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

Brémaud, Thibault

Université Toulouse 1 Capitole/Toulouse School of Management

Thibault.bremaud@tsm-education.fr

Résumé :

Les écosystèmes d'affaire sont étudiés depuis trente ans, dans la continuité de recherches portant sur les relations inter-organisationnelles ou les alliances stratégiques. Malgré l'existence de plusieurs revues de littérature exhaustives, différentes définitions de ce qu'est un écosystème d'affaires coexistent, centrées principalement sur une proposition de valeur, ou sur l'interdépendance d'acteurs évoluant dans un environnement commun. J'étudie l'émergence de nouvelles propositions de valeurs dans un contexte d'industrie mature. L'historique des relations entre les acteurs impliqués a un impact sur la façon dont de nouvelles structures se constituent. Je mène une étude qualitative et inductive avec deux études de cas. J'étudie l'émergence de deux propositions de valeur portées par des acteurs historiques de l'industrie aéronautique européenne. Cette étude contribue à la compréhension des écosystèmes d'affaires et du renouveau stratégique d'industries matures. J'apporte des éléments de réponse au pourquoi et quand des acteurs vont s'aligner pour permettre l'émergence d'une nouvelle proposition de valeur. Je suggère enfin un classement de huit antécédents permettant ce type d'émergence.

Mots-clés : Ecosystem as structure, Strategic renewal, Path dependence, Mature industries, Ecosystem antecedents

1. INTRODUCTION

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, 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 *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 antecedents to a new ecosystem 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 field 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.

2. THEORETICAL BACKGROUND

2.1 Ecosystems

The traditional model of the firm that would be integrated with its hierarchical supply chain is now often replaced by ecosystems where dynamic groups of largely independent partners work together to deliver integrated services or products. An ecosystem can either be special arrangements of actors around a specific product or value proposition, be that for innovation or knowledge-sharing purpose (Adner, 2006; Pierce, 2009; van der Borgh & al, 2012; Adner & Kapoor, 2016; Jacobides & al, 2018), or as loose networks of different kinds of actors who share the fate of their network (Iansiti & Levien, 2004; Moore, 1996; Teece, 2007; Edouard & Gratacap, 2010). For Iansiti & Levien (2004), "ecosystems are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival" and "most companies today inhabit ecosystems that extend beyond the boundaries of their own industries". 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). There is a 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, in the article, I use the definition given by Adner, who 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).

I adopt this 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).

This definition entails two complementary dimensions that need to be explored further regarding the 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.

There is now a consistent research literature about ecosystem strategy (Moore, 1996; Iansiti & Levien, 2004; Adner, 2006; Dattée & al, 2018) which starts from the point that most innovations do not stand alone. They depend on accompanying changes in the firm's environment for its own success. Therefore, an ecosystem strategy has to take into account many interconnected pieces and players. The strategy literature suggests that ecosystems lead to competitive advantages for each of the partners in the ecosystem (Clarysse & al, 2014).

Iansiti & Levien (2004) described how firms like Walmart and Microsoft developed competitive advantages building a business ecosystem around their value proposition. This completes Gawer and Cusumano (2002) who refer to multinationals in the digital economy, which adopt the strategy to manage innovation through their ecosystem as 'platform leaders'.

Most businesses share the goal to capture value following a step of value creation (Jacobides & al, 2006). For an ecosystem to allow such an outcome, there is a need to align several actors, to have them invest time and resources and to evolve in an uncertain context (Dattée & al, 2018). 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. 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).

2.2 Antecedents to a new ecosystem

Actors within an ecosystem and roles they may play

Shipilov & Gawer (2020) 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.

Authors such as Iansiti & Levien (2004) stressed the role of ecosystem managers, "hub" or "keystone" firms, as the providers of stability (Jacobides & al, 2018). The presence of an architect 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). It 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.

Constituting an industry's ecosystem are producers (including suppliers, competitors and complementors) from the supply side, distribution channels and consumers from the demand side, and regulators and other interested stakeholders from the institutional side (Ansari & al, 2016). Those roles can be taken by several actors 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. What past research also does not indicate is how many partners a new ecosystem should gather.

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, reevaluation 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 the internal momentum is a necessary antecedent for the external momentum, which is essential for an ecosystem creation.

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. 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).

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 multipartner 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, 2017) 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.

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. This starts with the definition of the blueprint during the construction phase of a new value proposition.

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). 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).

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).

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. 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.

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 would 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, which stated that organizations within the ecosystem were not hierarchically managed, the risk might be to sacrifice efficiency for flexibility. I will thus see in my empirical research 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.

Figure 1 synthesizes the position of a new ecosystem as structure towards an ecosystem as affiliation and shows which antecedents should be observed to understand better when and why actors get involved in a new ecosystem. Several of those antecedents have been borrowed from literatures that are close to the ecosystem literature, such as strategic alliances, interorganizational relationships and networks. Therefore I need to check if they really apply to ecosystems as well. I will also explore if some other antecedents might be important to include and whether they can be ranked along their respective weight. Eventually, I will see if they should be considered in a specific sequence.

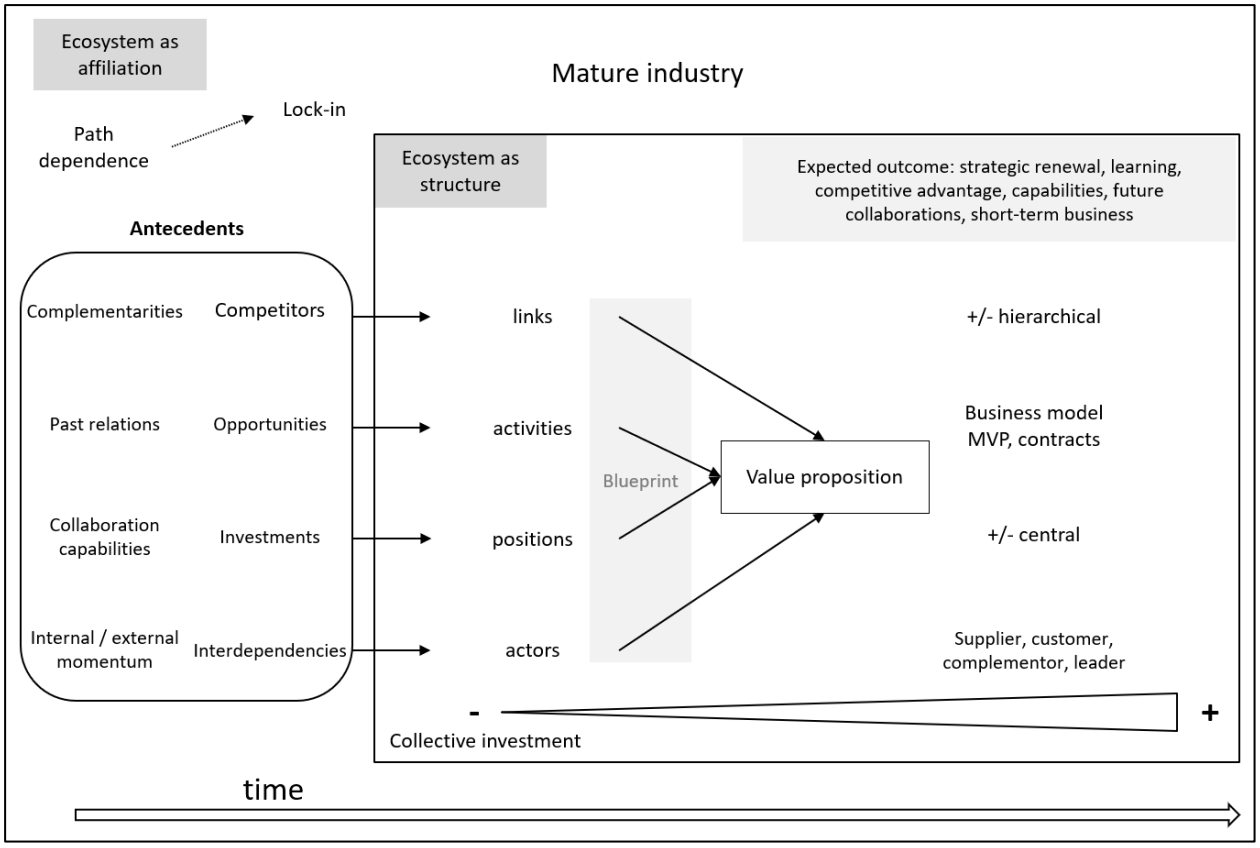

Figure 1. Antecedents to a new business ecosystem in mature industries

3 METHODS

Research design and context

Given the limited theory and evidence produced so far on business ecosystems in the particular context of a mature industry, I conduct a theory-building, multiple case study (Eisenhardt & Graebner, 2007). 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.

I consider the creation phase that happens before the first visible steps of a new value proposition. The two case studies I focus on are both in their early stages. Airbus started Skywise business in 2017 but as an internal activity. It currently has no independent structure. The second case I study is the initiative launched in 2019 by Safran and several other players to start a new ecosystem to exploit the value of data and offer services to airlines.

I first lead 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.

Data sources and collection

I use two main data sources: interviews and archival data. 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. To gain an in-depth understanding of the ecosystem strategies in the organizations, I collected data during visits to the organizations. 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, 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.

My interviews have three sections. The first covers the informant's background and role. The second is 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 is to understand major ecosystem management processes and how they are reassessed depending on their achievement or not.

The third section goes deeper in the ecosystem reality and the relationships among actors. I always explore topics that arise in the interview.

Interviews lasted between 45 and 120 minutes, were recorded then transcribed. Where necessary to fill in gaps, I use follow-up interviews and emails. I also use 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.

The interviews with non-focal firm participants allow me to triangulate insights. Complementors bring an insightful point of view regarding efficiency within the company.

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

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 inductive study to try to understand which options are considered by a focal firm along its strategy making process.

At the end of an interview, when I consider it would be useful to meet again later, I always ask when there should be following steps achieved and it would be interesting to meet again, so that I always set a following meeting with my interviewees, before leaving them. I also always ask my interviewees if they think of someone else I should contact to have more insight on my topic of research.

phase 1 - exploration				**phase 2 - case studies**			
primary data			**secondary data**	**primary data**			**secondary data**
management informants				**management informants**			
interviews	**key people**	**companies**		**interviews**	**key people**	**companies**	
5	President, Programme manager, R&T manager	Dassault Aviation	annual reports	3	Business strategist	Airbus	annual reports
2	Strategy communication VP, programme manager	Airbus	Xerfi studies	5	Programme director	Safran	Xerfi studies, customers video testimonies
2	Programme director, business development director	Safran	newspapers articles	1	Director	Sopra Steria	newspapers articles
			press releases				press releases

Table 1. Sample and scope of data collection

Data analysis and theory building

I used grounded theory (Glaser & Strauss, 1967; Charmaz, 2006) to analyze my data, following three primary steps. First, using interviews and field notes, I use open coding to capture informants' meanings of their work, organization and perception of ecosystem reality. I generate codes from the raw data and continue to add and refine codes as I progress through the data multiple times.

I revise my codes iteratively, moving among existing data, new data, and the literature (Locke, 2001). I also engage in constant comparison by comparing data across participants while allowing the emerging analysis to benefit from my interpretation (Charmaz, 2006). I then move to more theoretical abstraction by creating second-order themes to identify relationships among first-order codes.

Finally, I use 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 is 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 pictures my empirical observations but also to develop theory outside of the immediate context.

Third, I test 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 check with key informants about my developing ideas and ask for feedback (Lincoln & Guba, 1985). I use several data sources to check key interpretations and create tables to provide additional empirical support to the quotes I include 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).

It is important to question every actor to see what they think the other actors within the ecosystem expect from it and for how long they should be involved. I opted for qualitative data collecting, focusing on different kinds of actors, from different companies and asking them about their companies but also about the other companies in their environment.

After having reviewed the literature on business ecosystems and defined key drivers and antecedents to a new BE, I have then adopted an inductive approach to synthetize the raw data I had collected.

4 FINDINGS

This case is unique because it is seldom to have access to 2 potentially competing value propositions in their creation phases.

4.1 Antecedents and historical elements

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.

Airbus and Safran 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.

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.

4.2 Data structure and cases overview

Figure 2 is the data structure that emerged following my data exploitation that stresses four aggregate dimensions of key antecedents to new ecosystems.

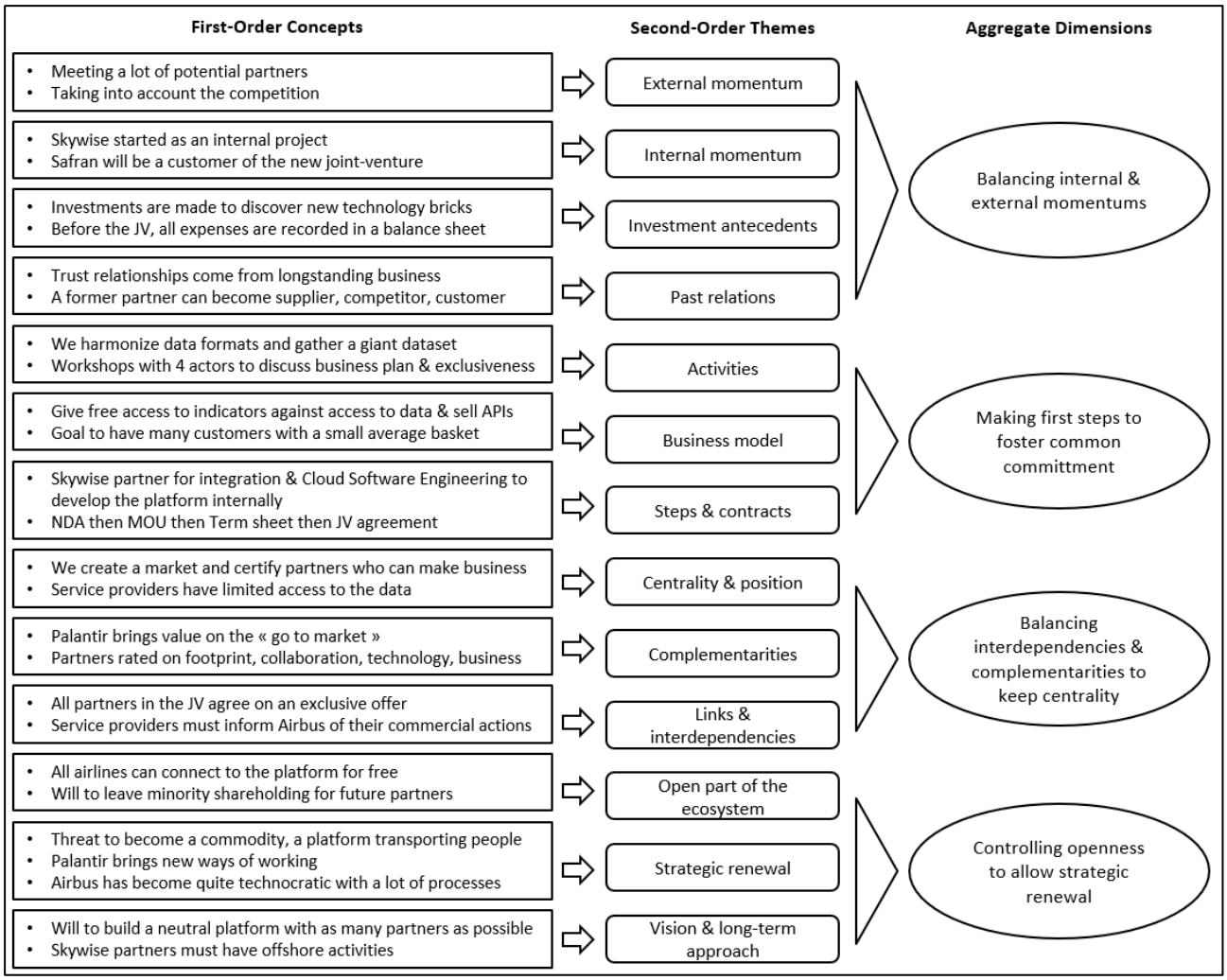

Figure 2. Data structure

Table 2 introduces the main features of the new ecosystems that Airbus and Safran have been launching since 2017. Both projects are new ecosystems because they gather actors with different degrees of commitment and strive 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."

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.

	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

Table 2. Comparison of 2 new ecosystems

4.3 Antecedents to an ecosystem structure

Balancing internal and external momentum

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.

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."*

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*."

"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 competitors."

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'."*

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." 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."*

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

Making first steps to foster common commitment

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."*

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."

They are in the blueprint definition phase (as defined by Dattee & al, 2018) 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."

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."*

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."

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."*

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."*

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." 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."* 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." It thus appears to be a smart move to bring value to traditional customers as long as they share their data.

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."*

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

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."*

"Palantir deployment strategists have the mission to find value for their customers, they have technical and business strong skills."

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."

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

Safran rated all potential partners on "*footprint, location, international position, brand image, collaboration capabilities, technological inputs and business aspects*." 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.

Controlling openness to allow strategic renewal

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. 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"*) 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*."

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."*

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: "*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*."

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 3 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.

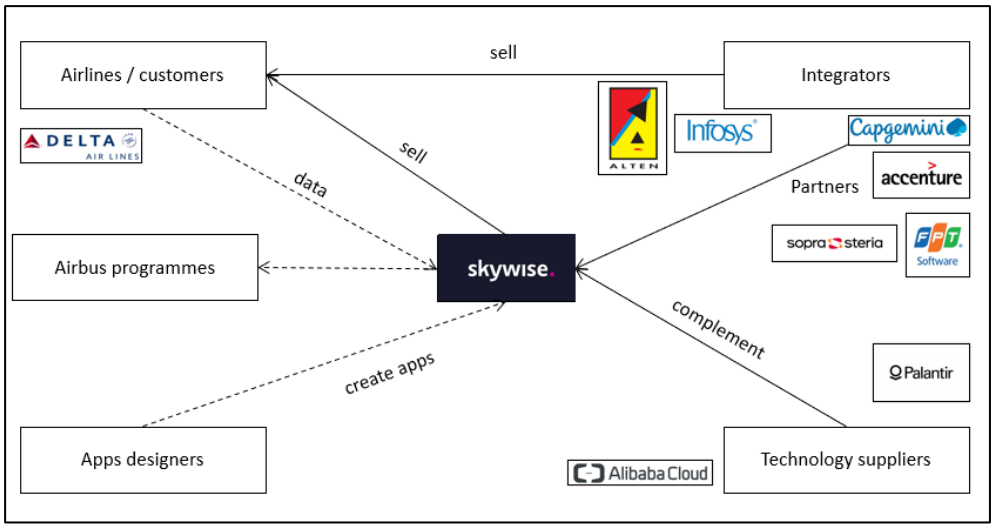

Figure 3. Airbus Skywise ecosystem

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."*

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.

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."* 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."*

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*."

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."*

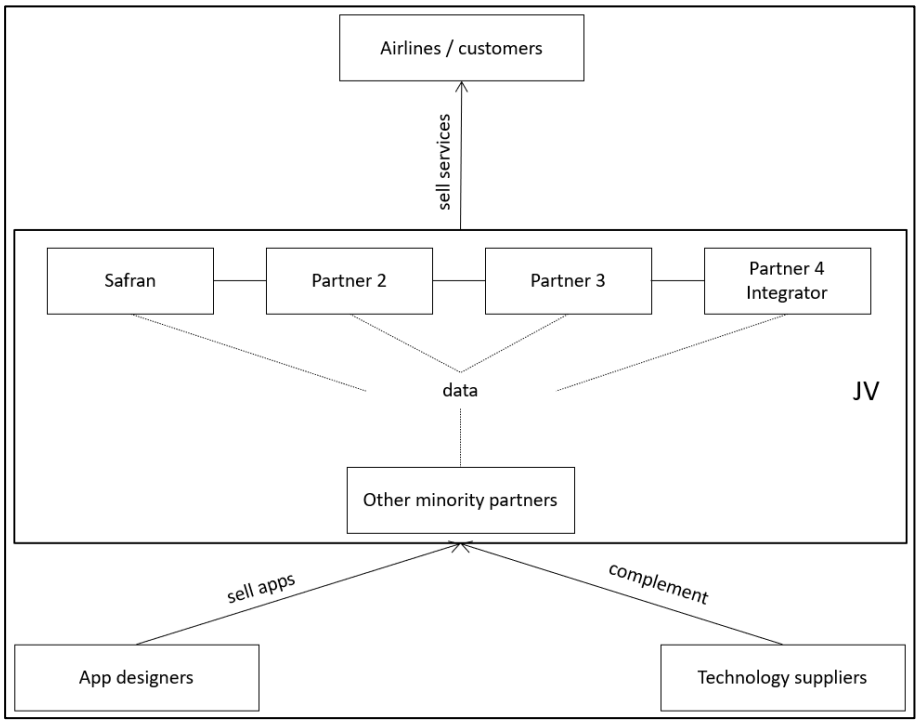

Figure 4. Safran Data ecosystem project

Ranking the antecedents

All antecedents identified in Figure 1 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.

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."*

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."*

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. Following Jacobides & al (2018), 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*." 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 dependency and to favor 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."*

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."*

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*." 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."*

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."*

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)."

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."*

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."*

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 we 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."* 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."* 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."* 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."*

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."* 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 (Dattée & al, 2018), 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.

Table 3 gathers the ranking of the eight main antecedents I identified and compared.

Rank 1 antecedents	internal / external momentum	past relations
Rank 2 antecedents	complementarities	opportunities
Rank 3 antecedents	competition	collaboration capabilities
	interdependencies	investments

Table 3. A ranking of the antecedents to a new ecosystem as structure

5 DISCUSSION

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 fix 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 my interviewees, "*the aeronautical world is small, we have to learn to be customers, suppliers, partners, competitors of each others."* 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 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. A strong internal momentum should allow a rather centralized leadership of the new ecosystem, while a motivation to invest based on a rather external momentum oriented new ecosystem would rather demand a shared leadership of the ecosystem. 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 multipartner relationships. As long as I have focused on the creation phase, my study will be much more insightful in a few years, when both ecosystems have evolved in autonomous businesses. Some longitudinal

observations are thus required, at least over two more years and probably rather over five more years. The covid crisis has indeed frozen the pace of development of such innovation related projects.

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 could hinder strategic renewal and on this point also, my study only brings partial answers because we 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 are “non-hierarchically managed” because part of the structure is opened, there is a mitigation of uncertainty in the choice of a portfolio of heterogeneous relationships.

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