

Analysing the Impact of EU Market Fragmentation Affects the Scalability of Space Startups

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CONTENTS

Executive Summary	4
Acknowledgment	5
1. Introduction	
1.1. General introduction	6
1.2. Problem statement	6
1.3. Research objectives	6
1.4. Research questions	7
1.5. Research structure	7
2. Literature Review	
2.1 Market Fragmentation in the European Union	9
2.2 Scaling Challenges Faced by Space Startups	10
2.3 Scaling of Startups in the EU	10
2.4 Effect of Market Fragmentation on Startups.	11
2.4.1 Regulatory Complexity	12
2.4.2 Financial Barriers	13
2.4.3 Operational Challenges	14
2.5 Comparative Analysis with U.S. Startups	15
2.6 Mitigation Strategies	16
3. Methodology	
3.1. Research Design	18
3.2. Data Collection	18
3.3. Interview Questions	19
3.4. Data Analysis	19
3.5. Research Quality Indicators	20
4. Findings and Discussion	
4.1. Converging Opinions	22
4.2. Diverging Opinions	25
4.3. Managerial Recommendations	30
5. Conclusion	
5.1. Conclusion	31
5.2. Limitations of the Study	32
5.3. Future Scope	33

Self Reflection	34
Bibliography	35
Acknowledgment of Generative AI Usage	37
Appendices	38
Appendix A: Theoretical Framework	39
Appendix B: Interview Guide	42

EXECUTIVE SUMMARY

This master's dissertation aims to understand the effects of market fragmentation in the EU on the ability of space startups to grow and expand their operations within the EU. The study also aims to raise awareness about how the effects of market fragmentation can harm the startup ecosystem in the EU and its ability to compete in the global space market.

The study begins with a review of existing academic literature, encompassing not just academic journals but also market reports, books, and online newspaper articles. With the review as a foundation, the author continues the study with case studies and one-on-one interviews with professionals in the NewSpace industry. The study also includes a comparative study of the startup ecosystem in the EU versus the one in the US as the author found that the space startups in the US are thriving compared to their EU counterparts.

The literature review begins with the understanding of market fragmentation in the EU and its causes with the help of theoretical frameworks like transaction cost theory, resource-based view theory, and theory of growth. The author continues the study by understanding the values startups especially space startups bring to the economy of a country and why it is important to consider startup culture for the EU which already has established players in the industry largely dominating the infrastructure. With the help of the above-mentioned theoretical frameworks and industry knowledge, the author then compares and contrasts the findings from the interviews and discussions with colleagues and industry professionals with existing academic perspectives. For the case studies, the author closely studied real case scenarios of space companies. The companies studied are different examples - one suffers due to market fragmentation, one has successfully found the middle ground and the last one gets an unfair advantage from it.

The study leads to many interesting findings. Most importantly the author finds that market fragmentation brings more challenges than it does opportunities. The study also finds that this phenomenon affects the commercialization phase of the company more than it does the R&D phase, thanks to the abundance of non-dilutive funding opportunities but it is not enough to keep them in the EU, which damages the startup ecosystem and affects the EU's competitiveness in the market. The author also finds that a lot of the issues lie in the mindset of the business owners, and investors and a net negative perception of the industry that affects the attention, interest and ultimately funding that these startups garner.

The study is concluded with the understanding that there is no quick fix to the issues that market fragmentation. All the suggested amends will take a lot of time and negotiations. Until then the best way to go for startups would be to be mindful of the factors that affect their growth and sustenance in the EU market and find a way around it.

Key concepts

market fragmentation, scaleups, geo-return policy, regulatory heterogeneity,
compliance requirements, capital market

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1. INTRODUCTION

1.1 General Introduction

The space industry presents a considerable economic opportunity. According to McKinsey & Company (April 2024), by 2035, the space economy is expected to expand significantly, reaching \$1.8 trillion—a threefold increase from \$630 billion in 2023. This growth is driving innovations in sectors like meteorology, energy, telecommunications, insurance, transportation, maritime, aviation, and urban development which are not only boosting the economy but also benefitting the society.

However, the space industry heavily relies on advanced technologies and significant capital investment, which makes it a highly specialized sector and harder for startups to gain entry into the market. Having a good startup ecosystem helps countries stay competitive in the global market because they drive innovation and bring new technologies and services to market, often challenging established players and bringing new growth opportunities.

For these startups, scaling their operations is critical to success as it allows them to expand market reach, increase revenues, and achieve economies of scale, all of which are vital for competing globally. However, scaling comes with technical, financial, and regulatory challenges. Space startups have it harder because the space market is also rapidly evolving. Since, countries like the US also believe that space capabilities are very important to national security and global positioning, which puts a lot of pressure on the industry and new laws and regulations are being introduced very frequently.

The European Union (EU) presents a unique market environment for space startups, as it is composed of 27 member states and each state has its own regulations, policies, technological preferences, and market conditions. This creates a fragmented market that businesses must navigate unlike, businesses in more unified markets, such as the United States. This complexity can slow down the expansion process, delaying market entry and scaling across the EU. A direct consequence of this is that startups often struggle to stay and grow within the EU and they move abroad looking for more favorable environments. This negatively impacts the EU startup ecosystem and in turn EU's standing in the global market, as it misses out on the opportunity to retain industry leaders, who could also mentor upcoming entrepreneurs in space.

1.2 Problem Statement

“To what extent does market fragmentation in the European Union affect the ability of the aerospace startups to scale and what are the strategies that can be adopted by the NewSpace startups to successfully scale?”

1.3 Research Goals

This study aims to understand how the differences caused by the fragmented market in the European Union (EU) impact startups as they attempt to grow and expand their operations

across multiple jurisdictions. The research seeks to examine both the opportunities and the obstacles presented by the fragmentation, how the startups in NewSpace can use these opportunities to their advantage and the strategies they can adopt to mitigate any challenges they may encounter while trying to scale successfully.

The goal is also to ascertain whether there are specific measures that the European Union could implement to facilitate the scaling of startups and to identify the nature of those measures, if applicable.

1.4 Research Questions

1. How does the fragmented market within the European Union impact the growth and expansion of startups across different jurisdictions?
2. What opportunities do startups encounter as a result of market fragmentation in the EU, and how can these opportunities be leveraged to support their growth?
3. What are the primary obstacles startups face when attempting to scale across multiple EU jurisdictions due to market fragmentation, and what strategies can they employ to overcome these challenges?
4. What specific actions or measures could the European Union take to support startups in overcoming the challenges posed by market fragmentation?
5. To what extent can proposed EU policies or interventions facilitate the scaling of startups, and what would be the most effective measures?

1.5 Research Structure

To properly structure the research, the author has carefully selected relevant concepts, theories, and working definitions to delineate the scope of this thesis. In Chapter 1, the foundation of the study will be laid out, including the research goal, problem statement, and the research questions that guide the investigation. This chapter will also introduce the context of the European Union's market fragmentation and its potential impact on space startups, setting the stage for the subsequent analysis.

Chapter 2 will provide a comprehensive review of the academic literature, starting with an exploration of the general challenges that startups face when attempting to scale. This will be followed by a focused examination of the specific challenges encountered by startups in the space industry operating within the European Union due to market fragmentation and the strategies that startups have used to navigate these challenges. The review will then discuss opportunities that arise from this fragmentation and how they can be utilised to ensure successful scaling. The chapter will conclude by evaluating potential actions that the EU could take to support startups, drawing from existing theoretical frameworks and empirical studies.

The chapter will also explore different theories and models that explain the mitigation strategies that were presented previously, such as those that prioritize the growth of startups versus those that emphasize the broader economic impact on the EU.

Chapter 3 will provide a detailed explanation of the research methodology utilized in this study. This chapter will explain the rationale behind the choice of a qualitative research approach, including a discussion of the data collection and analysis methods. The author will describe the use of case studies to explore the effects of market fragmentation on startups in the EU, examining real world examples to assess how theoretical insights align with practical outcomes.

Finally, Chapter 4 will present the findings of the study, offering a critical analysis of the interviews, discussions, and case studies in light of the research questions. The author will then discuss each finding in depth. These findings and the discussions are meant to broaden the perspective of the reader about the problem at hand. The chapter ends with managerial recommendations.

The thesis will conclude with Chapter 5 with a summary of the key insights gained from the study, highlighting the potential actions that the EU could take to support startups in scaling across a fragmented market. The chapter also includes conclusions from the study, a side note on the limitations of the study, and closes it with recommendations for further study.

2. LITERATURE REVIEW

This section will first explore the concept of market fragmentation within the European Union, emphasizing its regulatory, financial, and operational dimensions. It will then delve into the specific challenges that space startups face, including regulatory complexity, cross-border supply chain management, access to capital, and the theoretical frameworks behind it. The review will further discuss the comparative analysis of market conditions between the EU and other regions, such as the U.S., highlighting the implications of these differences for the scalability of space startups. Finally, it will address potential solutions and strategies that have been proposed or implemented to mitigate these challenges, setting the stage for the research questions that will be addressed in the subsequent chapters.

2.1 Market Fragmentation in the European Union

According to Foucault, T., & Menkveld, A. J. (2008), market fragmentation is the process in which a larger market divides into smaller, distinct segments or sub-markets, each with its unique characteristics, preferences, and needs. This occurs due to several factors like differences in consumer preferences, technological advancements, regulatory environments, or competitive dynamics.

Despite the EU's efforts to create a cohesive single market, significant barriers still exist that prevent businesses, particularly startups, from operating seamlessly across member states. Digital Public Policy, Regulation, and Competition (2024) have highlighted that while the EU single market is one of the world's most integrated, it still suffers from regulatory heterogeneity, where different member states maintain divergent rules despite overarching EU directives. This regulatory heterogeneity is a key component of market fragmentation, as it forces businesses to adapt their products, services, and operations to comply with multiple sets of regulations, thereby hindering their ability to scale efficiently.

The historical context of market fragmentation in the EU can be traced back to the origins of the European Economic Community (EEC) and the subsequent evolution into the European Union. The Treaty of Rome signed in 1957, laid the foundation for the creation of a common market aimed at fostering economic integration among member states. However, the process of achieving a truly unified market has been fraught with challenges.

One major historical cause of market fragmentation is the principle of subsidiarity, which was formally introduced in the European Union (1992) and laid the groundwork for the modern European Union. It asserts that decisions should be made as closely as possible to the citizens and that the EU should only take action when individual member states cannot sufficiently achieve objectives at their national, regional, or local levels. which allows member states to retain control over certain policy areas, particularly those that are not explicitly within the competence of the EU (Paul Craig and Gráinne de Búrca, 2020). This has led to a situation where, despite the presence of EU-wide regulations, member states often maintain their own additional rules and standards, contributing to a fragmented market environment.

Moreover, the expansion of the EU to include new member states with varying levels of economic development and regulatory standards has exacerbated market fragmentation. As noted by Baldwin and Wyplosz (2019), the accession of Central and Eastern European countries in the 2000s introduced new layers of complexity, as these countries brought with them distinct regulatory frameworks that were not always fully aligned with those of the existing member states.

Several key regulations and policies contribute to market fragmentation within the EU, even as they aim to promote integration. For example, the Services Directive (2006/123/EC) was designed to remove barriers to cross-border service provision within the EU. However, its implementation has been uneven, with member states applying the directive in ways that protect their domestic markets. This uneven implementation has led to persistent barriers in the services sector, one of the largest areas of the EU economy.

The General Data Protection Regulation (GDPR) is another example where a well-intentioned EU-wide regulation has contributed to market fragmentation. Although GDPR was designed to harmonize data protection laws across the EU, its broad framework allows member states to impose additional requirements, leading to variations in how the regulation is enforced across different jurisdictions (Kuner et al., 2020). This creates additional compliance challenges for startups operating in multiple EU countries.

Economic factors also play a role in market fragmentation. The economic disparities between member states mean that markets within the EU can vary significantly in terms of consumer behavior, purchasing power, and market demand. These disparities make it difficult for startups to apply a one-size-fits-all strategy across the EU, further complicating efforts to scale across multiple jurisdictions.

2.2 Scaling Challenges Faced by Space Startups

Scaling a startup in the tech industry is inherently complex, with companies often facing challenges such as securing sufficient funding, managing rapid growth, building scalable infrastructure, and navigating competitive pressures (Skawińska, E., & Zalewski, R. I., 2020). The EU underperforms in generating unicorns, which are the most successful scale-ups and this is widely attributed to the lack of funding from venture capital (VC) investors (Aernoudt, 2017)

For space startups, these challenges are amplified due to the capital-intensive nature of the industry, which requires a significant upfront investment for research, development, and satellite deployment. The long development cycles and high risks associated with space missions further complicate the scaling process.

Technical challenges are also more pronounced in the space sector, where startups must ensure that their technology can operate reliably in the harsh environment of space. Extensive

testing and iteration are often required to meet these demands. Additionally, the competitive landscape is becoming increasingly crowded, with both established players and new entrants vying for market share. These factors make scaling a significant hurdle for space startups, necessitating not only innovative solutions but also strategic planning and robust support from investors and policymakers. (Kostopoulos et al., 2021)

2.3 Scaling of Startups in the EU

In the European Union, as companies mature, they face widening financial constraints. According to European Investment Bank (2024), European scaleups typically raise 50% less capital by their tenth year compared to their US counterparts. This capital gap persists across various industries and economic conditions. The scarcity of largescale EU investors forces many firms to seek foreign funding and often results in them exiting foreign buyers or stock exchanges. Consequently, Europe struggles to retain industry leaders and experiences a loss in potential technological innovation and entrepreneurial talent, weakening its local startup ecosystem.

The financing challenges faced by EU scaleups are primarily due to the shallow and fragmented nature of European capital markets, particularly in venture capital. Venture capital investment in the U.S. is significantly higher, often six to eight times more than in the EU. Although the EU attracts some foreign venture capital, it remains insufficient to close the gap. The EU's venture capital market is highly localized and lacks sufficient specialized, large-scale funds.

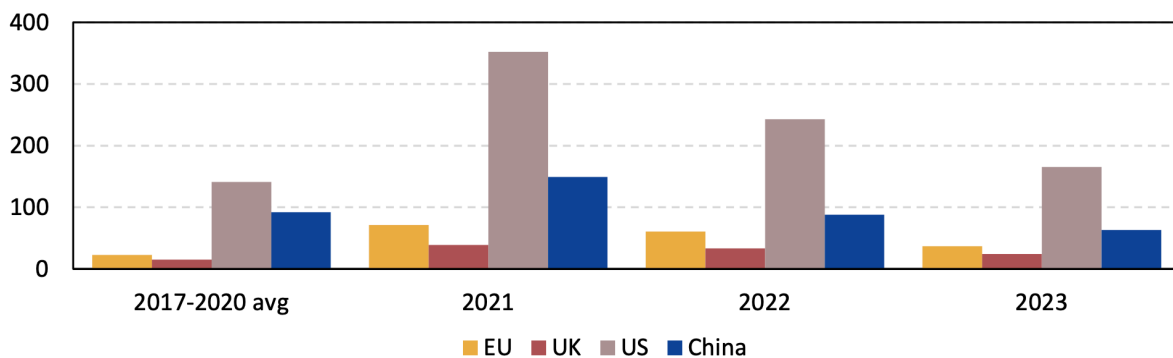


Figure 1: Venture capital investment in the European Union, the United Kingdom, the United States, and China (\$bn)
 Source: European Investment Bank, The Scale-Up Gap

The diverse licensing requirements across EU member states also introduce significant challenges. Each country has its regulatory framework, which can differ considerably in terms of requirements, timelines, and costs for obtaining necessary licenses. This complicates the compliance process, increasing both the complexity and cost for startups operating across multiple jurisdictions. Furthermore, varying safety standards enforced by different countries add another layer of complexity, making it difficult for startups to ensure their products meet the necessary criteria across the EU. The need to interact with multiple regulatory bodies at both the national and EU levels, such as national space agencies, the European Space Agency

(ESA), and the European Commission, further exacerbates bureaucratic delays and creates uncertainty in regulatory compliance. (Schimanietz, et.al. 2020)

2.4 Effect of Market Fragmentation on Startups

To better understand the challenges presented to the growth of startups, the author would like to use the transaction cost theory, which according to Williamson, O. E. (1981) posits that companies aim to minimize transaction costs associated with conducting business such as negotiating contracts, obtaining information, and enforcing agreements. In fragmented markets, increased compliance, operational, and market entry costs can lead to inefficiencies and higher overall expenses. Businesses thus tend to take a more conservative approach to growth and may avoid cross-border expansion due to these elevated transaction costs.

The Institutional theory as in North, D. C. (1990), helps us understand how institutions—defined by laws, regulations, norms, and cultural practices—shape business behavior. In a fragmented market like the EU, institutional challenges can significantly impact space startups. Since the member states have differing institutional frameworks, it complicates compliance for space startups. Each country's regulations regarding space activities, environmental considerations, and safety standards vary widely which creates a complex landscape to navigate. The theory highlights how cultural norms and business practices can differ across regions. In the EU every country puts a lot of emphasis on national pride especially when it comes to sectors like the space industry and they try to reduce their reliance on foreign countries. Moreover, every member state uses their language as the working language in the country. Hence, for startups, understanding local market behaviors, networking customs, and consumer preferences becomes challenging. Establishing relationships with regulatory bodies, industry partners, and customers can be difficult in a fragmented market. Especially when there are different regulatory bodies with different legislations whose goals can be both overlapping and conflicting at the same time. The varying institutional contexts mean that startups must adapt their approaches based on local expectations and norms, which can slow down the process of building necessary networks.

2.4.1 Regulatory Complexity

Pelkmans, J., & Renda, A. (2014) argue that regulations can both stimulate or hinder innovation depending on the nature of the regulation and the context in which it is applied. Well-designed regulations promote innovation by creating clear standards, driving competition, and encouraging the development of new technologies. However, overly complex or rigid regulations may stifle innovation by increasing compliance costs and uncertainty.

When it comes to the European Union, the main challenge for aerospace startups is due to its fragmentation. Diverse licensing requirements are a primary concern, as each EU member state imposes its own unique set of regulations for aerospace activities, often varying widely in

terms of documentation, approval processes, costs, and timelines. Fonseca et al., 2001, 2007 have shown that start-up costs are significantly higher in more regulated economies.

European Systemic Risk Board (2019) highlights how this regulatory diversity hampers the ability of startups to scale efficiently across the EU. Inconsistent licensing processes across member states create barriers to entry and expansion, particularly for smaller companies that lack the resources to manage complex compliance processes in multiple jurisdictions. Similarly, the study European Commission (2016) underlines that the fragmentation in licensing requirements complicates cross-border operations, increasing the time and financial resources needed to bring products to market.

Safety Standards also differ significantly between member states, adding another layer of complexity. Each country may have its safety certification processes, which can conflict with or differ from those in other EU nations. For example, European Aviation Safety Agency (EASA) standards are sometimes supplemented or overridden by national regulations, forcing companies to undergo multiple certification processes to operate in different countries. These discrepancies in safety standards increase the cost and time required for compliance, creating significant hurdles for startups attempting to achieve market penetration across the EU.

Finally, the Multiplicity of Regulatory Bodies adds further to the complexity. Aerospace startups must interact with a range of national and EU level entities, including national space agencies, the European Space Agency (ESA), the European Union Agency for the Space Programme (EUSPA), and the European Commission. The overlapping jurisdictions and sometimes contradictory requirements of these bodies can lead to bureaucratic delays and uncertainty in regulatory compliance. European Commission (2014) has discussed how the interplay between national and EU level regulations often leads to regulatory inefficiencies, further complicating the business environment for startups.

These challenges underscore the need for a more harmonized regulatory framework within the EU to support the growth and scalability of aerospace startups because, as pointed out by Klapper, L. and C. Richmond (2011), regulatory reform results in higher market entry rates by startups.

2.4.2 Financial Barriers

The financial landscape for aerospace startups in the European Union is characterized by significant challenges, particularly in terms of financing constraints and the venture capital gaps that exist compared to more developed markets like the United States. As emphasized in Penrose, E. (1959), according to the Theory of Growth, firms grow based on their ability to develop and exploit resources over time. EU capital markets often struggle to provide the necessary scale of funding that startups require to grow, particularly during the scaleup phase. (Bottazzi, L. and Da Rin, M., 2002)

Financing Constraints arise due to the fragmented and relatively shallow nature of European capital markets, which are less capable of supporting high-risk, innovative startups. The scarcity of large-scale venture capital funds in the EU exacerbates this issue. According to European Investment Bank (2024) study, European startups often face a "scaleup gap" where access to substantial capital diminishes just as they are poised for significant growth. This forces many startups to seek funding outside the EU, often from U.S. or Asian investors, or to relocate their operations entirely to access deeper capital pools.

The venture capital gaps are evident when comparing the EU to regions like the U.S., where venture capital investment is significantly higher. For instance, European Investment Bank (2024) study has shown that annual venture capital investments in U.S. companies can be six to eight times higher than those in the EU, reflecting a structural disadvantage for European startups. It noted that this disparity limits the ability of EU startups to scale effectively, as they lack the necessary financial backing to compete on a global stage.

The role of EU Capital Markets is crucial yet currently insufficient to bridge these gaps. The market's fragmentation and the localized nature of venture capital investments hinder the flow of capital to where it's most needed. International Monetary Fund (2024) argues that while EU venture capital markets are expanding, they remain too small and too regionally focused to fully support the growth of aerospace startups. To improve access to funding, there is a need for deeper and more integrated capital markets within the EU. This would involve mobilizing private savings into venture capital and enhancing the role of institutional investors.

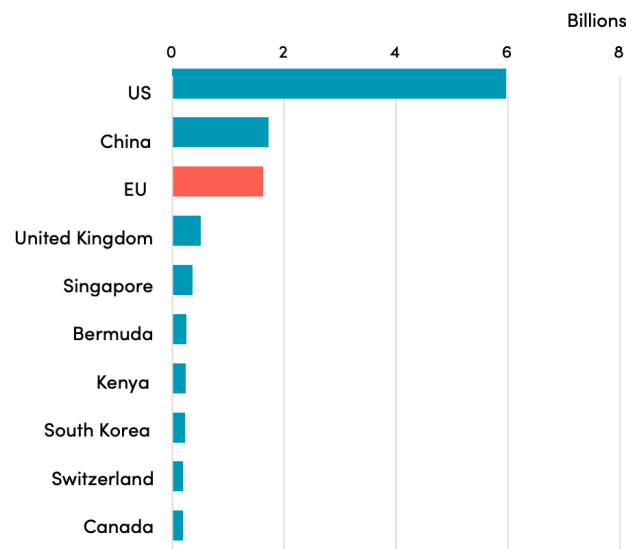


Figure 2: Startup and scaleup funding in USD Source: Frontier Economics analysis of ASPI data

2.4.3 Operational Challenges

Managing cross-border supply chains within the EU presents significant operational challenges due to the regulatory fragmentation across member states. According to Mariniello, M., & Salemi, F (2015), the fragmentation of the EU market – and the resulting smaller scale of operation – has been identified as one of the factors behind the worse financial results of

European telecoms companies compared to their US, Japanese and Korean counterparts. Each country may have different standards and regulations for aerospace components, complicating the logistics and increasing the cost of compliance for startups. For instance, aerospace companies must navigate varying certifications and quality control measures, which can lead to delays and higher operational costs. According to, these complexities can hinder the efficiency of supply chains, affecting the overall scalability of startups.

Customization for local markets is another operational hurdle. Due to the diverse regulatory and market conditions across EU countries, startups often need to adapt their products and services to meet local requirements. This customization not only increases costs but also complicates the production and distribution processes. This need for adaptation can prevent startups from achieving the streamlined operations necessary for scaling, as they must maintain multiple product variations for different markets.

The difficulty in achieving economies of scale is closely related to both supply chain management and market customization (Verbeke, A., 2009). Startups are often unable to leverage economies of scale due to the fragmented nature of the EU market. Instead of benefiting from uniform production and distribution processes, they must deal with segmented operations, which limit their ability to reduce costs as they grow. emphasize that this fragmentation forces startups to operate more like a collection of small businesses rather than a single, scalable enterprise, severely limiting their growth potential.

2.5 Comparative Analysis with U.S. Startups

When analyzing market scalability for space startups, the European Union presents unique challenges compared to the United States (Negrutiu, C., 2020).

In the U.S., space startups operate under a centralized regulatory framework primarily overseen by the Federal Aviation Administration (FAA) and other federal bodies. This contrasts sharply with the European Union. For instance, in France, companies must comply with the Law on Space Operations (LOS), which requires authorization from the French Space Agency (CNES) and imposes stringent liability and insurance requirements. Germany's space law mandates permits from the Federal Ministry for Economic Affairs and Energy (BMWi), with a strong emphasis on environmental impact and safety. In Italy, space activities are regulated by the Italian Space Agency (ASI), while Luxembourg's laws on space resource exploration require companies to obtain licenses from the Ministry of the Economy. Even within the UK, which was recently part of the EU, the Space Industry Act 2018 sets out specific licensing requirements through the UK Space Agency. These complexities add significant challenges and costs for companies seeking to operate across multiple EU member states, in stark contrast to the more streamlined regulatory environment in the U.S. This means that U.S. startups benefit from a large, homogenous market that allows for significant economies of scale while the EU startups must often customize their products and services to meet the diverse regulatory and market conditions of different member states, hindering their ability to scale efficiently.

This also leads to the U.S. providing a more developed venture capital ecosystem for their startups, which is crucial for their growth and scalability. U.S. capital markets are deeper and more integrated, offering easier access to funding. In contrast, the EU's venture capital market is more fragmented, with lower levels of investment and fewer large funds available, limiting the growth potential of startups. Pisoni, A. and Onetti, A. (2018) highlight the importance of exit strategy, especially for VC-backed startups, for high growth, as this is when the investors gain a return on their investment. The study also highlights the gap in the European startup ecosystem's ability to produce large, innovative companies (or unicorns) and while the US and EU favor acquiring local firms, the US is more active in acquiring startups and has been more and more interested in EU companies.

This disparity between the two markets is also seen in the global competitiveness of space startups. U.S. startups are often better positioned to scale rapidly and capture international markets due to their more favorable domestic conditions. Meanwhile, EU startups face delays and increased costs, making it more challenging to compete on a global scale.

2.6 Mitigation Strategies

From the literature, several mitigation strategies have been proposed to address the challenges faced by space startups and to enhance their growth potential. These mitigation strategies are mainly based on two theoretical frameworks: (1) *The Resource Based View of the Firm*, a concept introduced by Wernerfelt, B. (1984), which indicates that effectively allocating resources and efficient resource use can mitigate some transaction costs associated with compliance and market entry. Startups that can identify and leverage unique resources like their patented technology or products can better position themselves against competitors operating in fragmented environments; and (2) *Dynamic Capabilities* which refer to a firm's ability to reconfigure its competencies to address rapidly changing environments. According to Eisenhardt, K. M., & Martin, J. A. (2000), this adaptability is crucial for long-term success, especially in the space sector which is so dynamic. This also enables firms to develop localized strategies that align with diverse consumer behaviors and cultural practices across member states which can enhance customer engagement and market acceptance.

The Capital Markets Union (CMU) is a crucial initiative designed to overcome market fragmentation and improve access to finance for startups across the EU. For aerospace startups, which often require substantial capital investment for research, development, and scaling, the CMU offers several significant benefits. By striving to create a more integrated capital market, the CMU aims to reduce barriers for both investors and startups involved in cross-border activities. This integration could enhance liquidity and provide aerospace startups with a wider range of financing options, such as venture capital and private equity. Additionally, by promoting alternative financing mechanisms like crowdfunding and angel investment, the CMU can help aerospace startups access diverse funding sources, which are vital for meeting the high capital demands of the industry. The CMU's efforts to harmonize capital markets across EU member states could lead to better resource allocation and risk sharing, thereby supporting the growth and scalability of aerospace startups through stronger financial backing.

However, the success of the CMU depends on addressing challenges such as regulatory inconsistencies and ensuring investor protection across various jurisdictions.

Regulatory fragmentation can hinder cross-border operations and elevate compliance costs. For aerospace startups, consistent regulatory standards across the EU are essential for complying with safety, environmental, and operational requirements. Standardized regulations can simplify market entry and expansion across member states. Streamlined regulatory processes would reduce the administrative and financial burdens associated with compliance, allowing aerospace startups to allocate resources more efficiently toward innovation and growth Langenbucher, K. (2020). Moreover, greater legal certainty could attract investment and build confidence among aerospace startups and their stakeholders. Nonetheless, achieving regulatory harmonization involves complex negotiations among member states.

Targeted policy support is also critical in addressing the specific challenges faced by aerospace startups, which often involve high capital intensity and extended development cycles. Government grants, subsidies, and tax incentives can help startups manage the substantial costs associated with research and development, accelerating their growth. Policy initiatives that establish aerospace-specific incubators, accelerators, and networking platforms provide valuable resources, mentorship, and industry connections, which are essential for navigating the complex aerospace sector and scaling operations (McKinsey & Company, 2018). Furthermore, implementing regulatory sandboxes and simplifying compliance requirements can enable aerospace startups to test innovative technologies and business models under reduced regulatory constraints, fostering innovation and facilitating market entry (Accenture, 2017).

The literature suggests that while policy support is vital for nurturing aerospace startups, it must be carefully tailored to the unique needs and challenges of the aerospace sector to be truly effective.

3. METHODOLOGY

This chapter outlines the framework used to drive data collection and analysis operations. The first subsection outlines the study's design. The next section elaborates on data collection methods and the chapter concludes with a summary of data analysis methods, operationalization, and validity assessment, as well as a brief discussion of the first findings.

3.1 Research Design

The author started working on the topic of “Challenges Faced by Space Startups in the European Union”. As suggested by the supervisor to align more with the academic aspects the author dug deeper to identify the major challenges faced by startups that were specific to the space industry and the European Union. This was followed by identifying the root cause of most of these challenges which was Market Fragmentation. The next step was to do a thorough study of what market fragmentation is and what the root causes of it were. Further into the study, the author came to understand that the startups were not as affected by market fragmentation, as they did when they had to start scaling. This refined the topic more now that the logical next step would be to understand to what extent they impacted the scaling process.

Several articles and discussions online and offline, brought to light that this fragmentation in the market brought both opportunities and challenges, but these were dependent on the specific space activity of the company, the country they were based in, and their level of maturity in the market. This led to a lot of different views and opinions. Investigating case studies and conducting interviews helped the author narrow down the most relevant points and further investigate.

3.2 Data Collection

The data was largely collected through interviews. Since the interviewees were contacts of the author or the author's colleagues, there were not a lot of formalities except for two of them asking to keep their name and company anonymous and some points of discussion off record. These points were strictly to give the author a better understanding of the concept and the rationale behind their opinions.

The interviews were conducted online and offline. The interviews were 45 minutes long. Two interviews had to be cut short as, in one case, the interviewee had something come up during the interview and the other was because the duration of the interview crossed the allotted time. The author has also used information from informal discussions with colleagues. The interviews were recorded but the author has not added transcripts of the interviews as per the request of the interviewees to not record most parts of the interview, as they were sensitive/confidential and they were shared with the author in confidence to help the author better understand the topics discussed. As a result, only excerpts from the interviews are used in the findings and discussions that were authorized to be published in the report.

One planned interview with Kammy Brun, *Founder & Chief Executive Officer*, KALAXIE had to be rescheduled, but it did not fit within the submission timeframe.

Interview invitations were sent to the following:

1. Pierre BERTRAND, *CEO/ Co-Founder* (Skynopy)
2. Paul COUTURIER, *System Engineer* (Skynopy)
3. T, *Founder/ Engineer* (French startup – Payload Missions)
4. E, *Space Investor* (European Accelerator)

As for the literature, the author used information from around thirty academic journals, eight books, a thesis, and other sources such as annual reports, and news articles.

The data collection for this study follows a mixed approach with case studies and interviews. The author was suggested, by two interviewees, to closely study three space startups within the European Union (EU), namely Endurosat, a Bulgarian startup, The Exploration Company, a German company, and Belgium-based Aerospacelab. This was to give detailed and context-specific insights into the phenomena being studied.

3.3 Interview question development

The interview questions were developed such that they aligned with the research objectives and to make sure that the interviews would provide data relevant to the study. To structure the interviews and ensure consistency, an interview guide was developed to cover all the topics, so that the different answers could be compared, to identify patterns. The guide also allows for adaptive questioning, so that any emerging topics that may not have been anticipated could also be accounted for.

It began with a review of existing literature on regulatory frameworks, market dynamics, and innovation within the telecommunications industry. Insights from the literature helped to develop questions that would probe the practical implications of these theoretical concepts.

3.4 Data Analysis Method

The initial step in working with the data involves transcribing pertinent information from the interview recordings. Following the transcription process, the subsequent step is to perform simple coding, wherein the text is segmented into manageable paragraphs. Subsequently, these paragraphs are assigned labels to represent concepts. The author identifies recurring concepts and those that stand out from the collected data. These labels are then utilized to pinpoint the most significant concepts, enabling the author to concentrate more on them. The main objective is to identify patterns and gain insights that contribute to addressing the research questions and the problem statement.

After identifying patterns, the next crucial step is to contextualize these patterns. This is also the stage to revisit the theories that have been studied in Chapter 2. The author then draws connections between the identified concepts or themes and existing literature and theories.

Additional validation efforts are made by comparing the findings with articles, press releases, annual reports, and other relevant sources.

3.5 Research Quality Indicators

To ensure the validity of the research, the study was designed to accurately reflect the phenomena under investigation. The research questions were aligned with the study's objectives, and the methodologies employed were chosen to provide a comprehensive understanding of the issues. Triangulation of data sources, including academic literature, industry reports, and case studies, was employed to enhance the credibility of the findings. This approach helped to crossverify the data, reducing the likelihood of bias and ensuring that the conclusions drawn were well-founded.

Reliability was maintained by using consistent methods throughout the research process. The procedures for data collection and analysis were documented, allowing for the research to be replicated by others in the future. The study's reliance on established frameworks and methodologies further supports its reliability. By applying these standardized approaches, the research findings are likely to be consistent and repeatable, even when applied to different datasets or in different contexts.

While the study focuses specifically on aerospace startups within the EU, careful consideration was given to the extent to which the findings might be generalizable to other contexts. The analysis was designed to highlight not only contextspecific insights but also broader trends and patterns that could apply to aerospace startups in other regions or industries. However, the limitations related to the study's scope were also acknowledged, and future research was suggested to explore these areas further, enhancing the potential for generalizability.

Ethical standards were adhered to throughout the research process. This included ensuring the confidentiality and anonymity of any sensitive information, particularly in case studies and interviews. The research was conducted with integrity, ensuring that findings were reported accurately and without bias. Furthermore, the study followed all relevant ethical guidelines as set out by the institution, including obtaining necessary approvals and consents where required.

Transparency in the research process was achieved through clear documentation of methodologies, data sources, and analytical frameworks. This transparency allows others to scrutinize the research process and understand the basis for the findings and conclusions. All sources of data and literature were appropriately cited, and any potential conflicts of interest were disclosed.

Throughout the research process, reflexivity was maintained to consider the influence of the researcher's background, perspectives, and potential biases on the study. Regular reflection

on these factors helped to mitigate their impact on the research outcomes. By acknowledging and addressing these influences, the study aimed to present an objective and balanced analysis.

These research quality indicators were integral to the study, ensuring that the findings are credible, reliable, and ethically sound. By adhering to these indicators, the research provides a robust foundation for understanding the challenges and opportunities facing aerospace startups in the EU, while also laying the groundwork for future research in this area.

4. FINDINGS

The findings are laid out in this chapter by comparing the inputs received from interviews and the case studies. All the findings where there is common agreement are laid out first, followed by points where diverging opinions exist. Direct quotes from interviews and direct citations from articles, websites, and so forth will also be presented.

4.1 Converging opinions

Finding 1

One thing that can be unanimously agreed upon is that - the impact of market fragmentation on scaling efforts is significant and is more negative than it is positive. The literature consistently highlights the challenges that market fragmentation within the European Union (EU) imposes on the scaling efforts of aerospace startups. Market fragmentation, characterized by divergent regulatory frameworks, disparate standards, and varying certification processes across different member states, creates significant barriers for startups, as it increases the cost of compliance and slows down the pace of expansion across the member states. This aligns very well with the transaction cost theory where elevated costs and inefficiencies can be viewed as high transaction costs that deter cross-border expansion and hinder scalability in the EU market.

For aerospace startups, which operate in a sector that is highly specialized and regulation-intensive, these challenges are more profound and the need to meet different regulatory requirements in each member state often results in duplicative efforts, delayed market entry, and constraints on its ability to achieve economies of scale. As noted by Digital Public Policy, Regulation and Competition (2024), this regulatory heterogeneity undermines the most fundamental objective of the EU's single market, which is to facilitate the free movement of goods and services and create a more cohesive business environment across the EU region. The fragmentation thus significantly impedes growth, limits the ability of aerospace startups to capitalize on the full potential of the EU market, and diminishes their competitiveness in the global aerospace industry.

The convergence of these findings underscores the need for harmonization and integration within the EU's regulatory landscape to support the scaling ambitions of aerospace startups which brings us to the next finding.

Finding 2

The literature, case studies, and interviews overwhelmingly support the view that increased standardization and harmonization across the European Union (EU) are crucial for alleviating the regulatory burdens faced by aerospace startups.

The unification of regulatory frameworks—through initiatives such as the adoption of common certification standards and streamlined market entry protocols—has been identified as a key strategy for mitigating these challenges. By harmonizing these processes, the EU could

create a more predictable and navigable business environment, enabling aerospace startups to operate more efficiently across borders and enhance the overall competitiveness of the European aerospace sector on the global stage.

Moreover, as discussed in European Commission (2021), the benefits of such harmonization extend beyond mere operational efficiencies. Standardization would also foster innovation by allowing startups to allocate more resources to research and development rather than to navigating fragmented regulatory landscapes. This would be particularly beneficial in the aerospace industry, where technological advancement is paramount. Thus, the convergence of perspectives on the importance of regulatory harmonization underscores its critical role in supporting the sustainable growth and success of aerospace startups within the EU.

Finding 3

A considerable body of literature converges on the critical role that European Union (EU) funding programs play in bolstering the research and development (R&D) efforts of aerospace startups. Programs such as Horizon Europe and initiatives spearheaded by the European Space Agency (ESA) are widely recognized as vital instruments that provide the essential financial resources and technical support needed to foster innovation and enable the growth of these startups. The rise of business angels and accelerators has made it easier for innovative start-ups to secure early-stage funding and survive long enough for them to develop their technology (Aernoudt, 2017).

Horizon Europe, the EU's flagship R&D funding program, offers substantial grants and funding opportunities that allow aerospace startups to undertake ambitious projects that would otherwise be financially unfeasible. These resources are particularly important in an industry where the costs of technological development and certification are prohibitively high for early stage companies. Similarly, ESA initiatives provide not only funding but also access to a network of expertise and infrastructure that significantly enhances the capacity of startups to innovate and bring new technologies to market.

As highlighted by Fagnoli, J.D. (2020), these EU programs do more than just provide financial backing; they also create a collaborative ecosystem that encourages knowledge sharing and partnerships across borders. This collaborative environment is instrumental in overcoming the challenges posed by market fragmentation, as it enables startups to leverage collective expertise and resources, thereby accelerating their development and scaling processes. The convergence of findings on this topic underscores the indispensable role of EU funding mechanisms in nurturing the aerospace startup ecosystem and driving technological advancement within the sector.

Pierre points out that “...*what works super well though, is raising money. First of all, our main investor is Danish...from Denmark. So they have a national team in France, but, I think what is really, at the European level that so there will be issues when we want to raise more money, provide services and raise, I don't know, a hundred million or more. But for now, the stage [Skynopy] is at, it's like, really fluid.*”

In the interview E's statement aligns well with that of Pierre, saying “*Speaking of that [access to funding], I think in a way it [EU fragmentation] opens doors to a lot of different*

funding opportunities. Sure it can get a bit overwhelming with all the calls out there but this mix is something you can really benefit from—like tapping into grants, subsidies, and contracts from ESA or national programs like CNES or DLR. The variety of funding sources can be a big plus, especially when national programs offer special incentives for developing space tech. It's definitely something that can work to a startup's advantage."

In summary, the EU's strategic investment in R&D through programs like Horizon Europe and ESA initiatives not only sustains the innovative capacities of aerospace startups but also strengthens the overall competitiveness of the European aerospace industry on a global scale.

Discussion

From the finding, the author learns that the European Union (EU) funding programs and initiatives by the European Space Agency (ESA), play a pivotal role in supporting the R&D efforts of aerospace startups. These programs provide crucial financial resources that enable earlystage companies to pursue ambitious projects, which would otherwise be financially out of reach due to the high costs of technological development and certification in the aerospace industry. Beyond just financial backing, they also foster a collaborative ecosystem, facilitating knowledge sharing and crossborder partnerships that help startups overcome the challenges of market fragmentation. As highlighted by Pierre and E, the diversity of funding sources—ranging from EU grants to national programs—offers startups a broad spectrum of opportunities to tap into, enhancing their capacity to innovate and scale. This strategic investment not only sustains the innovative potential of these startups but also bolsters the global competitiveness of the European aerospace sector.

Finding 4

EU startups that relocate in their early stages are more likely to be successful. This is mainly due to the fact they are in a new environment and have access to new investors. These are the startups that are more likely to get acquired, get an IPO, and have better exit outcomes.

While this might seem like a good solution for the startup, it comes at a cost to Europe. The continent misses out on the opportunity to nurture and retain industry leaders, hindering the development of cuttingedge technologies. It also undermines the flywheel effect, where successful entrepreneurs typically support and mentor the next generation of startups. As a result, Europe loses talent and expertise that could have driven innovation and growth in the local ecosystem.

Discussion

From the interviews, it is advisable and very beneficial for startups to join incubators and accelerators. The EU startup ecosystem is gaining momentum despite its complexities, largely due to the support of incubators and accelerators. These organizations offer valuable resources, including expertise, funding, and networking opportunities. Although EU incubators are generally smaller and more dispersed compared to their US counterparts, they really help startups in their early stage funding (preseed and seed investments). Moreover, the financial support from incubators and accelerators is often complemented by technical guidance,

including (1) intensive training for founders to drive technological advancement; (2) validation of business models and structures, and (3) access to a network of peers, mentors, industry experts, corporate financiers, and investors

4.2 Diverging Opinions

Finding 1

T finds a silver lining for startups. He goes on to say that “...because the market is fragmented it also means that different countries have different priorities. So they are willing to fund different types of space technologies. For example, we [France] focus more on launch systems and earth observation while Allemagne [Germany in French] prioritizes satellite technologies and space exploration. This is good for us in a way because we know where to strategically position ourselves to take advantage of these national interests. This is like the silver lining I or should I say, my company has found by market fragmentation.”

But favoring a certain technology affects the space ecosystem in the EU as pointed out by Pierre with an example of The Exploration Company, which is a European spacecraft manufacturer. “...they are doing, like, you know, like a capsule, that it's gonna be in space and so on. And right, from the beginning, they started, like, a company in France and Germany. And that's also why I was inspired by what they're doing.

“...and they were right to do that because, on the political level, they've been kind of like a fight between Germany and France on small launchers since the beginning... the exploration company is not doing small launchers, but historically, France has kind of the monopoly in Europe of doing the launchers, doing most of the Ariane 6 launchers and Germany was starting to be to feel frustrated because they did not believe that it was a good launcher. So they actually, they kind of, like, broke this monopoly and say, okay. Now we are gonna start our own, like, private small companies doing launches, small launches. And so they started, like, ISAR and the RFA and so France was super frustrated with that and they decided to not stop, and they encourage small players to have, like, a micro launchers company to start in France to compete with the launcher.”

And although this may seem like good news for the startups working on small launchers, in Pierre's words “...it is not super, healthy because you have, like in 2 small countries, you have, like, a lot of, like, companies doing micro launches, so it's not super efficient.” Coming back to how The Exploration Company worked out these differences, he says, “they are not doing launchers, but capsules. They didn't want to start in Germany, and have competitors in France or start in France to have their competitors in Germany. So they start in both countries, and so it's kind of like the best of both worlds because, all of the French consider that the company is French, and Germany considers that the expression company is German, and that works well for them.”

Discussion

The interviews reveal a complex picture of how market fragmentation in the EU space sector impacts startups. While often seen as a challenge, fragmentation also presents strategic opportunities.

T highlights a silver lining: different EU countries prioritize different space technologies, allowing startups to align with national interests and secure targeted funding. For example, France focuses on launch systems, while Germany prioritizes satellite technologies. This allows startups to strategically position themselves to benefit from these national priorities, turning fragmentation into a competitive advantage.

However, this specialization can lead to inefficiencies. Pierre points out that competition between countries, such as the rivalry between France and Germany over small launchers, can oversaturate the market. Instead of fostering a collaborative environment, this rivalry can lead to duplicated efforts and a fragmented industry, which ultimately hinders overall growth.

The Exploration Company illustrates a way to navigate this landscape. By establishing operations in both France and Germany, they positioned themselves as a domestic entity in both countries, maximizing resources and market opportunities while avoiding the pitfalls of national competition. This approach suggests a viable strategy for other startups to thrive in a fragmented market.

While national competition can drive innovation, it needs to be balanced with industrywide efficiency. Too many similar companies in one area can lead to wasted resources and hinder scalability. A more coordinated approach at the EU level could help reduce duplication and ensure that the industry moves toward shared goals.

To harness the benefits of fragmentation while mitigating its downsides, policymakers should encourage crossborder collaboration and provide incentives for startups to operate in multiple countries. This could help create a more unified and efficient European space industry, leveraging national strengths without falling into the traps of inefficiency and rivalry.

Finding 2

E suggests one logical way to navigate through the complex regulatory landscape and hold your ground in the market by working things in your favor. She says, *"Space scaleups can get creative with their compliance strategies by focusing on markets with easier regulations first. It's like starting with the lowhanging fruit—Luxembourg for example, it has a super supportive legal framework and it is also a very, umm... probusiness environment. But then again they are mostly into space mining and ventures, so not everyone can tap into it. But yes, it is a plus in my opinion. Like you get your operations off the ground quickly, and then tackle the tougher countries [in terms of regulations] as you expand. This is one way, I think you can establish a solid presence without getting bogged down by all requirements right from the start."*

But T, when presented with what E said, had a varying opinion on the matter. He thinks that *"...that might seem like a smart move, but I actually think it could be a bit shortsighted. Sure, you might get your operations up and running quickly, but you're also avoiding the bigger, more complex markets where you'll eventually want to be. If you only start with the*

“lowhanging fruit”, you might end up delaying the inevitable—facing the regulations in places like Germany or France, where the real opportunities are.

Plus, there’s a risk that by the time you’re ready to expand, the landscape might have changed, or you might find that you’re not as prepared as you thought for those environments. It’s like taking the easy way out now but paying for it later. I’d say it’s better to tackle the more challenging markets early on, so you can build the necessary resilience and expertise from the getgo, at least that’s what we did [laughs].”

Discussion

The contrasting viewpoints on how space startups should navigate regulatory environments in the European Union highlight a key strategic dilemma: whether to start in more favorable, less regulated markets or to confront tougher regulatory landscapes from the outset.

On one side, the argument is made that space startups can benefit from initially focusing on markets with easier regulations which allows companies to gain early traction, establish operations quickly, avoiding the complexities of stringent regulatory environments and secure initial successes that provide a strong foundation for future expansion into more challenging markets. This minimizes early risks and allows companies to build momentum, making it easier to tackle tougher regulatory requirements later on. For startups, especially those with limited resources, this can be a practical way to enter the market without being overwhelmed by compliance burdens from the beginning.

However, the opposing view suggests that avoiding tougher markets initially could delay a company’s entry into key regions where significant opportunities exist, such as Germany or France. By focusing only on easier markets, startups might miss out on building the necessary resilience and expertise to navigate complex regulatory environments.

These diverging opinions underscore a broader tension between shortterm gains and longterm resilience. The decision to enter easier markets first is appealing for its immediate benefits, allowing startups to build a track record and secure early wins. However, this strategy might sacrifice the development of the robust regulatory expertise needed for sustained growth across the EU. On the other hand, tackling challenging markets early might slow initial progress but could equip startups with the tools they need to succeed in the long run.

In conclusion, the optimal approach for space startups likely lies in a balanced strategy—leveraging the advantages of favorable markets while not shying away from the challenges posed by more complex regulatory environments. This balanced approach could ensure that startups are both agile in their early stages and resilient enough to thrive as they scale across the European Union.

Finding 3

Another point of contention is the appropriate balance between government and private sector involvement in funding research and development (R&D) for aerospace startups. Some stakeholders advocate for a predominant role of government funding through programs like Horizon Europe and ESA initiatives, arguing that public investment is essential for derisking

early stage innovation and ensuring that startups can undertake the long-term, capital-intensive projects typical of the aerospace industry.

As pointed out by Pierre, “...like the European Commission and ESA, I put them in the in the category of institutional customers. ESA and the European Commission have done a lot of, like, initiatives to help startups to have, like, grants, loans, offers, contracts, and stuff like this. So, this is a good thing.”

Conversely, there is a school of thought that emphasizes the importance of increasing private sector investment in R&D. Proponents of this view argue that reliance on public funding can sometimes lead to bureaucratic delays and a lack of market-driven innovation. They suggest that private sector involvement, with its emphasis on market viability and return on investment, could lead to more efficient and commercially successful outcomes for aerospace startups. This debate highlights the need to explore whether a more hybrid funding model, combining public and private resources, might better serve the needs of the industry.

Pierre continues to highlight the pain points when it comes to working with “institutional customers” as he calls them. “The issue here is that, at least in space and in France, when you want to have, like, a decent contract from ESA, you need first to convince, CNES. And it's the same for, like, all of the other countries [EU]. They need to convince their national [space] agency to put to form, like, a program ESA program to receive money. And so, this means that it's still, like, a lot of work. And so, it's not really as if you are going to see ESA and they are giving you access to a lot of countries, contracts, and so on. So, it's I would say it's, like, in terms of commercial, institutional contracts, it's still a challenge that does not go to scale super well. And as you said, it's tough, like, because we started for example, we started to do all of the lobbying, understanding, like, doing a lot of, meetings with CNES.

I think we've done it well, but still a lot of work. We've started just a little bit to do it with, like, the European Commission, but we don't know it, super well yet. Okay. And then there we haven't started at all for ESA.

So, this is also a pain point that we have, like, 3 different entities to do all of the lobbying and the work with National Space Agencies, the European Commission, and ESA. So, this is a sort of, like, a pain point”.

Discussion

This finding highlights a key issue in the funding landscape for aerospace startups in Europe: the challenge of balancing government and private sector involvement in research and development (R&D) funding.

Public funding through programs like Horizon Europe and ESA initiatives is vital for supporting early-stage aerospace startups. These programs provide necessary financial resources and help reduce the risks associated with long-term, capital-intensive projects typical of the aerospace industry. However, securing this funding often requires navigating complex bureaucracies, such as lobbying national space agencies before accessing ESA funds, which can slow down the process and make it difficult for startups to scale.

The process of securing public funds can be burdensome, involving multiple layers of approval and extensive lobbying. This complexity can deter startups from pursuing these funds, limiting their growth potential. The administrative hurdles and time-consuming nature of accessing public funding present significant challenges for startups needing agility and speed to market.

On the other hand, there is a strong argument for increasing private sector involvement in aerospace R&D. Private funding is often more agile and market-driven, with fewer bureaucratic delays. By focusing on market viability and return on investment, private investment could lead to more efficient and commercially successful outcomes for startups.

A hybrid funding model that combines the stability of public funding with the market orientation of private investment could offer the best of both worlds. Public funds could de-risk early innovation, while private investments could help accelerate commercialization and scaling.

Policymakers should consider simplifying the process of accessing public funds and encouraging private-sector investment through incentives. This could create a more balanced and supportive funding environment, allowing aerospace startups to innovate and grow more effectively.

4.3 Managerial Recommendations

Based on the findings from the literature, interviews, and case studies, the author would like to present the following recommendations:

1. Take full advantage of EU funding opportunities such as Horizon Europe and ESA initiatives, which provide crucial financial resources for research and development. These funds can significantly reduce the financial burden at least at the early stage of the startup. This will also help to build a strong foundation for future scaling. From the author's experience at Skynopy, having a dedicated business development team or role (it can also be an intern position in case of financial constraints) established within the company to monitor and apply for relevant EU grants and programs and building relationships with key stakeholders in these programs to stay informed about upcoming opportunities and requirements can really help ease the process.
2. Identify and target specific EU countries where regulatory environments are more favorable to or 'prefer' specific space activities. Using these markets as launching pads to establish operations quickly before expanding into more complex regulatory landscapes is a great way to make sure that the launch of operations is not slowed down by regulations. The best way to tackle this issue is to thoroughly analyze regulatory environments across the EU to identify low-barrier markets and develop a phased expansion strategy that prioritizes these markets. But at the same time, also preparing for long-term success by building the capabilities needed to operate in more challenging markets
3. Adopt a hybrid funding model that combines public grants with private investment to maximize resources while maintaining agility. This approach ensures that the startup can benefit from stable public funding while also driving innovation through private investment. The idea would be to secure early-stage public funding to support research and development, and simultaneously build relationships with private investors who can provide additional capital as the startup scales. This dual approach can help mitigate the risks associated with relying solely on one type of funding.
4. Join incubators and accelerators to gain access to resources, expertise, and networking opportunities that are crucial for early-stage growth. These organizations can provide valuable support in admin activities, providing mentorship, funding opportunities, and industry connections which can help to accelerate growth and overcome initial barriers.

5. CONCLUSION

5.1 Conclusion

This dissertation set out to explore the multifaceted opportunities and challenges faced by aerospace startups within the European Union, mainly focusing on the impacts of market fragmentation on an aerospace startup's success. To understand the implications of market fragmentation, one needs to understand what it is and why it is a persisting issue even after the Single Market efforts by the EU. To understand how this affects the startup ecosystem, theories and frameworks like transaction cost, dynamic capabilities, and resource based-view can be used. The analysis of the literature illuminates several key factors that are critical to the success of these startups as they seek to innovate and scale in a highly competitive and regulated environment. However, as an employee in a French aerospace startup, the author cannot help but feel glum, as the literature mostly points toward the challenges that European space startups face, so much that it almost feels like things can only go two ways- you succeed if you relocate, or you don't. It is not until the author starts speaking to founders and professionals of other companies and delves into the case studies that the author sees that there is so much that can be done for the companies, and they would not have to pick and choose their battles after all.

The consensus on the importance of standardization and harmonization is particularly striking. There is broad agreement that unified regulatory frameworks would alleviate many of the operational challenges that startups face, enabling them to scale more efficiently and effectively. While literature suggests that regulation can help stimulate innovation, there is a persisting debate over whether the current EU regulations strike the right balance between encouraging innovation and ensuring inclusivity. This ongoing tension highlights the importance of continued dialogue between policymakers, industry stakeholders, and startups to refine these frameworks.

Although the divergence in regulatory standards and certification processes across member states creates a complex and often burdensome landscape for startups to navigate, the author finds that there are factors that are much simpler yet more profound than red-tape barriers, like cultural preferences and language barriers that pose significant barriers to the scaling efforts of aerospace startups within the EU. The author realizes, during the study, that regulations and compliance requirements could be eased up with negotiations, but the mindset of the people is not something that can be worked on, especially in Europe where language and sovereignty are a matter of national pride.

The supportive role of the European Union, particularly through funding programs like Horizon Europe and ESA initiatives, is another critical factor in the success of aerospace startups, as these non-dilutive funding programs are what provide the companies the initial capital required to develop their technologies although it falls short later on in the growth process. However, the discussion reveals differing opinions on the appropriate balance between public and private sector involvement in funding R&D. While public investment is crucial for derisking early-stage innovation, there is a growing recognition that private sector engagement

is equally important, especially when it comes to the scale-up phase when the startups require a significantly larger amount to scale their operations. The author finds that this is another pain point, as the venture capital market is not as developed in the EU as it is in the US or China, especially due to the risk-averse nature of European VCs and investors, who favor more stable and less speculative industries.

Finally, the growing importance of sustainability and environmental regulations presents both a challenge and an opportunity for aerospace startups. The author has found that the space industry has an overall largely negative perception in the EU when compared to the US. This is mainly due to the concerns that the industry activities are negatively impacting the environment. This also contributes to the funding challenges faced by the startups. As the industry increasingly prioritizes green innovations, startups that integrate sustainable practices into their operations are likely to gain a competitive advantage.

From the interviews and case studies, the author finds that there are so many ways to go by for startups to make the best out of the presented opportunities and challenges mostly by playing into and along with the country politics like The Exploration company does. These are highly dependent on the countries they belong to and the activities or services they offer. Although this is not the most ideal situation, it goes to show that there definitely is light at the end of the tunnel.

5.2 Limitations of the Study

The study relies heavily on existing literature, industry reports, and case studies, which are not the most up-to-date, given that the aerospace industry is constantly evolving. Additionally, the data sources used may have inherent biases or limitations in their methodologies, which could influence the findings. The reliance on secondary data also means that certain nuances or emerging trends may not have been fully captured in the analysis.

The study primarily employs qualitative analysis. While qualitative methods are well-suited for understanding complex, context-specific issues, they also limit the ability to quantify the impact of specific factors and make broad generalizations. The absence of quantitative data, such as statistical analyses of startup performance or financial metrics, means that the study's conclusions are more interpretative and do not provide a definitive measure of the factors influencing startup success.

Finally, the rapidly changing nature of the aerospace industry and the regulatory environment within the EU presents a limitation in terms of the study's relevance over time. As new regulations are introduced, market dynamics shift, and technological advancements occur, the findings of this dissertation may become outdated. Thus, this limitation underscores the need for ongoing research to monitor and analyze the impact of these evolving conditions on aerospace startups.

5.3 Future Scope

This dissertation provides a foundational understanding of the opportunities and challenges that are faced by aerospace startups within the European Union, particularly due to the market fragmentation in the EU. Although comparative studies were done with the startup environment in the US, the scope can be expanded to studying regions like Asia and other emerging markets to provide a more global perspective and to better understand the best practices that could be adapted from across the world in different contexts.

It would also be valuable to incorporate quantitative methods into future studies to offer a data-driven analysis of the impact of the factors influencing startup success. Longitudinal studies to track financial performance, growth metrics, and innovation outputs over time could help to identify key predictors of success and failure, that can offer more reliable and actionable insights for entrepreneurs as well as for policymakers. Additionally, with the rapid evolution of technologies like electric aviation, autonomous flight, and space tourism, future research could also focus on how these emerging technologies would impact aerospace startups and the role of regulatory frameworks in either facilitating or hindering their adoption.

Finally, as sustainability becomes increasingly central to the aerospace industry and of growing importance in the EU, future studies could further investigate how startups are innovating to meet environmental goals. This could include exploring the development of green technologies and assessing how sustainability regulations impact the competitiveness of aerospace startups. The author believes that with the growing awareness around sustainability, green initiatives by startups could give them a competitive edge.

SELFASSESSMENT

I have always been fascinated with the aerospace world. Even after completing my master's in aerospace engineering, I was not convinced I knew enough about this industry, and I was right. It really made me want to explore the business side of it. With the master's program at TBS and my internship at Skynopy, I can tell that I learned so much more about the industry than I had hoped to.

This industry is multifaceted, very dynamic and the competition is cutthroat. During the meetings at work, I noticed that even within the EU, the borders really mattered. It is complicated to hold your ground in the aerospace world, without having to navigate through the different administrative, cultural, and financial complexities that come with being an EU startup.

I remember my manager discussing future aspirations for the company and mentioning that even within the EU it was harder to open a second office in a different country because legislation is really different. Also, while introducing me to the process of bids and proposals, my manager/mentor talked about all these different bodies like ESA and the European Commission which really confused me. Even though it meant that there were more options and projects to work on, it was hard for me to wrap my head around the reason for different bodies with different jurisdictions, not only within just ESA but also outside it.

Working on this dissertation helped me understand and discover more and more topics. There was not a lot of literature relevant to the topic. The ones I found were mostly regarding access to funding or diversifying investments and those not specifically for space startups. I definitely gathered more information from the interviews and discussions I had with my coworkers who had also previously worked in other space companies. They were so kind to explain new concepts relevant to the topic like geo-return policy for example, which I did not stumble upon while doing the research, but this concept is what helped me understand why some countries did not want to be a part of ESA among other things.

The fact that not all interviewees weren't able to answer all the interview questions, made the interaction more a discussion rather than an interview. It was harder to find converging and diverging opinions when some fields were empty.

One thing particularly challenging while working on this topic was that the literature, case studies, and interviews all gave a lot of different opinions and perspectives. It was hard for me to identify the most relevant topics and narrow things down and group ideas into a more structured format for the report and presentation so that it could be of benefit, academically.

Time management was something I had to work on because working on the thesis while also having to go to work meant that things didn't go exactly as planned because many planned interviews did not fit into the time frame. A major constraint was that the interviewees were mostly only available during working hours i.e., when I was also at work. But it helped that I could talk to some of the close friends of my coworkers.

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Acknowledgment of Generative AI Usage

The author has used two generative AI tools for the preparation of this thesis. The tools were used at various stages of the research process like brainstorming ideas for the topic of the thesis, since the author had a very broad topic in mind. ChatGPT was used to summarise and synthesize large volumes of academic articles to identify key themes and trends in the already existing literature. Grammarly is another AI tool that was used to spell check and provide suggestions for sentence structure, grammar, and style, to make sure that the final report met the expected high academic writing standards.

Ethical Considerations

The use of generative AI in this thesis was conducted responsibly, ensuring that all AI-generated content was carefully reviewed and verified for accuracy and originality. The AI tools were used as an aid to the research process and not as a substitute for critical thinking, analysis, and originality required in academic research.

Purpose of AI Usage

The primary purpose of utilizing generative AI in this thesis was to enhance the efficiency of the research process, ensure clarity of communication, and maintain high standards of academic writing. At all times, AI was used as a supplementary tool, with the final responsibility for the content and quality of the thesis resting with the author.

APPENDICES

Appendix A: Theoretical Framework

1. Regulatory Federalism

Regulatory Federalism refers to the distribution of regulatory powers and responsibilities across different levels of government, typically in a federal system where authority is shared between a central government and subnational entities (like states, provinces, or regions). Theories behind regulatory federalism explore how this distribution impacts policy outcomes, governance efficiency, and intergovernmental relations.

1. *Decentralization Theory*: This theory argues that distributing regulatory authority across multiple levels of government allows for more tailored and responsive policymaking. Subnational governments are closer to the local population and can better understand and address regional needs and preferences. This can lead to more efficient and effective governance, as policies can be adapted to fit the unique circumstances of different areas.
2. *Race to the Bottom/Top Theory*: This theory examines how competition between subnational entities in a federal system can lead to differing regulatory standards. A "race to the bottom" occurs when governments compete to attract businesses by lowering regulatory standards, potentially undermining social or environmental protections. Conversely, a "race to the top" can happen when governments compete by raising standards, seeking to attract highquality businesses and residents.
3. *Intergovernmental Bargaining Theory*: This theory focuses on the negotiation processes between different levels of government. It suggests that regulatory federalism creates opportunities for bargaining and compromise, allowing governments to share the burden of regulation and to design policies that balance local autonomy with national coherence.

2. Institutional fragmentation

It refers to the division and dispersal of authority, functions, and resources across multiple institutions or organizations within a governance system. This concept is often used to describe scenarios where there is a lack of coordination among various institutions, leading to inefficiencies or policy inconsistencies.

1. *PrincipalAgent Theory*: This theory is used to explain institutional fragmentation as a result of the delegation of authority. In a fragmented system, various institutions act as agents carrying out the will of a principal (such as the government or the electorate). However, when multiple agents (institutions) are involved, it can lead to coordination problems, conflicting objectives, and difficulties in ensuring accountability.
2. *Complexity and Governance Theory*: This theory suggests that fragmentation is a natural outcome of the complexity inherent in modern governance. As societies grow more complex, the range of issues governments must address expands, leading to the creation of specialized institutions. While this can improve expertise and focus, it can also lead to a lack of coherence and challenges in policy implementation.

3. *Path Dependency and Institutional Isomorphism*: These theories explore how historical choices and institutional mimicry can lead to fragmentation. Path dependency suggests that once a certain institutional structure is established, it becomes difficult to change, even if it leads to inefficiencies. Institutional isomorphism, on the other hand, suggests that organizations within a fragmented system may begin to resemble each other over time, often leading to redundant or overlapping functions.

3. Financial integration

Financial Integration refers to the degree to which financial markets in different countries are interconnected, allowing for the free flow of capital across borders. Theories behind financial integration explore the implications of this interconnection for economies, financial stability, and global markets.

1. *Law of One Price*: This fundamental theory suggests that in fully integrated financial markets, identical financial assets should have the same price regardless of where they are traded. Financial integration should eliminate price discrepancies across borders due to arbitrage opportunities, where investors buy low in one market and sell high in another until prices equalize.
2. *International Capital Asset Pricing Model (ICAPM)*: This extension of the Capital Asset Pricing Model (CAPM) incorporates the effects of international markets. It theorizes that financial integration leads to a convergence of risk-adjusted returns across countries. In an integrated market, the expected returns on securities are determined by global rather than local risks, and investors can diversify their portfolios internationally to achieve optimal returns.
3. *Market Efficiency Hypothesis*: This theory posits that financial integration contributes to market efficiency by allowing more investors to participate, thereby increasing competition and reducing information asymmetry. As markets become more integrated, prices more accurately reflect all available information, leading to more efficient allocation of resources.
4. *Globalization and Risk Sharing*: Theories in this area suggest that financial integration allows countries to share risks more effectively. By pooling their financial resources, countries can better absorb shocks, leading to more stable consumption patterns and economic growth across the integrated region.

4. Capital Market Efficiency

Capital market efficiency refers to the extent to which asset prices in financial markets reflect all available information. Theories behind capital market efficiency address how quickly and accurately markets respond to new information, influencing investment decisions and economic outcomes.

1. *Efficient Market Hypothesis (EMH)*: This is the most well-known theory related to capital market efficiency. It posits that financial markets are "efficient" in that prices of securities fully reflect all available information at any given time. EMH has three forms:
 - *Weak Form Efficiency*: All past market prices and data are fully reflected in asset prices, meaning that technical analysis cannot yield consistently superior returns.

- SemiStrong Form Efficiency: All publicly available information is reflected in asset prices, making it impossible for investors to gain an advantage through fundamental analysis.
 - Strong Form Efficiency: All information, both public and private (including insider information), is reflected in asset prices, meaning that no one can consistently achieve higher returns.
2. *Arbitrage Pricing Theory (APT)*: APT suggests that asset prices are influenced by multiple factors or economic variables rather than just the overall market risk (as in CAPM). It assumes that markets are generally efficient, but inefficiencies may exist temporarily due to multiple factors, creating opportunities for arbitrage.
 3. *Behavioral Finance*: While traditional theories like EMH assume rational behavior, behavioral finance challenges this by incorporating psychological factors and cognitive biases. It suggests that markets are not always efficient because investors are not always rational. This can lead to anomalies, such as asset bubbles or crashes, where prices deviate from their intrinsic value.
 4. *Information Asymmetry Theory*: This theory explores how differences in the availability and interpretation of information among market participants can lead to inefficiencies. When some investors have access to better or more timely information than others, markets may not be fully efficient, leading to mispricing and suboptimal investment decisions.

5. Supply Chain Management

1. *Supply Chain Integration Theory* emphasizes the importance of coordinating and integrating all activities involved in the supply chain, from suppliers to customers, to enhance efficiency and responsiveness. In the context of EU startups, operational fragmentation can hinder this integration, leading to inefficiencies, higher costs, and delays in product delivery. Effective supply chain management requires minimizing fragmentation to create a seamless flow of goods, information, and resources.
2. *JustInTime (JIT) Theory* is a production strategy that aims to improve a business's return on investment by reducing inprocess inventory and associated carrying costs. In a fragmented operational environment, such as what might be experienced by EU startups dealing with different national regulations and supply networks, maintaining a JIT system becomes challenging. Fragmentation can disrupt the timely flow of materials and products, leading to delays and increased costs.
3. *ResourceBased View (RBV) theory* posits that a firm's competitive advantage is derived from its ability to manage and optimize its unique resources and capabilities. For EU startups, operational fragmentation can be a significant barrier to effectively utilizing resources, such as supplier networks, distribution channels, and technological assets. Fragmentation may prevent startups from fully leveraging their resources, thus impeding their ability to scale and compete.
4. *Transaction Cost Economics (TCE) theory* focuses on the costs associated with making an economic exchange, including costs of search, negotiation, and enforcement. Operational fragmentation increases transaction costs for EU startups, as they have to navigate multiple regulatory environments, deal with different suppliers, and manage crossborder logistics. High transaction costs can reduce market efficiency and limit the growth potential of startups.

6. Market Efficiency

1. *Market Efficiency Hypothesis (MEH)*: As mentioned earlier, the Market Efficiency Hypothesis suggests that asset prices in financial markets reflect all available information. However, in a fragmented market, information asymmetry is more likely, as different regions may have varying levels of transparency, regulatory requirements, and market access. For EU startups, this can lead to inefficiencies in capital allocation, pricing strategies, and market entry decisions.
2. *Information Asymmetry Theory* highlights the impact of uneven distribution of information among market participants. In a fragmented operational environment, startups might face difficulties in accessing crucial market information, leading to suboptimal decisionmaking and reduced competitiveness. Information asymmetry can prevent startups from fully exploiting market opportunities and can increase their vulnerability to risks.
3. *Network Theory* examines how the structure and dynamics of networks—such as supply chains or customer networks—affect performance. For EU startups, fragmented operations often result in weak or disconnected networks, which can hamper their ability to efficiently manage supply chains, reach customers, or collaborate with other firms. A wellintegrated network is crucial for reducing operational fragmentation and improving market efficiency.
4. *Institutional Theory* suggests that organizations operate within a framework of formal and informal rules, norms, and regulations that influence their behavior. For EU startups, the varying institutional environments across different EU countries can create operational fragmentation, making it difficult to achieve market efficiency. Navigating these institutional differences requires strategic adaptation, but also incurs additional costs and complexity.

Appendix B: Interview guide

Background and Context

1. Can you describe your role within the company and how long you have been involved in the aerospace industry?
2. What inspired the foundation of your startup, and what are the primary goals and products/services you offer?
3. Can you provide a brief overview of your company's growth trajectory since its inception?

Understanding Market Fragmentation

4. In your experience, how would you describe the current state of the aerospace market in the EU?
5. What are some specific examples of market fragmentation you have encountered in the EU aerospace sector?
6. How do you think the regulatory environment within the EU contributes to market fragmentation?

Challenges Related to Market Fragmentation

7. What challenges has your company faced in navigating different regulatory frameworks across the EU?

8. Can you discuss any difficulties in accessing different markets within the EU? For example, have you experienced barriers related to varying national regulations?
9. How has market fragmentation impacted your ability to scale your operations across different EU countries?
10. Are there particular aspects of market fragmentation that have affected your access to funding or investment?

Impact on Scalability

11. In what ways has market fragmentation influenced your company's growth strategy?
12. How has the need to comply with multiple regulatory standards across different EU markets impacted your company's resources and timeframes for scaling?
13. Have you had to modify your product or service offerings to meet different market requirements across the EU? If so, how has this affected your scalability?
14. Can you describe any instances where market fragmentation has created opportunities for your startup rather than challenges?

Coping Strategies

15. What strategies has your company adopted to manage or overcome the challenges posed by market fragmentation in the EU?
16. Have you engaged in any partnerships or collaborations to help navigate market fragmentation? If so, how have these alliances supported your scalability?
17. How do you prioritize which markets within the EU to enter first, given the fragmented market landscape?
18. What role, if any, have EU wide initiatives or programs played in helping your startup address market fragmentation challenges?

Comparative Perspectives

19. Have you had any experience in non EU markets, and if so, how does market fragmentation in the EU compare to those regions?
20. In your view, how does the EU's market fragmentation affect its competitiveness compared to more unified markets like the US?

Recommendations

21. Based on your experience, what recommendations would you offer to EU policymakers to reduce market fragmentation and support startup scalability in the aerospace sector?
22. What advice would you give to other aerospace startups facing similar challenges in the EU market?
23. Looking ahead, what changes or developments in the EU market would most benefit your company's ability to scale?

Outlook

24. How do you see the future of the aerospace market in the EU evolving, particularly in terms of market fragmentation?
25. What are your plans for scaling your company in the next 35 years, and how do you anticipate addressing ongoing market fragmentation challenges?

Closing

26. Is there anything else you would like to share about your experience with market fragmentation and scaling in the EU that we haven't covered?
27. Would you be open to follow up discussions if further clarification is needed on any of the topics we discussed today?