it can have positive impacts on their relationships and in the long run, it can bring new business opportunities. This is linked to the concepts of keystone or dominator strategies. Companies should always look for ways to develop their business and allow the actors evolving in the same ecosystem to also strengthen their position, as long as it is not contradictory. This will increase the trust among actors. This relatively altruistic position however has to be combined with a focus on bottlenecks (Jacobides & al, 2016; Hannah & Eisenhardt, 2017) and keeping a strong bargaining power. Skywise certified partners agreements are exemplary because they show how Airbus brings business to partners and leaves them freedom to use Skywise platform to generate value. Airbus however always chooses four to five partners for each subproject. This is a way to make sure that their performances can be compared and that none of them ends up becoming more powerful than Airbus in the EAA.

Section 3 Managerial implications

My focus has been on mature industries which is a very specific context, but all companies look for growth, innovation and target a sustainable strategic position in their environment. This study adopts an historical and longitudinal approach that can be insightful for managers who deal with industrial environments, where they wonder how to collaborate with competitors or how to deal with digital transformation. Managers can always adopt an historical approach to be more aware of their working competitive environment. Each company belongs to an ecosystem as affiliation, where some actors play a keystone role and some others adopt complementors' positions. Meeting those actors and discussing the past, before tackling potential future collaborations is a first step to understand what complementarities could be valued.

My study was led at the ecosystem level, but all strategic decisions are made by individuals, who first focus on firm level impacts. Going back to this individual level shows how difficult it can be to get involved in the long-run and to keep continuity in the work of boundary spanners. Boundary spanners are key representatives who engage in activities that are at the boundary of their organizations. They have two primary roles of information processing and external representation (Aldrich & Herker, 1977). They are often middle managers who exchange information and help their organization develop their dynamic capabilities (Haas, 2015). They thus play a unique role that requires cautious to be shared among their organisation in the long run. Safran case showed how several years of innovation and collaboration could be threatened because those activities rely on individuals. This is not the core business of the firm so they appoint small dedicated teams and there is a need to build an interfirm dynamic. This relies on individuals and when the uncertainty is high, those individuals also have opportunities to change jobs and need a strong vision to keep the right level of commitment. When the internal focus of the project is lighter than the external focus, it can kill the project. The managerial implication goes beyond the mere context of business ecosystems and applies to all innovation projects that imply a focus on the external environment of the company. The top management of the company needs to commit and give long-term prospects so that the operational teams keep engaged.

Section 4 Limitations and suggestions for future research

Several dimensions emerged from my study than can be explored further in future studies.
My results show that it is possible to create a successful new ecosystem as structure based on an existing ecosystem as affiliation, provided that the structure is based on a blend of historical partners and new actors. I also show that a strong leadership from one company is mandatory

to sustain the required investments for the new ecosystem inception. New ecosystems creations should be further explored with a specific focus on those two dimensions of how partners are chosen and of single company leadership. On the first dimension of complementarity, ecosystem developments should take into account a thorough understanding of the regulatory environment and how changes might happen in the coming future, which might affect the competitive landscape (Jacobides, 2022). This aspect might be searched further in future qualitative studies on ecosystems, to the extent that it might considerably increase or decrease the attractiveness of some potential complementors. On the second dimension, Chapter 4 showed that it was not possible to have a shared leadership. I however only observed two projects, and there might be a shared leadership after an inception led by a single actor.

The study in Chapter 5 brings insight on what value is at the ecosystem level, how it can be created with a broad view that goes beyond the traditional focus on internal or external needs. In line with the research on digital servitization, I showed that financial outcomes were hard to achieve and wondered to what extent there could be long-term financial value for the keystone that helps its customers using the new ecosystem as structure. Following the study to explore potential B2B2C business models can be insightful.

Future research could explore the impact of ecosystems creation in the context of mature industries, with a focus on the negative impacts on the environment. When a new value proposition is created, when there is business model innovation, there might also be some value destruction for other actors involved in the ecosystem as affiliation (Snihur & Bocken, 2022).

My study can be continued, to see if the development of those dynamic capabilities can lead to explore new businesses beyond the boundaries of the usual ecosystem as affiliation.

The results of Chapter 4 led me to explore the concepts of digital transformation and servitization before going further on the topic of dynamic capabilities for strategic renewal. It

would thus be interesting to seek cases were new ecosystems are created and check whether the key results are found again.

It might be interesting to study further the competitive dynamics inside the EAA, to see in an even longer term how the partners to the keystone manage to generate new business.

As a conclusion, I would put forward that firms evolving in mature environments need to adopt an ecosystem approach to renew their strategic position and improve the prospects of their whole ecosystem as affiliation. Actors who have been in a leading position for a long time risk needing to sustain their competitive position at the expense of other actors evolving in the same ecosystem. Adopting an ecosystem strategy will lead them to attract new partners from outside their usual environment, develop new dynamic capabilities and prevent them from becoming dominators inside their ecosystem. Digital technologies provide opportunities for new capabilities development, so that commoditization may be avoided. Most importantly, digital transformation and agile new ways of working, combined with the will to create a new ecosystem as structure forces a leading company to generate value at the ecosystem level. A keystone can thus strengthen its long-term strategic position, as long as it finds a balanced split between investments on core business and new activities development. Value creation is an outcome of ecosystem as structure creation and servitization can be an outcome, but value will mostly come from increased operational efficiency and better understanding of the customers.

I hope that this doctoral dissertation contributed to the understanding of business ecosystems and will motivate new research that will jointly take into account the ecosystem as affiliation and ecosystem as structures lenses.

Annexes

Phase 1 interview guide

Warm-up questions, about the person I interview, his/her job, history inside the company, what does his/her department does:
What is your current job?
What did you do before?
What is the history of your company, department, unit?

Questions about the ecosystem as affiliation landscape and about competition:
What kind of partnerships does your company have?
What is your position towards competition?
Who are your main competitors?
Do you sometimes consider your partners as potential competitors? In which context?
Are you aware of initiatives to develop joint new innovation projects or business models, inside or outside your company?
How would you define the level of competition that your business currently faces?
How did this level of competition evolve over the last years?
How do you see the current position of your company in the industry?

Questions about growth prospects, value creation and value sharing:
Which products and services does your company sell?
What is or what are the main business models?
Who are your customers? What do they expect from you?
How did your business model evolve through time?
How do you define value creation?
How do you see the coming future for your division?
What is the position of your company in comparison to the other main actors of the ecosystem?

Questions about the new ecosystem as structure development
What is your knowledge about the ecosystem development?
Would you define it as a platform?
What is your view on the balance between internal and external focus?
Was there a will to address both internal and external aspects from the start of the project?

Questions about partner relationships
What kind of contracts do you have with your partners?
What is the scope, commttment, length of the contract?
What was done by partners involved in the new ecosystem creation? What did you expect from them and what did they expect from you?

Phase 2 interview guide

Personal thoughts about the ecosystem as structure development and performance:
Inside the company, what were your thoughts about the project?
What have been the different development stages of Skywise platform?
What are the investments made to develop the platform? Who takes the risk?
From your point of view, would you say that Skywise has been a success? Why?
For you, what are the main KPIs to assess Skywise performance?
Over the past two years, how have you seen the project evolve?
Is there clarity about the direction you are heading in?

Questions about business model and value creation?
How would you define value creation inside your company?
To what extent are your partners playing an important role for this value creation?
What is the share of services in your current business?
What are Skywise teams currently doing?
Which actions are lead towards the outside, for development?
Is there a relation between growth targets on the product side and on the service side?
Do you have some actions towards your customers to understand which new services you could develop to meet their needs?
To what extent do you discuss value creation and sharing with your partners?
Is that sometimes discussed with your customers? Is there a will to help them create value?
Who are your customers?
What do they expect from you?

Questions refering to digital transformation process, adjustment of processes:
What do you know about the Digital Transformation Office delition? Do you think it was the good timing?
Do you think Skywise helped accelerate a mindset change internally? To what extent?

Questions refering to servitization and digital servitization:
Do you know when the topic of services is tackled in discussions with customers?
How would define the development of services inside Airbus?
What is your competitive positioning on services with your core product usual competition (Boeing)?
Who is developing applications for Skywise today?
Which data do you analyse? Where does it come from and how do you access it?
Do you know how much turnover is generated by services?
Are there some targets of development and a will to balance product and service shares?

Questions about capabilities & human resources:
How did your human resources evolve since the creation of your company (for start-up)?

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Résumé

Les écosystèmes d'affaires sont étudiés depuis trente ans et cette perspective d'analyse peut désormais s'appliquer à la plupart des industries. Les écosystèmes deviennent des structures populaires pour collaborer avec plusieurs acteurs et développer de nouvelles capabilités. Ils peuvent contribuer à l'innovation et au renouvellement stratégique d'une entreprise. Ces réseaux interdépendants d'acteurs créant ensemble de la valeur, peuvent être étudiés selon deux perspectives. L'approche par les écosystèmes comme affiliation, ou ECA, s'intéresse à la communauté économique d'acteurs qui interagissent pour faire évoluer ensemble leurs capabilités. L'approche par les écosystèmes comme structure, ou ECS, se concentre sur la structure d'alignement que des partenaires créent, pour faire émerger une nouvelle proposition de valeur. Mon étude vise à adopter ces deux perspectives conjointement, pour montrer comment des sociétés évoluant dans des industries matures peuvent utiliser des écosystèmes, pour enclencher leur renouvellement stratégique, renouveler leur modèle économique, tout en renforçant durablement leur avantage compétitif. Adopter de telles structures de collaboration innovantes est de plus en plus facilité par le développement des technologies digitales. La transformation digitale est une opportunité pour les acteurs industriels historiquement en position de force, qui peuvent créer de nouveaux ECS, afin de développer des capabilités dynamiques au niveau de leur écosystème. Ils peuvent ainsi redéfinir leur positionnement stratégique vis-à-vis de leurs partenaires et de leurs concurrents. Cette thèse contribue à la littérature sur les écosystèmes d'affaires par une étude empirique longitudinale. J'y explore la façon dont l'environnement d'un ECA influence la création d'un nouvel ECS, avant que ce dernier permette l'évolution de l'ECA construit dans la durée.

Mots-clés : écosystèmes d'affaires, écosystème comme affiliation, écosystème comme structure, renouvellement stratégique, capabilités dynamiques

Abstract

Business ecosystems have been studied for thirty years and this lens of analysis is spreading to all industrial sectors. Ecosystems tend to become mainstream structures to collaborate with several actors and develop new capabilities. They can play an important role for the success of a firm's innovation strategy and strategic renewal. Those interdependent networks of self-interested actors jointly creating value, can be observed with two perspectives. The ecosystems as affiliation approach, or EAA, considers the ties among actors, the economic community of interacting organizations and individuals who coevolve their capabilities. The ecosystems as structure approach, or EAS, focuses on the alignment structure that is designed by partners so that a new value proposition may materialize. My study aims at jointly taking those two perspectives into account, to show how companies evolving in mature industries can resort to ecosystems to foster their strategic renewal, renew their business models, and strengthen their long-term competitive advantage. Adopting these innovative collaboration structures is increasingly enabled by the surge of digital technologies. Digital transformation provides opportunities for historical leading industrial actors, who can create new EAS to codevelop dynamic capabilities at the ecosystem level, renew their strategic position among partners and towards competition. This dissertation contributes to the literature on business ecosystems through a longitudinal empirical study. I explore how an EAA environment influences the creation of a new EAS. This new EAS will then also contribute to the evolution of the longstanding EAA.

Keywords: business ecosystems, ecosystem as affiliation, ecosystem as structure, strategic renewal, dynamic capabilities