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Exploring the Aerospace Sector: A Resource Dependence Perspective on Key Resources and Strategic Behaviour

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Abstract

This research investigates pivotal resources and strategic actions in the aerospace sector, focusing on interactions organisations have with the industry's participants. Based on the Resource Dependence Theory, the study addresses the lack of prior applications of this theoretical perspective in the aerospace sector, aiming to contribute to the academic research and also explore challenges in a dynamic environment. Results emphasise the importance of engagement of companies with its network but also the necessity of internal efforts to mitigate resource dependencies.

Keywords: Aerospace sector, Resource Dependence Theory, Strategic actions, Critical resources, Strategic partnership.

Acknowledgements

This project marks the end of my academic education, yet I do not consider it as a complete turning point but rather a transition of my life. University has been a rocky journey with ups and downs, each experience serving as a step for growth and learning. I value every experience, appreciate the opportunities given, and acknowledge the people and new friends I have met along this path.

Several times I have questioned my decisions and compared myself to my peers. This made me feel anxious about my own purpose, role, and identity. However, I am starting to change my mindset as I am now comforted by the fact that I have the privilege to choose.

I express my gratitude to everyone who has supported me in any way through this project, who showed concern about me, and who gave me advice. I am learning to share my thoughts and burdens with people, leaning more on them and being more flexible, trying to find balance. Thank you all for your help and patience.

While this chapter of university is closing, I am certain there will be numerous lessons to be learned. With the promise of continuing to grow and becoming a better person, I look forward to the new opportunities that lie ahead.

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1. Introduction

New market trends, technological advancement and collaborations between aerospace companies are pushing the frontier of the sector, improving their activities and opening up new business opportunities. Moreover, with the emergence of the New Space, every organisation involved in space exploration will be affected by increased competition, the rise of up-to-date capabilities and revision of the traditional ways of operating in the sector.

It is important to acknowledge the intricacies and strategic implications of a complex and dynamic industry. According to experts and management consulting firms, the characteristics of this sector and the potential innovative applications on space create both opportunities and uncertainties in the space ecosystem (Deloitte, 2023; McKinsey & Company, 2022). Indeed, incumbents and new entrants might benefit as well as struggle with the new challenges brought about by the industry. On the one hand, established businesses have to be alert of opportunities and threats and review strategies, together with their resources, and capabilities useful to keep a competitive position. On the other hand, the many newcomers without experience in the sector need careful planning and analysis. At the moment, few companies are particularly striving in the sector, therefore both established enterprises and newcomers must implement strategies that can help them navigate this dynamic environment.

The aim of this thesis, thus, is to give a better understanding from a strategic point of view on what is needed and what is relevant for the companies playing in the aerospace sector and also give more insights for entrepreneurs willing to enter the market. In particular, this study is based on the belief that there might be strategic perspectives related to the companies' resources and interactions with other actors.

Due to the sector complexity (Kassotaki, 2019a; Salvetat et al., 2013) and requirements to successfully operate, greater emphasis is placed on the aerospace ecosystem, instead of investigating internal processes and capabilities as the main source of competitive advantage. Although knowing which are the internal valuable resources and how to manage them together with many other factors such as history and social complexities is essential for a company's success (Barney, 1991), a more system-based view and framing for strategy might be more effective. Looking at a

company as being part of a business ecosystem where more importance is given to interactions among different organisations in its network can, in this instance, be considered more appropriate for strategic purposes. Hence, the Resource Dependence Theory (RDT), first developed by Pfeffer and Salancik in 1978, is deemed a suitable approach.

According to the existing literature on strategic management, the RDT is a framework that emphasises the impact the external environment has on companies. Companies are not entirely self-sufficient but, as the name of the theory suggests, depend on entities outside of the organisation to secure critical resources such as financial means, technology, raw materials, and expertise among others. Thus, understanding how to navigate and manage interactions and mitigating dependencies by taking more control over the environment are aspects particularly highlighted by this theory (Nienhüser et al., 2008).

When viewed through the lens of the RDT, the aerospace industry reveals an intricate network of interactions and interdependencies. Operating within a complex environment, subject to sudden changes, where actors have different influences on each other (Salvetat et al., 2013), businesses must employ fitting strategies to acquire vital resources. Substantial fixed costs, high barrier to entry, and long payback periods to realise return on investment are critical factors to reflect upon (Kim, 2018). For example, an important aspect to consider is the considerable amount of capital required to commence and to continue over time operations. As a consequence, companies rely on both public and private bodies to retrieve financial resources for their functioning (Dy, Perrot, & Pradal, 2017). In fact, through funding institutional entities can sustain the growth of the sector, promote technological advancement and can support high-risk projects. Implementing proper measures and actions to control and better manage this relationship is crucial for the interest of such companies.

Additionally, given the industry's high-technology nature, companies must anticipate new technology and market trends, and comprehensively understand consumer’s needs (Kassotaki, 2019b). Taking this into account, the literature has also emphasised the importance of constant innovation for the market to be sustainable, and as a result both knowledge and relationship management are crucial (McAdam et al., 2008; Rose-Anderssen et al., 2008; Varriale et al., 2023).

Taking advantage of a company's own network, and for other authors, coopetition (Salvetat et al., 2013), the mix of collaboration and competition with competitors in the ecosystem, are all considered relevant for the evolution and the growth of the aerospace industry and to improve efficiency while maintaining a high performance. The importance of collaboration, strategic partnerships, and effective resource management are possible solutions to navigate the challenges imposed by the external resource dependencies.

From a strategic standpoint, it is clear that managing and obtaining the right resources is fundamental to operate well and stay in the market. Being aware of which resources are necessary in an industry and taking more control of dependencies within the company's environement are relevant insights for the entire industry.

For these reasons, getting a deeper understanding of and investigating the resources and relationships necessary in the industry is a method to effectively tackle the challenges companies encounter.

As each industry is characterised by its own specific dynamics the goal of this study is to specifically explore the aerospace sector. In fact, the literature around it is scarce and often focused only on the engineering aspects rather than venturing into strategic analysis of such enterprises. More attention is needed from a strategic management point of view. Examining resources and relationships among stakeholders entails conducting a more in-depth analysis. Moreover, given the innovative environment characterising the whole aerospace sector, seeking new, updated, and more precise insights becomes crucial for the industry heading to the future.

The thesis will adopt a qualitative approach with the aim of acquiring further and deeper insights. The chosen methodology involves conducting interviews with experts and professionals active in the aerospace companies to gather valuable data. A survey with open-ended questions to provide detailed and unrestricted responses was also utilised. Subsequently, the accumulated information will be synthesised to draw considerations, contributing to a more profound understanding of the topic under investigation.

2. Literature Review

This qualitative study will adopt the Resource Dependence Theory as its theoretical framework. This strategic management theory explores how organisations rely on external resources and actors for their survival. Given the complexity of the industry, the focus is on confirming the dependency of organisations within this sector on external entities controlling critical resources, such as financial means, technology, and innovation, and human resources. Furthermore, as the theory highlights possible actions that companies could undertake to reduce resource dependency, the literature review will also aim to identify which strategies are considered valuable to pursue based on the academic literature available on the aerospace sector and comparable industries.

2.1. RDT core concepts

The concept of Resource Dependence Theory gained public awareness in 1978 when Pfeffer and Salancik first presented it through their book “The External Control Of Organizations”. Although this theory was developed around 45 years ago, it is still very much relevant as it significantly contributes to explain behaviour, structure and change in organisations (Nienhüser et al., 2008). Taking a more sociological perspective, RDT serves as a valuable framework for understanding organisations’ management behaviour within their own ecosystem. Alternatively, as described by scholars and researchers, this theory is a useful tool for exploring how companies interact with and depend on external entities. It provides an insightful perspective on the dynamics intrinsic to the “ecology of the organization” (Hillman et al., 2009).

As briefly introduced, the fundamental assumption of this theory is that companies' decisions and actions are shaped by their reliance on essential resources. Oftentimes, the environment is turbulent, uncertain, novel, and ambiguous making it inevitable for companies to analyse and understand the context within which they function (Ramírez et al., 2017).

Authors highlight the importance of value creation in such environments, emphasising how value stems through a complex set of actions and interactions rather than attaching it to a specific object (Ramírez et al., 2017; Ramirez & Mannervik, 2016).

Hence, in a networking economy value resides in the organisation's actions and relationships with other actors within the system.

Redirecting the conversation to RDT, the concept of control over resources is highlighted by this theory as one of the most important factors for the success of an organisation. Connected to this is thus the concept of power and how actors within the environment either have the power to influence others or need to make efforts to reduce the effects coming from influential entities. According to Nienhüser and Werner (2008), the higher the dependency of an organisation is on the external environment, the higher is the amount of uncertainty surrounding a company. For this reason, the RDT stresses the fact that companies should take more control and make a greater management effort to lower dependencies.

The theory explains which could be the appropriate reactions to navigate this challenge. Pfeffer and Salancik (1978) identified five different strategies to reduce uncertainties and hence dependencies. Mergers & Acquisitions (M&A) are valuable to reduce competition by extending the company's control through the different stages of the supply chain. Through M&A, an organisation can better manage the interdependence with either the sources of input or purchasers of output. Joint ventures and other interorganizational relationships, for example, strategic alliances or R&D agreements, are instrumental to gain more power and access to key resources. Effective board of directors which members actively contribute by aligning the organisation behaviour with the external environment can help to combat against the company's contingencies. Political dynamics also plays an important role in companies' decisions; indeed, firms that are more dependent on government and other bodies must engage more in corporate political action. Finally another aspect emphasised by the theory is executive succession and on how executive turnover can be beneficial to align organisations' activities with the circumstances posed by the outer environment (Hillman et al., 2009). All in all, organisations must develop connections with other entities and employ strategies that can decrease uncertainties.

The level of influence of the external environment on the aerospace sector for resource retrieval and eventually management is considerable. Other entities such as the government, suppliers, fellow competitors do have a great influence on aerospace

companies' behaviour (Koshova et al., 2023). For this reason, looking at the sector through this lens can produce interesting results.

Another theory which could have been employed for this study and that is also close to the RDT is the Resource-Based View (RBV) by Barney (1991). Indeed, both of them highlight the importance of owning, controlling and managing critical resources. However, while examining the industry, it turned out to be more suitable to utilise the RDT rather than the RBV. Although the RBV is an extremely influential framework in strategic management, its focus on the control of internal resources and capabilities might fail to recognize and stress the current interdependent relationships of aerospace companies with other entities in their network.

At the moment, identifying resources in the commercial launch industry, and obtaining more insights on where control over these resources reside, is something that has not been academically identified. This will give more insights to build sound strategies.

Having introduced both the core concepts of the RDT and the relevance of applying such a framework to the aerospace sector, the focus of the next section will be on identifying key resources within the industry.

2.2. Identifying Key Resources

Resources are numerous and can be a source of competitive advantage if valuable, rare, difficult to imitate, and non-substitutable (Barney, 1991). The theory usually divides them into categories based on their nature. Indeed, they are classified into three broad groups: Physical capital resources, Human capital resources, and Organisational capital resources (Barney, 1991). Nonetheless, regardless of their nature, they enable a firm to conceive of and implement strategies that can improve its efficiency and effectiveness.

It is widely recognized that organisations, without distinction of the nature of their business, necessitate resources such as financial means, basic infrastructure, facilities, human capital and other foundational resources, needed to carry out operations. Nevertheless, their relative importance may vary based on several factors such as the industry the organisation is competing in, the type of business model created, and overall market conditions.

Hence, this section aims to shed light on the most frequently mentioned resources necessary for operating in the aerospace sector. Locating which are the most critical ones is useful to understand the locus of dependency. As a result, this allows the study to concentrate on instrumental interactions between actors in the ecosystem rather than attempting to analyse the entirety of the network, which is in fact intricate and challenging to discern (Rose-Anderssen et al., 2008).

Based on the examination of academic articles and official reports available on the aerospace industry, there is not an extensive body of academic theory that is applied to this sector. The literature from a management perspective is indeed quite scarce. There are no academic papers that specifically apply the Resource Dependence Theory as a theoretical framework, therefore the literature regarding critical resources in the aerospace sector or that carefully analyse relationships among actors is yet to be academically examined. By applying the theory on this industry, more insights on the unique challenges and dynamics can be explored. Given these limitations, the study relies also on research conducted in the broader high-tech industry to analyse the most important resources and actors in this ecosystem. This approach is justified by the OECD's classification of the aerospace industry as part of the bigger high-tech industry (Kassotaki, 2019b; Wang et al., 2018; Zakrzewska-Bielawska, 2013).

All in all, there are three types of resources that have been emphasised as the most relevant: technological, financial, and human resources. The three of them are in fact critical for innovation, a pivotal factor for companies operating within the high-tech industry. In the case of the aerospace sector, innovation is certainly instrumental for a company's competitiveness, business survival, but also economic growth and employment in a specific territory (Calabrese et al., 2013). Constant innovation is necessary for the sustainability of the market (Rose-Anderssen et al., 2008), it is a crucial driver of organisational success and can guarantee superior performance (Buenechea-Elberdin et al., 2017). Thus, it is considered to be the source of competitive advantage (Molling et al., 2023).

2.2.1. Technological Resources

In a company, innovation can take several forms and can be categorised based on different criteria (Buenechea‐Elberdin et al., 2018). In the case of high-tech and manufacturing companies technological advancements become key to the organisation. Usually technological development manifests in the discovery of new materials or improvements of processes to speed them up and reduce costs. Consequently, the many advantages technological improvements and therefore innovation can positively affect the firm and in particular the firm's financial performance (Yang & Okada, 2019).

In the last decade for example, artificial intelligence (AI) applied in a vast range of industries has driven growth and efficiency. Machine learning, deep learning are for instance AI methods that have been applied in the field of aerospace engineering with the objective of increasing the success rate of future space missions (Ni, 2022). Moreover, successful companies in the commercial launch segment, SpaceX and Blue Origin have indeed developed and perfected new technologies which make them the main players of the segment. Furthermore, the satellite industry has also benefited from miniaturisation and standardisation of components (Wekerle et al., 2017), technological advancements that have been instrumental for the growth and development of the market. Indeed, more than any other industry, continuous development in materials, designs, and manufacturing solutions are essential to this sector (McAdam et al., 2008).

Therefore, what follows is that in order to keep a strong position in the market it is of vital importance to foster innovation and manage it well. There are several variables that can directly affect a company's innovative behaviour. Certainly, technological knowledge and knowledge management are crucial determinants for driving innovation in high-tech industries (Varriale et al., 2023).

2.2.2. Financial Resources

This brings us to the next essential resource within the sector, namely financial means. Monetary assets are without a doubt indispensable for the functioning of any type of business. However, their importance is particularly emphasised in the aerospace sector. The sector reliance on financial assets intensified due to the nature of its activities. An important aspect to consider is indeed the considerable amount of capital required to develop products and continue over time operations. Products manufactured and services offered in the aerospace sector generally require high expenses because of the numerous components and related technology and innovation employed, but also quality standards and regulated control processes to comply which makes it difficult to cut costs (Rodríguez-Segura et al., 2016). Additionally, this sector suffers from frequent schedule overruns (Jaifer et al., 2021). Although companies seek to be at the forefront of technological innovation and develop new products with cutting-edge technologies, they seem to be confronted with several boundaries that stem from a lack of financial resources. For instance, in the case of launch vehicles development costs of most of them typically fall between $300 and $700 million per unit, if not several billion dollars, emphasising the significant financial investments necessary to operate (Kulu, 2021).

Monetary assets are essential for operations given the requirements coming from testing products and ensuring product reliability. In the aerospace industry where quality and reliability are important, the availability of sufficient monetary assets becomes indispensable, in addition to the fact that they could ease the process of renovating and experimenting with new technologies. However, the large number of stakeholders and regulations and laws applied to this sector make it difficult for companies to reduce costs by, for example, employing economies of scale (Jaifer et al., 2021). As a consequence, dependence on institutional support emerges as a critical factor for sustaining operations and fostering innovation.

2.2.3. Human Resources

Human capital is also considered an important resource for a company. Especially in high-tech industries where intellectual capital is precious. Indeed, intellectual capital consists of all knowledge-based assets which can enable innovation activities and are therefore a source of competitive advantage (Buenechea-Elberdin et al., 2018; Buenechea-Elberdin et al., 2017; Zane, 2023). For this reason, human capital, which is included in intellectual capital, can positively influence a company's ability to innovate, grow and survive (Zane, 2023). Innovation is often a product of human expertise, know-how, and talent, hence, human capital is one of the most relevant knowledge assets in high technology-based firms (Buenechea-Elberdin et al., 2017; Zane, 2023; Buenechea-Elberdin et al., 2018). In fact, employees are fundamental for acquiring and keeping the company's knowledge base up-to-date. Their experience, creativity, and collective expertise contribute significantly to the innovative behaviour of an enterprise (Martín De Castro & López Sáez, 2008). The literature also addresses the potential behind entrepreneurial capital as it is critical to identify new business opportunities, take challenging decisions, show initiative, and embrace risks (Buenechea-Elberdin et al., 2017).

2.3. Identifying key interactions related to critical resources

By identifying critical resources, it is possible to then detect who are the actors that control them or that can be very influential to the company's strategic behaviour aimed at obtaining such resources. Technological advancements, substantial investments, and valuable human capital are factors that can not only support the enterprise's operations but can foster innovation and make the company competitive. When analysed through a RDT lens, there is room to speculate that these necessary resources are under the control of or can be influenced by external entities. In particular financial resources retrieval is specifically dependent on public institutions, while technological advancements although they can be achieved internally are usually and more conveniently possible through collaboration of several actors such as other players along the supply chain or even the same competitors. Instead, human resources are frequently developed internally, yet collaborative efforts, crucial for technological advancements, can yield positive effects on the workforce. Therefore, by scrutinising companies' interactions with other entities, it is assumed that there could be favourable implications for human capital.

The following section will delve into examining the interactions between companies in the aerospace sector and public institutions as well as the relationship companies can exploit with other key actors within the aerospace network. The objective is to understand the importance of these interactions and the strategic decisions associated with them, with the overarching goal of reducing resource dependencies. As the RDT suggests, there are five strategic actions that can help organisations manage and navigate dependencies and uncertainties on external resources. Among those and based on the resources identified, government relations and collaborative partnership emerge as particularly important.

2.3.1. A Resource Dependence Lens on Institutional Influence

Financing in the aerospace sector has always been linked to "geopolitical interests" (Koshova et al., 2023). Indeed regional public institutions and governments emerge as the main clients for the majority of the aerospace companies, significantly influencing their operations. This dependence on funding is fundamental to face the high costs

and long production time typical of the sector (Jaifer et al., 2021; Rodríguez-Segura et al., 2016).

Public intervention has been extensively studied over the years, highlighting the government's important role for industry's growth and survival. The government through several instruments can indeed control and foster market developments when deemed necessary.

The literature has studied how in high-tech industries tax incentives and funding and other forms of grants from the government facilitate the operations and growth of a firm (Ghazinoory & Hashemi, 2021). With the support of public instruments, organisations can lessen the burden of production costs but also invest more on R&D, a central department for "knowledge-based firms" (Ghazinoory & Hashemi, 2021).

For instance, research on government subsidies has shown how they can stimulate innovation within firms, particularly in the context of R&D (Bronzini & Piselli, 2016). Governments usually use this tool with the objective of addressing market imperfections and encouraging optimal allocation of resources (Chen et al., 2020; Beck et al., 2016). At the same time, they are instrumental to decrease innovation risks and help organisations overcome barriers, namely alleviating financial constraints, that would otherwise hinder their ability to innovate (Howell, 2017; Einiö, 2014). Moreover, government subsidies have many other positive effects for the overall industry such as spillover effects (Xie & Zhang, 2021). Finally, subsidies send positive signals to external investors and financial institutions, attracting more capital and expanding the pool of external financing sources for businesses (Xie & Zhang, 2021).

This last aspect is significantly relevant in the context of the aerospace sector. Prior to commercialisation indeed, governments had absolute power in deciding which missions to pursue and finance. Thus, all the expenses were on the government's shoulders being it the prime stakeholder (Kim, 2018). Nowadays, both institutional and private bodies are needed from enterprises to secure financial resources. Over the past decade, there has been a significant increase in investment in the space industry due to mainly growing technological and demand trends (Deloitte, 2023). However, there are few cases in which private investment allows a company to operate without depending too much on governmental financing or other forms of support. Especially

in the segment of the commercial launch industry and satellite services, SpaceX and Blue Origin are two exemptions that can sustain themselves by utilising private investment as it comes directly from their respective CEOs (Burkhardt, 2018). Nevertheless, as of today governments still effectively play a pivotal role for the retrieval of monetary assets. In the majority of cases investments from such institutions are crucial for the development, competitiveness, and sustainability of the industry.

As a consequence, companies within the aerospace sector need to constantly engage with institutions. Interactions with national space agencies, national defence departments and regional entities such as the European Commission shape organisational behaviour, strategic decisions and future planning.

Hence, reliance on public funding remains a crucial and strategic element for any company operating within this sector. The relationship between institutions illustrates the Resource Dependence Theory's relevance in comprehending how aerospace organisations strategically engage with such external entities. Their interaction and relationships are aimed at securing essential resources and effectively navigating challenges and uncertainties.

In conclusion, developing strong relationships with governmental entities can be crucial, especially in industries where regulations and policies significantly impact operations. This may include active engagement, lobbying, or participating in industry associations.

2.3.2. The Role of Collaboration and Partnerships

Another aspect which should be carefully considered is the role of collaboration among actors within the aerospace sector. According to the RDT, managing interactions with key actors can reduce resource dependencies. Enterprises can collaborate with suppliers or competitors to enhance their resource base. Therefore, leveraging the network can help companies attain their objectives in a more effective manner.

Nowadays, organisations are becoming increasingly open to open innovation activities to seek resources and collaborations from external actors. In industries where innovation takes a leading role for competitive advantage, relationships built

within the network are suggested to overcome gaps in information, improve scientific knowledge, share resources and competencies (Calabrese et al., 2013). Looking at the aerospace sector which is characterised by a network made of multiple actors but by few large competitors that dominate the industry and thus have a great influence on market dynamics, creating a strong network is necessary to survive.

As a matter of fact, companies engage in collaborations for several reasons. In general, strategic alliances are known to provide positive results (Tarigan & Siagian, 2021). Most of the time, financial motives drive companies to partner with one another, but in other cases, marketing motives or political issues might encourage organisations to join forces and cooperate with each other (Malaval et al., 2014).

Cooperation between actors can happen either between competitors or with other organisations along the supply chain. In both cases partnerships are advantageous to face costs and technological uncertainties (Malaval et al., 2014). Financial objectives nevertheless are the most common. Mobilising capital can have positive effects on future market prospects attracting investment, combing and maximising also know-how can drive costs down and reduce overall uncertainty around technology (Malaval et al., 2014). All in all, pooling knowledge and expertise can enhance the partners' capabilities to develop innovation (Tarigan & Siagian, 2021) and acquire a stronger position in the market and against influential institutions. It might also contribute to anticipating demand uncertainty (Tarigan & Siagian, 2021), something crucial in the aerospace sector.

There is a form of collaboration that gains particular attention in high-tech networks, known as coopetition. Among open innovation activities, coopetition is considered one of the main factors for development and innovation in intensive, dynamic, and complex knowledge context such as the one of high-tech companies (Hameed & Naveed, 2019; Molling et al., 2023; Zakrzewska-Bielawska, 2013).

Coopetition is a type of collaboration that happens between competitors. It is defined indeed as the combination of cooperation and competition between firms. In high-tech industries it often manifests in the form of R&D agreements (Rodríguez-Segura et al., 2016).

This form of collaboration happens when there are strong motives to achieve competitive advantage. Efficiency gains are also a reason for coopetion to happen. The actors as a matter of fact are able to create value together because of their similarity in knowledge and processes which makes them more easily share costs, minimise risks related to R&D, create spill-over effects, and in some cases create economies of scale (Hameed & Naveed, 2019; Molling et al., 2023).

Of course, this type of collaboration can bring many advantages to both parties involved. However, as any other form of collaboration or alliance, there are risks concerning knowledge. Companies involved in collaborative activities expose themselves to other enterprises, therefore, a high level of trust between parties might be required. Furthermore, a high level of commitment and coordination is necessary for the collaboration to be successful. Strategic partnerships indeed do not happen only because parties want it to happen but finding organisational compatibility is necessary for the alliance to be thriving.

Partnerships where risks are shared are without a doubt powerful instruments that have been academically studied to be fruitful (Rose-Anderssen et al., 2008). Both in the case of partnerships between competitors and between actors along the supply chain, the risk is spread across actors allowing parties to improve competitiveness and strengthen their financial position (Rose-Anderssen et al., 2008). Nonetheless, every alliance should be managed carefully to maximise the benefits coming from collaboration, sustain long-term advantages, and reduce uncertainties. In summary, connecting the resource dependence theory to the literature just examined, this thesis project wants to highlight how the role of collaboration can be instrumental in mitigating dependencies and securing essential resources.

2.4. Conclusive remarks to the literature review

Operating in the aerospace sector poses several challenges. Capturing resources such as funding and technology are necessary to create effective networks, and overall value to be delivered to customer's needs. The companies navigate in a complex environment and must take into consideration the regional context in which they exist, the institutional challenges and regulations. The space ecosystem is very dynamic and undergoing changes therefore gaining more control over financial resources and fostering innovation are objectives that should be pursued by companies operating in

this sector. Co-creation, partnerships, strengthening organisation's presence in front of institutions are actions that this study will test as fundamental for companies success, survival, and effective resource management. The literature has stressed the importance of actions such as R&D agreements and other types of collaborations between actors to foster innovation and to overall reduce dependencies that might hinder the company from operating well. Being the aerospace sector strongly regulated, companies might face challenges in expressing their perspective. This suggests the necessity for proactive measures towards public institutions to ensure their voices are heard.

The RDT lens on the aerospace sector is appropriate to explain the aerospace ecosystem, to show how value creation stems from the appropriate management of interactions within an environment that is constantly renovating and that holds positive perspectives for further value creation.

3. Methodology

3.1. Research Design

As previously mentioned, this study employs a qualitative research design to investigate the aerospace sector through the lens of the Resource Dependence Theory. Given the theoretical framework chosen and objectives of this thesis, a qualitative study was deemed appropriate to acquire richer and more detailed data. Recognizing the complexities of this industry, semi-structured interviews (See Appendix A) were conducted with professionals who are currently working or until recently have worked in aerospace enterprises. In addition, to complement and gather more insights, a survey with open-ended questions was also used. Multiple methods were therefore employed to collect opinions and insights coming from experience.

3.2. Participant selection

Participants were selected based on their various backgrounds in the aerospace sector. A total of 12 participants contributed to this study. Their involvement took the form of semi-structured interviews or responses to an open-ended survey. Their valuable answers provided insightful perspectives into the dynamics studied by the Resource Dependence Theory.

The objective behind the selection criteria is to include managers and seniors with extensive expertise in different company's divisions. This ensures a diverse representation and a comprehensive understanding of the various aspects of the aerospace sector. Interviewees are or have been active in the areas of strategy, operations, sales & marketing, legislative, and government affairs in their respective enterprises. Answers from young professionals were also collected for the study to encompass a range of roles with varying levels of experience in the sector and provide a thorough overview of the industry.

Potential participants were contacted through referrals, university support, and personal network in international organisations.

To describe the sample and provide context for the findings, demographic information such as age, gender, nationality and specific roles within the organisations were collected.

All the participants are or have been active in aerospace companies. However, for privacy requirements coming from the company and personal preferences set as a condition to participate in the study, anonymity was ensured. Nevertheless, the data gathered was drawn by individuals working from a variety of aerospace businesses in the industry of satellites and launch systems, ranging from established corporations to more recent established companies. Among the names that are possible to nominate, Leonardo S.p.A, OMA S.p.A, Thales Alenia Space are some examples of companies for which participants are or have worked. In terms of gender, the sample comprised 9 males and 3 females. Moreover, participants' ages varied across a spectrum, ranging from 23 to 49. Finally, participants represented varied nationalities including individuals from the United States of America, Italy, Germany, and India.

Prior to conducting interviews and distributing the survey, the topic of the thesis was introduced, purpose of the study and objective of the methods employed outlined, and consent obtained. Participants were assured anonymity of their insights in the reporting and that the data would be processed for only academic purposes.

The interviews lasted around 30 minutes and were scheduled according to a time convenient for the participants. Although interviews were the preferred method to collect data, finding contacts and scheduling interviews have been one the most challenging aspects of this study.

3.3. Data Processing

After having gathered the answers from both the interviews and the surveys, the data was processed. Following the transcription of interviews the coding process was carried out. Answers from both methods used were analysed using open coding, assigning codes to opinions and insights. Afterwards, axial coding was conducted to organise codes into broader categories that shared similar themes, patterns, or concepts (See Appendix B). Finally, selected categories were grouped and analysed to focus on the central theme of the Resource Dependence Theory, specifically reducing resources dependencies (See Appendix C).

4. Results and Discussion

In the upcoming section findings regarding critical resources, interactions and strategic efforts to mitigate uncertainties in the aerospace sector will be presented. The data was gathered through interviews and surveys that were carefully analysed to offer a more comprehensive perspective. More on challenges or barriers, pivotal resources, the importance of the network, and strategic behaviour are the focus of this portion of the project.

4.1. Results

4.1.1. Challenges in the aerospace sector

Before directly delving into reporting which are the assets and capabilities considered critical by professionals in the sector, it is appropriate to remind some of the challenges companies usually face. This will allow for a better understanding of the resources necessary.

According to the participants, common challenges are imposed by the high cost of production, the highly bureaucratized and cumbersome process for obtaining product certifications, the long manufacturing times, and the regulations or restrictions imposed by public institutions:

"Investments are very burdensome and significant."

"The sector has quality and safety requirements that are at the highest possible level."

"100% of the products are rigorously inspected according to a strict logic."

"There are several important components that go into the building of a rocket. It is expensive and takes a long time to build."

In addition, due to substantial production costs, companies require significant financing. Nonetheless, they consistently struggle with limited budgets:

"The main challenge was to develop the product within the provided limited budget . Budgets were definitely an exogenous variable."

Moreover, because of regulations and restrictions enforced by governmental bodies, like for example ITAR, enterprises must comply with several requirements before engaging in transactions.

Difficulties also arise from their vulnerability to political agendas and the impact this might have on technology and innovation.

An interesting insight that participants emphasised was the fact that companies in this industry run on very thin profit margins because of the factors mentioned which contribute to the challenging financial environment.

Lastly, another aspect to take into account is the competitive job market and therefore the ability of the company to attract valuable individuals.

4.1.2. Key Resources

Identifying resources was one of the objectives behind the interviews and the questions asked through the survey. Participants' attention was mainly focused on a few resources.

First of all, being in the high-tech sector, technology and know-how are considered to be essential, together with manufacturing capabilities. Therefore, innovation is considered to be a critical factor because it is seen as a key to efficiency, helpful to ensure high-quality products and in short-time frames.

Talent has also been mentioned as something companies are always looking out for. Skilled individuals in a dynamic sector characterised by technology intensive activities are essential. Specifically, individuals that possess highly advanced STEM skills are necessary for the businesses' success. Also, apart from technological and technical knowledge, soft skills are particularly relevant in managerial coordination roles for effective business governance.

Among the resources mentioned significant attention was given to economic resources. Although any type of business necessitates financial resources, organisations in this sector critically need constant funding. The funding needed is greater and the returns take longer.

4.1.3. Interactions in the aerospace ecosystem

The interactions identified were multiple. Certainly, public institutions play a critical role for financial resources retrieval. Companies participate in innovation and research programs or in the national ministry of defence tenders to obtain funds and consequently continue to operate. For instance, in Europe, the EU Research and Innovation Horizon programmes have been and currently are fundamental for companies operating in this sector. Aimed at driving economic growth and creating jobs by fostering innovation and collaboration across various sectors, these programmes can be essential for aerospace businesses survival.

Furthermore, such programmes incentivise companies to establish important relationships between actors in the ecosystem. Indeed, universities and research laboratories are central to project submissions as funding is often given to those companies whose project involves the participation and collaboration of universities and research centres.

Furthermore, interactions with actors along the supply chain and other competitors were also mentioned. Again, research programmes such as the EU Horizon, promote the collaboration of technological clusters. Companies therefore try to cooperate to both secure funding and foster innovation:

"Funding from any government entity is provided when there are implications for technological clusters."

4.1.4. Efforts to mitigate resource dependencies

Given the reporting on fundamental resources and interaction happening in the industry, insights on strategic behaviour are explored.

Numerous were the strategic actions identified by the participants for companies to address resource dependencies. These actions include efforts to promote innovation and technological advancements, the importance of investing in human capital, and addressing financial challenges.

According to the interviewees, leveraging the network of actors each single company has, is definitely something to exploit. One of the interviewees in particular stressed how economic constraints and the promotion of innovation, fundamental aspects in

the aerospace sector, can both be approached appropriately through partnerships. Collaborative partnerships can offer advantages for the two or more parties involved and when successful, synergies are created for everyone to benefit. Usually, by sharing expertise and risks, companies can cut costs, speed up processes, whilst still ensuring reliability.

Moreover, with the emergence of the New Space economy and the founding of several start-ups, more established companies are engaging with the recently founded ones to form partnerships and are exploring and studying the idea of signing contracts to either have new partners or clients given the several layers in the production process of finished products. This complexity involves situations where companies may produce finished products at times and, at other times, sell components to others who will complete the final product:

"The company conducted scouting to use startups as clients to sell components or as partners to collaborate on satellite projects."

"Partnership with start-ups is crucial given the fact that they have fewer internal processes and sometimes have the ability to develop products with a smaller budget."

Moreover, in the satellite market, the shift towards smaller satellites by startups has notably impacted larger and more "traditional" companies, influencing them to adapt their strategies and core business focus.

An example of an existing partnership, mentioned by one of the participants, was indeed the strategic partnership ongoing between two launch companies, namely Northrop Grumman and Firefly Aerospace (Northrop Grumman, 2022). Indeed, Northrop Grumman, one of the major players in the aerospace and defence industry, teamed up with a rather new entrant Firefly Aerospace for the building of the Antares Rocket. This launch vehicle was previously created thanks to the cooperation of Russian and Ukrainian production and although part of the decision definitely comes from political implications, this new partnership between two local companies is an example of how they can share expertise and create important synergies to produce an upgraded version of what was formerly manufactured.

In Europe, as mentioned, funding can be obtained through innovation and research programmes. Companies that are especially able to team up with other actors are

favourably seen by institutions, both national and international, to obtain funding. As the programmes promote innovation, projects that succeed in forming collaboration with international companies, research institutions, and universities are selected.

Regardless of the programs, in the case of larger companies, there are also other activities towards open innovation that were mentioned. For instance, companies have created technology hubs dedicated to the research and development of leading-edge and breakthrough technologies:

" [...] to create a constantly evolving innovation ecosystem, a network of research and development laboratories interconnected with universities, polytechnics, research centres and partner companies is important."

The hubs are also instrumental to scout skilled workforce apart from renewing professional skills and competencies of current employees.

Continuing on the human resources front, the creation of an inclusive atmosphere is something organisations give their attention to. Acquiring and developing skills internally by promoting inter collaboration across teams is also among the efforts companies strive to accomplish.

Furthermore, to attract talent, one of the participants expressed their opinion by highlighting the importance of promotion of space and STEM culture through mainstream media to appeal to the interest of the newer generations.

All in all, these considerations must be applied to companies that do not operate solely for defence departments and public security as in this case innovation and the promotion of pure technological advancement might be disregarded, given the barriers coming from reliability of products.

Regarding companies' interactions with institutions, there is definitely a need to engage more with their institutional clients. Companies are aware of how it is important to maintain positive relationships with institutional customers and try to engage with lobbying activities to influence government decisions.

Forecasting activities aimed at mapping out future needs were also mentioned as an important aspect:

"The company had a dedicated function for this purpose, engaging in numerous institutional meetings with company representatives to map the needs of the end customer and market trends."

"Understanding the customer and the intrinsic logic of the space business also plays a key role in terms of both commercial development and business governance."

"Mapping market trends is crucial, given that products take time to be finalised, with an average of 2-3 years of development."

4.1.5. Other considerations

There was definitely an overall agreement on the challenges and complexities posed by this sector. High-costs, high quality standards, and high safety requirements coming from public institutions and ITAR might hinder the companies' willingness to innovate, especially when a company works mainly for public security and defence departments. Such companies tend to be actually resistant to innovative solutions unless they are instrumental to improve efficiency:

"Technological advancements are instrumental if focused on production methods that can improve efficiency, produce higher quality products in shorter time frames, and maintain increasingly competitive costs."

The influence of bigger companies (Original Equipment Manufacturers) should also be considered an influential factor to strategic decisions. Profit margins are indeed particularly thin.

Partnerships may not always be preferable as they can become more expensive than expected. Also, international collaboration can be discouraged:

"There are some restrictions from the government on what partnerships we can have and what we cannot have, and sometimes partnerships can be very expensive."

Instead, in some cases, offshoring might be more beneficial to reduce resource dependencies.

All in all, these are some aspects that will require further investigation.

4.2. Discussion

Behind every product or service offered in the aerospace sector, there is an important scientific and technological challenge that must be supported by the companies' assets, capabilities, internal and external processes. Constraints such as the large number of stakeholders, regulation and laws, limited budgets and the need for disruptive technologies poses questions into what the best strategies are to implement.

The research findings highlight the significant impact of external dependencies, in particular the role of institutional funding and control, and the strategic benefits derived from collaborative partnerships. Companies within this sector actively navigate these external dependencies by leveraging both governmental support and international innovation programs for funding, while also engaging in collaboration initiatives with other actors existing within the same network. Results show the intricate relationships companies have with institutional bodies, other players for partnership, and academic institutions. Therefore, organisations must engage in several strategic actions to guarantee their survival. This aligns with the principles of the Resource Dependence Theory to reduce resource dependencies.

Obtaining funds and fostering innovation seems the most pressing matters. For this reason, professionals in this sector have shared their insights on what companies are currently doing to achieve competitiveness and mitigate dependencies. Collaboration reveals itself to be an important factor to take into account and that can tackle issues arising from both monetary scarcity and the desire to technologically advance to exploit efficiencies.

Companies might also seek to gain control by building internal resources when too expensive, risky, or prohibited. However, the academic literature has empirically studied how partnerships are strategically undertaken to seek technological advancements in high-tech industries by collaborating with other actors. This together with other findings reinforces the belief that indeed cooperation and encouragement to create open systems is indispensable.

As presented in the literature review grants play a pivotal role. They indeed incentivise corporations to foster technological advancement, to form partnership with

other entities, and to contribute to the development of new talent, a crucial aspect for high-tech resources.

The network is therefore something organisations must carefully understand. It is through partnerships and greater involvement with institutions that it is possible to create value.

5. Conclusion

The main findings of this research contribute to defining resources and strategic actions necessary and employed by companies in the aerospace sector. Engaging with participants of the aerospace ecosystem was found to be one of the most important aspects to pursue. The underlying research question was indeed to find resources and reveal pivotal interactions.

The objective of this thesis was to apply the theoretical concept of the Resource Dependence Theory to examine the industry. As there are no previously published academic articles that apply this theory to this sector, the goal was to join the literary conversation and test the theory on a sector that is undergoing changes and facing challenges. Alongside the disruption of the New Space Economy, numerous expectations have been set. Incumbent companies are interested in finding new ways to be successful and new entrants might be eager to analyse approaches to survive.

Therefore, the study employed qualitative methods, including virtual interviews and the submission of surveys, to gather essential data on critical resources and insights on how companies are currently addressing related challenges.

The study presents limitations. Finding professionals in the aerospace sector willing to openly share their opinions proved to be challenging due to internal policies and confidentiality constraints. Therefore, it is important to acknowledge that these recruitment limitations might have influenced this study's findings. While the data gathered provided valuable insights, a more comprehensive understanding could be achieved by incorporating a broader set of perspectives.

Furthermore, the thesis, based on the resource dependence theory, focused on two kinds of strategic behaviour out of the five presented by this view. Future research might explore or focus on the remaining strategic actions for a fuller resource dependence perspective on the sector. Conducting additional analysis on partnerships and identifying the various types of collaborations could enhance the overall sector understanding. Further research on human capital as a critical resource might be also valuable to describe strategic behaviour.

In summary, this thesis contributes to the understanding of critical resources and strategic actions within the aerospace sector through the application of the Resource

Dependence Theory. By delving into the responses received by interviewees, the study emphasises the relevance of commitment to engage with the sector participants. Recognizing the study limitations, further research can be built upon this study's results.

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Appendix A - Interview Questions

The following is an illustrative set of questions posed during the interviews. Given the semi-structured nature of the interviews, some questions were omitted when considered unnecessary or redundant. It is important to note that this list is not exhaustive and may not include all questions asked, as some may have been spontaneously asked during the interview process.

- How long have you been working in the aerospace sector?
- What is your position at your current company?
- Based on your experience, what do you consider to be the most critical resources for a company operating in this sector?
- Are there resources that are particularly under the influence of external actors?
- What are the processes / actions / interactions that are put in place to manage resources and reduce resource dependency?
- Innovation is considered crucial for high-tech and manufacturing companies, as it is considered to be a source of competitive advantage. What are your thoughts on it?
- Could you elaborate on the efforts your company is making to foster innovation?
- Do you have any other suggestions aimed at improving the company's competitiveness in the aerospace sector?
- What is your age?
- How do you identify in terms of gender?
- What is your nationality?

Appendix B - Axial Coding

After open-coding, the codes were analysed to find connections and divided into categories. Only the codes relevant to the research objectives are reported.

Challenges of the Sector
High costs
High quality and safety requirements
Subject to political agenda
Long production time
Bigger companies (OEM) influence

Critical Resources
Monetary resources
Technology / Know-how
Manufacturing capabilities
Innovation
Talent / Skilled workers
Highly advanced STEM skills
Soft skills
Knowledge resources
Certifications
Accurate and apprehensive data

Actors within the Aerospace Network
Government
Public Institution
Competitors
Universities
Research Institutes
Partners along the supply chain

Managing interactions with governmental institutions
Participation to public tenders
Participation to innovation and research programs
Participation to EU Horizon programs
Lobbying activities
Cultivating a positive relationship with institutional customers
Forecasting activities on clients demand

Leveraging the network of partners
Partnerships with universities and research centres
Creation of technology clusters
Joint participation to innovation and research programs
Friendshoring
Participation to innovation events

Internal efforts
Creation of an outward-facing and highly professional environment
Innovation Lab
Technology Hubs
Substantial investments in R&D
Investments on engineering activities to foster innovation
Reinforcement of technological roadmaps
Investments in HR
Creation of an inclusive environment
Targeting young individuals through mainstream media
Offshoring

Appendix C - Selective Coding

Three of the groups of codes identified after axial coding are now grouped to answer the question: “What are strategic actions to mitigate resource dependencies in the Aerospace Sector?” or “How do companies mitigate resource dependencies?”. This allows the study to focus on the central theme of the RDT.