External Venturing
in the Dutch Aviation industry
by
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in the Dutch Aviation industry

by

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Preface

After graduating from my Bachelor degree in Aeronautical Engineering, I embarked myself into a new journey of doing the Management of Technology master program at the Delft University of Technology. I wanted to complement my engineering background with 'management know-how' to have a broader perspective on how to look at problems and find solutions to them.

During the course of this program I started to develop an interest in entrepreneurship and took several courses in this field of study. Also I decided that I wanted to complement this knowledge with practical experiences and decided to start a new business myself. My interest in aviation, combined with this interest in entrepreneurship, eventually led me to dedicate my master thesis on both topics: corporate venturing in the aviation industry. Before you lies the final report of what is the result of my graduation project.

This project would have not been possible without the cooperation of Fokker Services, who opened up their doors and allowed me to conduct this research within their organisation. I am especially thankful to my two external supervisors, Mareijn Willems and Rob Bosgraaf, who patiently shared their knowledge and expertise for me and helped to establish a lot of valuable contacts to conduct this research. Also I would like to thank Dap Hartmann for his continuous guidance as my first supervisor throughout this process. I would also like to thank my two other supervisors, Marina van Geenhuizen and Ricky Curran for their valuable insights which helped me improve this report. I would also like to thank all the persons who dedicated some time to me for an interview or small talk to help me continue this research.

Finally, I also want to thank all my friends, family and girlfriend who supported me throughout my entire life as a student. It has been a wonderful journey with many experiences and would not be possible without the support of all of you.

Bas Bolomey
Delft, October 2017
Summary

Startups are a major source of innovation and are capable of doing things where larger firms are not capable of. Many corporates are therefore looking at opportunities to collaborate with startups, also called external venturing, and to capture their value. Although working with startups has many benefits and great opportunities for corporates, it is currently not part of Fokker Services' innovation strategy, and therefore the objective of this study was to determine the first steps for Fokker Services to start with external venturing. However, Fokker Services is mainly active in the commercial aviation industry, and this industry differs from non-aviation industries in many ways. Therefore it has been decided that it was required first to determine how external venturing should be done in the (Dutch) aviation industry specifically. The answer to this question, which has also been the answer to the main research question, has been found in the form of a normative framework. This framework describes success factors and pitfalls for external venturing in the Dutch aviation industry and exists out of five different levels. These levels are found during the literature study and describe prerequisites to do external venturing in the right way.

The normative framework has been the foundation on which the first steps for Fokker Service, to start with external venturing, relied on and has been presented in the form of an implementation plan. This plan describes four short-term stage, a mid-long term stage and a long-term stage with accompanying steps at the five levels relevant for external venturing. The normative framework is, in its turn, has been build based on a two-fold approach. First by translating key learnings from other organisations and external venturing experts about the execution of external venturing (combined with a literature study) into a list of success factors and pitfalls. Secondly by translating solutions to overcome industry specific startup challenges into success factors and pitfalls.

The research strategy to answer the first part of this two-fold approach is chosen to be a literature study combined with a qualitative, multiple case study strategy. The research strategy to answer the second part of the two-fold approach has also been chosen to be a qualitative, multiple case study strategy. Unstructured interviews served as main data collection method for the case studies, and as a result, one of the most important solutions to overcome startup challenges is to grow and improve the Dutch aviation startup ecosystem. Another important solution is to clearly define the opportunities for entrepreneurs in the Dutch aviation industry. Both solutions aim at increasing the likelihood of entrepreneurs to enter the Dutch aviation industry. To overcome the remainder of the startup challenges, four external venturing ingredients have been found which should at least be present in each external venturing program aimed at the aviation industry. These four elements are business services, financing instruments, network and people connectivity and opportunities to use the corporate image. All these solutions have been translated into success factors for external venturing in the Dutch aviation industry by saying that having a full-grown startup ecosystem, clearly defined opportunities and an external venturing program with at least containing the aforementioned four ingredients increases the chances on successful collaborations. Together with the success factors and pitfalls for external venturing in general, we now know how Fokker Services and other organisations in the Dutch aviation industry can start with external venturing in an effective way.
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<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
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<tr>
<td>CFD</td>
<td>Computational Fluid Dynamics</td>
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<tr>
<td>CFO</td>
<td>Chief Financial Officer</td>
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<tr>
<td>COO</td>
<td>Chief Operational Officer</td>
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<tr>
<td>CVC</td>
<td>Corporate Venturing Capital</td>
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<tr>
<td>D&amp;M</td>
<td>Design and Manufacturing</td>
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<td>EASA</td>
<td>European Aviation Safety Agency</td>
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<td>EV</td>
<td>External Venturing</td>
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<td>FAA</td>
<td>Federal Aviation Authority</td>
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<td>FS</td>
<td>Fokker Services</td>
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<tr>
<td>GMA</td>
<td>General Member Assembly</td>
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<tr>
<td>HQ</td>
<td>Head Quarter</td>
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<td>IFE</td>
<td>Inflight Entertainment</td>
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<tr>
<td>IP</td>
<td>Intellectual Property</td>
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<tr>
<td>MRO</td>
<td>Maintenance, Repair and Overhaul</td>
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<tr>
<td>MRQ</td>
<td>Main Research Question</td>
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<tr>
<td>MVP</td>
<td>Minimal Viable Product</td>
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<tr>
<td>NAG</td>
<td>Netherlands Aerospace Group</td>
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<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
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<tr>
<td>PMA</td>
<td>Parts Manufacturer Approval</td>
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<tr>
<td>ROI</td>
<td>Return on Investment</td>
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<tr>
<td>RQ</td>
<td>Research Question</td>
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<tr>
<td>TRL</td>
<td>Technology Readiness Level</td>
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<td>USA</td>
<td>United States of America</td>
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<td>VR</td>
<td>Virtual Reality</td>
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Introduction

1.1. Background
Anton Herman Gerard or "Anthony" Fokker (6 April 1890 – 23 December 1939) is known as the founder of the Dutch Aviation Industry. Inspired by Wilbur Wright's flight exhibition in France in 1908, Anthony Fokker started to experiment with aeroplane designs and built his first aircraft in 1911. In 1912, he began his own aircraft manufacturing company called "Fokker Aeroplanbau" near Berlin in Germany. Over the years this company has successfully manufactured a wide range of commercial and military aircraft. The manufacturing of aircraft came to a standstill in 1996 when Fokker had to adapt to changing market situations and transformed from aircraft integrator to specialist supplier. Nowadays the company operates through five key units: Fokker Aerostructures, Elmo, Landing Gear, Techniek and Services. These units form together Fokker Technologies B.V. and Fokker Technologies B.V. in its turn has been taken over by GKN Aerospace in 2015. GKN Aerospace is one of the world's largest independent first tier suppliers to the global aviation industry.

Fokker Services is the company where this Master thesis has been conducted and typical capabilities of Fokker Services conclude engineering and documentation support, Airframe modifications, Aircraft parts MRO (Maintenance, Repair and Overhaul) and spare availability programs. The headquarters is located in Hoofddorp, The Netherlands, and has several departments in the USA and Singapore as well. Their ambition is "being the world's most innovative aerospace service provider of affordable and reliable solutions to airlines, OEM's (Original Equipment Manufacturers) and MRO organisations". After the bankruptcy of the aircraft manufacturer, the primary goal of Fokker Services was to provide support to the flying Fokker aircraft, but the amount of flying Fokker aircraft is decreasing every year. They expect that in five years from now all Fokker Aircraft are put 'end-of-life' because aircraft can't fly forever and have a limited lifetime. Since Fokker does not manufacture aircraft anymore, it means that if Fokker aircraft stop flying, no aircraft are coming back in return. Therefore, the company has to shift its services towards different (non-Fokker) aircraft types to continue its operation.

Fokker Services is currently undergoing a transition in which it is shifting its focus towards other aircraft types. They are slowly but surely earning its position in the global aviation industry by supporting an increasing amount of (non-Fokker) aircraft types. The transition is very challenging because Fokker Services was used
to be in a monopoly position. They are the only ones who know exactly how Fokker aircraft are built. Now, when they need to develop capabilities on new aircraft types, they will lose this monopoly position because they will work on aircraft which are made by other aircraft manufacturers. Therefore a (new) competitive strategy is needed as they will compete with other aircraft service providers. The need to be competitive again, along with its ambition of being most innovative service provider means that Fokker Services needs to work on new technologies, processes and innovations because innovations can lead to the ability to offer ‘cheap’ and ‘unique’ services. This is precisely what is needed to capture new markets. Therefore it is essential for Fokker Services to have a robust innovation strategy.

1.2. Problem Definition

Post-war innovations were mainly characterised by a linear process from scientific discovery to the marketplace (Ortt and Duin, 2008). This type of innovation is also called technology-push innovation because companies decided what was going to be developed. In the mid-1960s companies started to change their style of innovating towards market-pull innovations where the customers mainly decided in which areas they were looking for improvements. At this time, organisations were focused on increasing economies of scale and reducing the financial risks of product development. In the late 1970s, companies became more flexible by combining technology-push and market-pull type of innovations, and innovation became more and more part of the corporate strategy. Nowadays, most companies innovate in alliances by coordinating innovation process in a network of partners. This period is also known as the open-innovation era. Chesbrough firstly introduced the concept of open-innovation in 2003. He said that open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology” (Chesbrough, 2003). In other words, open innovation is about collaborating with other companies because together companies are stronger than alone.

At the same time within this era of open innovation, a new trend has emerged which focuses on collaboration with one particular type of company: startups. Collaborating with startups is also called external venturing. The main reason why an increasing amount of companies choose to work with startups is that startups are capable of doing things which a larger company is not capable of doing. Startups are known as a fundamental source of innovation as they develop emerging technologies (Kohler, 2016). Giuseppe Zocco, co-founder of Index Ventures, believes that every corporate manager should have an interest in startups as they are driving significant innovations that disrupt entire industries (Mocker et al., 2015). Furthermore, he thinks that corporations are increasingly recognising the impact of these startups and that all organisations should investigate mutually beneficial relationships with startups. Startups are all about the future because they just have no history and therefore don’t need to serve existing markets and defend their history like established companies have to do. This startup characteristic enables them to engage in radical innovations, rapidly changing business models and adjust to specific customer needs, required for long-term competitive advantage. Something which only a small percentage of established companies are capable of (Ford et al., 2010).

However, working with startups is currently not part of Fokker Services’ innovation strategy although many scholars and experts acknowledge the benefits of it. Fokker Services does, however, work with startups but working with startups is not part of their structured approach to become the most innovative service provider. Therefore the research objective of this Master Thesis is to study how Fokker Service can start with external venturing.
1.3. Research questions

The objective of this study is to investigate how Fokker Services can start collaborating with startups. To be able to reach this objective, we must look at the heart of what external venturing is. What lies at heart is a mutually beneficial relationship between a startup and a corporate. It is not possible to collaborate with startups without offering something valuable in return. From a corporate perspective, it has already been argued what the benefits of collaborating with startups are but from a startup perspective: what is in it for startups? There are different ways of determining how a mutually beneficial relationship, from a startup perspective, can be organised. One way, for example, is by looking at what resources startups are looking for and how corporates can offer them. Corporates and startups are decidedly different organisations and therefore have specific characteristics which the other does not possess but which are very valuable to them. The corporate, for example, has resources, scale, power, and the routines needed to run an established business model efficiently (Weiblen and Chesbrough, 2015).

However, this study decided that startups are mainly looking for opportunities to improve their chances for successfully raising their business. Therefore we want to know what success factors and pitfalls of external venturing are in the aviation industry so that it is known what should and should not be done to increase their chances for success. The central research question of this thesis is:

*What are success factors and pitfalls for external venturing in the Dutch aviation industry?*

To be able to answer this first sub-question, it is decided that a two-fold approach is required. **First** we must understand external venturing by learning from the experiences of other organisations and experts. Therefore the first sub-question is:

1. **What do literature and the experience of other organisations and experts say about the execution of external venturing?**

The learnings from the literature and the experience of others can be translated into success factors and pitfalls for external venturing in general. However, these success factors and pitfalls still need to be extended with aviation industry characteristics because it cannot be assumed that it is right to do external venturing the same in each industry. It is proven that the chances of success for startups are different among industries. For example, after four years there are, on average, only 37% of the startups are left in the information industry where the financial sector still has 58% of the startups left (Statisticsbrain.com). This example demonstrates that it is more likely for startups to succeed in some industries than in others which means that external venturing should also be done differently in each industry. Additionally to this argument, it is decided that the aim is to increase the chances of success for startups. Therefore, if external venturing is adjusted for industry-specific characteristics, it is likely that the chances of success for startups will be higher than if external venturing is practised in the same way as is done in other industries. Some forms of collaboration might work in one industry but not in others.

Therefore the **second** step of the two-fold approach is to find startup challenges and find solutions to overcome these challenges. Solving the startup challenges means that the startups are more likely to succeed because they are facing fewer challenges than before and this is what we are aiming for: to increase the chances of success for startups. Therefore the second sub-question is:

2. **What are the startup challenges in the aviation industry and how can they be solved?**
Answering two sub-questions and the main research question brings us to a list of success factors and pitfalls for external venturing in the Dutch aviation industry but this does not mean that the research objective is reached. The aim of this study is to determine how Fokker Services can start working with startups in a structured approach and therefore the list of success factors and pitfalls for external venturing needs to be translated into a plan which can be used by Fokker Services to start with external venturing. The translation of this plan aims to answer the third sub-question which is:

3. What can the first steps for Fokker Services to start with external venturing?

As a conclusion of this section, the results of the first sub-question has been used to formulate 'general' success factors and pitfalls for external venturing and the outcomes of the second sub-question have been used to develop success factors for external venturing in the aviation industry. A combination of the success factors and pitfalls from both sub-questions answered the main research question and formed a normative framework which has been used to answer the third sub-question by writing an implementation plan containing the first steps for Fokker Services. A further elaboration on how these research questions are answered is provided in chapter 3.

1.4. The research context

So far the aviation industry has been used as the name to describe a single phenomenon. However, the aviation industry is an inclusive term which contains many different market segments, many different aircraft types and many different sub-disciplines. In general, there are two main disciplines in the aviation industry: civil aviation (or non-military aviation) and military aviation. The aviation industry can also be divided based upon the various market segments. These segments are Design and manufacturing, In-service support, Aircraft operation, and complementary organisation which perform activities such as testing & certification. Given the time and resource limitations of this research, it would not be possible to study all the different segments and disciplines. The focus of this research will, therefore, be on two segments in the civil aviation industry: the design and manufacturing segment and the in-service support segment because Fokker Services is mainly active in both of them.

The Design and Manufacturing segment is about the design of aircraft by the aircraft manufacturers, also called the aircraft OEM's. The most important characteristic of this segment is that the design of civil aircraft takes approximately 10 - 20 years. There are only a couple of large aircraft manufacturers in the world, but they do not manufacture the entire aircraft themselves. The aircraft OEM's have many suppliers for all kinds of different parts. These suppliers contribute all to the design and manufacturing of aircraft. It doesn't matter where the supplier is positioned in the supply chain; the final customer will always be the aircraft manufacturer. The In-service support segment contains two types of organisations which provide support during the lifetime of aircraft. The first category is the MRO organisations. Aircraft operators (airlines) could have a MRO-department themselves but there also exist companies which provide independent support to the aircraft operators, and these are called the MRO-organisations. A MRO-organisation does not necessarily have to do the hands-on maintenance, but they can also provide support by sharing knowledge in a consultancy-like manner. The second type of In-service support organisations are the ones who design aircraft modifications. Developing aircraft modifications is similar to the Design & Manufacturing segment because new elements or technologies are integrated into aircraft. However, the main reason why modifications belong to the in-service support section is that their customers are the aircraft operators and not the aircraft OEM's.
Also, aircraft modifications follow different development trajectories than the design & manufacturing segment because modifications are not part of the new aircraft development process.

1.5. Report structure
The remainder of this report presents how the main research question has been answered. First, a literature study on the most important concepts of this study is done and presented in chapter 2. Next, the research methodology is described in chapter 3. The study results are presented in chapter 4, and a discussion of these results can be found in chapter 5. The translation of the case study results into success factors and pitfalls can also be found in this chapter. Also, the implementation plan for Fokker Service can be found in the fifth chapter. In chapter 6, conclusions, a reflection on the limitations, the results of the validation step and recommendations can be found. Also, the theoretical and practical contributions of this study are discussed in chapter 6.
To appropriately answer the research questions posed in the previous chapter, it is necessary to conduct a literature review to set the theoretical foundations this study can rely on. The primary topics of this study are startups, entrepreneurs and external venturing. Therefore these three topics are studied in this chapter. This chapter does not only provide a theoretical base which contributes to the understanding of this topic but also functions as the input for the implementation plan which will answer the main research question. Finally, this section also helps to narrow down the scope of this research. As will be discussed later on, there are no definitive definitions of the three main topics, so it is needed choose one. Section 2.1 will therefore first explain what is defined as a startup during this study. The same has been done for entrepreneurs in section 2.2. This section also describes categories of entrepreneurs and discusses the likelihood of people becoming an entrepreneur. Section 2.3 starts with defining external venturing and in what different ways external venturing can be executed. Section 2.4 describes environmental influences on the execution of external venturing, and finally, section 2.5 concludes on the literature study. Here an overview of the main learnings about the execution of external venturing is summarised as well as this is input for answering the first sub-question.

2.1. Startups
Defining a startup is not as easy as it may look because of many scholars, in their work about external venturing, startups and entrepreneurship assume that the definition of a startup is known as no elaborations on the concept have been done in their work. The difficulty of finding a definition for a startup shows that it is a broad concept which is adopted by many people differently. For example, Forbes magazine presents a startup company as an entrepreneurial venture which is typically a newly emerged, fast-growing business that aims to meet a marketplace need by developing or offering an innovative product, process or service (Robehmed, 2013). Other say that a startup is a temporary organisation built to search for repeatable and scalable business model and that most startups change their business model multiple times (Blank, 2010). According to business websites such as Investopedia, the definition of a startup is that "a startup is a company that is in the first stage of its operations". Businessdictionary.com, which is another well-known business website, uses a similar definition saying that "a startup is a company that is in its early stage in the life cycle of an enterprise where the entrepreneur moves from the idea stage to securing finance and initiating operations". Vintergaard
8 (2006) mentioned in his PhD-dissertation that most startups have scientific results as a start, which mainly stems from university-based research, corporate R&D, etc. and have a high risk and reward profile (Vintergaard, 2006). Because there are many ways to define a startup, one definition has been chosen which suits the objective of this study the best. This one is from startupcommons.org and is based upon startup development phases. Startup Commons divided the development of a startup into three phases: the formation stage (early-stage startup), the validation stage (later-stage startup) and the growth stage (scale-up).

To narrow down the scope of the research, it is chosen to exclude the growth stage (scale-ups) from this study because the aim of external venturing is to increase the chances on the success of startups. A scale-up can be seen as a successful startup because it is selling to more than one customer and has a proven and validated business model. Therefore it is assumed that it is not needed anymore for scale-ups to increase their chance of success. Also, it will not be interesting for Fokker Services to invest in a supplier-consumer relationship with a scale-up because competitors would then also be able to obtain the same benefits as Fokker Services which means that Fokker Services does increase their competitive advantage over others. For the two startup stages, which are part of the scope of this study, a short elaboration is provided in the next subsections to understand the difference between the stages. A schematic representation of the stages is provided in figure 2.1.

Figure 2.1: Startup phases

2.1.1. Early-stage startups

Early-stage startups are in the so-called formation phase where they are still forming a team and are looking for team members. In most cases, this formation process is driven by a single person, the idea/technology owner, who is looking for other team members. Once the team has been formed, they start developing the concept in which they try to find a problem for their solution or a solution for their problem. The early-stage startup is looking for an industry in which they can deploy their technology. Their aim, at this stage, is that their technology is minimal profitable but has the potential for scaling. Early-stage startups can be compared with a drowning person. It is looking for a lifeline to be rescued, and the industry which offers the lifelines is most likely also the industry in which the early-stage startups will start its business. Regarding technology development, early-stage startups typically develop their technology from Technology Readiness Level 1-3. Technology readiness levels (TRL) are a commonly used systematic measuring system to assess the maturity of a particular technology. It is often used to determine the progress of a startup but was originally introduced by NASA in 1995. (Mankins, 1995) TRL 1 is when scientific research is translated into research and development. TRL 2 is when the R&D results are formulated into an application. The application is still speculative because there is no experimental proof yet. (Mankins, 1995) TRL 3 is when the proof of concept has been made. The application from TRL 2 has then been put into an appropriate context to validate the theoretical predictions. As the early-stage startup ends at TRL 3, the output of this stage is a proof of concept and a decision in which industry they want to validate the proof of concept.
2.1.2. Later-stage startups

Later-stage startups are in the so-called validation phase where they are validating their proof of concept in the chosen industry. This stage contains a lot of iteration and pivoting as the startups are receiving feedback from the industry. They're modifying their proof of concept based on this feedback and try to maximise the customer offerings. The first step in this stage is to find a Minimal Viable Product (MVP), which is a product just enough to satisfy early customers. In other words, the later-stage startup is trying to fit their product (proof of concept) into a market. The outcome of this stage is a validated business model and an 'investment ready' business so that it can start to attract additional resources via investments or loans for equity, an interest of revenue and share from future revenues to grow the business in the scale-up phase. Concerning Technology Readiness Levels, the later-stage phase is typically known for its product development from TRL 4-7. TRL 4 is when the technology is validated in a secured or laboratory environment, depending on which industry has been chosen. TRL 5 is when a component of the technology has been tested in the relevant (real) environment. This environment could be a pilot at a relevant industry player to see how the technology works. TRL 6 is similar to the previous level, but then the complete technology has been put to the test in the relevant environment. TRL 7 is finally when a prototype demonstration has been made and therefore ready for scaling-up.

2.2. Entrepreneurs

The second main topic of this literature study are the entrepreneurs. Entrepreneurs are the driving force behind startups. Without entrepreneurs, there are no startups, and without startups, there is no external venturing. Therefore this section examines what entrepreneurs are, what categories of entrepreneurs there are and why entrepreneurs become entrepreneurs.

Similar to the situation of defining startups, there is no one definitive profile of an entrepreneur (Holden, 2007). One classical view about entrepreneurs assumes that personal reward by earning profits and capital growth is what drives individuals and thereby successful economic activity (Lee and Mo, 2011). Another classical view comes from Joseph Schumpeter who explains an entrepreneur as someone who is an extraordinary person who is promoting "new combinations" or innovations (Cheah, 1990). Schumpeter noted that "the function of entrepreneurs is to reform or revolutionise the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing an new commodity or producing an old one in a new way by opening up a new source of supply of materials or a new outlet for products, or by reorganising an industry and so on". Schumpeter describes the world as an equilibrium in which entrepreneurs should try to create a disequilibrium via the introduction of innovations. However, not everyone agrees with this perspective. The Austrian school, for example, says that the world is in disequilibrium and that entrepreneurs should try to promote an equilibrium by the introduction of innovations (Cheah, 1990). This is the fundamentally different from the Schumpeterian view. Other definitions say that entrepreneurship is all about seizing an opportunity or that an entrepreneur is someone who would rather run a small business rather than work as an employee of having a couple of personal attributes. Finally, Getz et al. (2004) describe an entrepreneur as an individual who works to increase personal benefits in the form of economic gains or social standing. This person creates benefits in the wider social and economic setting through increased economic activity, job creation and wealth generation. However, each of these definitions rules out categories of entrepreneurs while this study does not want to exclude any entrepreneurs beforehand. Every type of entrepreneur is welcome at Fokker Services as long as it provides added value to the organisation.
Therefore it is chosen to define an entrepreneur as someone with an innovative product or service which is willing to start a new business or already has an early / later-stage startup.

It is still relevant to understand where entrepreneurs come from and know what drives them so that they can, if necessary, be targeted. Scarborough (2012) identified different categories of entrepreneurs. The first group is called the Young Entrepreneurs who are young people setting the pace in entrepreneurship and are most likely students or post-graduates with a maximum of 5 years of working experience (Bindley, 2012). The second category is called the Part time entrepreneurs. These are the ones who can ease into a business without sacrificing the security of a steady income (Scarborough, 2012). One of the major advantages of being a part-time entrepreneur is having a lower risk when the startup goes bankrupt. Most part-time entrepreneurs are experiencing the field of entrepreneurship before ultimately entering it. The third category is called the Corporate spin-offs which most likely have years of experience, a vast network and the need to gain control over destiny. Similar to corporate spin-offs are University spin-offs. University spin-offs are startups based upon technology or research results developed within a university and created for commercially exploiting the knowledge (Soetanto and van Geenhuizen, 2010) as the creation and sharing of intellectual property is one of the core roles of a university (Tidd and Bessant, 2013). The fifth and final category of entrepreneurs is called the Pensioners. These entrepreneurs have years of experience and a thorough knowledge of the industry. Also, they have a vast network which provides them with the necessary contacts for market entries. To finance their new venture, they use their savings or apply for the same funds as other entrepreneurs would do.

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<td>Technical Preparedness: High</td>
<td>* Willingness and ability to develop opportunity</td>
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<td>Psychological Preparedness: High</td>
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Figure 2.2: The influence of individual and environmental factors on the likelihood of new venture creation (Xie, 2014)

Each type of entrepreneur may have different reasons to become an entrepreneur. For example, employees who are fired could decide that the best defence against future job insecurity is an entrepreneurial offence (Scarborough, 2012). However, Chuanyin Xie studied why some people become entrepreneurs and others,
not (Xie, 2014). She mentioned in her work that individual characteristics and environmental factors play a role in the likelihood of becoming an entrepreneur. She divided the individual characteristics into 'technical preparedness' to describe to what degree the individual possesses relevant knowledge and skill to start a business and 'psychological preparedness', to describe to what degree the individual can deal with uncertainty and risks associated with starting a new business. Aerospace Engineering students, for example, have a high level of technical knowledge but do not necessarily have the psychological preparedness to become an entrepreneur. Furthermore, she also divided the environmental factors into 'opportunity clarity' and 'the availability of support'. The clarity of an opportunity is important because "without opportunity, there is no entrepreneurship" (Xie, 2014). Support from the environment is, for example, the existence of external venturing instruments but also a supportive attitude and culture. There are many actors who play a role in a supportive environment. Government policies, for example, can do much to stimulate entrepreneurship and universities influences approach to entrepreneurship in the way they teach about business management (Stevenson and Gumpert, 2001). A startup ecosystem is an example of a supportive environment as it contains many external venturing instruments and also a supportive environment in which entrepreneurship is stimulated. There will be elaborated upon the startup ecosystem concept further later on.

Combining these four factors, Xie (2014) distinguished between four different likelihoods of new venture creation by entrepreneurs: very likely, likely, slightly likely and least likely and demonstrates in figure 2.2 what the influence of individual characteristics and environmental factors is on the likelihood of becoming an entrepreneur. What can be seen from this figure is that both a supportive environment as the clarity of the opportunities play a major role in the likelihood of someone becoming an entrepreneur. This figure is useful for our understand about entrepreneurs as it demonstrates what conditions need to be met for entrepreneurs to start a business.

2.3. External venturing

The third important concept in this study is external venturing and will be studied in this section. What is known so far about external venturing is that it is another word to describe corporate-startup collaborations. However, there are different flavours and instruments to execute external venturing. An elaboration of these flavours and instruments is needed to provide a theoretical base for the remainder of this study. First, a short introduction of the history will be provided.

2.3.1. History of external venturing

The concept of external venturing has been developed over the years, and the concept of external venturing as we know it nowadays is so-called to be in its fifth generation. However, the first type of external venturing started in the mid-1960s when its primary goal was to increase financial returns of the corporates (Kuiper and van Ommen, 2015). The choices for startups these days were limited because they could either go to an independent venture fund or a corporate fund. This ‘flavour’ of external venturing changed around the 1980s to what is so-called the second wave of external venturing. Here, the focus was not solely on the financial returns but also on the functionality of corporate-startup collaborations. The functionality requirements of external venturing started to develop around the 1990s until a third wave was born. Around this time, open innovation models began to take on a more prominent role in management literature, and this caused companies to start looking outside the traditional company boundaries. These developments finally led in 2006 to the realisation that external venturing was not longer about financial gains but a prerequisite for
corporate innovation. This realisation was the start of the fifth type of external venturing, which is commonly used nowadays. Here it is seen as a complementary activity to internal R&D and as an important additional source of innovation (Kuiper and van Ommen, 2015). Sharing knowledge, providing workspace and other resources are common among many of these “new” external venturing instruments which are different ways of organising mutually beneficial relationships between corporates and startups.

2.3.2. Selecting the right external venturing instruments

The fifth wave of external venturing has launched many new external venturing instruments, but not all of them fit the strategic goals of an organisation. Therefore it is needed to determine what external venturing strategies there are and which accompanying activities are appropriate for Fokker Services. Hill and Birkinshaw (2008) for example distinguish between four types of strategies which can be differentiated by the internal versus external orientation of the strategy and the difference in strategy goals between exploration and exploitation. Combining these dimensions creates four type of strategies: The internal explorer, the external explorer, the internal exploiter and the external exploiter (Hill and Birkinshaw, 2008). The internal explorer strategy is about investing in new opportunities that arise inside the firm and to nurture them so that they become areas of growth. The internal exploiter strategy is about using existing corporate assets to use them in a new way to develop innovations (Campbell et al., 2003). The external opposites are having the same purpose but are focused on the area beyond the traditional boundaries of the firm. Wolcott and Lippitz (2007) also defines four external venturing strategies based on two critical dimensions: the ownership of the venture and how it is funded. A further elaboration of this strategy is not needed because both classifications of strategies can only be used to determine a general corporate innovation strategy. However, the general innovation strategies also need to be translated towards concrete activities as well. Therefore another framework will is found to be more applicable to doing this. This is the framework proposed by two organisations: Bundl and Nesta.

Bundl, a company which consults corporates on how to collaborate with startups, also identified four categories of strategic objectives and recommended for each category which type of external venturing instruments to use. This strategy / external venturing device fit is similar to the ones identified by NESTA. NESTA is an innovation charity with a mission to help people and organisations bringing great ideas to life (Banerjee et al., 2016). The four categories are: 1) Innovate big brands/improve ecosystem to create a platform for startup engagement and to attract customers, partners and talent to the industry 2) Rejuvenate corporate culture to improve the entrepreneurial mindset among employees 3) Solve existing business problems for current and nearby markets and 4) To expand into new / future markets by accessing new capabilities or channels. For each of these categories, different instruments are recommended by Bundl and Nesta as can be seen in figure 2.3. The ones with three crosses are most recommended, and the ones with one cross are least recommended.

The two most right corporate objectives are chosen in consultation with Fokker Services to be most in line with the strategic objectives of Fokker Services. Therefore the instruments which are most recommended for these kinds of corporate objectives have been chosen to be within the scope of this study. These are the ones represented by a continuous line in figure 2.3. Mergers and acquisitions are also recommended by Bundl and NESTA for the two corporate objectives which are most in line with Fokker Services, but mergers and acquisitions are most likely to happen when startups have a commercial-ready product to access new technologies and markets (Mocker et al., 2015). This is after the later-stage stage, at the scale-up stage, and
CVC Investment or external venturing Capital Investment is when a large firm takes an equity stake in startups of strategic interest. It is a rapidly growing collaboration tool across European companies and can be applied using several models (Lerner, 2013). The first model is called the Internal Corporate Venture Group in which internal venture groups analyse opportunities and make investments (Gompers, 2002). The advantage of this model is that the organisation can give excellent in-depth assistance in the organisation’s area of expertise (Gompers, 2002). The second model is called the dedicated external fund in which the company places investment capital in a separate entity outside the firm. An example of such a fund is called the Mainport Innovation Fund (MIF) which is founded by KLM, Schiphol Group, NS Railways, TU Delft and the Port of Amsterdam. The fund focuses on logistic, transport and aviation and all founders locate resources inside this fund to invest in startups of strategic interest. The downside of such an investment model is that the startup is that the relationship is too distant for the startup to work closely with the organisations involved (Gompers, 2002).

Strategic partnerships are alliances between the corporate and the startup with a common mission (Mocker et al., 2015). It involves some shape of a formal agreement between two (bilateral) or more (network) organisations which have agreed to share finance, skills, information and other resources to pursue the common mission (PWC, 2009). How the partnership exactly looks like mainly depends on what the startup needs but the difference with CVC investments is that strategic partnerships are not only about financial resources but also about skills, information, equipment, etc. There are a couple of advantages of having strategic partnerships. One of the advantages is to have reduced development costs (Bonaccorsi and Lipparini, 1994). The second advantage of a strategic partnership is to have higher quality products with fewer defects caused by
the consistency between tolerances and process capabilities, refinement of the supplier's process and the availability of detailed process data (Bonaccorsi and Lipparini, 1994).

**Corporate & in-house incubators** are organisations with a physical facility that accommodates a business incubation process (Sanders et al., 2016). A business incubation process, in its turn, is an entrepreneurial, economic and social development process designed to raise new ventures from idea generation to start-up companies and eventually to scale-up companies. “It is a continuous relationship between the incubator and the entrepreneur with maturity as ‘graduation target.’” Typically an incubator provides four basic components which are the following:

1. **Infrastructure** in the form of office space, meeting rooms, electricity, internet, lab facilities, etc. Due to economies of scale, the incubator can decrease the costs of starting a business.

2. **Business Services** to help with patenting, accounting, strategy and market research to save time and money because they’re non-core business activities.

3. **Financing** such as equity, credit, guarantees or financial services to overcome the financial gaps of the startup. It also helps to leverage the credibility of the incubator.

4. **People connectivity** via mentoring, coaching and interaction with other entrepreneurs. These activities enhance the learning, exchange of ideas, psychological support and business relationships.

Despite the four basic components which are present in all incubators, it is possible to distinguish between different types. Many incubators are existing nowadays, and the amount is growing every day (Mocker et al., 2015). First, there is a difference between a corporate incubator and an in-house incubator. The difference between these two types is that an in-house incubator function as start-up setting within a corporate environment, also known as intrapreneurship. Important here is that the support program is oriented at growth for the startup and not necessarily towards the growth of the corporate host. A corporate incubator is known as a separate organisation and can be classified into nonprofit (publicly) and profit (privately) oriented incubators (Jørgensen, 2014). Public business incubators often focus on creating jobs, contributing to a community, or using unoccupied buildings, whereas university-based business incubators have a clear-cut focus on commercialising scientific research. The business model for private business incubators can vary, but the most frequently used approaches are either directly investing in the incubated companies or generating income from rent or services.

**Corporate & partnership accelerators** are similar to incubators as it is also a form of providing business support. Accelerator programs typically offer a highly structured program by sharing, resources, expertise and possibly facilities but accelerator programs do not necessarily have to be hosted at a physical location. Accelerator programs focus to speed up the product development process and to reduce the time to market. They primarily focus on later-stage startups so that they can enter the market more quickly (Mocker et al., 2015). Where an incubation program typically lasts for six months, last an accelerator program mostly three months. Nesta identified five different components which can be found among all accelerator programs (Clarysse et al., 2014). The variation in accelerator programs depends on how the accelerator is applying the following five components:

1. **Strategic focus**: What are the key objectives and what is the sector and geographical focus of the accelerator? Is it diversified or focused on a specialist segment?
2. **Programme Package**: How does the programme look like and what type of mentors are included? For example, an accelerator can organise different networking events, investor demo days or co-location in a shared office space.

3. **Funding**: How is the accelerator funded and how are startups able to obtain funding from the program?

4. **Selection process**: What is the screening criteria and how does the process itself look like?

5. **Alumni interaction**: What opportunities does the accelerator program offer to connect with other startups and scale-ups?

Furthermore, there are also different classifications in the type of accelerators. First, there is the difference between a corporate and partnership accelerator and is that a partnership accelerator is hosted in collaboration with an external party where a corporate accelerator is organised by the corporations themselves.

### 2.3.3. The timing of the external venturing instruments

The four external venturing instruments are not relevant for startups all the time. When to use which tool mainly depends on the startup needs. For example, if a startup has lots of own equity but does not know anything about raising a new company, it is not effective to provide more financial resources. Putting the startup in an incubation or accelerator program will then be more effective because it will then be able to make use of other than financial resources. Therefore CVC investments are most effective when a startup is only in need of money. Business support tool such as incubators and accelerators are most effective when the startup needs to have more than financial resources. Because strategic partnerships can be organised in many different ways, they fall in between these two ultimate EV instruments.

Although the timing of the instruments primarily depends on the specific startup needs, the timing of the instruments can also be positioned based upon the startup definition mentioned earlier this chapter. This is presented in figure 2.4.

![Figure 2.4: The timing of the instruments](image)

CVC investments are typically employed in the later stage. However, when technology has good promises, but an exact application is yet to be found, it also occurs that investors buy technology in the early stages.
Therefore investment instruments can be applied in both early and later stages. This is also true for strategic partnerships. They're most likely to happen in the later-stage because then the startup is probably active in the same industry as the corporate. Early-stage strategic partnerships could, for example, occur when a corporate wants to extend its capabilities in new areas of expertise. Next, there are the incubators and accelerators and have similar characteristics. The main differences are that accelerator programs have a shorter duration and are focused particularly at the later-stage of the startup development (Bannerjee et al., 2016).

2. The environment of external venturing

External venturing cannot be performed in isolation. The environment in which the EV activities are executed has a substantial influence on the result of them (Kuiper and van Omme, 2015). The external venturing instruments, which have described in the previous section, are just one piece of the puzzle to start successfully with external venturing. Their success or failure depends on multiple aspects at five different levels, both in and outside the organisation. These five levels are the ecosystem level, the company level, the venture unit level, the startup level and finally the personal level. The important elements on each level will be discussed separately in this the following subsections.

2.4. The ecosystem level

The first level is the ecosystem level and is the environment in which the organisation is positioned. James Moore was the first to introduce the biological ecosystem into business research. According to him, parallels can be drawn between the manner in which developments occur in nature and organisations. He describes it as a dynamic structure of interconnected organisations that depend on each other for mutual survival (Moore, 1993). He argues that innovative businesses can’t evolve in a vacuum and that they must attract resources of all sorts like capital, partners, suppliers and customers to create cooperative networks. This analogy is especially interesting because the world is continuously changing by the ongoing digitisation and globalisation. To survive, companies need to adapt to changing conditions and ecosystem theory understands the underlying strategic logic of change (Moore, 1993). In other words, companies need to try to control the changing environment and manage it in such a way that it could contribute to the total value offering towards their customers. They need to serve as catalysts for new business development when new businesses, new rules, new cooperation and new competition arises. The concept of business ecosystems has been shaped and refined a couple of times since the introduction of it by Moore in 1993 (Augusto et al., 2016). Especially since the introduction of the concept of open innovation systems by Chesbrough in 2003, the concept of business ecosystems changed to innovation ecosystems. (Open) Innovation ecosystems stress the importance of technology and information flow among people and enterprises to innovate. The fundamental hope behind innovation ecosystems is that one company can expand their innovation capabilities by transferring knowledge among others. Or in other words: companies need other businesses to expand and improve their innovation capabilities.

A further evolution of the ecosystem concept went from innovation ecosystems to entrepreneurial and startup ecosystems, in which the goal is to enhance entrepreneurial activity and to create new startup companies (Stam and Spigel, 2016). The ultimate outcome of such an ecosystem is new value to society. The main difference between innovation ecosystems and startup ecosystems is that big companies are the centre of innova-
2.4. The environment of external venturing

Entrepreneurial and startup ecosystems are centres of new ventures, and these ecosystems typically contain service providers, funding organisations, universities, research organisations, bigger companies, and support organisations. Also, there are a lot of supporting resources and activities available to stimulate startup development, such as co-working spaces, event organisers, startup competitions, crowdfunding portals, and advisory sessions. However, five key actors must at least be present for a startup ecosystem to succeed and these are (Aaltonen, 2016):

1. **Entrepreneurs and potential entrepreneurs** who identify opportunities and create new ventures.
2. **Investors** who are looking for opportunities to invest in promising startups.
3. **Large companies** who shape the competitive environment and cultivate professional talent.
4. **Universities** who provide inventions that may be commercialised.
5. **Policymakers** who create regional dynamics and provide smart funding to amplify private investments.

Startup ecosystems change over time, and there are four stages of ecosystem development (Mack and Mayer, 2015). First, there is the birth stage of the startup ecosystem where there is a low number of firm birth rates. The firm birth rates are higher than the firm exists so that the ecosystem keeps growing. Slowly but surely, more financial capital and support organisations are becoming available, but universities are still mostly oriented towards general degrees instead of entrepreneurs. Finally, the market is also not yet oriented towards entrepreneurship, but public organisations try to lower the entry barriers for startups. After the birth stage, there is the growth stage where the number of birth rates of startups is growing. Finance is getting easier to access; there are plenty of market opportunities for startups, universities start to offer entrepreneurial training programs, and supportive organisations start to become more specialised on new firm creation (Mack and Mayer, 2015). After the growth phase comes to the sustainment and decline stages in which there are declining firm birth rates, a more difficult access to finance, a decline of serial entrepreneurs, and fewer market opportunities are offered by larger organisations than before. The biggest difficulty for startup ecosystems is to move from its birth stage towards the growth stage. To enhance the vibrancy and growth of a startup ecosystem, there exist four indicators which access the vitality of an ecosystem and point the direction of potential actions to enable growth (Stangler and Bell-Masterson, 2015). The first indicator is called the ecosystem density measured by the new and young firms in a particular region, the share of employment in new and young business, and the sector density. The second indicator is the ecosystem fluidity measured by the population flux, the labour market reallocation, and the amount of high-growth firms. The third indicator is called the ecosystem connectivity, which is measured by the program connectivity, spin-off rate and the deal maker networks. Finally, there is the ecosystem diversity measured by the multiple economic specialisations, immigration, and the mobility (Stangler and Bell-Masterson, 2015).

The most important implication of ecosystem thinking is that top-level management should not solely focus on the benefits of external venturing for themselves but that its goal should be to contribute to its ecosystem or build one themselves. A one-to-one relationship with startups will not work, but when the ecosystem around the organisation is healthy and expanding, the organisation will also benefit from this expansion. The four stages of startup ecosystem development can be used to determine in which stage the ecosystem is currently positioned and to determine what is needed to stimulate growth and enhance the vibrancy of the ecosystem. Another implication of ecosystem thinking is that managers should be aware of its position inside its ecosystem because changes in ecosystems can lead to threats or opportunities (Kuiper and van Ommen, 2015). External venturing can function as eyes and ears for new developments. On the other hand, external...
venturing does not only provide a framework for looking at the outside world. Ecosystem thinking could also function as a mirror for its organisation by validating its value propositions. This kind of thinking is important since many companies tend to focus too much on its innovations and neglect ecosystem developments while ecosystem developments are an essential factor for their success.

2.4.2. Company level

The company level is the second level and is about top-level management and how they organise innovation inside the organisation. There are three core elements at company level which have a significant influence on the results of external venturing. The three aspects are the corporate innovation strategy, the organisation of innovation and the corporate culture (Kuiper and van Ommen, 2015).

1. The corporate innovation strategy: Regarding the corporate innovation strategy, it is first important to have a clear innovation strategy and clear innovation themes (Kohler, 2016). There must be an innovation roadmap because “just trying to be innovative”, without apparently knowing what to do and where to go, will not work. Corporates must try to align its external venturing goals with the corporate objectives (Lerner, 2013). For example, Fokker Services could formulate an innovation theme around additive manufacturing with the intent to reduce the delivery time of spare parts when an aircraft is broken. Having clear innovation topics is very important because startups and corporates speak different languages and therefore it must be as clear as possible what to expect from each other.

There are many ways to define an innovation strategy. Tidd and Bessant (2013) distinguish between two main influential strategies: the rationalist approach and the incrementalist approach. The rationalist approach assumes that the organisation is perfectly aware of its core strengths, weaknesses, opportunities and market threats so that they can draft an accurate strategy to prepare for future changes. The incrementalist believes it is impossible to accurately estimate those four factors and that the corporate innovation strategy must, therefore, be focused on being ready for future market changes (Tidd and Bessant, 2013). This distinction has similarities with Porters distinction between the choice for innovation leadership versus innovation followership (Porter, 1980). Here, the innovation leadership strategy aims at being first to a market and is also called technology leadership. Innovation followership matches more with the incrementalist strategy as it aims at being late in a market and by imitating from the technology leaders. According to Porter, the main difference in strategy is that the rationalist strategy requires strong corporate commitment and risk-taking to become a market leader and that the incrementalist strategy requires strong commitment to analyse competitors, cut prices and learn during manufacturing. It is a fundamental difference, which works all the way throughout the organisation and therefore management must choose one or another before starting with external venturing.

2. The organisation of innovation The second essential element at the company level is about how innovation and thereby also external venturing is organised inside the organisation. It is important here to acknowledge and understand that there are different types of innovations which need a different kind of innovation management. A ‘one size fits all’ approach does not work (Kuiper and van Ommen, 2015). There are incremental and radical innovations, product or service innovations and many other types of organisation. It is not the purpose of this study to elaborate on all of these different types of innovations, but it is important for management to understand that there is a fundamental difference between product development and new business creation. Product development is all about predictability, focusing on the execution and short/mid-term projects where new business creation is
2.4. The environment of external venturing

about uncertainty, learning and mid/long-term projects (Kuiper and van Ommen, 2015). Understanding these differences is important because they require different approaches. For example, there is a difference between failing and learning. When working on new business creation failure does not necessarily mean failure. It is rather a way of obtaining new insights. Also, business planning should be treated differently. Product development is often using a linear approach because the goals are defined where new business creation is mainly characterised by an iterative approach because the goals and objectives are not set yet. There are many more differences such as different customers, markets, positioning strategies, business models and critical resources but the main point here is that management must understand these differences and organise it accordingly. Finally, the management board must realise that external venturing needs time to pay-back investments because on average it takes a startup 5 to 10 years to provide significant added value for the corporate (Kuiper and van Ommen, 2015).

3. The corporate climate: The third and final essential element at the company level is the corporate climate. The company needs to have an entrepreneurial climate where the employees understand the concept of new business creation and are open to new ideas (Kuiper and van Ommen, 2015). With external venturing, employees will get in touch with startups, so they need to have an open mind for this. An important factor to stimulate an entrepreneurial culture among employees is support from senior management (Bannerjee et al., 2016). Senior management can change the corporate culture because they are the ones who make decisions. Full support from top-level management support can only be achieved when the managers understand the importance of innovations and when they acknowledge that they're not capable of doing this themselves. Another prerequisite for an entrepreneurial culture is that the corporate managers must have some forgiveness towards its employees and the startups because the only thing you know for sure is that mistakes will be made. This kind of forgiveness can be organised by creating a space (literally or figuratively) in which the startups can play around. If this is not possible for managers to accept, they should not want to work with startups. Tidd and Bessant (2013) describe six factors which contribute to an entrepreneurial climate. These six factors are:

(a) Trust and Openness: This factor is about the emotional safety of employees. An ideal situation is a safe environment in which the employees dare to put forward new ideas. In this situation, there must also be clear communication to enhance the openness.

(b) Challenge and involvement: The degree to which employees are involved in daily operations, long-term goals and the corporate vision. High level of challenge of involvement means that employees are very committed to contributing to the goals of the organisation.

(c) Support and space for ideas: This is the degree to which employee is able to work on new ideas. If there is no sufficient time, people will focus on their current projects only and not be focusing on innovations at all.

(d) Conflict and debate: Conflict is often perceived as something negative but there will always some degree of debate and tension between two people. If this level is too high, people hate each other and is not desired but if it is too low, people seem not motivated or not interested, so therefore a normal level of conflict and debate is an important factor.

(e) Risk taking: Employees must understand that risk-taking is acceptable. In a high-risk climate, disruptive new ideas can be put forward, but it must also not be too risky. Employees would then be confused and will start to complain that nothing is getting finished.
(f) **Freedom:** The final factor is freedom and can be described as the independence in behaviour by people inside the organisation. In an organisation with a lot of freedom, people have autonomy to define much of their work which enhances the entrepreneurial climate.

These six factors should be taken into account when developing an entrepreneurial climate but could also function as indicators to assess its current climate.

### 2.4.3. Venture unit level

The next level is the venture unit level, inside an organisation, and is the level responsible for the execution of the external venturing activities. This unit is the bridge between startups and the corporate. They have a mediating role as they have to understand both languages and protect both parties from each other (Kuiper and van Ommen, 2015). They are the executive body within the organisation, and therefore this subsection will elaborate on essential elements for the execution of the external venturing instruments. There are a couple of important factors which should be considered when organising external venturing.

1. **Use multiple EV instruments:** The first essential element is that external venturing instruments should not be used individually. Multiple instruments should be used to cover both early-stage and later-stage startups. An integrated approach to all the instruments are required, and ultimately corporates need to engage in both internal venturing and external venturing (Tidd and Bessant, 2013).

2. **Organise leverage:** The venture unit should also be organised so that they have leverage within the company to set-up meetings rapidly. Like already mentioned before, the venture group function as a bridge between the corporate and the startup. Therefore it is their job to make sure the collaboration runs smoothly. Leverage/power within the company is an important factor to ensure a smooth collaboration. Larger corporates often have a rigidly hierarchical decision-making structure, and research found out that the more the organisation is organised vertically, the longer a decision-making process takes (Bannerjee et al., 2016). Long decision-making processes are undesired for startups, and this is also one of the major barriers for startups to work with larger corporates.

3. **A degree of freedom:** The third important element is about the execution of the external venturing instruments, also called the process of external venturing. It is important here that the startups must have a degree of freedom. Corporates are good at providing funding, enabling access to markets but they’re not good at looking at other, disruptive, business models. Therefore they must, in their collaboration with startups, allow them to move freely. This room of experimentation and having the flexibility to deviate from the standard road is one of the essential conditions to have a good relationship with a startup. Also, it should be organised in such that startups are protected against any early failures because it is a learning process in which there must be room for failures (Kuiper and van Ommen, 2015). One way to organise the degree of freedom is by applying the concept of ambidextrous organisations in which the exploratory business units are separated from the exploitative business units (O’Reilly and Tushman, 2004) (Birkinshaw and Gibson, 2004). The venture unit can be seen as an exploratory business unit as it attempts to develop innovations which are new to the organisation. The exploitative business units would be the departments which are working on existing business models. O’Reilly and Tushman (2004) believe that "the concept of ambidextrous organisation provide a practical model for forward-looking executives seeking to pioneer radical or disruptive innovations while pursuing incremental gains."
4. **Remain incentives at all times**: The final important element is that it is important to have and keep incentives for the startups at all times (Bannerjee et al., 2016). They need to have a trigger to reach their maximum potential. For example, startups need funding, but when they've received too much funding, they could become lazy. Corporates should therefore not try to saturate all the startup needs but make sure that the rewards are positioned at the end. One way to accomplish this is by sharing resources such as testing facilities or knowledge which is of great value, but it is also something which does not still the hunger of the startup directly (Kohler, 2016). These kind of resources could save the startup money, but startups can't translate these type of resources into profits for their own.

### 2.4.4. Startup and entrepreneur level

The last level is the startup and entrepreneur level. The startup level is different from the entrepreneur level as the startup, and the entrepreneur is not the same. A good startup might contain bad entrepreneurs and good entrepreneurs not necessarily form a good startup. A startup is also about marketing and financing, not only for new product and new business creation. Both levels are important as the entrepreneur, in the end, is the one who raises the company. All the circumstance mentioned above can be prepared and organised perfectly by the corporate but without having the right entrepreneurs in the startup at the right spots, the startup is doomed to fail (Kuiper and van Ommen, 2015). For the corporate, it is important to assess the quality of the entrepreneur/startup before starting a collaboration. There is some common agreement about which criteria need to be considered, but there is a disagreement about the importance of this criteria (Tidd and Bessant, 2013). These five criteria are:

1. **The entrepreneur's personality**: This criterion aims at determining if the entrepreneur can evaluate and react to risk and if the entrepreneur is capable of putting sustained efforts into the startup for a prolonged period.

2. **The entrepreneur's experience**: This criterion aims at determining if the entrepreneur is familiar with the market, demonstrated leadership capabilities, has a relevant track record and if it possesses essential entrepreneurial skills such as psychological preparedness.

3. **The product characteristics**: This criterion aims at determining if the startup already has a (working) prototype, proved market acceptance, intellectual properties and the novelty of technology.

4. **The market characteristics**: This criterion aims at determining if the target market has high growth rates or that the startup is stimulating an existing market, the threat to competition.

5. **Financial factors**: This criteria aims at determining the prospects for the short-term and long-term financial returns for the upcoming ten years and if the investment can easily be made liquid.

These criteria can be used as a guideline to assess the potential of the business plan of the startup. However, it is up to personal beliefs and motivation which of these criteria are weighing the most in judging the startup. Financial investors will, for example, emphasise the financial actors while engineers will primarily look at the product characteristics.

### 2.5. Conclusions

The primary topics of this study are startups, entrepreneurs and external venturing and these three have been explored in this chapter to narrow down the scope of this research. For startups, it has been decided to
distinguish between early-stage startups (who are in the formation phase) and later-stage startups (who are in the validation phase). Scale-ups have been excluded from the scope. Furthermore, it has been decided that from now on entrepreneurs are people with an innovative product or service who are willing to start a new business or already have an early / later-stage startup. It was also found that entrepreneurs can be categorised based on their background and that an supportive environment and clarity of the industry opportunities increases the likelihood of people in becoming entrepreneurs.

With regards to external venturing, it can be concluded that there are four different instruments which are in line with the strategic objectives of Fokker Services. These are strategic partnerships, CVC investments, accelerators and incubators. When to use each of these instruments primarily depends on the startup needs although it is most likely that CVC investments, strategic partnerships and accelerators are used for later-stage startups. This tool cannot be executed on itself because the success of external venturing depends on the success of five different level. Each level has its important considerations and prerequisites for being able to start with external venturing successfully. These important considerations are half of the input for answering the first sub-question of this research. Therefore the main results are summarised in the following table:

<table>
<thead>
<tr>
<th>Level</th>
<th>Literature study results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem</td>
<td>Management should not focus solely on the benefits of the company itself</td>
</tr>
<tr>
<td></td>
<td>Management should be aware of its position inside its ecosystem and look at its dynamics</td>
</tr>
<tr>
<td>Company</td>
<td>A clear innovation strategy is important</td>
</tr>
<tr>
<td></td>
<td>Management must understand the difference between product development and new business creation and that external venturing takes time to pay-off</td>
</tr>
<tr>
<td></td>
<td>An entrepreneurial external climate is important with support and forgiveness from top level management</td>
</tr>
<tr>
<td>Venture unit</td>
<td>More than one EV Instrument should be used</td>
</tr>
<tr>
<td></td>
<td>Leverage of the venture unit inside the organisation is important</td>
</tr>
<tr>
<td></td>
<td>The startup must have a degree of freedom</td>
</tr>
<tr>
<td></td>
<td>There must be an incentive for the startup at all times</td>
</tr>
<tr>
<td>Startup</td>
<td>Having a well-balanced startup team</td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>Having good entrepreneurs with the right characteristics is key</td>
</tr>
</tbody>
</table>

Figure 2.5: Literature study results on the execution of EV
Research methodology

In the previous chapters, the motivation, objective and theoretical foundations of this study were specified. Before actually starting the research, it is necessary to determine the research strategy. This approach provides a structured means of answering the research questions. Section 3.1 will first elaborate on the research strategy and framework, followed by the data collection methods in section 3.2. Up next is the data analyses and synthesis section, which explains how the results from the literature study and case studies have been used for the remainder of this study. Section 3.4 is the final step of the research strategy and describes the validation and closure step. Finally, section 3.5 concludes on the most important points from this chapter.

3.1. Research strategy

The research strategy is chosen to be the process of building theory from case studies from Eisenhardt (2017) because the main research question requires building a new framework (the list of success factors and pitfalls). The reason why this process has been chosen is that it is especially appropriate when it comes to new topic areas. The first step in this process is to define the research questions, which has already been done in the first chapter and can be found in section 1.3. The research questions are the input for the second step of this process.

The second step is to select study cases, craft data collection instruments and to enter the field to collect data. The first research question will be answered by both a literature study and extra qualitative cases studies. The reason why extra study cases have been used, in addition to the literature study, is because publishing a paper in a scientific journal often takes more than one year. This means that there is a discrepancy between the latest practical insights in the field of external venturing and the available literature. The advantages of a multiple case study strategy are also that the collected evidence is more compelling which enhances the robustness of the study. The second research question has been answered only with the help of case studies. It is decided not to review the literature about startup challenges beforehand to prevent any biases. 'Generic' startup challenges do not matter if they don't apply to the aviation industry. Therefore, it is found to be sufficient to use the results from the case studies only as input the on startup challenges in the aviation industry. Furthermore, for answering the second sub-question, it is decided that the startup challenges and solutions have been divided into early-stage challenges and solutions and later-stage challenges and solutions. The
study cases to determine the later-stage challenges and solutions have also been further divided into the three aviation industry segments which are part of the scope of this research: the design and manufacturing segment, the MRO segment and the modification segment. This industry segmentation has not been applied to the early-stage challenges and solutions because if early-stage startups do not know in which industry they will become active, they also don't know in which industry segment they will begin. Also, the aviation industry is most often referred to as a single industry where people don't distinguish between the different segments beforehand. An elaboration of the second step is provided in section 3.2.

The third step as identified by Eisenhardt (2017) is to analyse the data and to shape the hypotheses. The hypothesis in our case is the normative framework with success factors and pitfalls and the implementation plan for Fokker Services. The framework and the implementation plan are both parts of this step as they are both based on the results coming from the previous step. An elaboration of how this has been done is provided in section 3.3. The fourth step according to the Eisenhardt (2017) approach is to enfold literature
3.2. Data collection method

The main data collection method for the case studies has been decided to be interviews. The interviews followed an unstructured nature which allowed for observing unaccounted data and the ability to steer the conversation Yin (2014). This is found to be a useful methodology for this study. This section will explain how, where, with what and with whom the unstructured interviews took place. An overview of this is provided in figure 3.2.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Who</th>
<th>Function</th>
<th>When</th>
<th>How / where</th>
</tr>
</thead>
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<tr>
<td>Philips</td>
<td>Maarten van den Boogaard</td>
<td>Open innovation leader</td>
<td>31-3-2017</td>
<td>Telechone + HQ Philips, HighTech Campus Eindhoven</td>
</tr>
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<td>Airbus Biz lab</td>
<td>Lena Bödeker</td>
<td>Intern</td>
<td>4-4-2017</td>
<td>Airbus Biz lab</td>
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<td>Airbus Biz lab</td>
<td>Rev Buckman</td>
<td>Bizlab Leader</td>
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<td>Airbus Biz lab</td>
</tr>
<tr>
<td>Innovation family</td>
<td>Corina Kuiper (EV Expert 2)</td>
<td>CEO / Founder</td>
<td>12-5-2017</td>
<td>Telechone</td>
</tr>
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<td>Eric Terv</td>
<td>Director/ founder</td>
<td>10-5-2017</td>
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<td>Wouter Riedijk</td>
<td>Co-founder</td>
<td>31-3-2017</td>
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<td>MOCS</td>
<td>Kristian Schmidt</td>
<td>Engineer</td>
<td>19-4-2017</td>
<td>Yes/Delft</td>
</tr>
<tr>
<td>Dutch VR</td>
<td>Duncan Smit</td>
<td>CEO/ Founder</td>
<td>12-7-2017</td>
<td>Telechone</td>
</tr>
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<td>Technobis Group</td>
<td>Max Baan</td>
<td>CEO</td>
<td>1-4-2016</td>
<td>Yes/Delft</td>
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<td>B-tree</td>
<td>Erik Klaas</td>
<td>CTO/ Co-founder</td>
<td>4-7-2017</td>
<td>NAG GMA</td>
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<td>AELS</td>
<td>Derk-Jan van Heerden</td>
<td>CEO/ Founder</td>
<td>11-4-2017</td>
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<td>Innovative Binaries</td>
<td>Soumil Misal</td>
<td>CEO/ Founder</td>
<td>4-7-2017</td>
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<td>Wheelwag</td>
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<td>Job Heimeriks</td>
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<td>Marcvan Elling</td>
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<td>Kevin Clark</td>
<td>CEO/ Founder</td>
<td>13-4-2017</td>
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<td>Inflicht VR</td>
<td>Nikolas Jaeger</td>
<td>CEO/ Founder</td>
<td>23-3-2017</td>
<td>AIX2017+ Skype</td>
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<td>Starburst</td>
<td>Hannah Kiel</td>
<td>Senior consultant</td>
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<td>NAG</td>
<td>Frank Janssen</td>
<td>Managing director</td>
<td>26-4-2017</td>
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<tr>
<td>TU Delft</td>
<td>Femke Verdoejaal</td>
<td>Coordinating External Affairs</td>
<td>13-6-2017</td>
<td>TU Delft</td>
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<td>Fokker Services</td>
<td>Rick Visser</td>
<td>Head of airworthiness office</td>
<td>28-2-2017</td>
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<td>Fokker Services</td>
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<td>Design Engineer</td>
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<td>Fokker Services</td>
<td>Manfred Hooiendoom</td>
<td>E-commerce manager</td>
<td>3-3-2017</td>
<td>HQ Fokker Services</td>
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</tbody>
</table>

Figure 3.2: Overview of the participants
3.2.1. Participants
The selected study cases have been selected based upon the availability of the people and the network of Fokker Services. To comply with the triangulation principle, at least three sources for each study purpose have been used to cover different angles. The study cases for external venturing are chosen to be Philips, and the Airbus Bizlab combined with two external venturing experts who have relevant experience in the corporate-startup collaborations. The study cases, to determine the early-stage challenges and solutions, have been chosen to be startups which are active in non-aviation industries, but which had (or still have) the potential of being so. These study cases are more interesting than existing aviation startups because aviation startups already overcame the early-startup challenges as they’ve already entered the aviation industry. It will be harder for aviation startups to identify the early-stage startup challenges because they cannot identify something which they might not even have experienced. For the determination of the later-stage challenges and solutions, a different type of study cases have been selected, namely: aviation startups and aviation-related organisations. These have also been divided over the three (sub)segments because we could not be sure upfront if challenges in one segment are the same as in another. Finally, there are also organisations which have been interviewed which have relevant experience with both early-stage and later-stage startups. These are not startups but are in touch with entrepreneurs/startups and can, therefore, provide insights into the startup challenges. A description of all the participants and why they’ve been selected can be found in Appendix A.

3.2.2. Interview locations
The interviews have been conducted at different locations. Most of the interview were conducted at the corporate location of the interviewees. However, due to geographical distances, time limitations or practical issues some interviews were also hosted by Fokker Services via Skype or telephone. Finally, some interviews have also been conducted at relevant events. The Aircraft Interior Expo (AIX) in Hamburg has been visited to perform short interviews. This expo was firstly introduced in 2000 by UKIP Media & Events in Cannes and was the world’s first event dedicated entirely to aircraft interior design. It is the main show to see the future of air travel and what it has in store for corporate owners. Last year it broke new records as it counted an amount of 16,000 attendees, more than 180 airlines across 26 worldwide markets and more than 530 exhibitors. The type of exhibitors varies from industry leaders to large players and startups. Many different exhibitors and many startups were attending the show and this why it has been decided to visit the show.

Also, the general member assembly of the NAG has been visited. The Netherlands Aerospace Group or NAG is the trade association for national and international organisations established in the Netherlands and active in aerospace or airport development industry. For each segment, the NAG arranged a group discussion topic and invited a speaker to open the discussion. The purpose of the manufacturing meeting was to raise awareness of the Dutch supply chain to keep up with innovation to hold and improve its supply chain position as a co-creator, not as a ‘build-to-print’ low-cost supplier. During this meeting but also before and after this session there was the possibility to share experiences, and this provided exciting findings for the design & manufacturing segment.

3.2.3. Interview procedure
Even though the interviews followed an unstructured nature, the procedure of each interview has been done the same to improve the reliability of the results. Also, a couple of techniques have been studied beforehand
to prevent any biases. Key learnings from Yin (2014) are for example to ask right questions and interpret the answers reasonably, to be a good listener, to try to stay objective, to stay adaptive during the interview (which is of particular importance for unstructured interviews in which new situations are encountered), to be familiar with the topic and to avoid biases (Yin, 2014).

1. **Invite:** The participant was asked to participate in the study via an introduction of this study and a motivation of why their input was of interest to this study.

2. **Prepare:** If the participant agreed to an interview, the next step was to prepare the interview with a background study on the interviewees and the organisations they were representing. Also, a list of topics has been prepared for every interview to guide the interviews and to steer it if necessary to obtain the results I was looking for. These lists can be found in Appendix B but note that these questions functioned as guidelines. Not all the questions have been answered during all the interviews due to the unstructured nature of the interviews.

3. **Execute 1:** The participant was asked for permission to record him/her during the interview.

4. **Execute 2:** The participant was provided with a short introduction of the study objective and the reason why the participant was selected for an interview. For the external venturing interviews, the objective was to learn as much about how the organisation must execute external venturing. For the startup challenge and solution interviews, the objective was primarily to determine what challenges they were facing and how they think those can be solved. The introductory part has been updated during the study as it was found that the introduction is important to start the conversation of the right foot.

5. **Execute 3:** I was making notes during the whole interview and kept track of the topic list to make sure all themes are covered, and I asked supporting questions when the conversation needed guidance.

6. **Process data:** I collected the notes and sound samples and wrote a more detailed story based on these notes. In most cases, it took not more than two days until the notes and audio fragments had been processed into an extended version so that there would be a minimum loss of information. The audio fragments were also transformed into a written form.

This procedure has been repeated for every interview and generated the output of the results. The supporting materials for the interviews were a smart phone to record the conversations, pen and paper to write down quick reminders about the interview and a printed topic list with supporting questions for each interview. The topics were divided in early-stage startups, later stage startups and topics to learn about external venturing.

### 3.3. Data analysis and synthesis

After all the data from the interviews had been collected, it turned out, due to the nature of the unstructured interviews, that for example, later-stage startups provided results on early-stage challenges and solutions. Also, startups which had been interviewed for the early-stage startup challenges and solutions mentioned some interesting things about external venturing and later-stage challenge and solutions. Therefore, the output from the interviews was accumulated and split again into five categories: external venturing, early-stage challenges, later-stage challenges, early-stage solutions and later-stage solutions. This process is demonstrated in figure 3.3.
Also, when looking at the data, there were a couple of results which could be relevant for other studies but which are found not to be relevant for this study. Likewise, some of the results are not part of the scope of this study and are therefore also left out of this study. These results have been split from the results presented in chapter 4 and put in Appendix C. In this Appendix are also the results from the short interviews with startups at the Aircraft interior Expo. These results are not taken into account because these interviews only provided a small amount of data which is found insufficient to be taken into account as a study case. Sometimes it also occurred that the results from one interview were contradictory to the results from another interview. In this case, it is decided to include both arguments in the results. For example, one external venturing experts mentioned that corporates should use more than one instrument, both internally as externally oriented while another external venturing expert mentioned that intrapreneurship or internal venturing would not work. In this case, it has been solved by saying that corporates should use more than one instrument at the same time and by saying that intrapreneurship might not always work and that extra care has to be taken when doing intrapreneurship. Similar contradictions have been dealt with in the same way.

The results from the external venturing study cases have been translated into success factors and pitfalls by first comparing the case study results with the key learnings from the literature study to see if there were contradicting results here as well. Based upon the outcome of this comparison, the results have been translated into success factors and pitfalls using synthesis. The same is true for the translation of the startup challenges and solutions into success factors and pitfalls which has also been done based on synthesis. A more detailed explanation of how this is done is provided in the discussion section.
Furthermore, one rule for this research was that all results were going to be taken into account. It didn't matter if a result was only mentioned by one interviewee or by three interviewees because the more challenges can be resolved, the higher the chances on success for startups will be. This is also what is decided to be the base for a mutually beneficial relationship. Another reason why there is chosen not to put a minimum amount of interviewees, for a result to be taken into account in the synthesis part, is because of the limited sample size. Only a small percentage of the total amount of startups and experts have been interviewed as a part of this study, so therefore it could be that only one startup, for example, mentioned a challenge while in fact hundreds of startups are facing the similar challenge but which have not been part of this study. Finally, the reason why there has been chosen to comply with the triangulation principle is not to say that for each results at least three people must have experienced the same difficulties. Rather the purpose of using the triangulation principle was to approach the same challenges and solutions from different angles, to be sure that no results are left out of this study. Due to all the aforementioned motivations, all the results (even when the result was only found at one interviewee) have used in the synthesis part.

To be sure that all the data from the interviews has been interpreted and translated correctly and that no results were missing, it is also chosen to send a summary of the results by e-mail to all the interviewees. Together with this summary the research background, objective and strategy and a request to review the results were sent along with the relevant results. Not all the interviewees responded to the request for validation, but the responses from the interviewees who did review the results are presented in Appendix D. Before the synthesis part has been done, the feedback from the interviewees has been incorporated into the results.

So far this section explained how the results have been used and that the results have been translated into success factors and pitfalls using synthesis. However, the translated results into success factors and pitfalls for external venturing in the aviation industry are not an implementation plan in itself. Therefore the success factors and pitfalls have been translated again, using synthesis into an implementation plan which is ready to be used at Fokker Services and other organisations in the Dutch aviation industry. This plan describes the first steps for Fokker Services to start with external venturing and is also the answer to the third research question.

3.4. Validation and closure

The final step in the Eisenhardt (2017) approach is to enfold literature to build internal validity and to sharpen the generalizability of the synthesis. This, however, is not possible as this is a new area of study and there is no literature available to be able to check any contradictions or similarities. Therefore this final validation step has been done by interviewing two experts who have relevant experience in this field. One of the interviewed experts is the head of the business development and sales department at Fokker Services, and the other one is an external venturing expert and is called Corina Kuiper. She has also been used as study cases for this study. Both experts were sent a summary before the interview which contained the research results from the data collection phase and the results from the synthesis part including the list of success factors and pitfalls and the implementation plan. Both were asked about the relevance, accuracy and value of the implementation plan to give the implementation plan more weight. Both interviews lasted approximately one hour, and notes were made during this interview. The main results from the interviews are presented in Appendix E, and their feedback has been used in a two-fold approach. Feedback which could be integrated within the time limitations of this study have been incorporated into the study and feedback which could not be included is used as input for chapter 6. One of the sections describes how their feedback can be used as a starting point.
3.5. Conclusion
The main research strategy has been the process of building theories from qualitative case studies from Eisenhardt (2017). The accompanying data collection method is chosen to be unstructured interviews because unstructured interviews allow for observing unaccounted data and being able to steer the direction of the interview. An interview procedure has been made to assure that the required data is obtained from the interviews. For the corporate venture study cases, two organisations and two external venturing experts have been chosen. For the early-stage startup challenges and solutions, it was decided to pick startups which are active in non-aviation industries, but which had (or still have) the potential of being so. For the later-stage challenges and solutions, different type of study cases have been selected and have been further divided into the three aviation industry segments which are part of the scope of this research: the D&M segment, the MRO segment and the modification segment. This industry segmentation has not been applied for the early-stage challenges and solutions. The results from the interviews have been validated with the interviewees and translated using synthesis first to draft a list of success factors and pitfalls for external venturing in the aviation industry and secondly to translate this list into an implementation plan for Fokker Services. The final step was to validate the synthesis with two experts: one expert from the industry and one external venturing expert.
Case study results

This chapter presents the results from all the case studies. Not all the results have been used, and the ones who didn't are presented in appendix C. The results, who are part of this study, about external venturing are presented in section 4.1. The early-stage challenges and solutions are presented in section 4.2 following by the later-stage challenges and solutions in section 4.3.

4.1. External venturing

The results about corporate venturing have been organised per environmental level of influence on external venturing as indicated in the second chapter. The results are summarised and presented in figure 4.1. An elaboration of the results is presented in the subsections below. All the results are free of own interpretation, and the source of the result can be found in the most right column of the figure.

4.1.1. Ecosystem level

Expert 1 mentioned that the most important thing at ecosystem level is that corporates should try to build a portfolio of start-ups and build a so-called startup ecosystem. Also, he mentioned that corporates should not try to develop a one-to-one relationship with startups but look at other (complementary) organisations as well because, in product development, typically many organisations are involved. He also thinks that ecosystem thinking should be incorporated into the company at all levels: personal, department and corporate level. The second result, mentioned by three startups, is that not all startups are looking for financial investments only. Some mentioned that they are primarily looking for development partnerships. One startup, for example, mentioned that they did not want to work with partners who could only provide finance. Rather than working with financial investors, they were looking for a partner who could provide more resources than just money and who wanted to do the whole development process together. Another startup mentioned that they joined a fund but that they were hoping to find another kind of partnership. Finally, a third startup mentioned that they were looking for collaboration partners instead of investors because they did not want to sell-off a part of their company because it is a family/friends business.
4.1.2. Company level

At the company level, a couple of insights regarding corporate venturing have been found. First, many interviewees said that it is important to have a clear innovation strategy with clearly defined innovation themes. Furthermore, it was also mentioned that it is important to determine where a corporate is fixed in a business model and what the disruptive innovations are where the corporate is looking at. Will that be short-term innovations or long-term innovations? Those are the things senior management has to be aware of because if there is no clear innovation strategy, it will not happen. The importance of having such a strategy beforehand is confirmed by the example of one of the startups. They were participating in the Airbus Bizlab program and experienced to be in a strange position because Airbus did not know what to do with them. Airbus lacked a proper innovation strategy because they were not sure how the startup could fit into their business model. Airbus is manufacturing aircraft and was not necessarily active in the area of the startup. Before continuing to collaborate with the startup, Airbus wanted to clarify the situation, but this uncertainty from Airbus’ side caused the decision-making processes to slow down.

Philips also mentioned that defining clear innovation themes are important. Philips used to be mainly focused on the healthcare industry and lifestyle technologies, but nowadays it is undergoing a transition where all the departments are going to be categorised under the same denominator: Health continuum. Health continuum focuses on ensuring people’s health during their entire life. This means that they 1) develop products for a healthy lifestyle 2) support people if needed with diagnosing equipment and 3) support people with curing technologies. In other words, its ambition is to provide any health-related support during a person’s entire life. If for example, this continuous support can be drawn as a line between two points (birth and death), the current product groups and capabilities of Philips make a dotted line between the two points.
Philips’ ambition is to make a continuous line to justify the health continuum principle. Making a straight line from a dotted line can be done in two ways: expanding the existing dotted areas by incremental innovations in current product portfolios or by creating new dots to fill up the space between the existing dots by developing new capabilities with radical innovations. The example of the dotted line has also been used to explain their current corporate venturing strategy. Philips has already more than ten years of experience with corporate venturing, and during this period they’ve learned many things. Therefore they’ve decided that they only want to engage with startup companies, referring to the dotted line example, which can fill up the gaps with radical innovations and not engage with startups which are only capable of increasing the length of the existing dots with incremental innovation. This also reduces the chance of cannibalising their current markets.

Secondly, it was found by the experts that it is important to have support from top level management. They said that they are, in the end, the ones who make the decisions about investments. One startup mentioned that the success of their startup depended on high-level commitment and thought that without the commitment they wouldn’t exist anymore nowadays. Expert 1 also mentioned that in his daily job as a corporate-startup specialist, the first thing what he does when they get a new project assigned is talking with C-level management (CEO / COO / CFO) to find out whether or not they support the idea of working with startups. If not, he gives back the assignment because when there is no support from top management, he believes that it will not work. A disruptive startup works against a smooth operation because innovation means chaos. Therefore he mentioned that if you’re trying to seek support bottom-up, you will get resistance everywhere throughout the organisation. Middle management will work with the disruptive startup when top management tells them to do so.

Finally, it is found important by many startups that a corporation must possess an entrepreneurial climate in which employees understand new business creation. For example, Philips mentioned that their employees find it often difficult to work with startups because they are biased by years of experience (within the company). These employees often act in the interest of the corporate only which hinders the development of the startup. Expert 1 mentioned that this could be prevented by for example “firing” someone from the corporate and putting that person into the startup so that it will only act in the interest of the startup, without being constraint by other views. Philips prevents this from happening by separating entrepreneurship departments from their main offices. Another startup, which has been in contact with Fokker Services before mentioned that changing the corporate culture of Fokker Services might be the most challenging task before starting with corporate venturing.

4.1.3. Venture unit level

Many different results have also been found at the venture unit level. One of them is that corporate should use multiple corporate venturing instruments, both internally and externally. According to one of the experts, corporates which only chose one type of instrument will fail and a partnership with a startup will then be likely to end in less than three years. Also at Philips is corporate venturing organised into three ways: A health tech accelerator team which support intrapreneurs using an internal accelerator, an accelerator program with an external incubator (High Tech XL) and a venturing team. Another result is that internal communication between the multiple instruments is found to be important. One startup, for example, was involved in the Airbus Bizlab program and mentioned that Airbus was inviting their venture capital unit for the final day of the Airbus Bizlab program. However, none of the startups received an investment from the venture capital
unit after finishing the incubation program. This is strange because the Airbus Bizlab program is, according to the startup, very much focused on the added value for Airbus. Therefore they expected it to be likely for startups, who participate in the Airbus Bizlab program, to obtain an investment afterwards.

Furthermore, it is also found to be important for a venture unit to have leverage inside the organisation to arrange meetings for example. One startup for the Airbus Bizlab mentioned that it was precious to participate in the Airbus Bizlab program because the people were supporting them intensively to set-up meetings but that they still experienced difficulties in arranging these meetings. He said that having a venture unit is one thing, but if it does not have a commitment from the organisation, it will not work. He also thinks that an entrepreneurial culture will most likely also contribute to this. Not only setting up a meeting should be leveraged but also the decision-making process. People from the Airbus Bizlab mentioned that assigning “technical” project champions could help to increase the required leverage. Another result at venture unit level is that many startups, both experts and Philips mentioned the importance for startups to have a degree of freedom. One way of organising this degree of freedom is by literally creating a space in which startups can play around. Collaborating with startups is the same as “Living apart together”, and no control over the startup development is of vital importance to the success of corporate venturing. Philips learned to allow this kind of freedom the hard way. They started to collaborate with startups using an incubation program. In this program, both intrapreneurs and entrepreneurs were given the opportunity to get funding from Philips but this initiative more or less failed because Philips was expecting too much from the teams. They invested significantly in these startups, but because of this, they were expecting too much from them. They were, according to themselves, trying to control the progress of the startup too much and therefore none of the startups succeeded. Also, the Starburst accelerator mentioned not to stick with just one company but to move freely around many businesses and do business with everyone. One startup confirmed the importance of this kind of freedom as well by saying that the organisation where they were collaborating with was too much focused on the benefits for themselves. They were constantly looking for opportunities how the startup could help improve their businesses, and the startup found that this was a little bit too much because other industry players could also provide interesting insides which would’ve helped them further.

Regarding the execution of the instruments, there are also a couple of results. First, it is found important to have an incentive for the startup available at all times. One of the experts provided an example to demonstrate this by comparing the corporate with a tanker and the startup with a lifeboat. He mentioned that a corporate-startup collaboration should be as such that the corporate is feeding the lifeboat just enough resources (knowledge, money and market access) until it is running at the same speed as the tanker so that they can pick-up the lifeboat from the water. The corporate has to be careful in providing just enough resources so that the startup is still motivated to continue. If more funding than required is obtained, it could happen that the startups becomes lazy and does not push itself to the limit causing the product to be less disruptive than it could be. Similar, when loading the lifeboat with too many resources, it could sink because it cannot carry the weight. The rewards of the startup should be at the end of the development process and not at the beginning. At the general member assembly of the NAG, someone was also more in favour of providing loans instead of subsidies. Loans make sure that the startup is triggered to pay the full amount of money back to the creditor. Secondly, it is found important by the expert to have people inside the venture unit who are capable of speaking the language of both the startup and the corporate. It is a continuous argue about who should adjust to whom and therefore it is important to have someone in the organisation which understands both situations. Thirdly it was mentioned by expert two that corporates must start slowly with corporate venturing
because it is a corporate competence which needs to be developed. She said that it is impossible to start out of the blue with corporate venturing because it is very complicated and requires a thorough organisational transition. It is very dangerous to start collaborating with startups without having any experiences, and she recommended that it would be better first to start with 'light-versions'. First learn, then accelerate and make use of experts who have experience in raising companies. Not only should corporate venturing be started slowly, but she also mentioned that engaging with startups should start slowly. An open environment works well here, where people can work near the corporate so that the startup and the corporate can get to know each other. It feels uncomfortable to sign a contract without even knowing each other very well so with this area the two parties can "date with each other before getting married". Finally, it is found to be important by both experts to communicate the goals properly because startups like predictability.

4.1.4. Startup / entrepreneur level
At the startup/entrepreneur level, there are two main results from the interviews. First, it is mentioned by one of the experts that assessing the quality of the startups is very important nowadays. He mentioned that the whole "startup-hype" means that more and more people are trying to start a business, including the ones which do not have the right capabilities to do so and the ones who should not have started in the first place, without the hype. Secondly, it is found to be very valuable to have people with the required knowledge and skill-sets inside the startup team. One startup mentioned that it is often difficult to obtain the right domain knowledge and that a solution could be to put an experienced guy from the corporate in the startup. The same startup mentioned that in their certification-process, it would’ve been beneficial for them to have a guy with knowledge of the regulations on board to provide them with the required knowledge for such a certification process. They lacked a good understanding of the regulations and experts like that would have helped them very much. Another startup mentioned that their core capabilities were not in the aviation industry and therefore were looking for strategic partnerships to obtain knowledge about the aviation industry. The entry-barrier for them was high and complex, and they would’ve never entered the industry without having someone on their team who knows about this.
4.2. Early-stage startup challenges and solutions

This section presents the main findings from the identification of the early-stage startup challenges in the aviation industry. Early stage challenges are difficulties which startups are facing when they're forming their team, vision, mission and strategy. The startup is looking for a problem/solution fit and is not sure yet in which industry their technology or solution can solve a profitable problem. No industry segmentation has been applied at this early-stage because if early-stage startups do not know yet in which they will be active; they also don't know in which segment (Design and manufacturing, MRO or modification) they will become active. Also, the aviation industry is most often referred to as a single industry where people don't distinguish between the different segments beforehand. The results are presented in figure 4.2.

<table>
<thead>
<tr>
<th>Category</th>
<th>Results</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>The public view</td>
<td>Startups assume that the industry is slow, conservative and stubborn</td>
<td>Three startups and the NAG</td>
</tr>
<tr>
<td></td>
<td>Startups decided to enter a non-aviation industry based upon assumptions</td>
<td>Two startups</td>
</tr>
<tr>
<td></td>
<td>Startups consider non-aviation industries first when choosing an industry</td>
<td>Four startups</td>
</tr>
<tr>
<td></td>
<td>to start a business in</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>Students are not familiar with the industry</td>
<td>One startup and the NAG</td>
</tr>
<tr>
<td></td>
<td>Students have primarily theoretical backgrounds</td>
<td>Two startups</td>
</tr>
<tr>
<td></td>
<td>Many students start working in other industries</td>
<td>One startup and the TU Delft</td>
</tr>
<tr>
<td>Distance to industry</td>
<td>There are no aircraft manufacturers located in the Netherlands</td>
<td>Two startups</td>
</tr>
<tr>
<td></td>
<td>Only a few big Dutch aviation organisations play a role in the international industry</td>
<td>Two startups</td>
</tr>
<tr>
<td></td>
<td>Business link between startups and the industry is missing</td>
<td>The NAG en the Starburst Accelensor</td>
</tr>
<tr>
<td></td>
<td>Startups don't know whom to contact and where to go</td>
<td>One startup</td>
</tr>
<tr>
<td>Incentives</td>
<td>Yes! Delft has wrong incentives to stimulate entrepreneurs to start a business in the aviation industry</td>
<td>One startup</td>
</tr>
<tr>
<td></td>
<td>Regional grants are not aligned</td>
<td>One startup and the Starburst accelerator</td>
</tr>
<tr>
<td></td>
<td>It is easy to go with aerospace engineering knowledge towards other industries</td>
<td>Two startups</td>
</tr>
</tbody>
</table>

Figure 4.2: Early-stage challenge results

4.2.1. The public view

Many startups believe that the aviation industry is slow, conservative and stubborn. As a result, startups do not even consider the aviation industry as an industry to start a business in. The startups base their decision for an industry upon assumptions or 'gut feeling'. One entrepreneur, for example, mentioned that he believes that the aviation sector is very progressive but that he thinks that people are just scared of it. One of his colleagues also mentioned that the industry has high barriers due to regulations, that it is conservative and that this influences the overall culture of the industry. However, neither of them verified these assumptions when they started their business. One of the entrepreneurs mentioned that they consciously chose for an industry where they were able to improve fast and where they were capable of surviving for the first couple of years, but they did not think the aviation industry was suitable for achieving this. The entrepreneur continued by saying that he believes that their technology could be interesting for many industries, but that startups don't have the time to look into all different markets and find out which one would be the most profitable. They made assumptions based on conversations in their network, reading publications and by "just looking
around”. They made a decision based upon their general knowledge without going studying the details. Another non-aviation startup also mentioned that they’re not unwilling to start working in the aviation industry but that they don’t have time nor budget to look into the opportunities of it.

4.2.2. Students

The NAG found that many aerospace students do not know the market very well. Most of the students only know one or two big industry players and that these students don’t know how to reach out to the market in a well-thought and structured manner. One of the startups agreed upon this by saying that the aviation industry is a complicated one which requires years to understand. Therefore young professionals and students find difficulties founding ground in the industry because they do not have these years of experience. Other startups believe that this is because of students’ theoretical background. They mentioned that it is challenging to start a business out of the blue because many students don’t have any experience in companies and are therefore not capable of solving practical issues. Also, it is found that many aerospace Engineering students end up in non-aviation industries, but a representative of the TU Delft thinks that this is also because some aerospace engineering students chose the program because of the high level and not because of their interest in the aerospace industry.

4.2.3. Distance to industry

One startup mentioned that startups, in general, are very much depending on customers and suppliers so that it is important to have a good connection with them. A larger, geographical distance is according to the startup undesired because it increases the difficulty to get in touch. Innovations in the Design and Manufacturing segment, for example, are mostly bound to aircraft manufacturers because they are the end customers. However, the Netherlands does not have aircraft manufacturers anymore, and this forms a major barrier for startups in this segment. Another entrepreneur mentioned that there are only a couple of large organisations in the Netherlands which play a role in the international aviation industry but that this role is still limited. If these organisations cannot facilitate the needs of the startup, the startups have to go abroad, and this might form a major barrier for these startups. According to him, it is therefore likely that at least Dutch startups in the Design and Manufacturing segment have to go abroad to Airbus or Boeing for example. Another startup also mentioned that they wouldn’t know where to go and who to contact if they’d chosen for the aviation industry. Finally, the Starburst accelerator together with the NAG are investigating the startup climate for aerospace startups in the Netherlands, and they found that a proper business link is missing between startups and the industry. Therefore they are both looking for opportunities to improve this so that startups can find their way more easily into the industry. One startup mentioned the example of an area where the industry is much closer and accessible for startups and is the high-tech campus in Eindhoven. It also has the nickname of being ”the smartest square kilometre of the world” and is well-known for its healthy ecosystem. There are many startups, incubators and accelerators located at this campus. This is due to the presence of many world-leading OEM’s such as Philips, ASML, Dassault Systems Intel, KPN and more. The presence of these big corporates attracts startups because it is easy for them to connect with one of these companies. These startups mentioned that this presence is missing for aviation startups but that it is also difficult to start because of the limited role of the Dutch aviation industry in the global aviation industry. This result has also been recognised by the Starburst accelerator and by the NAG. They mentioned that there are many startups elsewhere in the world but not in the Netherlands.
4.2.4. Incentives

One of the first results was that is attractive to go with aerospace engineering knowledge towards non-aviation industries. Two startups mentioned that aerospace engineering technologies are often top of the notch in non-aviation industries and therefore have a stronger business case in industries elsewhere. According to one of the entrepreneurs, this is mainly because technological development is very high in the aviation industry due to intense competitions and a mature market. For example controlled fluid dynamics applications (CFD), which have already been applied in the aerospace industry for years, was entirely new in the civil engineering and building construction industries until a few years ago. One of the startups mentioned that startups must have powerful beliefs in their technology to keep on developing something for a challenging industry, while it is relatively easier to earn money elsewhere. It’s hard to stay focused on something which might have a return on investment in ten years while there could be money made elsewhere, and even quicker. The short-term benefits always look more promising than the long-term benefits. His startup experienced this themselves and finally chose to abandon the aviation industry and start somewhere else.

When talking about incentives, one startup also mentioned that regional subsidies in the Netherlands are not aligned well and that this increased the cost and uncertainty of their development process. This startup is situated in Alkmaar and wanted to apply for high-tech R&D subsidies. However, the majority of Dutch high-tech companies are located in the Brainport area in Eindhoven. Therefore, relevant grants for the startup can only be obtained near or around Eindhoven. It was not possible for them to apply for these subsidies unless they were opening an office in Eindhoven. Because they were in a great necessity of this subsidy they did initiate an office in Eindhoven accordingly but this example reveals that the local grants are not aligned properly. He mentioned that it could be a significant barrier for early-stage startups to start an office elsewhere without even knowing if they will raise the money in the end. Another results, mentioned by one startup, is that the Yes!Delft incubator (which is the incubator closest to the biggest aerospace engineering faculty of Europe) does not have the right business model for startups to chose for the aviation industry. The business model of Yes!Delft is to support startups in return for a commitment fee when the startup generates revenue. When the startup produces €200,000,- revenue, the startup has to pay €5,000,- and when the startup has made €1,000,000,- revenue they have to pay Yes!Delft €20,000,-.

He said that this business model means that Yes!Delft will support and steer their startups in the direction of which it can reach the €1 million revenue the quickest. Because of the nature of the aviation industry, he thinks that it is not likely that startups earn €1 million revenue faster in this sector than in other sectors. Therefore they are indirectly encouraging startups to move away from the aviation industry, even if they have a good chance of succeeding there. Because of the Yes!Delft business model does not reach beyond the €1 million revenue he said that they don’t mind (strictly rationally speaking) what happens to the startup afterwards. If Yes!Delft, for example, has to choose between a startup which can reach €1.5 million of revenue in 6 months in a non-aviation industry or €10 million in 2 years in the aviation industry, their business model suggests that the first option would be the most attractive one. Of course, they will not make such a decision based on 100% rationality, but at least he thinks that it demonstrates that their business model does not suit aerospace startups very well. Most other incubators in the Netherlands are applying different business models than the one Yes!Delft is using. The most common business model for external incubators is to take a minority share (typically 6 to 10 %) in return for the resources the incubator provides. He believes that this type of business model accommodates aerospace Startups better because, referring to the example from the
previous paragraph, it would become more attractive for the incubator to wait a bit longer and go for the sec-
ond option because the potential profits are higher there. Finally the NAG, which resides inside the Yes!Delft
incubator found that there is little to none support for aviation startups in and around Delft. They did not
elaborate on this, but the fact that they’re mentioning this in one of the interviews means is a result on itself.

4.2.5. Solutions found
Not only did the interviews result in a list of challenges, but some interviewees also proposed solutions to
solve the above-mentioned challenges. One startup, for example, mentioned that a lot of students are mo-
tivated to become entrepreneurs, but they simply have no idea to start with. Therefore he thinks that com-
panies should connect with these motivated students and present them company problems to work on. The
NAG also proposed this solution by saying that they believe that every organisation has at least 100 ideas for
a startup but that they don’t have time to work on it internally. Therefore they think that these ideas should
be gathered and handed over to the motivated students. The NAG also thinks that universities and profes-
sors play an important role in the awareness of students to become entrepreneurs. If the professors focus
too much on a theoretical background, the students will also be more theoretically oriented, but if they are
more oriented towards entrepreneurship, they believe that the students will also be more oriented towards
entrepreneurship.
### 4.3. Later-stage challenges and solutions

This section presents the main results from the identification of the later-stage startup challenges in the aviation industry. Again, later-stage challenges are difficulties which startups are facing when they've chosen for the aviation industry and are working to validate their solutions into one of the market segments. This stage contains a lot of iterating, testing and demonstrating the added value of their solutions towards (potential) customers. The challenges these later-stage startups are facing are different from the challenges early-stage startups are facing, and therefore different study cases have been selected. For this stage, market segmentation is applied because the startups are active in one of the segments and therefore possibly experience different challenges. Cross-pattern matching has been applied after the result of each segment, and the combined results, which are true for each segment are presented in this section. There are four major categories of challenges: the slowness of the industry, the negative attitude of the industry, the difficulty of finding investors and specific challenging market segments, which are different for each segment.

#### 4.3.1. The slowness of the industry

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Cause / example</th>
<th>Source</th>
<th>Found solution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long development cycles</td>
<td>Difficult to determine customer needs</td>
<td>NAG + Starburst</td>
<td>Approach international contacts in an early stage to obtain feedback</td>
<td>Starburst + 1 Startup</td>
</tr>
<tr>
<td></td>
<td>Takes time to understand all the regulations</td>
<td>2 Startups</td>
<td>Have someone available in the startup team who has knowledge about the regulations</td>
<td>2 Startup</td>
</tr>
<tr>
<td>High amount of regulation</td>
<td>Takes years to get something certified from the OEM's</td>
<td>3 Startups</td>
<td>By getting customers (airlines) behind the startup to pressure the OEM's because they will listen to their customers</td>
<td>1 Startup</td>
</tr>
<tr>
<td></td>
<td>Low scalability of products</td>
<td>1 Startup</td>
<td>Find a creative way of dealing with the stringent regulations</td>
<td>1 Startup</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>To find a generic product or service which is scalable (which has the same regulations and do not need to be integrated in the aircraft)</td>
<td>2 Startups</td>
</tr>
<tr>
<td>The big size of the organisations</td>
<td>Difficult to find the right guy / decision-maker</td>
<td>5 Startups</td>
<td>No results found</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Departments don't know what they're doing from each other and sometimes do the same things at the same time</td>
<td>4 Startups</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Need to go through different bureaucratic layers</td>
<td>1 Startup</td>
<td>Having contacts at top level management to speed-up the process of going through layers</td>
<td>1 Startup</td>
</tr>
</tbody>
</table>

Many startups mentioned that the industry is very slow moving and that everything in the industry just takes very long. The main drivers behind this slowness are the long development cycles and the big size of the organisations. They mentioned that startups need to find its way into the industry and "pivot" a lot to find the right direction. Pivoting is when a startup changes its business model, direction or market segment and is mainly based on customer feedback which will then be used to integrate it into the new product or service. However, they mentioned that it is difficult to determine what the actual customer needs are and where it
4.3. Later-stage challenges and solutions

takes longer to create the right product. The Starburst accelerator and one startup, therefore, advises startups
to approach international contacts and not stay too much within their region. The aviation industry is inter-
nationally oriented, so therefore it is not likely that all relevant customers/suppliers are located nearby. An-
other cause for the long development cycles is the high amount of regulations. The whole industry is focused
on safety and complying with the 'airworthiness code' is a time-consuming process. It is found difficult to
understand all the safety regulations, and startups, therefore, mentioned that it would be very useful to have
someone available in their team who has experience with the regulations. Also, due to the high amount of
regulations, it is needed to get new products or services certified by the aircraft manufacturers, but startups
mentioned that this could take up to 3 years.

This is a long period for startups, so one startup found out that Airbus and Boeing, for example, do listen and
respond quickly to their direct customers. So what one startup did was to find customers first (which are the
same customers as the direct customers of the aircraft OEM's) and then use these customers as leverage at
Airbus and Boeing to get their products certified. When they presented a significant number of customers
waiting for the product of the startup, Boeing and Airbus were willing to speed-up their certification process.

The long development cycles are finally caused by the low scalability of the products or services. There are
many different aircraft types, and therefore it is found challenging to find a product which can easily be ap-
plied to multiple aircraft types at the same time. Especially startups in the modification sub-segment expe-
rience this difficulty because airlines have not only different aircraft types but also have different interiors.
Modifications inside the aircraft cabin must therefore not only be certified for aircraft type but also for the
specific interior configurations. Also, there are multiple levels of regulations (International, national and
even regional). The Federal Aviation Authority (FAA) and the European Aviation Safety Agency (EASA) are
operating worldwide, but each country also has its kind of regulations. For example, an airline operating in
the Netherlands has to comply with a different type of rules than when they’re flying in Mexico. So the reg-
ulations are not uniform across the world but also a number of different aircraft configurations is very high.
One startup, for example, mentioned that their biggest learning was the mistake to try to develop a universal
product which fits onto every aircraft type: "Bringing a complete product to the market requires a lot of extra
certification and therefore time and costs without knowing if it would work. Therefore it would've have been
better not to waste any time trying to fix everything, but we should've focused on the minimal viable product
like we're doing now." However, another startup mentioned that their success depended upon the ability to
find a way through all different regulations and find a universal solution. What they did is not illegal, but they
managed to find a "creative" way in which the certification times could be decreased.

The big size of the organisations in the aviation industry also increases the slowness of the industry. One of
the startups mentioned that because of the big sizes, it is difficult to find the right persons. A startup may
have whatever kind of idea, but if they cannot find the right connection in an airline, an MRO or OEM, it
is doomed to fail. Especially when dealing with the aircraft manufacturer, it is difficult to find the right guy.
However, another startup mentioned that bureaucratic costs are not only applicable to aircraft manufacturers
but also at Tier 1, 2 or 3 suppliers like Fokker Technologies. Although these companies have much fewer
employees, the startup mentioned that this was still one of their biggest challenges. The big size means that
these organisations are cut into different departments and countries spread around the world. One of the
consequences of the departmentalisation is that departments don't know what they're doing from each other
and that this has large bureaucratic costs. "People in the US don't know what colleagues in France are doing,
and even among the various departments there is so much going on that it is tough to find the right person.:
It costs a lot of time to go through the different hierarchical layers and sometimes it appeared that startups were talking to the wrong departments because they found out other departments were working on the same things. One startup mentioned that they have been trying to talk to people within Airbus, but they mentioned that the bureaucratic costs are very high and that it is complicated to speak to the decision-makers. Also for another startup, it took 1.5 months to have a meeting with the right decision-maker. A proposed solution to go through the different bureaucratic layers is to find contact and support at top level management so that they can resolve the bureaucratic costs by having a top-down approach.

4.3.2. The negative attitude

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Cause/example</th>
<th>Source</th>
<th>Found solution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry players are risk averse</td>
<td>Industry players don't like single force contracts</td>
<td>NAG + Starburst</td>
<td>By creating a strategic partnership with a well-known and reliable aviation company</td>
<td>3 Startups</td>
</tr>
<tr>
<td>Industry players require redundancy at all times</td>
<td>2 Startups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry players only look at companies who already have revenues, a fully developed product, history and paying customers</td>
<td>3 Startups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Startups need to earn trust from the industry</td>
<td>Startups need to prove the industry players why to invest time, money and energy</td>
<td>1 Startup</td>
<td>1. By creating a strategic partnership with a well-known and reliable industry player 2. By getting a certificate from well-known startup experts which access the capabilities and potential of the startup</td>
<td>3 Startups 1 Startup</td>
</tr>
<tr>
<td>The industry is not very open for new ideas</td>
<td>Organisations contain a lot of 'old-school thinking' guys</td>
<td>5 Startups</td>
<td>No results found</td>
<td></td>
</tr>
<tr>
<td>Organisations do not take new ideas serious</td>
<td>4 Startups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisations try to kill new initiatives to protect their business</td>
<td>OEM’s force airlines to use original parts to protect their business</td>
<td>1 Startup</td>
<td>By getting customers (airlines) behind the startup to pressure the OEM’s</td>
<td>1 Startup</td>
</tr>
</tbody>
</table>

Figure 4.4: The negative attitude

Many startups from all segments mentioned that the industry is very conservative and that most people are not waiting for new innovative products or services. During the general member assembly (GMA) of the NAG, there was a discussion about the risk aversion of the industry players. They mentioned that manufacturers don’t like single force contracts because they want to assure that they will have a supply of the goods for the coming years. They require having any form of redundancy all the time because common questions are: what will happen if the company will go bankrupt? Or what will happen if your only factory will get fire? The manufacturers do usually not collaborate with an organisation if no redundancy can be guaranteed.
One person from the audience during the discussion mentioned that he had a situation in which a contract had been rejected because they only had one factory. One of the startups also said that airlines are very risk averse and that the industry will only look at a startup when it already has revenues, a fully developed product, history and paying customers. If one of the elements is missing, the airlines will tell you to come back later when the product or service has been fully developed. Another startup encountered challenges by saying that it was especially difficult to find a first customer. Their business model is not based upon a new innovative product or service but mainly based on reducing the workload of airlines. Startups think that by creating a strategic partnership with a well-known and reliable aviation partner helps to lower the risks for their customers. This is also why two startups, who are currently working with Fokker Services, chose to work with Fokker Services. One of them thinks that working with Fokker adds credibility to their product because it has a good reputation in the market. They could go to other parties as well, but very few players have built aircraft, so the fact that Fokker has been building aircraft is seen by one of the entrepreneurs as a huge competitive advantage.

The reason why the industry is so risk-averse is, according to one of the managers at Fokker Services, because massive investments need to be made by the industry and because there the aviation industry typically allows only for a small room for error. There is a lot of competition in the aviation industry which results in this small room for error. Because of the small margins, it’s hard to take risks. Therefore the industry wants to make sure that their suppliers are reliable. One startup mentioned an example in which Lion Air invested over €100 million into seatback Inflight Entertainment (IFE) systems but that the supplying company went bankrupt after a couple of years meaning that they could not provide any services to Lion air anymore. They got stuck with the IFE systems and cost a lot of money to replace them. This example shows that earning the trust of the industry players is very challenging. Startups need to prove the airlines why they should invest time and energy in them without even knowing if it will work eventually. One startup thinks that earning the trust could take up to 2-3 years, but another startup mentioned that airlines act like sheep: if one sheep leaps over the ditch the rest will follow. Another startup mentioned that they had to make some lucrative arrangements to get the first deals. They could not develop a proof of concept because they depended on data from airlines. This made it extra challenging to them to earn the trust of the airlines. A couple of startups think that this can be solved by creating strategic partnerships or by getting a certificate by well-known incubators which demonstrate the potential of the startup. Well-known accelerators are found to be the experts in the field of entrepreneurship so if they believe in a concept, why wouldn’t the airlines do so? Also, many startups feel that organisations do not take new ideas seriously and that they are very sceptical about new ideas. One startup, for example, mentioned that from a user perspective they received many promising reactions but that the airlines were sceptical. They said the idea was good, understand the concept but think that it’s hard to realise and mentioned afterwards that they could come back when they’ve developed their product. Also, they mentioned that organisations contain a lot of ‘old-school thinking’ guys and that therefore changing the internal culture of the organisations is also very important. One of the design engineers at Fokker Services agreed upon this by saying that there is not much space, time and budget available for new ideas at Fokker Services. He also mentioned that some people are insufficient in their thinking and that if people propose new ideas, they get negative feedback immediately from others. This limitation in their thinking does not contribute to an entrepreneurial climate because people are afraid of adverse reactions from their colleagues.

Finally, the negative attitude of the industry towards startups and innovations is caused by the fact organisation try to kill new initiatives to protect their business. Aircraft manufacturers, for example, threaten that if
airlines use so-called PMA parts (Parts Manufacturer Approval which is manufactured by MRO organisations) instead of the original parts (which are manufactured by the aircraft OEM’s), that they then will lose warranty on the aircraft. This scares airlines away from use PMA parts and makes it extra challenging for companies to enter the market. A similar situation is with car manufacturer KIA. They are currently advertising that every car has six years warranty. However, this warranty does only apply when KIA-owners strictly follow the prescribed maintenance procedure by KIA. This involves replacing parts with original KIA components and having the car maintained at an original KIA-dealer. They’re therefore forcing KIA-owners to follow the maintenance program and not go to local shops. Startups think that this kind of protectionism can be solved by getting customers behind the startup to pressure OEM’s to allow the airlines to work with PMA Parts.

### 4.3.3. The difficulty of finding investors

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Cause / example</th>
<th>Source</th>
<th>Found solution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfavorable investment conditions</td>
<td>High risks and long return on Investment</td>
<td>2 Startups</td>
<td>1. Look for investors who understand the aviation industry and are willing to invest.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agreements with OEM’s can cost millions</td>
<td>5 Startups</td>
<td>2. Focus on a MVP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High amount of regulations</td>
<td>4 Startups</td>
<td>3. Sell Components first</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expensive certification process</td>
<td>4 Startups</td>
<td>4. Sell knowledge first (soft-start)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low scalability of products</td>
<td>4 Startups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long sales cycles: From moment you start to first revenues takes a lot of time so the startup needs money to cover the first expenses</td>
<td>4 Startups</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Startups also face challenges about obtaining finance and finding investors. One startup mentioned that it’s hard to convince share and stakeholders of the aviation industry because it has unfavourable conditions for investors. Regional investors did not want to invest in the startup because they were expecting a short(er) return on investment (ROI). Therefore the startup mentioned that it is crucial to have investors with patience which understand the aviation industry. Another startup mentioned that investors are very conservative and that it is tough to get funding at the right time. Most investors, according to them, do not understand the aviation industry correctly. They mentioned that finance is more likely to be obtained from investors who understand the aviation industry because they understand the development cycles, the high uncertainty and the duration of the sales cycles. One of the reasons why it is difficult to find investors is also because the industry is very expensive. One startup mentioned a situation in which they have been in touch with the usual large aircraft manufacturers, but before they reached the point where they could discuss the technical details, they first had to sign service and technical agreements which would cost them around 2 million US dollars. They think that this number is a significant amount of money for startups, especially when this is only to enter a collaboration process. No guarantees are granted at that point by the manufacturers, so it is a lot of money without even knowing if it will ever pay-off. Also, the certification process is expensive, and due
to the low scalability of the products, money is needed each time to certify the product or service for a new aircraft type or cabin configuration. Finally, the slowness of the industry also means that the startup needs to finance itself during the entire product development period. One startup is for example already more than eight years busy with the development of their product. This is quite a while because no revenues are made during this period. When they’ve developed the product, and it is time for sales it will take another extended period before the actual revenues are received. Another startup also mentioned that the sales cycles are much longer than they were used to in other industries. When they are talking with a customer at the moment, it means that a decision will be made in approximately nine months and that their product will be fit onto an aircraft within 18 months so until then they will not see any revenues. He mentioned that if they solely depended on the revenues from this product, that they would’ve been starving by now.

The startups proposed a couple of solutions to overcome the financial challenges. The most straightforward solution was to look for investors who understand the aviation industry and who are willing to invest in aviation startups. One startup things that these kind of investors are typically ones who have a long history in the industry and know all about it. A second solution is to start selling knowledge first in a consultancy-like manner to generate a stream of revenues to finance the product development. This is also called a soft-start. Trying to start with selling products is called a hard-start by one of the startups. The main difference between the two is that services require fewer resources than products do. Therefore less money is needed to start generating revenues than is needed with a hard-start. So if startups could not find any investors, they can decide to sell their particular knowledge first and create a vast stream of revenues to finance the development of a product. This is how a couple of startups began their companies. However, one startup mentioned that this technique is not always possible because they would have given their Intellectual Property (IP) away. They tried to work around this, but then they faced another challenge. While they were trying to feed their product development by working in other industries and selling their knowledge elsewhere, they found it difficult to remain focused on the product development. Over time, the work on the development was getting less and less. It was more attractive to focus on generating income than spending money on a project with an uncertain outcome. In other words, the short-term rewards were stronger than the long-term benefits. Another solution which has been mentioned by one of the startups is to focus on an MVP first which could generate a vast stream of revenues. After the MVP has been sold, the startup can concentrate on a more "total solutions", but it first needs money to do so. This is similar to what Apple and Samsung are for example doing. The Samsung S8 is their latest smartphone, and each year they bring a new one to the market with technology upgrades are new features. They probably have the technologies and features for an S12 in place, but they are not putting all these technologies on the S9 next because this will cannibalise their business. They are focusing on the minimally viable upgrade for each year to generate a stream of revenues, and this is also what startups could do according to some. Another startup also mentioned that they first aimed at offering a "total solutions" but that they changed their focus now to provide components of the "total solution" first to generate income and finance the development of the other elements. This technique is similar to the technique of selling an MVP first.

4.3.4. The challenging market factors

An overview of the challenging market factors for each segment are presented in figure 4.6. In the Design and manufacturing segment, startups found it challenging that the market is dominated by a few big players, which have a lot of power. Also, as most organisations in this segment are building aircraft components and not making an end product, startups are always depending on other companies. This dependency increases
the difficulty in developing the technology, and they said that it would be easier to produce an end-product yourself because then you're able to decide on what direction to go and what exactly to do. One startup, for example, had a technology to modify the wing of an aircraft but if they wanted to do this, they had to sell it to one of the more prominent players because they can’t just make an aircraft or wings themselves.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Sub. cat.</th>
<th>Indication / example</th>
<th>Source</th>
<th>Found solution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>D&amp;M</td>
<td>Dominated by a small amount of big players</td>
<td>OEM’s have a lot of power</td>
<td>NAG + Starburst</td>
<td>No results found</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Startups are always depending on other companies</td>
<td>2 Startups</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Departments in big organisation work against each other because they think of their own budgets only</td>
<td>3 Startups</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Extreme form of competition</td>
<td>Startups are limited to sell to one company</td>
<td>4 Startups</td>
<td>No results found</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Startups need clearance to talk to the right people</td>
<td>4 Startups</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>MRO</td>
<td>Weak competitive position of the startup</td>
<td>Hard to obtain the right information from Airlines or OEM’s: they decide who to share the information with so the startup is depending on the OEM</td>
<td>5 Startups</td>
<td>By getting customers (airlines) behind the startup to pressure the OEM’s</td>
<td>1 Startup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OEM’s need to certify the tools and it is uncertain if they will</td>
<td>1 Startup</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difficult to get on the radar</td>
<td>1 Startup</td>
<td>Attend events, shows and other opportunities to keep the topic ‘hot’</td>
<td>1 Startup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difficult to protect your IP</td>
<td>1 Startup</td>
<td>No results found</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Small market size needed</td>
<td>Low scalability of the products</td>
<td>1 Expert</td>
<td>To find a generic product or service which is scalable (which has the same regulations and do not need to be integrated in the aircraft)</td>
<td>2 Startups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specific window of opportunity</td>
<td>1 Expert + 1 Startup</td>
<td>No results found</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Specific industry knowledge is needed</td>
<td>Startups don’t know the industry dynamics</td>
<td>NAG + 1 Startup</td>
<td>Having someone available (in the startup team) who has relevant industry knowledge</td>
<td>1 Startup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Startups lack experience in the industry</td>
<td>TU Delft + 1 Startup</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 4.6: Challenging market factors

They depended on other players, which in this case also turned out to have a lot of power. Also, it is found that there is an extreme form of competition in this segment. During the general member assembly of the NAG, someone mentioned that they were stuck to work with one of the big players. They could not sell their technology to the other players because they had to sign a contract saying that they could not work with the
4.3. Later-stage challenges and solutions

The extreme form of competition is caused by the fact that small improvements in aircraft design could already result in significant benefits for the airlines. For example, a reduction of weight around 20 to 50 kilograms in aircraft weight already causes major savings in fuel costs over the entire lifetime of an aircraft.

Therefore aircraft manufacturers are trying to protect each small competitive advantage. The extreme form of competition is also noticeable in the fact that clearances are needed in organisations to talk to the right people and to retrieve the right information. Because of the small margins in the segment, one startup mentioned that the organisations are very scared to tell their exact needs. They told an example where they were in a meeting with one of the large aircraft manufacturers were the representatives of the manufacturer first denied everything they were interested in so far until another person entered the room and said to the representatives that they had clearance but forgot about this. Suddenly, the representatives started to talk very openly about their situation and their needs. This experience was unusual because they were still talking to the same people who were lying at first hand. However, for outsiders, it is tough to "earn" this kind of clearance and therefore determine the actual needs of the manufacturers.

For the MRO segment, startups mainly mentioned experiencing challenges because of their relatively weak competitive position. One startup even mentioned that MRO’s are the slaves of the aircraft Manufacturers because they much depend on the information they possess. Aircraft manufacturers are the only ones who know exactly how the aircraft is built and how it should be maintained. Therefore they have the power to decide with whom they are willing to share the information. Also, they have to certify the tools and processes MRO’s are using to maintain their aircraft, and this results in power to decide which innovative tools can be employed and which tools cannot be used. Another startup mentioned that the information they were looking for was very sensitive and therefore it was difficult to convince the airlines from sharing it with them without being able to demonstrate their product. Another startup was facing similar challenges and mentioned that one of the biggest challenges of entering the MRO segment was the uncertainty whether or not Boeing and Airbus were going to approve their technology. Also, they found out that there is a lot of politics involved in large organisations. "Sometimes people have other agendas which you're not aware of, or sometimes they just don't like the guy who causes the delay or uncertainty about the situation." Also, it was found challenging to get on the radar, but one startup mentioned that this could be solved by attending events, shows and other opportunities so that the startup remains visible. Finally, one startup mentioned that it is also difficult to protect the IP rights as organisations do not want to invest in startups without knowing if the actual technology is working. This can easily be solved by sharing the IP with the investment candidate, but this is of course not what the startup wants. They have a weak competitive position as they need money and want to protect their IP! No solution was found during this study which could overcome this challenge. Solutions to the earlier mentioned challenges are to find customers first and use these customers to pressure the OEM’s to give information away and certify their innovations.

Finally, for the modifications sub-segment, startups mentioned that the scalability of the modifications is very low unless a uniform solution is found. This low scalability means that the size of the market is very limited. Modifications have to be custom-fit for each airline, but one employee from Fokker Services also mentioned that the modification segment also has a particular window of opportunity. The modification market, also called the retrofit market, begins when the aircraft has been delivered to the airline by the aircraft OEM. However, it is not likely that airlines upgrade their aircraft straight after its delivery. They would instead place an order at the aircraft manufacturer so that the aircraft comes out of the factory according to their
requirements. It is also not highly likely that airlines will invest in new equipment if an aircraft is going to end-of-life within a couple of years because they are always looking for a return on investment. One startup also mentioned that airlines take a lot of time to find the right moment for integrating it into the aircraft because it also has to fit with their maintenance schedule. It is, for example, cheaper to leave an aircraft one day longer on the ground after a required maintenance check than putting it on the ground for one day when it is in service. Therefore the window of opportunity for the retrofit market is very particular. A manager at Fokker Services mentioned that Fokker Services is currently struggling with this at the moment. As the Fokker aircraft are slowly put end-of-life, the time to earn a return on investment for these aircraft is decreasing every day. Fokker Services position is, therefore, worsening every day because of previous arguments that about difficulties in obtaining the right information. Designing modifications for other aircraft types are therefore more challenging than for own aircraft types. The low scalability of the products can, according to one of the startups, be solved by finding a generic product which is scalable to other aircraft configurations. Finally, startups in this segment mentioned that they often lack specific industry knowledge because startups in this segment often have backgrounds in other industries. They are therefore not aware of the industry dynamics and lack experience in the industry. Other startups think that this can easily be solved by having someone in the team available who has this kind of relevant industry experience.
Now that the results have been categorised, it is time to translate the results into the list of success factors and pitfalls for external venturing in the aviation industry so that there is input for the implementation plan. Figure 5.1 demonstrates which part of the research strategy has been done in this chapter. This figure is part of figure 3.1 from chapter 3.

How the latest theories and insights on external venturing are translated into 'generic' success factors and pitfalls for external venturing is explained in section 5.1. For the early-stage challenges and solutions this is explained in section 5.2, and for the later-stage challenges and solutions, this is explained in section 5.3. A combination of these two sections is presented in a schematic overview in section 5.4. Finally, the translation of the success factors and pitfalls for external venturing in the aviation industry into an implementation plan is discussed in section 5.5.
5.1. External venturing

As has been mentioned in the methodology section, the key learnings from the literature study (figure 2.5) and the case study results (figure 4.1) have been compared to see if there were any contradicting results. As a result of this comparison, there are no contradictions between the results, many similarities and only a few literature study results which are not found in the case study results and the other way around. This discrepancy is not a problem because the primary reason in the first place to verify the literature study results with additional study cases because we assumed that there would be variations. Therefore a combination of the literature study results and the case study results formulate the answers to the second sub-question.

The combination of the results now has to be translated into success factors and pitfalls for external venturing. This has been done based upon a synthesis of the combined results. For example, it was both found during the literature study and the case studies that support from top-level management is important, a success factor for external venturing would, therefore, be that having support from top level management. It works the same way for pitfalls. For example, it was found that corporates should, when doing external venturing, not focus too much on its benefits but that it should focus on ecosystem building. This finding can be translated in a pitfall by saying that focusing too much on the own interests decreases the chance of success for the startup. These kinds of translations have been done for all the results, and a definitive list of success factors and pitfall can be found in figure 5.2.

<table>
<thead>
<tr>
<th>Level</th>
<th>Success factors</th>
<th>Pitfalls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem</td>
<td>No success factors</td>
<td>A corporate focus which is too much on own benefits</td>
</tr>
<tr>
<td>Company</td>
<td>Support from top level management</td>
<td>Too high and many expectations from management towards the startup</td>
</tr>
<tr>
<td></td>
<td>A clear innovation strategy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>An entrepreneurial culture</td>
<td></td>
</tr>
<tr>
<td>Venture unit</td>
<td>Leverage inside the organisation to work on corporate venturing</td>
<td>Bad communication between the instruments</td>
</tr>
<tr>
<td></td>
<td>Having people who understand both languages</td>
<td>Starting too fast with external venturing</td>
</tr>
<tr>
<td></td>
<td>Using more than one corporate venturing instrument</td>
<td>Having too close control on the startup progress</td>
</tr>
<tr>
<td></td>
<td>Clear communication towards the startup</td>
<td></td>
</tr>
<tr>
<td>Startup</td>
<td>Working with a well-balanced startup team</td>
<td>No pitfalls</td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>No success factors</td>
<td>Selecting ‘second-best’ entrepreneurs</td>
</tr>
</tbody>
</table>

Figure 5.2: Success factors and pitfalls of external venturing

It is assumed in this study that these ‘general’ success factors and pitfalls of external venturing are valid for each type of organisation and industry. However, the goal of this study is to determine how external venturing can successfully be done in the aviation industry. Therefore the results from the previous chapter on startup challenges and solutions have also been translated into success factors and pitfalls to extend figure 5.2 and will be presented in the next sections.
5.2. Early-stage startups

For the early-stage startups, it was found that there are four main categories of early-stage startup challenges: the public view category, the student’s category, the distance to the industry category and the incentives category. These results are 50% of the answer to the third sub-question as the results on the later-stage challenges and solutions are also part of the answer to the third sub-question. However, findings of the early-stage challenges also need to translate into success factors and pitfalls for external venturing in the aviation industry. This is described in this section.

When looking at the results, it seems that entrepreneurs are not entirely aware of the possibilities of the aviation industry and that there is no infrastructure for Dutch aviation startups. This increases the likelihood of entrepreneurs starting a business in non-aviation industries. In other words and referring to Mack and Mayer (2015): the startup ecosystem around aviation startups in the Netherlands can be seen as if its still in the birth stage because entrepreneurs find many reasons in their early-stages to start a business in non-aviation startup ecosystems. The market is not yet oriented towards startup collaboration but public organisations, such as the NAG, are trying to launch initiatives which lower the entry barriers for entrepreneurs to enter the aviation industry. The result from one startup is exemplary for this conclusion because they mentioned that they are not unwilling to work in the aviation industry but that they don't have time to look into all opportunities. It is therefore fair to say that if the aviation industry was found to be more attractive, it is likely that the startup would’ve attempted to start in the aviation industry earlier on. Apparently, only entrepreneurs who have a strong belief in succeeding in the aviation industry are at the moment capable of overcoming the early-stage challenges and proceeding to the later stage. This brings the need for finding a solution to increase the likelihood of entrepreneurs to enter the aviation industry. According to Xie (2014) and as described in chapter 2, there are two main factors which a corporation is capable of influencing to increase this likelihood and these two factors are 1) a supportive environment and 2) clearly defined opportunities. Because we want to find success factors and pitfalls of external venturing, we need to find solutions to overcome the early-stage startup challenges we must look at these two main factors more closely.

5.2.1. A supportive environment

A supportive environment is an environment in which entrepreneurs are stimulated to start a business and in which instruments are available which are oriented at providing support for the startup. This is also what is currently missing in the Netherlands. Therefore we must look at how such an environment can be created. I think that creating such an environment requires more than the efforts of an individual organisation because changing the public view or closing the gap between the industry and the startups will be far more effective if there is a shared initiative among many large (Dutch) industry players. Therefore I think that it is needed to develop a supportive ecosystem around aviation startups. The environment would then include external venturing opportunities at much large organisation and will also bring a supportive culture and attitude along as there would be many organisations which stimulate and put effort into entrepreneurial activities. I think that creating a startup ecosystem around Dutch aviation startups would also demonstrate that entrepreneurship in the aviation industry is not something unusual and that the industry is open for entrepreneurial initiatives. Referring to the words from Mack and Mayer (2015), I think that the Dutch aviation startup ecosystem is still in its birth stage and that is therefore important to look at what is needed to grow the Dutch aviation startup ecosystem from its birth stage towards a growth stage. Mack and Mayer (2015) describe the growth stage of the startup ecosystem as a stage in which the ecosystem contains many financing and market entry
opportunities, a close network and a growing perception among policymakers about the importance of entrepreneurship. This stage would be the ideal situation for the Dutch aviation industry. Also, it was found by Aaltonen (2016) that accomplishing this requires the startup ecosystem to at least contain entrepreneurs, investors, large companies, universities and policymakers.

<table>
<thead>
<tr>
<th>Level</th>
<th>Success factors</th>
<th>Pitfalls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem</td>
<td>Having a (Dutch) aviation startup ecosystem containing:</td>
<td>No pitfalls</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Investors</td>
<td></td>
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<tr>
<td></td>
<td>Large companies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Universities</td>
<td></td>
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<tr>
<td></td>
<td>Policy makers</td>
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</tbody>
</table>

Figure 5.3: Early-stage success factor 1

Because this section aims to translate the result into success factors and pitfalls, we can say that a success factor for external venturing in the aviation industry would be to have a startup ecosystem in its growth stage containing entrepreneurs, investors, large companies, universities and policymakers. These success factors are also presented in the figure 5.3.

5.2.2. Clarifying the opportunities

The second main factors which influence the likelihood of entrepreneurs to join the aviation industry is to have clearly defined opportunities. Clearly defined opportunities are needed as entrepreneurs need to be aware of the possibilities of entering an industry. To do so, corporates must understand the different backgrounds of entrepreneurs and where they come from. This is difficult because except for the category of young entrepreneurs and university spin-offs, it’s hard to predict when people inside the other categories are considering to start a new venture. Young entrepreneurs and university spin-offs can easily be found by targeting universities but the other categories (Pensioners, corporate spin & cast-offs and part-time entrepreneurs) are too broad to target. Therefore only general statement can be made about these last four categories.

I think that to improve the visibility of the industry opportunities for young entrepreneurs and the university spin-offs that professors at universities play an important role. This is similar to what the NAG and the TU Delft also have mentioned. For example, if professors are only focused on teaching their students to perform research, the students will also be more focused on research. If the professors are advocating to start a new business, I think that students will also be more likely to do so. Furthermore, it was mentioned by one the interviewed startups that there are plenty of enthusiastic students, but most of them do not have a good idea for starting a new business. This challenge can be solved by bringing the industry problems towards the young entrepreneurs so that they have a problem to work on. The NAG mentioned that in every company a lot of ideas exist but they most of the time do not get any attention because of the limited time available. A matchmaking event or something similar between young entrepreneurs and industry problems will enhance the clarification of the opportunities because it will demonstrate what the business case will be. Another way of doing so is by integrating industry problems into design project courses at universities, which are part of the study program curriculum. This will allow students to work during their studies on industry problems so that they will get a feeling of the industry and get triggered to continuing to work on the problem as a startup.
Not only do initiatives like this clarify the opportunities of the industry, but it also enhances the supportive attitude and culture because it is more accepted to work on aviation industry problems and solutions because it is more integrated into the "everyday life".

For the other categories of entrepreneurs, it is mainly the task of the corporate industry-players to demonstrate that the aviation industry has lots of opportunities for entrepreneurs. There are many ways of doing so, but one way of doing so is by showing successful startups to the outside world in which they demonstrate how they've achieved their success. Probably the most well-known aviation entrepreneur is Richard Branson, founder of Virgin, who inspires others by writing books about his experiences. Another way is to communicate the innovation themes and targets of the company to the outside world. This can, for example, be done using the dotted line example mentioned earlier and learned from Philips. Entrepreneurs might have a limited view of the corporate capabilities without knowing that corporates are looking into new market segments or capabilities. For example, Fokker Services doesn't currently have many projects going on with virtual reality, but it could be one of their innovation themes at the moment. For startups with VR solutions, it might not look attractive to talk to Fokker Services because they are currently not doing anything with that technology. This might result in the startup to move to another company or industry. Therefore I think that it is important to communicate the innovation goals and objectives of a company so that startups (from other disciplines) learn about the innovation opportunities companies has to offer.

<table>
<thead>
<tr>
<th>Level</th>
<th>Success factors</th>
<th>Pitfalls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venture unit</td>
<td>Clear communication of opportunities</td>
<td>No pitfalls</td>
</tr>
</tbody>
</table>

Figure 5.4: Early-stage success factor 2

This can also be translated in another success factor for external venturing in the aviation industry by saying that having clearly defined objectives helps to overcome the early-stage startup challenges. This is also presented in figure 5.4.

5.3. Later-stage startup challenges and solutions

The previous chapter presented four main categories of later-stage challenges and accompanying solutions. For the discussion, we're mainly interested in the proposed solution because we are looking for success factors and pitfalls. In other words: we are looking for important factors which external venturing must at least contain so that the later-stage startup challenges can be resolved. To do so, we must look at the proposed solutions. The startup challenges are not relevant anymore as it is now time to determine what role corporates can play in overcoming the startup challenges. The proposed solutions are the main input for this, and it is found that the proposed solutions can be categorised into four main categories. These categories form the basis 'ingredients' for external venturing in the aviation industry at venture unit level and are at least required to overcome most of the later-stage startup challenges. The four ingredients are business services, network and people connectivity, Financing instruments and opportunities to use the corporate image. Which proposed solution belongs to which category can be found in Appendix F.

However, the interviewees did not propose a solution to all the later-stage challenges. Most of the challenges which do not have an accompanying proposed solution are also found difficult to solve. For example, the fact that departments work against each other in a large organisation is more of an internal struggle with a negative externally for startups but cannot easily be solved by external organisations with external ventur-
ing. Also the fact that organisations contain a lot of ‘old-school thinking guys’ is not something which can be influenced easily from outside the organisation. Finally, the extreme form of competition and a few aircraft manufacturers in the design and manufacturing segment cannot be solved by organisations because it is impossible to for example create extra manufacturers to overcome this challenge. It is not a problem that there a couple of challenges which are difficult to overcome because the goal of external venturing is to increase the startup success rate and not necessarily guarantee a 100% chance for success. The more challenges can be solved, the higher the chances of success would be, but if there are a couple of challenges which cannot be solved, external venturing can still be effective. An elaboration of the four important "ingredients" of external venturing is provided below:

1. **Business services:** The business service ingredient is about sharing relevant experiences, knowledge and tips & tricks with startups to fill up a knowledge gap. The case study results presented many new tricks to overcome startup challenges but they have to be communicated towards the startups, and this can be done with the business service ingredient. A couple of these tricks are for example that the long development cycles can be reduced by using the customers as leverage to speed up processes, that focusing on a minimum viable product first is important, that selling components or knowledge could help to finance technology development and that finding a generic product or service helps to overcome scalability problems. Also, it is sometimes found by startups that they lack any industry-specific knowledge. Therefore it helps if an experienced employee can share her/his knowledge with the startup or is available to answer all kinds of questions. Business services can, for example, be done in a consultancy-like manner in which an experienced person is available for some hours to support the startup. An ultimate solution could be to "fire" an experiences person from the organisation and put that person inside the startup so that it is entirely available to provide these kinds of business service activities.

2. **Network and people connectivity:** The network availability and people connectivity ingredient help startups to find the right persons inside an organisation. Being able to find the right persons easily is found relevant for many reasons. For example, startups found it difficult to determine customer needs. When having access to a certain network, startups would be able to approach these (international) contacts. Also having contacts at top level management available can help to overcome the bureaucratic costs of going through organisational layers. Therefore it is important to have the network and people connectivity ingredient.

3. **Financing instruments:** Financing instruments suitable for the aviation industry are the third ingredient and are also important as the aviation industry does not have the most attractive investment conditions. Therefore there must be investors or investment organisations involved in the external venturing program which understands the aviation industry and who are willing to invest in aviation startups. This can organised in different manners but at least there must be some sort of financing instrument available as money is the driving force of any organisation.

4. **Opportunities to use corporate image:** Finally opportunities to use the corporate image are also needed as the industry tends to behave risk-averse. Allowing startups to use the corporate image demonstrates commitment from the corporate which will take a lot of concerns (such as redundancy) from the industry away. A strategic partnership works similarly as it demonstrates that the corporate is willing to work with the startup. A prerequisite for this ingredient is that the company which is doing external venturing must have a good reputation. Otherwise, it will not work.
At the beginning of this report, it has been argued that the focus was going to be on four external venturing instruments. A logical result of this discussion would, therefore, be an instruction about how to use these instruments, when to use them and why. However, it is found irrelevant to do so because which instruments to use and when depends on the available corporate resources. Also, it was not found during the case studies that the interviewees have a preference for one tool or another. This means that it is not possible to recommend to use one tool above another. As long as the four ingredients mentioned above are part the total external venturing offering, corporates will be able to start with external venturing in the aviation industry successfully. The composition of the instruments will not matter in this case.

Because this section aims at translating the case study results into success factors and pitfalls, we can say that success factors for external venturing in the aviation industry, to overcome the later-stage challenges, are the availability of these four ingredients in the external venturing program. This is also shown in figure 5.5.
5.4. Success Factors and Pitfalls

In the previous sections, the case study results have been translated into success factors and pitfalls. A combination of all the translated results in success factors and pitfalls can be seen in figure 5.6. The dotted lines are the "generic" success factors which have determined in section 5.1 and the success factors inside the boxes with a continuous line are the success factors from section 5.2 and section 5.3.

Figure 5.6 summarises the main interpretations of the case study results from this study. This figure also answers the first sub-question and forms the normative framework for future studies. It is the first indication of important considerations for external venturing in the aviation industry. It also forms the primary input for the implementation plan which will answer the main research question.
5.5. Implementation plan for Fokker Services

For the successful implementation of external venturing at Fokker Services, a systematic implementation plan has been made. This plan is based upon the synthesis of the normative framework of success factors and pitfalls for external venturing in the aviation industry. It provides a starting point for Fokker Services which can be followed to start with external venturing in a structured way. The plan contains short-term, mid-term and long-term steps because it is difficult to make a time estimation beforehand. This is primarily because not all actions can be executed by Fokker Service themselves. Fokker Services also depends on others to do so. The plan is presented in figure 5.7 but a more detailed explanation of the figure is provided in the subsections afterwards.

![Implementation scheme for Fokker Services](image-url)

**Figure 5.7: Implementation scheme for Fokker Services**
5.5.1. The first stage

The first step in the early stage is to organise commitment from the top-level management of Fokker Services as commitment is the driving force behind the execution of external venturing. An important part of organising engagement is to determine how many resources can be appointed to external venturing. How many budgets are there available and how many employees can be appointed to guide the startups? Those are typical questions which are needed to be answered to determine the available resources and commitment from top level management. It is important that this is done carefully as it is one of the two major input for the decision on how to organise external venturing. When organising commitment, it is important to work on expectation management at the same time as well in which realistic expectations must be presented to management. External venturing takes time to pay-off and therefore it is important to commit the long-term. Also, because the level of commitment forms a major factor in determining which external venturing instruments to use, it is important to have the same level of commitment for a longer period. It is impossible to change the level of commitment because new external venturing instruments will then need to be developed every time.

The other major input for the decision about which external venturing instruments should be used is the value of the corporate resources and its core competencies. Fokker Services must assess its resources and competences to determine the value of them. Important questions to be asked here are for example about the position of Fokker Services in its network and about how strong their corporate image is. Also, the corporate competencies must be assessed, but according to Tidd and Bessant (2013) there is no accepted definition or method of measuring the corporate competencies. Richard Hall attempts doing so by distinguishing between intangible assets and intangible competencies (Harris, 2012). This is found to be a useful framework which helps to determine how these corporate competencies contribute to the performance of the organisation. The intangible assets include intellectual property rights and corporate image. The intangible competencies include strategic, organisational, technology, market and improving competencies (Hall, 2006). Therefore this framework can be used by Fokker Services. Based on the assessment of the corporate resources and the level of commitment, the composition of the external venturing instruments can be chosen.

Management should also review its innovation strategy and determine what their strategic goals are. They have to question themselves to what markets they want to target and expand to and thereby clearly define multiple innovation themes. This innovation strategy will later function as input for the development of the external venturing instruments and the selection of startups. A first decision must be made about which fundamental innovation strategy Fokker Services wants to obtain. Does it aim to be a technology leader or do its ambitions to be technology follower? Based upon Fokker Services’ ambition, it is likely to say that Fokker Services aims at using the incrementalist approach/innovation leadership strategy, but this requires a high level of commitment and risk-taking. Furthermore, Fokker Services could use the same technique as Philips to draft the innovation themes. The dotted line example from Philips can also be used as marketing instruments to demonstrate clearly in which markets Fokker Services is looking to expand to.

5.5.2. The second stage

Based upon the commitment and value of the resources, the next step is to decide what external venturing instruments to use. The assessment of the value of the corporate resources and the determination of commitment have not been part of this study. Therefore it is difficult to decide for Fokker Services which instruments to use and how. However, to give an idea of what the different opportunities are and what the impact of
the resource assessment and level of commitment is, two ultimate situations have been drafted. These are straight-forward and simplistic situations but believed to be a good way of looking at the different options.

**Situation 1: High commitment and high value of resources:** In this situation, management is more than willing to start with external venturing. They are willing to invest a lot of time, money and energy. Also, they have office space available at their headquarters which can be used to facilitate startups. Furthermore, the organisation has a good reputation because of their long history in the aviation industry. The result of this long history is also that the organisation has a lot of good contacts and a dense network in which they exactly know how to find the right guy. Finally, thanks to its the far-reaching history, the organisation has many employees with industry-specific knowledge so that they exactly know how the industry works and how to deal with its challenges such as certification.

In this case, I would recommend the organisation to hire someone who is familiar with external venturing and working with startups as it is found important during the case studies to have someone working int he organisation who understand both worlds. This person would function as a contact point for startups and is responsible for the internal development of the external venturing instruments. As there are many resources available (and especially the resources which are the basis for the four important "external venturing ingredients", the organisation is capable of starting an internal CVC investment department, internal accelerator and internal incubator. A combination of the instruments is important as startups have different needs but the introduction of all three instruments at the same time will be too much to handle as it is found to be a pitfall to start with external venturing to fast. The organisation needs to develop its external venturing competences, and it requires time to adapt to its new strategy / situation. Therefore a first step could be to launch an acceleration program in which employees can get used to working with startups. When this is working well, the organisation can invite the startups to start working at the corporate location to decrease the distance and increase the intensity of working together. A final step would be to create a separate corporate venture capital unit which manages investments and which actively scouts for investment opportunities.

The key importance of this situation is that the organisation has much to offer and are also willing to do so which means that they don't necessarily need to connect with other organisations before starting with external venturing.

**Situation 2: Low commitment and low value of resources:** In this situation, management is reluctant towards working with startups but is willing to 'give it a shot'. However, they see it as a trial and therefore do not want to invest too much time and money but rather focus on other development projects. They're not having any spare offices available, and their corporate image is questionable as their reputation has been damaged over the years by failing development projects and delivery problems. The company is only a couple of years old and therefore has a limited network in which they encounter difficulties of finding the right people. However, the company is specialised in specific market niches so that they have some knowledge about the industry dynamics.

In this case, the organisation should appoint someone inside the organisation who function as a point of contact and who will start developing the external venturing instruments. Hiring someone who understands both worlds is not possible because of the budget limitations. As their corporate image is weak and management does not want to commit many resources, there is a need to collaborate with other organisations which can provide this kind of resources. To obtain the financing instrument, one option would, for example, be to join a dedicated external fund such as the Mainport innovation fund or to find for investors who are willing
to invest in aviation industry startups. A final option to obtain financing instruments externally would be to collaborate with an incubator because incubators have internal investment opportunities as part of their incubator. Collaborating with an incubator could also be beneficial in this situation to provide the startup with office space and a network. A prerequisite will be that the incubator has a network which is of interest to the startup. Also, aviation startups need to overcome the risk-aversion of the industry. A questionable corporate image does not help, so the organisations need to find others means to prevent the risk-averse behaviour from the industry. One way of doing so is to connect with startup experts from well-known incubators/accelerators and use them to access the market potential of the entrepreneurs and their business model. If these well-known experts with a good reputation judge the startup as being a high potential, why would people question it? For the organisation in this situation, a first step to start with external venturing could be to launch an aviation specific incubation program with an external incubator such as Port of Rotterdam is currently doing with Yes!Delft. Only aviation startups would then be allowed to enter this program, and both the incubator and the organisation provide resources to run this program. Aviation industry-specific knowledge in the form of business services can be provided by the company whereas a network, people connectivity, office space and possibly also investors can be hosted by the incubator.

The key importance of this situation is that the organisation is in need of partnerships with other organisations to start with external venturing. This is very different from the first situation. This comparison demonstrates that is important, as a first step, to organise commitment and to access the value of the corporate resources such as network, knowledge and image before a decision can be taken on what instruments to use.

When a decision has been made on what external venturing instruments to use and when an external venturing manager has been appointed or hired, first initiatives can also be taken at ecosystem level to improve the Dutch aviation startup ecosystem. A first step would be to assess the current ecosystem and determine which of the five key stakeholders is missing. It is for example relevant to determine here how many Dutch aviation companies offer collaboration opportunities, how current public incentive structures look like, how the connection with universities is and what the current infrastructure for startups is to start a business in the aviation industry. A second step would be to find support among other key Dutch industry players to improve the Dutch aviation startup ecosystem. Like there is already argued before, improving the ecosystem would be far more effective when more than one industry player is trying to improve it. A coordinated effort from multiple large industry players would be much more effective as it demonstrates commitment from an entire industry to make a success out of it. This kind of commitment can also be used as leverage to for example change public policies or incentive structures so that they fit the aviation industry. A combined effort would be stronger than a single initiative from one player.

Finally, there is an action to be taken into account at venture unit level. This action contains the acquisition of knowledge about the execution of external venturing. This study provides a top-level indication of what should be done but not in detail how it should be done. Therefore this step is to talk with external venturing experts, contracting experts, financing experts to for example learn how contracts between a corporate and startup typically look like. Another way to acquire the knowledge is to hire someone who is experienced in this field. This, however, depends on the available budget and the level of commitment from top level management.
5.5.3. The third stage

The main activity during the third stage is to develop the external venturing instruments. If it has been chosen to create internal instruments, the 'external venturing manager' should look how external venturing can be integrated into the organisation. For external instruments, it would be important to create relationships and partnerships. Another important activity during the third stage is to start communicating the external venturing opportunities for startups. Clarifying the opportunities is found to be important, and at this stage, it is already known how and where startups can apply for the external venturing instruments. This can be done via the conventional communication channels such as the corporate website and social media pages or via specific advertisements at universities and startup networks. This stage should also be the start of a series of initiatives to create or improve the entrepreneurial culture. External venturing is part of the corporate identity, and therefore it is important that employees understand the concept of new business creation and that they have an open mind towards new ideas. This is something which cannot be created overnight, but when it is known what the external venturing strategy is going to be, it is also a good moment to start working on the corporate attitude towards entrepreneurship.

The literature study presented six factors which contribute to an entrepreneurial climate. These factors can be used as a guideline for management to decide on what initiatives would be the most effective. From the case studies, one of the employees from Fokker Services mentioned that currently, people are afraid of proposing new ideas because these ideas are not taken seriously. This means that a lot of work needs to be done regarding the trust and openness factor to create an emotional safety environment for employees. Also, one of the startups mentioned that when they wanted to work with Fokker Services, they were behaving risk-averse, like other industry players are doing as well. Therefore it is might also be good to look at the risk-taking factor here. Finally, it is also important at this stage to start looking for startups and entrepreneurs who are willing to enter a mutually beneficial relationship via one of the external venturing instruments. Without startups, there is no external venturing. One way of scouting startups is to collaborate with organisations like the venturescout or launchpadmeetups. Launchpadmeetups, for example, is designed to connect corporates with startups around a specific innovation theme. The innovation themes of a corporate function as their input and they will scout and invite startups to pitch at the corporate location. The corporate is then able to invite the startups to join one of their external venturing instruments. Another option is to do scouting yourself. In this case, the criteria presented in the literature study to assess startups can be used as entering criteria. However, organisations like launchpadmeetups or the venturescout have a database of thousands of startups and a good track-record of successful matches. If the budget allows to, I would recommend using one these organisations.

Further actions can also be taken at the ecosystem level. When it is known what is missing in the Dutch aviation startup ecosystem, and if the commitment from other large Dutch industry players is organised, the collaborative commitment can be used to improve the ecosystem. For example, universities can be approached to improve the infrastructure between universities and the aviation industry. Perhaps the NAG, which is located at TU Delft campus, can function as a bridge between the startup world and the industry. Also, the collaborative commitment from large industry players should focus on finding investors for aviation industry startups. Furthermore, it was also found that public subsidies are not aligned very well in the Netherlands. Therefore the collaborative commitment can also be used to make the subsidies more in line with what the aviation industry requires. Finally, it is important to raise awareness in startup communities, incubators and accelerators program of the aviation specific needs and how they should deal with entrepreneurship in the
aviation industry. It has been discussed before that, for example, the business model of the Yes!Delft incubator does not necessarily stimulate entrepreneurs to start a business in the aviation industry. This is not beneficial for the Dutch aviation startup ecosystem, and therefore solutions must be found to overcome this. One way could, for example, be to provide incubators (financial) incentives to stimulate entrepreneurship in the aviation industry. Another way could be to launch separate aviation programs, with different models, so that aviation startups are getting a fair chance of surviving the early-stage challenges.

5.5.4. The fourth stage and ideas for the future
The fourth stage is mainly characterised by the launch of the first external venturing tool. Although using more than external venturing tool is one of the success factors, it is also important to start slowly with external venturing and develop the corporate competence of external venturing. Therefore one external venturing tool should be launched first so that the corporate can get used to it. This stage should also be used to learn from the launch of this first tool so that the instruments can be adjusted accordingly. Steps after this stage are about extending the portfolio of the external venturing instruments. In case of high commitment from top-level management, a venture unit similar to Airbus Bizlab would be considered as an ideal situation. This unit would then coordinate all external venturing activities for Fokker Services. At the ecosystem level, the fourth stage would be to start something like a shared platform which connects all the external venturing initiatives in the Dutch aviation industry, contain investors for the aviation industry, offers resources such as office space, training opportunities and consults. In other words, the platform should function as a central portal for all the startups towards the external venturing possibilities in the Dutch aviation industry. This platform should be the driving force behind the creation of a supportive environment for aviation industry startups to overcome the early-stage challenges. Perhaps something like a Dutch aviation or aerospace incubator is something which could function as a central portal. However, the feasibility of such an incubator very much depends on the level of commitment from other industry players as well.
6.1. Conclusions

The research objective aimed at determining the first steps for Fokker Services to start with external venturing in the Dutch aviation industry. This objective, and answer to the third research question has been reached by the completion of an implementation plan and is presented in figure 5.7. This plan consists of four stages, mid-long term and long-term goals. This plan also contains actions to be performed at different levels: the startup, venture unit, company and ecosystem level because external venturing is not only about choosing instruments of collaborating and executing them. The success of this execution merely depends on the activities performed at all four levels. The foundation for this implementation plan has been a normative framework which presents success factors and pitfalls for external venturing in the Dutch aviation industry. This normative framework answers the main research question and can be found in figure 5.6.

The framework is built based upon two components. First, it is based on success factors and pitfalls for external venturing in general. These have been subtracted using synthesis from interviews with external venturing experts, from relevant academic literature and the experience of other organisations engaging in external venturing. A combination of the results taken from the interviews and the literature study is also the answer to the first research question. The second component of the framework is based on a Dutch aviation industry-specific list of success factors and pitfalls for external venturing. These lists have been based upon aviation startup challenges and solutions (which answered the second sub-question). The startup challenges have been divided into early-stage startup challenges and later-stages startup challenges.

For the early-stage startup challenges, four categories of challenges have been found. These categories indicate that entrepreneurs are not entirely aware of the possibilities of the aviation industry and that there is no infrastructure for Dutch aviation startups which increases the likelihood of entrepreneurs to start a business in non-aviation industries. A first solution to overcome the early-stage startup challenges is found to be improving the Dutch aviation startup ecosystem. In other words to creating a supportive environment in which startups feel comfortable. A second solution is to clarify the startup opportunities of external venturing in the aviation industry and thereby also at Fokker Services. These solutions have been translated into success factors by saying that by having a Dutch aviation startup ecosystem and clearly defined opportunities increase
the startup success rate.

Four categories of challenges have also been found for the later-stage startup challenges. For most of the identified challenges, solutions have also been found during the interviewees to overcome the accompanying challenges. Not all the challenges can be resolved, but for the solutions that were proposed, it was questioned what role corporates could play in these solutions. The answers to this question have been translated into ‘external venturing ingredients’. It turned out that having four ingredients will solve most of the later-stage challenges and are: business services, network and people connectivity, financing instruments and opportunities to use the corporate image. These four elements are business services, financing instruments, network and people connectivity and opportunities to use the corporate image. All these solutions have been translated into success factors for external venturing in the Dutch aviation industry by saying that having a full-grown startup ecosystem, clearly defined opportunities and an external venturing program with at least containing the four ingredients mentioned above increases the chances on successful collaborations. Together with the success factors and pitfalls for external venturing in general, we now know how Fokker Services and other organisations in the Dutch aviation industry should start with external venturing.

6.2. Practical and theoretical contribution

This research has both a practical as well as a theoretical contribution. The practical contribution, first of all, is that Fokker Services has a starting point for external venturing: the implementation plan. Furthermore, this study also provides them input for future collaborations with startups. Fokker can use this study to learn about the startup’s perspective and to increase the effectiveness of the collaborations. This study also presented a couple of useful tricks which can help in overcoming startup challenges. These tricks can be used as an input for the business service ingredient. A couple of indirect practical contributions of this study are for example that the network of Fokker Services has grown by talking to many different companies and by attending many exciting events. A couple of first steps have also been taken to organise commitment at large Dutch industry players for improving the Dutch aviation startup ecosystem. Also by conducting this research at Fokker Services, and thereby talking to employees, the first initiatives have already been taken towards enhancing the entrepreneurial climate at Fokker Services. Another practical contribution is that the results of the study have also been presented to the management board of Fokker Services which is a first step towards organising commitment. Finally, the practical contribution of this study is also that it is a first step in raising awareness among industry players about the immature status of the Dutch aviation startup ecosystem. It is also in their favour if there is a vibrant startup community aiming at succeeding in the aviation industry. Therefore it is important that these industry players understand the problems and I think that this study is a first attempt at highlighting these problems.

The theoretical contribution is the extension of external venturing literature. There is no literature available which attempts to describe what factors can increase the effectiveness of external venturing or which describe the differences of external venturing among industries. This study is a first attempt of doing so with the focus being on the aviation industry. It is assumed that ‘general’ external venturing instruments are less efficient when they are used for each industry in the same way. The lists of success factors and pitfalls form a normative framework for future studies. The framework provides a first indication of the success factors and pitfalls but needs further investigation to strengthen and to test the results. It could also function as guideline for starting with external venturing activities in the aviation industry.
6.3. Limitations and Validation

The synthesis part, in which the results have been translated into a normative framework and in which the normative framework has been translated into an implementation plan, has been validated by two experts. One expert has a lot of experience in the field of external venturing, and the other expert has a lot of experience in the international aviation industry and Fokker Services’ organisation. They were asked about the relevance and value of the synthesis part, and this resulted in a couple of research limitations and opportunities for future studies. These are described in this section.

One of the first limitations is that the normative framework does not consider different external venturing strategies. In general, their are two ways of working together with startups and Mrs Kuiper thinks that these are missing in the current elaboration of the normative framework. The different external venturing strategies might bring different collaboration challenges foreword so the normative framework might not be true for the two different EV strategies. Future studies should, therefore, consider the influence of different EV strategies on the normative framework. Furthermore, this research is very much focused on the differences between industry segments and the different startup challenges within these segments. However, the industry segments could have also been studied from another perspective: the external venturing perspective. Mrs Kuiper, for example, thinks that service model venturing strategies are for example less suitable in the D&M segment and the other way around. Therefore this study should have taken into account more than it is now which external venturing strategies and external venturing business models suit which kind of aviation industry segments the best and translate this into the framework. Finally, Mrs Kuiper mentioned that she thinks that the four ingredients are relevant and that the implementation plan is a good indication what should be done. However, the plan could have contained more detail about how it should be done. Although she acknowledged that this is something which experts and specialists should fill in, this is also something for future studies.

The expert from Fokker Services mentioned three important points. First of all did he see a couple of empty boxes in the solution columns which could be filled. During the interview, he already mentioned some solutions which demonstrated that future studies should focus more on finding solutions to the startup challenges. Although this study presented many solutions, talking to more industry experts would probably provide more interesting solutions, and this should, according to the expert from Fokker Services, therefore be the focus for future studies. Furthermore, he thinks that the implementation is a good lead to build an internal program around. He mentioned that he couldn't expect much more from me, so the practical contribution turned out to be valuable. Future elaboration of the practical implications of this plan should, according to him, focus on the level of detail. This feedback is similar to what Corina has mentioned. Finally, he mentioned that the steps on the ecosystem level are focused on the Dutch aviation companies in general and that I could’ve mentioned more explicitly Fokker Services’ role and actions to improve the ecosystem. I think that this is something which other students can as an internship.

6.4. Reflection

Like any other research, this research has some limitations, which should be documented and discussed for a better understanding of the relevance and robustness of the results. Also, the limitations of the research in its current form might provide an incentive for further research on the subject, extending and confirming the results and conclusions from this study.
1. This study assumes that external venturing has only positive effects on the innovation capabilities of an organisation while it also has a couple of downsides. For example, external venturing can bring reputational damage if the corporate image is connected to a startup and this startup fails to deliver as promised. It would have been interesting to study the mechanism for external venturing to prevent these kind downsides from happening but none of the downsides has been taken into account.

2. One of the category challenges for later-stage startups is the long development cycles category. This category is supported by a couple of examples and solutions to these examples. The four ingredients for external venturing are partly based upon these solutions, but the fact itself that certain processes take longer in the aviation industry than in comparison with other industries has not been taken into account. An important factor, for example, could be that accelerator programs should not last for three months but at least a year because of the long duration of the development cycles. This principle, however, is something which is important to understand but has not been included in the four ingredients.

3. It is assumed that entrepreneurs act fully rationally and that increases the chances of success (by overcoming the startup challenges) will automatically lead to startups who are willing to collaborate. However, this might not be true for all entrepreneurs. Some entrepreneurs also mentioned that they did not want to join an incubator or accelerator because their competitors were also involved in these incubators and accelerators and are therefore afraid of losing their competitive advantage. Another reason why startups might not join an external venturing program is that they don't want to give away a part of their company. Therefore the limitation is that also personal motivations and emotions could have been taken into account.

4. Only four different CV instruments have been taken into account during this study. This decision has been made based upon the strategic objectives of Fokker Services, but this does not have to be true for other organisations. Therefore, if other organisations want to use the same ingredients and implementation plan, they need to consider if they have the same strategic objectives as Fokker Services. The startup challenges and the accompanying proposed solutions, however, can be used by other organisation because these results are not depending on the corporate strategy. Important to note here is that the startup challenges and proposed solutions are only true for the D&M segment and the in-service support segment. This is another limitation of this study because the results cannot be used for the entire aviation industry. Future studies should investigate the applicability of the results for other segments of the aviation industry.

5. Only Dutch startups have been interviewed for the early-stage startup challenges and solutions. This means that the early-stage results cannot be used by companies outside the Dutch aviation industry.

6. Startups are hard to define but to be able to make the concept work for this study, it has been decided to define startups based upon their development process, by using technology readiness levels and by making a distinction between early-stage and later-stage startups. However, these definitions are comprehensive, and the startup development can perhaps also be divided into more than two stages. The use of two stages turned out to be very useful for this research but using different definitions would have probably resulted in different findings.

7. The case study results did not propose solutions to overcome all of the startup challenges, and no extra efforts have been made to find solutions to the challenges. This means that the effectiveness of the CV
6.5. Recommendations for future studies

Instruments is less than it could have been. Finding more solutions, to increase the effectiveness of external venturing is something which can be done in future research efforts. This also came forward during the validation session with one the corporate expert from Fokker Services. He named a couple of solutions to challenges which were not included in the results. This demonstrated that future studies should also focus on finding more solutions and translating these solutions again into external venturing ingredients.

8. The exploratory and qualitative nature of the study also brings limitations with. First, the qualitative nature of the study results in a risk of interpretation bias by the researcher. Although some precautions have been taken to prevent biases, it is difficult to remain unbiased during the research. Qualitative research also poses a risk of misinterpreting the results and typically involves a relatively small number of respondents. Some case studies for this study have been based upon the minimal required to comply the triangulation principle. This amount was found to be more than enough to obtain the required data, but quantitative research would have allowed for more respondents which improve the external validity of this study. However, at some point during the interviews, no new challenges and solutions were found anymore, and this was also true for the latest theories and insights on external venturing. The later the interviews were planned, the more similarities were found with other interviews until all the findings became familiar. I cannot be 100% sure that because of this all the challenges and insights have been identified, but the more are similar, the more it is likely that all have been identified within the boundaries of this study. The exploratory nature of this research brings a limitation along which is primarily about the quality of the results. The implementation plan, which has been written for Fokker Services, is primarily based upon unverified results and synthesis. In an ideal situation, the success factors and pitfalls should first be tested on their applicability before using them to start with external venturing. This has not been done and therefore forms one of the limitations.

9. Participants have been interviewed in the name of a company and might not have been totally open about their experiences. Although the results are made anonymous, the interviewee could have felt uncomfortable talking about some experiences which could have resulted in biased data.

6.5. Recommendations for future studies

The above-mentioned limitations present opportunities for future studies. It is not necessary to discuss the recommendations for the management board of Fokker Services as the implementation plan is one major recommendation to them. Everything that Fokker Services should be doing next is incorporated in this plan.

From a theoretical perspective, it would be interesting to continue:

1. Verifying the success factors and pitfalls of external venturing in the aviation industry by testing the results from this thesis. The normative framework is only a first indication and needs further verification to make sure that these are correct.

2. Studying the effects of using different external venturing strategies on the normative framework.

3. Studying which kind of external venturing strategies suit which industry segments and how this effects the normative framework.

4. Finding more solutions to overcome the startup solutions so that the effectiveness of external venturing in the aviation industry can be increased.
5. Studying the risks of doing external venturing for corporates and study how these risks can be integrated into the external venturing instruments.

6. Study what the influence of personal motivation and other factors are in the decision-making process of entrepreneurs to decide whether or not to join an external venturing tool.

7. Studying how the aviation startup ecosystem in other parts of the world looks like so that they can be compared with the Dutch aviation startup ecosystem. This could provide examples of how to grow the ecosystem from its birth stage towards its growth stage.

8. Determining what the actual effects of adjusting the ‘generic’ external venturing tools are towards industry-specific characteristics. It has been assumed that we cannot use these generic external venturing instruments but does it pay-off to adjust it towards the industry characteristics or not? If it significantly increases the startup success rate, it is interesting to perform the same study for other industries as well.

Finally using another research strategy with other data collection methods should also be used in future studies to see if the same results come forward. For now, the results from this study can be used as guidelines for many successive studies.
Bibliography


Case study description and motivation

Corporate venturing study cases

1. Duke Urbanik (Expert 1) is a serial entrepreneur, generalist coach, investor and currently active as coach at Yes!Delft and UtrechtInc. He participated and invested in several start-ups up to 2008 but quit this to coach startups. Due to his career and current job at Yes!Delft, he is found to be an interesting study case.

2. Corina Kuiper (Expert 2) is currently an adjunct professor innovation, venturing & Entrepreneurship at the Antwerp management School and regularly lectures as a guest speaker at many international universities and business schools. She regularly speaks at international conferences and seminars and is a board member of the corporate venturing network Netherlands. She has over 20 years of experience in the field of venturing and designed and implemented a corporate venturing business development structure for Philips. Due to her impressive career in the field of corporate venturing, she has been chosen as study case.

3. Philips has been chosen as study case to learn about corporate venturing because it has years of relevant experience in the field of corporate venturing. Innovation has been in its DNA for centuries, and over the years they have initiated many innovation initiatives. Especially the Philips Technology incubator is an important part of this innovative character and is raised by the Philips Research organisation. This has been a strategic partner of Philips business by developing meaningful innovations. Over the years. This experience could be of big value to the case of Fokker services, and therefore Philips has been used as a study object for this study. Also, at first sight, the healthcare industry looks similar to the aviation industry as it faces similar challenges due to the number of regulations and corresponding entry barriers and is beneficial for the external validity of the findings.

4. Airbus Bizlab is a global network of accelerators where start-ups and Airbus intrapreneurs can work together to translate innovative ideas into valuable business. It is one of the corporate venturing tools from Airbus and as they are active in the same industry as Fokker Services, it is found an interesting study case to learn from their experiences.
Early-stage study cases

1. **Actiflow** is founded in 2005 as a spin-off from the Delft University of Technology by two aerospace engineering students. Their kick-off project involved the development of an active flow control system for aircraft, something which they have worked on during their master thesis project but soon they moved away from the aerospace industry towards the automotive industry. Nowadays they are offering analysis and consultancy services in many other industries like the medical, maritime and civil industry. However, the aviation is not one of them and therefore I wanted to know what early-stage challenges they were facing so that they moved away from the aviation industry.

2. **E-trailer** is also a spin-off from the Delft University of Technology and founded in 2016. E-trailer is working on innovations in the trailer and caravan industry and started with the idea of positioning an electrical motor on a trailer/caravan to decrease the fuel consumption of the protruding vehicles when driving through an elevated landscape. The reason why E-trailer has been chosen as one of the study cases is that of two reasons. The first reason is that another startup, called Wheeltug, is using the same idea/concept as E-trailer but apply it to aircraft instead of trailers and caravans. Wheeltug positions an electrical motor onto landing gears of aircraft to reduce the turnaround time (which is the time between the landing and take-off between two different flights). Therefore E-trailer had a high potential of successfully grounding in the aviation industry with their idea but did not decide to do so. Apparently they faced challenges in the early-stages to chose for the aviation industry.

3. **MOCS** joined the Yes!Delft incubator in 2012. It is a tech company which combines engineering and consultancy work with the launch of new products for the maritime, offshore and civil industry. Over the years MOCS has completed several projects throughout different industries (except for the aviation industry) based on innovative solutions they created. A number of these solutions had the potential of being applied in the aviation industry, but until now they’ve not made an attempt to diverge here. Boeing and Airbus confirm this potential for the aviation sector by the fact that both have patents close to the innovative technologies MOCS has patented. Two people from MOCS have been interviewed. One of the co-founders and an engineer who is involved in the company from an early stage. The main purpose was if and if not, why they’ve never considered the aviation industry as potential industry.

4. **DutchVR** is a young company situated in the Hague. As the name of the company suggests, it is developing Virtual Reality applications for many different organisations and industries. In their short existence they already worked with KPN, Dell, Nike and other big corporations but none of them in the aviation industry. However, as will be discussed later on, there are many VR startups which try to bring the VR technology towards the aviation industry. Therefore, the purpose of this study case was to find out what their view of the aviation industry is and why they’ve not made a step towards it so far.

Later-stage study cases

Design and Manufacturing

1. **Parapy** is specialised in automation of repetitive, time consuming engineering design processes. They were founded in 2016 and are currently situated in the Yes!Delft incubator. Customers approach them for engineering consulting, training and support but they also develop software applications for their clients. The ParaPy software allows engineers to build parametric, rule-based software applications that automate simulation-driven engineering design processes. As their software is mainly focused
upon design, they have been position in this segment and are chosen as a study case to see what type of challenges they were facing and how they think these can be solved.

2. **Technobis** is a group of companies providing development and supply of high-tech instruments and modules for businesses worldwide. They’ve developed fibre sensing technology which enables the monitoring of vibration, shape and temperature which is vital in predicting health and remaining lifetime of aircraft parts to ensure availability, reliability and safety. Although the whole Technobis group cannot be called a startup anymore, the aerospace division is still in its developing stages and is a form of the corporate spin-off as described in the introductory chapter. Therefore it was asked how they experienced this.

3. **8-tree** developed a 3D surface inspection tool to reliably and consistently measure surfaces and solve chronic problems. It can both be applied as quality improvement tool in the OEM manufacturing segment, but it can also be used in the MRO segment to improve efficiency's. They were founded in 2013 and are located in Munich. As they’ve developed a technology for both the D&M and MRO segment, it is interesting to learn from their experiences of starting a business in those segments.

**MRO segment**

1. **Innovative Binaries** is active in the area of aircraft health management, predictive maintenance and inventory control optimisation. They use mathematics, statistics and data science and apply it to disparate sources of information to find patterns and correlations. The startup is also active in four different kinds of incubation and acceleration programs. Two of which are mainly focused on the aviation industry and therefore it is also interesting to learn from their experiences regarding the different type of incubators and challenges they were facing.

2. **AELS** or Aircraft End-of-life Solutions is an aircraft dis-assembly and dismantling company founded in 2006 as spin-off form the aerospace faculty of the Delft University of Technology. The company offers complete support in any stage of the end-of-life process of an aircraft. Also AELS has been selected as study case to learn from their experiences of launching a business in this segment.

**Modification segment**

1. **Wheeltug** has already shortly been introduced with E-trailer, but from 2005 onwards, they spent researching, fine-tuning and overcame many technical challenges in the process. Finally, in 2012, they performed the first ground tests of the in-wheel motor design. After more than a decade of effort they’re planning to bring their concept to an aircraft in the nearby future, and therefore Wheeltug has been selected as a study case. They’ve managed to put an idea through all developments phases after a long and challenging trajectory, so they have many experiences which are of great use for this study.

2. **MI Airlines** was founded in 2010 and developed a Portable Wireless IFE platform with nowadays over 20 airlines and 200+ aircraft flying AirFi every day. AirFi is a proven, fast and cost-effective way to introduce a great new PaxEx and create new ancillary revenues streams. MI Airlines has its services integrated at many airlines, so it is fair to say that they’ve successfully started a business in the aviation industry. Therefore the purpose of this study case is to learn from their experiences and get to know the major burdens of their development stages.
3. **BlueBox Aviation** was formed in January 2017 after a merger of AviIT and Bluebox Avionics. Together they’ve been providing software solutions to the aviation industry since 2004. Bluebox is not a classical example of a startup, but together they are developing technologies a technology for In-flight Entertainment systems (IFE systems) for aircraft and therefore they’ve many experiences in the industry specific challenges.

4. **Recalm** is German startup which introduces an intelligent acoustic device to reduce unwanted disturbances of noisy industrial equipment. The basic concept of active noise control is known since the 1930s and works by sending out an anti-noise signal of opposite polarity to the sound source. The noise can, therefore, be eliminated by destructive interference. They joined the Airbus Bizlab accelerator in 2016 and are still working on the development of a first prototype. Due to their involvement in the Airbus Bizlab program, and because they are just entered the later-stage, it is found interesting to see how they are experiencing their development.

5. **Inflight VR** is a Munich based company that is creating a virtual reality ecosystem for the Inflight Entertainment Industry. The company was founded in 2014 and they believe that a passenger can experience sitting in a close to the real cinema or listen to relaxing music on a tropical beach while actually being in an aircraft cabin. Inflight-VR joined the Airbus Bizlab accelerator at the same time as Recalm. The same motivations for interviewing Inflight VR has been used as with Recalm.

**Overarching study cases**

1. **The NAG** is one of them and has already been introduced before but they represent a large variety of companies and are therefore able to operate within the whole aviation transport system. From airport development & infrastructure to aircraft manufacturing and aircraft maintenance: it has an extensive international network that can be put to use for its members. Their involvement industry makes

2. **The faculty of Aerospace Engineering from the TU Delft** is another organisation which is performing research in many different areas of the aviation industry and is the biggest Aerospace faculty in Europe. Femke Verdegaal is closely involved in entrepreneurial courses provided at the faculty and therefore knows about the students and their view regarding entrepreneurship. Her experiences are found relevant to use as study case.

3. The **Starburst Accelerator** is a worldwide aerospace accelerator which one the one hand is supporting startups in their early stages and on the contrary has a consultancy department which supports corporates in open innovation initiatives by identifying and tackling growth challenges. The consultancy office, for example, could help to figure out how companies should organise their innovation processes, whether or not a corporate incubator is needed and what they can do to stimulate the innovation ecosystem in some areas. For startups, they provide office space, financial support, strategy consulting and aerospace experts. Also, they are trying to connect startups with corporates and because of all these activities and experiences, Starburst has been chosen as a study case.

4. **Fokker Services** has been selected for interviews because Fokker employees are relevant as they know how the industry works and what problems they’re facing when developing new products or services themselves. These challenges are similar to the challenges later-stage startups are facing, and therefore they’ve been selected as case study. To follow the triangulation principle, an E-commerce manager, a Design Engineer and an Airworthiness have been interviewed.
Study case questions

1. External venturing study cases questions

1. What are the do's and don'ts when doing external venturing?
2. What is the most successful external venturing strategy and how does it work?
3. What is their view on the aviation industry and how does this differ from other industries?
4. What are common challenges in a relationship between a corporate and a startup?
5. What are prerequisites from a corporate perspective to start an external venturing program?
6. What external venturing instruments do they prefer?
7. What are potential dangers of the startup hype?
8. What do startups think of corporates and the other way around?
9. What are the essentials of working with startups?

Figure B.1: EV study case questions
## 2. Early-stage study case questions

| The industry          | 1. How would they describe the aviation industry?  
<table>
<thead>
<tr>
<th></th>
<th>2. What are the main differences with other industries?</th>
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| Decision for industry | 1. How did they startup / how did they gathered a team?  
|                       | 2. What are the backgrounds of the entrepreneurs? |
| Forming a team        | 1. Why did they decide to be active in the industry they are in nowadays while having a  
|                       | background in the aviation industry?  
|                       | 2. Did they consider the aviation industry? If Yes, why did they decide not to enter it?  
|                       | 3. Did they verify the assumptions which made them chose not to enter the aviation industry?  
|                       | 4. Did they know who to contact and where to go? |
| Development of the startup | 1. What were crucial moments in their development?  
|                         | 2. What where their biggest obstacles? |
| **Startup Challenges** | 1. What do they think is the reason that many startups and entrepreneurs may chose for non-aviation industries?  
|                       | 2. What do they think is the reason there are not many aerospace startups at Yes/Delft and in Delft in general?  
|                       | 3. Why do they think that there are more aviation startups elsewhere in the world? |
| Solutions             | 1. How can the Dutch aviation industry be more attractive for entrepreneurs?  
|                       | 2. What is currently missing what would increase the likelihood for entrepreneurs to enter the aviation industry?  
|                       | 3. How can the above-mentioned challenges be solved? |

Figure B.2: Early-stage study case questions

## 3. Later-stage study case questions

| Opinion about the aviation industry | 1. How would they describe the aviation industry?  
|                                   | 2. How does the . . . segment differs from other segments?  
|                                   | 3. What is the attitude of your customers?  
|                                   | 4. What are the main differences with other industries? |
| Decision for industry             | 1. Did they consider starting a business in other industries and if so, why did he chose the aviation industry instead of others?  
|                                   | 2. Would they’ve chosen another industry instead with the knowledge they have nowadays? |
| Development of the product        | 1. How did their product development go?  
|                                   | 2. Who are your customers and how would you describe them?  
|                                   | 3. What was of big value during the development and what can be improved?  
|                                   | 4. Did their team contain members with industry specific knowledge? |
| Challenges                        | 1. What were the most significant challenges they faced when starting their business? (Money, expertise, network?)  
|                                   | 2. How did they try to overcome these barriers?  
|                                   | 3. What does he need at the moment what would improve its situation and why didn't they already have tried to obtain this.  
|                                   | 4. Do they already have customers and if so, what was the most important moment in the process of getting a first customer?  
|                                   | 5. What would he recommended other startups to do first when starting in the aviation industry? |
| Collaborating with corporates      | 1. How does the ideal company look like to collaborate with?  
|                                   | 2. Did they already try to reach out to companies to collaborate with and what were their responses?  
|                                   | 3. Did they consider to join an incubator / accelerator program?  
|                                   | 4. How did these programs contribute to your development process?  
|                                   | 5. Did they ever consider to sell their ideas to a company? |
| Solutions                         | 1. How do they think the above-mentioned challenges can be overcome?  
|                                   | 2. What was the key turning point in their development?  
|                                   | 3. What was their key-learning moment in the development? |

Figure B.3: Later-stage study case questions
Results left out of study

One startup in the modification segment
The motivation for the desire to have high margins can also be found in the financing structure of the company. They are using risk-sharing partnerships in which funding is obtained by 1) issuing shares and 2) deferred payments in which money is borrowed from a company and only has to be paid back when they are making money. They did not want to take public investments from venture capitalist etc. because these types of funding often require to give away a percentage of the revenues. This will negatively impact the margins and therefore they decided not to go for public investments. This is also the reason why they decided not to join an incubator or start-up program like starburst because these programs often offer public funding and this is not what they wanted. Another reason for not joining an incubator was because they were scared that their IP and patents could be somehow affected. They felt that talking to others about it could harm their IP and therefore they preferred to develop it themselves.

Philips
Philips has already more than 10 years of experience with collaborating with startups and during this period they’ve learned a number of things. First of all they’ve learned that they don’t want to engage with startup companies which are competing in markets niches in which Philips itself is also operating. This is because Philips has years of experience and therefore the chance that a startup that is operating in the same niche with approximately the same technology has a better value proposition than Philips is very small. Therefore they’ve decided that they only want to engage with startup companies, referring to the dotted line example, which can fill up the gaps between the existing dots and not engage with startups which are possibly increasing the length of the existing dots. This also reduces the chance of cannibalizing your own markets because filling up the gaps between the existing dots more or less means trying to reach new markets.

Startup companies in the healthcare industry often enter the market with products which are simplified or inferior to the technology which they aim to develop. They make “soft claims” about their new solution in order to protect it from any criticism. Reputation is key in this industry so therefore they will try to find a “safe” way of entering the market before reaching the full potential of the solution. This will enable them to
meet the expectations and see how the market responds to a new solution.

**One startup in the modification segment**

Talking about their experiences in joining the Airbus Bizzlab program: He expected more from the program. They did provide the network and helped to get information but he thought that everything he got from the program he could’ve done it himself. Especially the funding part was not covered by the program. He found funding himself from the government via subsidies but he would’ve wanted Airbus to help with that part. When he applied to the program he was still in an early stage of development and after finishing he actually still is. The program provided him lots of training on general entrepreneurial skills but when I asked how they are going to certify it he said that they might need some help there as well. This help could’ve easily been provided when he was part of the program where he had free workspace on sight etc. but now afterwards they have to pay for the workspace and they’re not sure whether or not to stay.

**The Airbus Bizzlab**

They acknowledged that the program was not very well organised yet. This is probably because it just started but there is not yet too much internal support from Airbus employees which make it difficult. The objective from the Bizzlab for Airbus is to learn from the new business models from startups and to see how the markets reacted. They are also investing resources in startups which do not directly could add value to Airbus aircraft but for them it is interesting enough to see how the market responds. For example they allowed a startup Called InflightVR into their program which uses a VR headset for inflight entertainment. This is interesting for Airbus because sooner or later these VR-glasses will be found in aircraft so keeping this startup close means sitting on the front row to learn about how these things are going to be used in aircraft. This will provide Airbus valuable information and they could possibly adapt to this. The Airbus Bizzlab program differs from general incubators or acceleration programs by providing industry specific insights. They’re able to link the startups with experts within Airbus and this is very valuable because

**Startup spoken at the AIX 2017**

They developed a product which can be also applied in different industries like the railway industry but they found that the business case in the aviation industry was much more significant than in other industries. They joined the starburst accelerator to improve upon their visibility. The program did provide them with trainings but they only joined parts which were interesting to them. He thinks that one of the major success factors of his company is that he came up with a product which does not have to comply to the strict certification rules. (Like Airfi).

**Startup spoken at the AIX 2017**

They joined the starburst accelerator program in order to improve their network and raise money.

**Startup spoken at the AIX 2017**

This startup is also active in the IFEC niche of the aviation industry and said that the major challenge was to earn the trust of the airlines and that this could take up to 2-3 years. Furthermore it is important to find the right people within the industry and that it could be very valuable to use a network to find these people. They originally started in the automotive industry but decided to shift towards the aviation industry because
the market was developing and they saw some good chances here. They did not want to join the startburst or bizzlab accelerator because their competitors are also active in these incubators. Therefore they were afraid that they might lose competitive advantage over the others.

**Startup spoken at the AIX 2017**

After explaining the background of my research he immediately stated that getting the right contact was his major challenge. He was thinking of joining an incubator because he did not succeed in finding the right contacts. He has been trying to talk to people within Airbus but he said that the bureaucratic costs are very high and that it is extremely difficult to talk to the decision-makers. In order to do so you have to get through different layers and that takes a lot of time. Also finding investors is quite challenging because not many investors understand the aviation industry.

**NAG**

In a country such as the Netherlands where the cost of production are very high you need to be innovative in order to remain or increase the international market position and they think that the startup scene is a major source of innovation. Not only the NAG itself but also governmental institutions want to stimulate entrepreneurship in the industry because they also see entrepreneurship as a prominent source for grow and development. They also thinks that startups should first talk to OEMS which are accessible to them such as Embrear and Airbus via the network of the NAG and then move down the supply chain. This because if you start talking to airlines it will not work because they're having different priorities at the moment. Another point which could be of interest for this study is that the NAG arranged pensioners from Branch companies to be available for startups to ask advice to. These pensioners were ex top level managers in companies like Fokker but he noticed that startups are not very eager to approached these people. He thinks that is might be due to the fact that these people have a very narrow vision.

**Duke Urbanik**

About Intrapreneurship, when people are assigned to work as a startup within a company the following things happen:

1) the employees do not really get the time necessary to work on it. When there are problems in their regular work they have to drop anything but the regular work in order to solve the problem. 2) If the people come up with a different idea which deviates from regular business for the corporate the other employees tend to thwart the idea because they're used to the way they're working right now. 3) It's doomed to fail and it is very demotivating for the people working in it. 4) You will get the second-bait entrepreneurs instead of the “pure entrepreneurs” because they are not able to start a business there selves and choose a secured environment where they're having certain guarantees.
Validation of results

**Corina Kuiper**

1) The thesis is mostly about external venturing and not internal venturing. Therefore I would suggest to call it external venturing instead of corporate venturing because corporate venturing is about external and internal venturing.

2) Too much control on startups should be defined more clearly. You need close observation (stage-gate process with GO / NO GO) as the startup and the corporate are speaking different languages. On the other hand exerting too much control over financial development is killing. You need remain the entrepreneurial spirit.

3) Figure 2.3 is not entirely true if you talk about internal venturing as well.

4) Figure 2.4 Should have another review as strategic partnerships could also be with scale-ups.

5) Split startup / entrepreneurial level in a startup level and an entrepreneur level because you can have really good entrepreneurs without a startup and the other way around. A good entrepreneur does not make a good startup. Therefore it is important.

**Femke Verdegaal**

Een beetje last minute maar wat een mooi stuk wat je heb geschreven – helemaal in lijn met onze ideeën ten aanzien van wat er nodig is voor innovatie.

**Erik Klaas – 8-tree**

This is really interesting and as far as I can tell accurate from my perspective.

**Jan Vana - Wheeltug**

IMO you captured the start-up challenges pretty well, but I’d still recommend to add one more – Intellectual Property and its’ protection. IP is a very important for any start-up because they need to come with something innovative and new if they want to succeed. And IP is (also because of OEMs domination) not very well appreciated by quite a few predators in the industry as well as by the industry. So this creates a kind of hen
and egg paradox – open-up the kimono and show me what you have and I can only than tell you if I am prepared to partner or invest. This is a tough choice for start-ups and IMO quite a few fell because of that.

**Boy Trip – E-trailer**
Het ziet er goed uit. Zoals aangegeven in het interview denk ik dat het erg belangrijk is dat startups zelfstandig blijven en niet te veel verantwoording af hoeven te leggen aan de corporate. Het blijft een zelfstandig orgaan namelijk. Een startup moet gebruik kunnen maken van de faciliteiten van een corporate maar moet geen corporate worden.

**Job Heimerikx – Airfi B.V.**
Erg goed. Op een paar uitzonderingen herken ik me in het beeld dat je schetst.
Synthesis validation with Experts

Corina Kuiper

1) There are two ways to collaborate with startups: to see it as a extended R&D lab and letting the startup aim for corporate growth, or to attract startups and let them use your corporate platform so that the size of the platform is growing. The first type is called business model venturing and the second one is called ecosystem venturing. The external venturing strategies and objectives have not been taken into account in my implementation plan.

2) My research is very much focused upon the differences between industry segments and how startups have different challenges in these segments. However, industry segments also have different venturing strategies as Corina thinks that service model venturing strategies are for example not suitable in the D&M segment. Therefore this study could have more taken into account which external venturing strategies and external venturing business models suit which kind of aviation industry segments the best.

3) The four ingredients as described in the discussion are valuable and she thinks that they are right.

4) With regards to the implementation plan, it is very important to understand that developing external venturing capabilities is not enough. The organisation must also think about how these capabilities are leveraged within the organisation. In other words there must also be an internal program which is aimed at dealing with the external venturing programs.

5) A external / corporate venturing specialist is needed which knows how to deal with contracts, investments, collaboration methods and more. This research is a good indication of what should be done but how it should be done should be learned from specialists.

6) A box in the implementation plan is missing which describes the step in which knowledge and experience is used to build capabilities. This must be at stage 2, before the CV instruments are being developed.

7) Reviewing the innovation strategy could have been more explicit. It is very important to have explicit strategic goals which is not expressed in profits or revenues.
Business development and Sales manager Fokker Services

1) He mentioned that there are a couple of empty solution boxes, where no results were found, but where he believes are solutions to find for. He already mentioned two solutions to challenges which were not found during the study. He thinks that more effort could have been put into finding solutions to the challenges.

2) He thinks that the implementation plan is a good lead to build a program around it. It could've got a little bit more detail but he believes that it is a good first step to develop an external venturing program at Fokker Services. In fact, he said that I couldn't have done more, except for the level of detail, as management should now decide on how to proceed and this isn't something what can be done by me.

3) One remark about the ecosystem level is that this level is about the entire Dutch aviation industry so I could've been clearer about what specific actions should be undertaken by Fokker Services and which actions should be done by other stakeholders. Also he wanted to know what percentage of his investments should for example should be put in the ecosystem level and how much in the company level. This would have given him more feeling about what is important and what is not.
Proposed solutions per ‘EV ingredient’

Network and people connectivity

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub category</th>
<th>Cause / example</th>
<th>Proposed solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The slowness of the industry</td>
<td>Long development cycles</td>
<td>Difficult to determine customer needs</td>
<td>Approach international contacts in an early stage to obtain feedback</td>
</tr>
<tr>
<td></td>
<td>The big size of the organisations</td>
<td>Need to go through different bureaucratic layers</td>
<td>Having contacts at top level management to speed-up the process of going through layers</td>
</tr>
<tr>
<td>Challenging market factors</td>
<td>Weak competitive position of the startup</td>
<td>Hard to obtain the right information from Airlines or OEM’s: they decide who to share the information with so the startup is depending on the OEM</td>
<td>By getting customers (airlines) behind the startup to pressure the OEM’s</td>
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<tr>
<td></td>
<td></td>
<td>OEM’s need to certify the tools and it is uncertain if they will</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difficult to get on the radar</td>
<td>Attent events, shows and other opportunities to keep the topic ‘hot’</td>
</tr>
</tbody>
</table>

Figure F.1: Solutions belonging to the network and people connectivity ingredient
### Business services and people connectivity

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub category</th>
<th>Cause / example</th>
<th>Proposed solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The slowness of the industry</td>
<td>Long development cycles</td>
<td>High amount of regulation</td>
<td>Takes time to understand all the regulations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>By getting customers (airlines) behind the startup to pressure the OEM's because they will listen to their customers</td>
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<td></td>
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<td></td>
<td>Find a creative way of dealing with the regulations</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>To find a generic product or service which is scalable (which has the same regulations and do not need to be integrated in the aircraft)</td>
</tr>
<tr>
<td>Difficult to find investors</td>
<td>Unfavourable investment conditions</td>
<td>High risks and long return on investment</td>
<td>Advising the startup to: 1. Focus on a MVP 2. Sell Components first 3. Sell knowledge first (soft-start)</td>
</tr>
<tr>
<td></td>
<td>Very expensive industry</td>
<td>Agreements with OEM’s can cost millions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High amount of regulation</td>
<td>Expensive certification process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low scalability of products</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long sales cycles: From moment you start to first revenues takes a lot of time so the startup needs money to cover the first expenses</td>
<td></td>
</tr>
<tr>
<td>Negative attitude of the industry</td>
<td>Organisations try to kill new initiatives to protect their business</td>
<td>OEM’s force airlines to use original parts to protect their business</td>
<td>By getting customers (airlines) behind the startup to pressure the OEM’s</td>
</tr>
<tr>
<td></td>
<td>Startups need to earn trust from the industry</td>
<td>Startups need to prove the industry players why to invest time, money and energy</td>
<td>By getting a certificate from well-known startup experts which access the capabilities and potential of the startup</td>
</tr>
<tr>
<td>Challenging market factors</td>
<td>Weak competitive position of the startup</td>
<td>Hard to obtain the right information from Airlines or OEM’s: they decide who to share the information with so the startup is depending on the OEM</td>
<td>By getting customers (airlines) behind the startup to pressure the OEM’s</td>
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<td>OEM’s need to certify the tools and it is uncertain if they will</td>
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<tr>
<td></td>
<td></td>
<td>Difficult to get on the radar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small market size</td>
<td>Low scalability of the products</td>
<td>To find a generic product or service which is scalable (which has the same regulations and do not need to be integrated in the aircraft)</td>
</tr>
<tr>
<td></td>
<td>Specific industry knowledge is needed</td>
<td>Startups don’t know the industry dynamics</td>
<td>Having someone available in the startup team who has relevant industry knowledge</td>
</tr>
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<td></td>
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<td>Startups lack experience in the industry</td>
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</table>

Figure E2: Solutions belonging to the Business services ingredient
## Financing instruments

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub category</th>
<th>Cause / example</th>
<th>Proposed solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to find investors</td>
<td>Unfavourable investment conditions</td>
<td>High risks and long return on investment</td>
<td>Look for investors who understand the aviation industry and are willing to invest.</td>
</tr>
<tr>
<td></td>
<td>Very expensive industry</td>
<td>Agreements with OEM’s can cost millions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High amount of regulations</td>
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<tr>
<td></td>
<td></td>
<td>Expensive certification process</td>
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<tr>
<td></td>
<td></td>
<td>Low scalability of products</td>
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<tr>
<td></td>
<td></td>
<td>Long sales cycles: From moment you start to first revenues take a lot of time so the startup needs money to cover the first expenses</td>
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</tbody>
</table>

Figure E3: Solutions belonging to the Financing instruments ingredient

## Opportunities to use corporate image

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub category</th>
<th>Cause / example</th>
<th>Proposed solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative attitude of the industry</td>
<td>Industry players are risk averse</td>
<td>Industry players don’t like single force contracts</td>
<td>By creating a strategic partnership with a well-known and reliable industry player</td>
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<tr>
<td></td>
<td></td>
<td>Industry players require redundancy at all times</td>
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<tr>
<td></td>
<td></td>
<td>Industry players only look at companies who already have revenues, a fully developed product, history and paying customers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Startups need to earn trust from the industry</td>
<td>Startups need to prove the industry players why to invest time, money and energy</td>
<td></td>
</tr>
</tbody>
</table>

Figure E4: Solutions belonging to the 'opportunities to use corporate image' ingredient