

The role of policy frameworks on strengthening intermediaries in the “New Space” market

A qualitative study on how the role of intermediaries in the “New Space” market can be strengthened through the mission-oriented policy framework to boost the creation of the “New Space” market

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Abstract

Our world is changing constantly and is being shaped by disruptive technologies that revolutionize the market and change the market dynamics. The space industry belongs to the most innovative industries and has provided the world with great technologies that are used in our everyday lives, without the majority being aware of it. For example, the following everyday technologies originate from research and development in the space industry: glass lenses, thermometers, tap water filters, baby formula, camera phones, CAT and MRI scans, LEDs, laptops, and the most relatable one to us, the satellite navigation system, known as GPS (Global Positioning System). The past decade the space industry has undergone a significant decrease in launching costs because of the reusability of the launching capabilities. This has opened the door to a new market, the “New Space” market where new business opportunities appear, with a projection of reaching USD 1.7 trillion by 2040. The question, however, is raised: How is a market that is capital intense due to the high R&D costs and heavily dependent on the government, created? Since the space sector is dependent on governmental policies and regulations and involves many stakeholders (both public and private ones) this study aims to investigate the role of the mission-oriented policy framework in creating the “New Space” market, by strengthening the role of intermediaries. To accomplish this, a qualitative study using semi-structured interviews was conducted among “New Space” start-up founders, politicians, and governmental space agencies in Europe. The main goal of the study was to understand the role of policy frameworks in intermediary interactions in the “New Space” market and how these policies can lay the foundation for its market creation. The findings suggest that the intermediaries are seen as the most valuable variable in the creation of the “New Space” market and the current innovation policies are lacking the directionality towards them. Furthermore, the findings suggest that mission-oriented policy portfolios should be constructed based on policy instruments that target the intermediaries with the end goal of establishing market confidence and incentivization. This study extends the mission-oriented policy framework by Mazzucato (2018) into the creation of the “New Space” market and yields valuable insights for both academics and practitioners on how to select, design and implement innovation policies to create the “New Space” market.

Keywords: New Space, Entrepreneurship, Mission-oriented policies, Private-Public-Partnerships, Intermediaries

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Definitions

Downstream: space applications where the following systems are involved:

- the use of data (data processing, communications, and cybersecurity)
- data analysis (radar and optical imagery, geolocation data)
- the final product (data platform, mapping, monitoring, location, and tracking)

Upstream: the upstream sector includes:

- the building (space hardware, materials, manufacturing)
- launching stage (launching vehicles, infrastructure)
- the satellites used for Earth Observation (EO)

Smallsat: A small satellite of low mass and size, under 1.2 kg

Cubesat: A miniaturized satellite around a form factor consisting of 10 cm cubes with a weight of less than 2 kg and constructed from off-the-shelf components

(Nano)-Satellite Constellation: a group of satellites that work together with a single purpose

IoT: Internet of Things- the enabling of billions of devices with sensors worldwide to connect via the internet, communicate and share real life data with each other without any human action

Market Failure: A situation characterized by inefficiency of goods and services distribution in the free market. The individual incentives for rational behavior do not result in rational outcomes

Mission-oriented Innovation Policy: regulatory measures and policies that use innovation to realize challenging societal issues in a specific timeframe

Austrian Economics: an economic school of thought from Vienna founded in the 19th century by Carl Menger. The emphasis lies on processes of cause-and-effect in real-world based on the subjectivity of human actions. Main components of this economic school of thought are the following: time and uncertainty, the central role of the entrepreneur, and the economic activity coordination based on current and shared information and prices

Market Equilibration: a systematic process where market actors acquire increasing accurate and complete mutual knowledge about potential supply and demand behavior

Abbreviations

EC: European Commission

ESA: European Space Agency

EU: European Union

NASA: National Aeronautics and Space Administration

PPP: Public-Private-Partnership

R&D: Research and Development

ROI: Return on Investment

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1. Introduction

1.1 The Industrial Revolution History

Our world as we know it now has been radically shaped by people's ideas, visions, and their actions. These ideas, visions, and actions have been the source of the development of the human society and have been manifested through technological products that marked the socioeconomical landscape of our modern world. There have been four major transformational events in our economies that allowed the transition of an agrarian and handicraft economy to a large-scale manufacturing, and fully mechanically automated one (Horn, et al., 2010; OECD, 2017). In the 1780s the steam-powered mechanical production equipment was a turning point for the economy in Britain and continental Europe, having iron, coal and textiles in the center of their economy (Berg & Hudson, 1992). A century later the next wave of technological progression led to the rise of the internal combustion engine driving forward the automobile industry, together with numerous inventions such as the plane, the development of steel demand, chemical synthesis, and the telephone (Horn, et al., 2010). New sources of energy such as electricity, gas and oil were at the center of the economy (Hobsbawm, 1988). Another century of technological evolution led to the third industrial revolution in the 1960s with the rise of telecommunications, electronics, and computers, which assisted in the era of automation through programmable logic controllers (PLCs) and robots (OECD, 2017). Today, half a century later, we are going through another industrial revolution where digital technologies and the use of the Internet of Things (IoT) are opening a door for increased efficiency in industrial production (Schwab, 2017; Chalmers, et al., 2020). Through the last 50 years the digitization and digitalization of the industrial sector have transformed it tremendously and no business today could imagine operating in the pre-internet era; every company today is a technology company (Chalmers, et al., 2020). There is an increasing number of companies that want to harness the future potential of digital technologies and have turned their focus on space technologies to achieve this (Syam & Sharma, 2018; SpaceTec, 2022).

1.2 The Space Industry

Historically, the space industry was dominated by governmental agencies and its sub-contractors with a political, strategic, or scientific focus (Peeters, 2018). Consequently, the industry was characterized as capital intense, involving high costs and starting capital, and by a top-down regulatory structure (Morelli & Campostrini, 2010). Private players historically were not in the business landscape, and nobody considered them to play a part (Peeters, 2018). Governments decided on an agenda of strategic objectives regarding their space strategy and asked space specific governmental organizations, such as NASA, to follow and execute the objectives (Smith, 2006). Governmental support in the early years of the space industry (1950-1970) had its roots in the Space Race and was therefore focused on research and scientific goals. When the "fever" of the Space Race decreased and the Cold War ended, the US government did not have prestige motives behind its space strategy anymore which resulted in NASA's budget to decrease dramatically (Scott & Leonov, 2014). This rapid decrease affected large industrial complexes that supported the U.S. space programs during the period of the Space Race and had been left with a decreased demand and a significant drop in their turnover. During the years these industrial complexes had

acquired considerable know-how in the space hardware and quality assurance. Given the decreasing interest from the government they used their own funding and debt funding to develop space projects with telecom operators who ordered their satellites from them. This know-how turned the space technologies into an enabler of growth in commercially oriented sectors with a focus on navigation and telecommunication data, for example, offering higher resolution images of Earth Observation (EO). This was the first space commercial market where commercial telecom operators such as Inmarsat, Intelsat, and SES Astra proved to be profitable (Morelli & Campostrini, 2010). Private companies in the space sector bear the capital risk fully themselves or use debt funding for service provision to the private sector (Iacomino, 2018). The U.S. National Space Policy of 2022 identifies as commercial any provision of space goods, services, or activities from private actors who bear the risk and responsibility for the activity and operate with typical market-based incentives for cost control and ROI optimization (National Space Policy, 2022). There are different frameworks for what constitutes commercial space, but the current one identifies commercial activity in space if it fulfills the following criteria: a) it has an efficiency seeking nature and is exposed to multiple risks (operation, investment, development, market), b) it operates in a legal marketplace where there are existing laws that are enforced, and c) it realizes independent non-governmental goals.

In the late 1970s space technology lost its monopoly from the government and opened its commercial potential to the private industry. After mergers and acquisitions this led to the formation of larger entities with the goal to unite resources, infrastructure, and financial capacity, as the private actor bears all the risk with the commercial activities (Iacomino, 2018). For example, Boeing acquired McDonnell-Douglas, De Havilland, Rockwell, and Hughes Space, while Lockheed-Martin was formed by Lockheed, GD Aircraft, Martin-Marietta and Loral. The increasing presence of private actors in the years afterwards gave rise to a new term- “New Space”- where the private industry increased its presence in the commercial space industry. This has enabled a plethora of opportunities, but at the same time it creates specific challenges to entrepreneurs and policy makers. The space industry is a capital intense industry and involves many actors. It is an industry that is heavily impacted by regulation and governmental policies, and the right recipe for how to successfully create sustainable business models in the “New Space” market has not been found yet.

1.3 Purpose and Research Question

Purpose

The purpose of this thesis is to address the gap in the literature of business management in the “New Space” industry market. This research gap is going to focus on (a) how a new market such as the “New Space” market can be created from a mission-oriented policy. This research study is examining the government as a market creator through the mission-oriented policy framework and attempts to bring to the surface how these mission-oriented policies can bolster the “New Space” market by targeting the intermediaries in the “New Space” ecosystem. The topic of the thesis is touching a niche area of market creation where very limited research articles focus on that market. The existing literature is touching on the following three topics: a) the identification of the “New Space” ecosystem, b) the definition and supply chain of the “New Space” market, and finally on c) the existing regulatory policies that govern the “New Space” market. There has been a lack of literature regarding a mission-oriented policy approach on creating the “New Space” market and how the governments with their innovation policies can strengthen the intermediaries to bolster the creation of the “New Space” market.

Research question and literature gap

To address this research gap and add further knowledge in the business management literature this thesis will examine the following research questions:

How can policy frameworks strengthen the role of intermediaries in the new space market? And, in what ways do policy frameworks lay the foundation for a new space market to take off?

To address the above research questions and gap we need to dive deeper into the following literature topics:

- 1) “New Space” definition and the industry framework
- 2) Space policies in Europe and the U.S.A.
- 3) The intermediaries (actors) and local regions in the new space ecosystem
- 4) Public-Private-Partnerships (PPPs)

2. Literature Review and Theoretical Framework

This section guides the reader through the existing literature in the “New Space” market by focusing on the mission framework of the market and the entrepreneurial processes that is part of this framework.

The first part (2.1) presents the theoretical framework that is used as a backbone to the literature review process to the reader. The second part (2.2) presents the market boundaries of the “New Space” vs the “Old Space” market, where the main market components are presented. The third part (2.3) presents the current literature of governmental policies in the space industry. While the first and the second part give an overview of the “New Space” market in regard to market boundaries and governmental policies, the fourth part (2.4) is enhancing this general view with a more granular depiction of the different players in the “New Space” ecosystem and shows the value chain that has been described in the existing literature. The fifth part (2.5) brings together the different stakeholders and relationships presented in the previous three parts (2.2, 2.3, 2.4) in the form of Public-Private-Partnership (PPPs). This section finishes with the sixth and final part (2.6) where the theoretical gaps in the mission-oriented policy framework from sub-section 2.1 are described. This part sets the ground for the methodology section of this thesis in section 3.

2.1 Theoretical Framework

The main theoretical framework that is the guide for this thesis is based on the mission-oriented policies. Mission-oriented policies utilize the scientific and advanced knowledge frontiers to achieve specific goals, which are normally complex and intricate. Mariana Mazzucato is the leading representative of the “mission economy” and the “mission-oriented” approach (Mazzucato, 2016), which has a clear goal: to transform the notion of governments from market fixers to market creators. Mazzucato’s economics are institutionalist with influences from the Austrian School of Economics which is going to be discussed further in this sub-section. What differentiates the government as a market creator is that as a creator it pushes the technological frontiers and does not operate within the existing ones. It increases the capital expenditure with the goal of market growth, while having in its center that markets are dynamic and result from both public and private activity and investments. On the contrary, the governmental economic activity is based on the market failure theory (MFT) which assumes that markets are efficient, and governments can intervene to fix them when they fail. MFT assumes and uses as a benchmark that markets are perfect in competition, they have access to information, and they are free of transaction costs (Mazzucato, 2021, p.171-173). However, markets are imperfect and incomplete. The government should be the catalyst in the reaction of market creation and align policies to attract new market actors to spot investment opportunities.

Mazzucato’s work is influenced by economists such as Schumpeter. According to Schumpeter there is an interconnected relationship between the institutions and the actors that drive the economic growth, as known as the entrepreneurs (Festré, et al., 2016).

The institutions are seen as resilient forms that do not immediately change, but in the course of time they are being shaped by the activity of their economic actors (Scott, 2001). There are two types of influence on the market: the “shaping” and the “bursting” one (Schumpeter, 1947). The interplay between the market actors and institutions is a dynamic one: constantly changing, where the interactions are shaped by the activities of the market actors. Neoclassical economists see the market being in equilibrium while Schumpeter and the Austrian school of Economists see the market being in a dynamic equilibration process triggered by spontaneous market discoveries, which are coordinated by local actors. These local actors are in a constant state of alertness. That state of alertness requires the exposure of the market actors to situations in which knowledge is not available, but they engage in the process of acquiring knowledge and plan their market activities accordingly. Through this process, entrepreneurial market opportunities are brought to the market and favor the market actors that are prepared and alert (Kirzner, 1997).

The objectification of markets can be misleading in reaching insightful means to market creation. An objectification of the market relies only on historical data as input without any immediate consideration of the current and the future situation. The market creation is a dynamic process, and it should be seen as a process and not a thing that emerged suddenly and started existing (Mazzucatto, 2018). The market takes the shape that its actors give it with their actions. Actions are seen as the means to achieving a goal and form the axioms that surround that goal. Looking at the epistemology of the Austrian School of Economics we can dive deeper into three *priori* postulates focusing on *human action*, *action scarcity*, and *human fallibility*. The first axiom of *human action* states that each individual seeks to improve their situation from their viewpoint, while the second axiom (*action scarcity*) indicates the limited resources. The third axiom (*human fallibility*) focuses on the mistakes made during this process.

The above-mentioned three axioms will enhance the mission-oriented policy framework of building the “New Space” market. The first axiom focuses on the importance of human actions and the opportunistic behavior of the market actors. According to the Austrian School of Economics the drive of business founders is the great profits that they can have as a return. As markets are not objects and do not form suddenly, but rather they are shaped and created by human actions and their surroundings, they rely on the resources or better said on the scarcity of the desired resources. A key element in the Austrian school is the element of “alertness”. In the view of the Austrians the market is in constant equilibration state where human actions result in mistakes, and mistakes create opportunities. These opportunities can be the beginning of the shaping of a new market and that is where the focus on processual ontology comes into the framework of the thesis. The sharing of the mutual knowledge and the exchange of stories from the failures results in the early creation of an emerging market. A market can be described as intuitive (Collinson and Shaw, 2001, p. 764), but Carson & Carson (1993) characterize it as informal, creative, and opportunistic.

2.2 “Old Space” and “New Space”

“Old Space” can be defined as the time when a space activity was executed and designed only by the government, where the government shaped and directed the activity through its constituents and agencies. The activities from the government have risk-averse character and are publicly financed with the goal to generate sustaining innovations. On the contrary, the shift from the government monopoly to the inclusion of private actors the past years has created a commercial environment where private actors pursue non-governmental market goals, driven by market forces (cost, time pressure, and risk). This new commercial environment enhances entrepreneurial activity in the space industry, by risk-taking activities which are privately financed, with the end goal to disrupt the market with innovations from other industries (Vernile, 2018). There are multiple definitions of the “New Space” focusing on: i) its activities, ii) different ways of approaching solutions utilizing different ecosystems (Frischauf et al., 2018), iii) the finance and entrepreneurial aspect of the actors acting independently from space policies and funding, and iv) the technical perspective. One key topic in the “New Space” is cost reduction (Concini & Toth, 2019). This cost reduction opportunity has caught the eye of many private industry players where they realized that they can use the available space data for free, or little cost from existing satellites and combine them with tailored algorithms and machine learning for niche applications (Vernile, 2018). Furthermore, the decreasing launching, and satellite manufacturing costs have resulted in an exponential growth of companies focusing on tailoring the space data for niche market applications. This turning point from large scale satellites to smallsats constellations is one of the major drivers in the “New Space” evolution; smallsats are cheap and allow scalability. SpaceX, Boeing, and Amazon have announced mega-constellations which will reduce manufacturing costs and enable high performance space applications. SpaceX is going to launch 4225 satellites (Starlink), Amazon 3236 satellites (Kuiper), and Boeing 1396 (Wang, 2013).

Other activities signal the era of “New Space” as well. The privatization of research activities has emerged aboard the International Space Station with scientific experiments being conducted there such as ScienceBox (Spacetec, 2022) and the ICE Cubes Service (Space Snapshot, 2017). These have been added to Europe’s Columbus module and focus on an end-to-end service for commercial microgravity scientific projects. Furthermore, space tourism is another emerging market that appeared in the popular culture due to SpaceX’s reusable launchers, which launched both astronauts and civilians in space.

2.3 Governmental Policies in the “New Space”

In Europe there are both national and union related initiatives to create policies for the space industry and its growing presence in the private industry. In 2016 the European Commission has issued the “Space Strategy for Europe”, and the European Space Agency has released its Resolution “Towards Space 4.0 for a United Space in Europe” (European Commission, 2016, 2021). The main objectives of the governmental policies express their commitment to foster entrepreneurship, stimulate new business opportunities, and increase investments, to make the European space industry more competitive (van Burg, et al., 2017). The key to enhance the new space entrepreneurial ecosystem lies in the common understanding of the regulations and policies set by the government. The European Space Policy Institute has identified the gap of tangible

indicators for the common understanding and has evaluated private investments in European space start-ups (Clormann, 2021). They have investigated the new space entrepreneurship ecosystem which is described in the following section (Iacomino, 2018).

The space sector the past years has seen an increasing interest and entry of commercial actors driven by the private flow of capital and public funding. In Europe, European institutions such as the European Space Agency and the European Commission have noticed that there is an increasing interest from commercial actors and have created their agendas accordingly to foster that interest (ESA, 2016). The creation of the Space 4.0 era involves multiple actors, both private and public ones and intermediaries between them. The relationships and the framework of establishment of the “New Space” era have not been clear, though, and a common standardized and agreed understanding of the interplay of all the actors is lacking (Hansen & Wouters, 2012; Landoni & Ogilvie, 2019). In the USA the public and private partnerships have been successfully established through the years, but in Europe their establishment has not been met with great success (Orešković & Grgić, 2021).

In the field of space exploration there are key challenges that appear when Public-Private-Partnerships (PPPs) take place (Iacomino, 2018). The main challenge is to identify the boundaries of the frame of the relationship of these two actors and design in this frame a common path on how the desired scientific, technical, economic, political, regulatory, and legislative objectives are going to be achieved (Moranta & Donati, 2020). The capacity of public actors to successfully leverage commercial contributions for space exploration and take advantage of the associated benefits can only be the outcome of two engagements (Space Snapshot, 2017):

- 1) On the offer side. So far, the European public policies touched upon the support they can provide for business development by creating a network of technical expertise, financial advisors, VCs, banks, grants and zero equity funding.
- 2) On the demand side. What lacks here is that the an anchor customer to integrate commercial solutions from the private industry and enhance business sustainability and profitability.

2.4 “New Space” Ecosystem and Intermediaries

The government has enabled the emergence of space-based services the past years and has created technologies that can be leveraged to tackle current societal, economic and environmental challenges (Davidian, 2020; Dennis et al., 2020). The private actors have realized that the potential of these technologies is immense for the future and placed themselves in a more dominant role in the emerging “New Space” ecosystem where the focus is shifting towards a more business and service-oriented market. Financial markets see this strong potential and predict significant value for the space sector. The Bank of America Merrill Lynch estimates the value of the space sector to be around \$3 trillion in the next 20-30 years. The current trends that raise the interest of the financial market are summarized in Fig. 1 where the government has noticed the increasing trends and was committed to act by issuing their commitment to the “New Space” ecosystem (Peeters, 2018).

The space industry is growing exponentially and that is mainly due to the decreasing costs of electronics that are used to manufacture satellites and the public free access of generated data. The latter enable cloud-based platforms with a focus on management of operations and data (Adlen, 2011). The past decade, the UK, and especially Scotland, has appeared to be one of the global leaders in the “New Space” market with technology specialization on nano-sat platforms and data applications, with data generated from satellites (Macdonald, 2019). Furthermore, the UK was the first that commercialized the satellite TV broadcasting which increased interest in policy around that area (Willetts, 2013). The major issues seen with these policies, though, are the arm’s length relationships among the different players in the value chain and the lack of direct intervention (Vidmar, 2021; Vidmar et. al., 2021). The policymakers are solely playing a supporting role by providing funding opportunities to enhance the knowledge creation and take advantage of any possible technology spillovers (Salter and Martin, 2001). There is specific interest in innovation policy intermediaries in the high-tech sectors such as the space sector (Petroni & Santini, 2012) with the focus on creating scientific knowledge and possibly facilitate the technology transfer. The technology transfer is not the main part of these innovation policies and there is a lack there in understanding how the intermediaries can play the direct and main role in technology spillovers and not the supporting role (Vidmar, et al., 2021). The respective governmental organizations have introduced some initiatives such as the Business Incubation Centers (BICs) to assist new space business ventures, and also innovative mechanisms to enhance the idea generation. Furthermore, more PPPs materialize, and the collaboration is encouraged between non-space actors, investors, and other public and private entities. This has created an ecosystem of both public and private actors, and intermediaries that are heavily dependent on the current regulatory environment that they operate in (ESA, 2016).

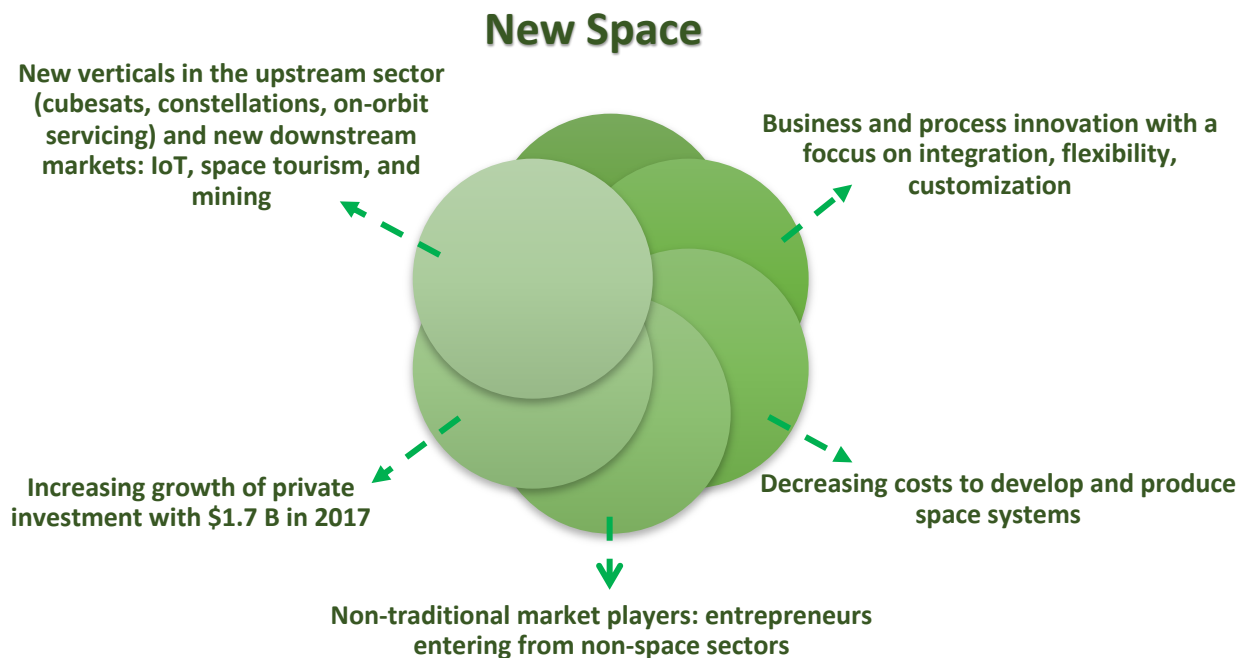


Figure 1. Key trends of the new space ecosystem

2.5 Public-Private-Partnerships (PPPs)

The space industry is a global industry and is international. One of the largest economies around the globe, India, is projecting a key commercial activity in its market. Murthi (2018) in his paper is focusing on the commercial prospects of the “New Space” market and mentions a policy framework for creating the commercial landscape of the market. This policy framework has been shaped by national strategic goals that create competition-driven markets. The word "strategic" as a word signals the importance that is placed in that activity. Hence, a signaling cascade starts in the market from private investments, where the alertness of the market actors drives the market competition.

The Earth Observation (EO) policies shape the market with the following two segments into consideration (Sweeting, 2018): a) the space infrastructure that needs specialized technologies and b) the services and products that are generated by downstream applications having as end-users the businesses and governments. The portfolio of policy models is important and according to Murthi (2018) there are three types of portfolio policy models:

- 1) Public Policy Dominance model: in the public policy dominance model the value of the EO policies is captured through the society and is seen solely as a governmental responsibility to create its infrastructure, invest in it, maintain it, and make it grow. Data access in this case is made publicly available, which opens up the commercial opportunity door to the industries
- 2) Free Market Policy model: in this policy, the competition-driven investments and open market access dominate. The government intervenes minimally to form any regulatory framework. Both private and public sector players compete in the same level field
- 3) Public and Private Linked Policy Model: in this model a number of products and services are open for the private sector players. If we take as an example high resolution data and low-resolution data or weather data, with the latter being less attractive to private investments, we can see that the less attractive field is being supported by the public sector, which creates the regulatory framework for data policies and creates public value, by providing these data for free of cost or at a subsidy. Public investments are necessary for technological developments, for the national maintenance of the country and continuity of service. The problem that arises here is the incentives from the governmental contracts, known as conflict of interest and what is the way to avoid them. There is need of a transparent and improved regulatory network. The transitioning of private sector role in India needs policy intervention and risk mitigation measures. One of these measures could be that the government as a safety net will buy back the data. Government policies and interventions play a role in signaling private sector participation.

If we take a closer look how public and private partnerships have evolved from the “Old Space” to the “New Space” we should investigate how the business contracts were shaped through the shift from the early space age to the commercial “New Space” age. There are eight differences that can be summarized in the Table 1. The major difference is that the owner in the “New Space” age is the private industry and not the governmental agency (Mazzucato & Robinson, 2018; Rottner & Ventresca, 2021). Furthermore, the contract type is not the cost-plus contract, but a contract with a fixed price where the private industry is responsible for delivering the request with minimal

intervention from the government. Both the governmental agency and the private actors share the costs. The engagement in strategic partnerships with private industry and space agencies enables the technological advancement, reduces the risk and the cost for the partners involved. Both Mazzucato (2016) and the Austrian School of Economics emphasize that markets are dynamic and result from public and private partnerships. The role of the public partner is to enable the technological advancement, whereas the role of the private one is to take part of the risk and cost, expecting the high ROI. The incentive of the entrepreneur according to the Austrian School is the outstanding financial returns that are rewarded, by being alert and taking risks (Kirzner, 1997).

The European Space Agency in the late 70s launched a series of initiatives to foster space commercialization with the private sector. For example, in 1980 Arianespace was the world's first private space launch operator and since then ESA engaged in multiple public and private partnerships to enhance space commercialization such as ARTES program, TerraSAR-X, RapidEye, and HYLAS project. In the space strategy for Europe in 2016 the EU commission mentioned two key areas for commercial space exploration: 1) the support of research, innovation, and development skills, and 2) fostering entrepreneurship and new business opportunities (European Commission, 2016; ESA, 2016). The support of research and innovation skills involves the stimulation of innovation from the private actors' side and their investments in the "New Space" age. As far as the fostering of entrepreneurship is concerned the focus is on supporting young entrepreneurs via business incubators, and the grant prizes from competitions. The promotion of PPPs, including the sharing of risks and rewards, was also part of the ESA (2016) council meeting, giving emphasis on pre-operational space activities with commercial potential. There are four areas that ESA is interested in its partnerships: a) user-driven Low Earth Orbit (LEO) infrastructure exploitation, b) Lunar and Mars exploration, c) joint research and development and d) inspiration. ESA supports innovation and development of private ventures through the following initiatives: ESA Business Incubator centers, Calls for Ideas, Grand challenges, SME instruments and the cooperation of investment banks, and VCs. The Call for Ideas is a mechanism to boost the private sector engagement and involvement, where ESA is a sponsor and business partner. The ESA provides both business development and technical support, co-funding of technology development and access to its facilities.

The EU released the EU space industrial policy with the most significant emphasis on research and innovation for both increased competitiveness and sustainable economic growth with the focus on SMEs (European Commission, 2016).

The new space business frame includes the following types of founders/businesses (Iacomino, 2018):

- 1) Visionaries (for example, asteroid mining)
- 2) Business Opportunity seekers such as Airbus Defence and Space (Bartolomeo) where they are interested in commercially exploitation
- 3) Autonomous exploration companies
- 4) Exploration support service providers

	Old Space Age	New Space Age
Owner	Governmental agency	Private industry
Contract type	Cost-plus	Fixed price
Customer	Governmental agency	Government & non-government
Contract management	Prime contractor	Public-Private Partnership
Funding	Governmental Agency procures capability	Governmental agency provides investments via milestone payments
Governmental role	Defines “what” and “how”	Governmental agency defines “what” and private industry defines “how”
Definition of requirements	Governmental agency defined detailed requirements	Governmental agency defines top-level capabilities required
Cost structure	Governmental agency is responsible for the total cost	Governmental agency and private industry share the total cost

Table 1. Overview of “Old Space” vs “New Space” in Public-Private Partnerships (Martin, 2017)

2.6 Literature Gaps in the Theoretical Framework

In the previous sections (2.2, 2.3, 2.4 & 2.5) the governmental policies and the involvement and relationship of the state with private players were described in the literature of the “New Space” market. The existing literature in the mission-oriented policy framework about niche markets, which are also names as “wicked”, is primarily led by Mariana Mazzucato (Mazzucato, 2016, 2018, 2021) and focuses on innovation policies through mission-oriented policies that transform the government from a market fixer to a market creator. Mazzucato focuses on “wicked” and non-specific markets. This thesis is going to contribute to the mission-oriented policy framework of market creation by focusing on the “New Space” market with the mission-oriented policy lens. The aim of the thesis is to enhance the mission-oriented framework with mission-oriented policies targeting the intermediaries with the end goal to bolster the “New Space” market. In order to accomplish that the right methodology needs to be chosen to construct a theory that adds meaning to the existing theoretical framework. Hence, the methodological fit is described in detail in the next section, section 3.

3. Methodology

This section will present the chosen methodology of the research study and is divided in five different sub-sections. The first sub-section is going to describe the appropriate methodological fit and the research approach. The second sub-section is going to present the research method. The third sub-section will describe and present the data collection method (the pilot interview, interview guide, participant sampling, data documentation), and the fourth sub-section the data analysis method. Finally, the fifth sub-section is going to address the quality, validity and transferability of the research study.

3.1 Methodological Fit

The aim of this study is to understand how mission-oriented policies can strengthen the intermediaries in the “New Space” economy and lay the foundation to create a sustainable business sector. The research on the field of market creation in the “New Space” industry utilizing the mission-oriented policy approach is limited, and existing studies frame the boundaries and definition of a mission-oriented and innovation policy framework in general, focusing on the procurement side and not intermediaries in the ecosystem (Edquist & Zabala-Iturriagagoitia, 2012; Mazzucato, 2016). In order to cast light in the research gap of mission-oriented policies for intermediaries in the “New Space” industry this study follows an inductive, qualitative, and explorative approach to enhance the existing literature and create a road map of value in the “New Space” market creation research (Bryman & Bell, 2011; Gephart, 2004). The appropriate methodological fit for this explorative study after careful consideration was chosen to be a qualitative study based on semi-structured interviews which were used to gather the empirical data. A quantitative study was rejected to be the most suitable methodological approach because of the following reasons:

- 1) According to Yin (2003) if a study touches upon a limited researched topic where there are not established patterns and themes for the research topic, then a qualitative study is best suited to explore the emerging themes and patterns, construct theory and bring new knowledge to the research topic (Wilson & Vlosky, 1997).
- 2) When conducting a qualitative study, the emerging theories and patterns that are used to construct the theory are the source of individual perspectives, and world views which assist in deciphering patterns and behaviors and evaluate the models and theories that are constructed (Flick, 2018).
- 3) A qualitative study is standard in the field of management and business creation since it focuses on the “why” and “how” questions that constitute the pillars of market success. Since the “New Space” market is an emerging market with limited information about its creation the focus should be on “why” and “how” questions. These questions are in the center of the qualitative approach (Yin 1994, 2009).

Qualitative studies, however, can include the risk of bias from the interviewees side and the risk that they did not understand the question and gave a biased answer, which is portrayed to favor them (Silverman, 2017). The empirical findings of this thesis have secured to a great extent to eliminate the above-mentioned risks by conducting pilot interviews, ensuring anonymity, and comparing the answers (Flick, 2018).

3.2 Research Approach

In this section the combination of existing theory and gathered empirical data is going to be discussed further. There are three main research approaches that can be used: deductive, inductive, and abductive.

The deductive approach uses existing theory as a starting point and uses the data gathered from the interviews guided by the existing theories to test and confirm the accuracy of the theory (Bryman & Bell, 2011). The inductive approach starts on the contrary with the empirical data and from there the theory is constructed (Neuman, 2003). Finally, the abductive approach combines the inductive and deductive approach by formulating a theory based on the research topic and then it tests the theory via the empirics and iterates if it sees fit. For this study the inductive approach is going to be used. The reason that the inductive approach was chosen was based on multiple literatures that suggests this type of research approach when there are no existing theories and theories need to be formed, based on the pattern and themes of the raw data observed (Goddard, et al., 2004). An inductive approach begins with a topic and the researcher develops empirical generalizations and relationships during the research progress (Thomas, 2006). It should be mentioned that there are no hypotheses formed initially and the researcher is uncertain of the findings and the nature of the research till the study is completed (Saunders, et al., 2012). The creation of the “New Space” market is a research area that is not well researched and there is limited theory about its creation. Hence, an inductive approach allows to formulate a “bottom-up” theory from raw textual data, by establishing links between the research objectives and the findings to construct a theory based on the experiences collected form the raw data as shown in Fig. 2 (Lodico, et al, 2010).



Figure 2. Inductive reasoning approach

3.3 Research Design

The space industry has its roots in governmental institutions and is predominantly driven by them till now. The governmental involvement is of great importance for the continuation and success of the space industry, so the focus of the industry for this study is on governmental policies that strengthen the creation of new businesses in the space sector. From the start of the study the main concern was to gather as diverse data as possible from many different sources in the “New Space” business ecosystem that could lead to significant findings. The evaluation of importance of the findings initially could not be determined concretely so an open-ended data gathering approach using inductive analysis was considered to be the best fit, where a constant comparison method (Anderson & Jack, 2015) enabled the identification of categorical themes and further explanatory accounts.

To enhance the data gathering approach multiple expert participants from diverse positions in the “New Space” offered a more concrete layer to achieve the diversity of data collection that was aimed for in this study. The diverse participants allowed the analysis of the data within each situation and across various situations with the goal to understand the similarities and differences between the participants and provide the literature with a theory based on the similar or different observations between the various participants (Yin, 2009). Furthermore, diverse participants offer strong and reliable data where the researcher can evaluate the value of the findings (Yin, 2003). Finally, when the patterns derive from different empirical evidence, they are more grounded and create a more convincing theory (Yin, 2009).

3.3.1 Selection of participants

The selection of participants in the “New Space” followed a purposeful sampling approach (Pratt, 2009; Palinkas et al., 2013) and took place in the richest learning environment (Bryman & Bell, 2011) as the purpose of the qualitative study is to achieve depth of understanding from participants who have deep knowledge and expertise. The companies selected for this study are split in two main groups as seen in Fig. 3: 1) start-up companies in early stage, and 2) governmental and financial entities. A table of the participants is seen in Table 2, in the sub-section 3.5.1. All the start-up companies belonged to the “New Space” and were well-suited for the research study of the “New Space” market creation since they are in early investment stages. The geographical focus is based in the German and the U.K. market, because they are the biggest markets for the “New Space” economy in Europe. The second group consists of governmental institutions such as the European Space Agency, the Swedish Space Corporation, and politicians from Germany. The split of the two groups was made since the space industry was and is still heavily dependent on governmental initiatives, policies and regulations.

3.4 Pilot Study

The refinement of the method of the study is necessary through pilot interviews to determine the suitability of the questions, and the study before the complete launch of the whole research study (Yin, 2010). Three pilot interviews were executed lasting 30-50 minutes with two CEOs of the “New Space” start-ups and one governmental representative to assess the relevance of the research questions for the qualitative study and the design of the semi-structured interview method. The confusion in some parts and the specific interest in others allowed to redesign for more focused questions and eliminate some other questions. Furthermore, the pilot interviews helped to get acquainted with the process and made the process of being an interviewer more comfortable with the upcoming interviewee sessions.

3.5 Data Collection

The main and only source of data collection in this study is the in-depth semi-structured interviews.

3.5.1 Interview sample

The interview sample consists of 18 in-depth interviews and three pilot interviews. The semi-structured interviews lasted from 30-60 minutes (Table 2). All the interviews were conducted via the help of the software platform tool, Zoom, taking into consideration the COVID-19 pandemic that the world is facing and the strict regulations that the companies are enforcing to limit physical meetings. The interviewees were ensured of full anonymity. The recordings were transcribed in a timely manner of no more than a week from when the interview took place with the help of Google docs that facilitated the transcription of the recording by the dictation function.

The in-depth interviews were conducted with 11 founders of start-ups that identify and belong to the “New Space” industry, and with seven governmental representatives, including one governmental representative from the German parliament (Bundestag), one from the Swedish Space Corporation, one from the U.S. Space Force, three participants from the European Space Agency (ESA) and one participant from the European Commission. An overview of the groups and the sampling size is depicted in Fig. 3.

The 18 in-depth interviews provided rich data touching on intermediaries and the role of policy framework to boost the creation of the “New Space” market and a repetition and saturation of data was observed after the first nine interviews, which suggested that the quality of the data was sufficient for a qualitative analysis (Brinkmann, 2013). Furthermore, the emphasis of qualitative methods is on data saturation when there is no new substantive information (Miles & Huberman, 1994). Finally, an excessive amount of data complicates their management and can prevent detailed analysis of the data (Brinkmann, 2013).

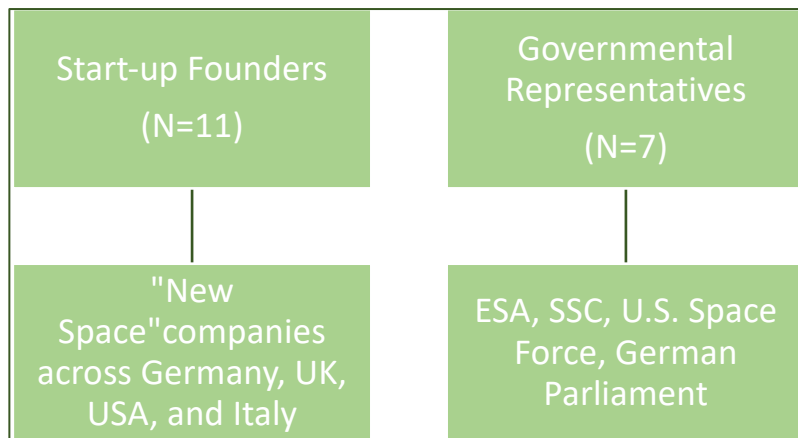


Figure 3. Overview of interview sample grouping

Participant	Position	Industry category	Location	Interview Type	Date (dd-mm-yyyy)	Duration (min)
Pilot Participant 1	Founder	Start-up in "New Space"	UK	Digital-Zoom meeting	01-02-2022	30
Pilot Participant 2	Founder	Start-up in "New Space"	Germany	Digital-Zoom meeting	07-02-2022	50
Pilot Participant 3	Ex-Politician	Swedish Parliament	Sweden	Digital-Zoom meeting	14-02-2022	35
Participant 1	Founder	Start-up in "New Space"	UK	Digital-Zoom meeting	21-02-2022	56.2
Participant 2	VP Business Development	Swedish Space Corporation	Sweden	Digital-Zoom meeting	22-02-2022	43.5
Participant 3	Project Manager	European Space Agency (ESA)	Europe	Digital-Zoom meeting	25-02-2022	35
Participant 4	Politician in the German Parliament	Bundestag-German Government	Germany	Digital-Zoom meeting	25-02-2022	30
Participant 5	Investment Director/Founder	Investor in "New Space"	UK	Digital-Zoom meeting	28-02-2022	30
Participant 6	Department Head	European Space Agency (ESA)	Europe	Digital-Zoom meeting	04-03-2022	30

Participant 7	Founder	Start-up in “New Space”	UK	Digital-Zoom meeting	06-03-2022	55.2
Participant 8	Founder	Start-up in “New Space”	Germany	Digital-Zoom meeting	07-03-2022	41.3
Participant 9	Department Head	European Space Agency (ESA)	Europe	Digital-Zoom meeting	09-03-2022	40
Participant 10	Founder	Start-up in “New Space”	Germany	Digital-Zoom meeting	16-03-2022	35
Participant 11	Director/Founder	U.S. Space Force	US	Digital-Zoom meeting	17-03-2022	45
Participant 12	Department Head	Start-up in “New Space”	UK	Digital-Zoom meeting	21-03-2022	40
Participant 13	Founder	Start-up in “New Space”	UK	Digital-Zoom meeting	22-03-2022	35
Participant 14	VP Business Development/Founder	Start-up in “New Space”	Italy	Digital-Zoom meeting	30-03-2022	40
Participant 15	Founder	Start-up in “New Space”	Germany	Digital-Zoom meeting	01-04-2022	45
Participant 16	Business Development	Start-up in “New Space”	UK	Digital-Zoom meeting	07-04-2022	50
Participant 17	Department Director	German Aerospace Center	Germany	Digital-Zoom meeting	26-04-2022	40
Participant 18	Commissioner	European Commission (EC)	Belgium	Digital-Zoom meeting	26-04-2022	40

Table 2. Interview participant sample

3.6 Data Analysis

After the transcription of the interviews, a thorough read of the answers of all the interviewees was conducted and the data was analyzed with an inductive approach (Gioia, et al., 2012). The initial analysis of the data led to the identification of a first set of concepts which were grouped into categories (Straus & Corbin, 1998). In this first stage of analysis, phrases and specific language from the participants was used which reflected to their comments (Gehman et al., 2018). The continuous process of reading and reflecting on all the answers that the participants provided enabled the comparison of the different views and enhanced the reflective process through the constant comparative approach (Anderson & Jack, 2015). During the data analysis process there

was a focus on intermediaries and the institutional policies on creating the “New Space” market. During the constant comparison of the answers and comments that the participants gave, and utilizing the pattern-matching method, in which theoretical and empirical patterns are compared (Yin, 2003), 21 categories were constructed. After the construction of the 21 categories, connections within and between these categories were searched and seven second (2nd) order themes emerged.

The focus during the whole process was to recognize the patterns between all the participants’ answers related to institutional policies and the role of the intermediaries on the creation of the “New Space” market. The last step of the data analysis process concluded in the creation of “aggregate dimensions” which formed the ground of the emerging theoretical framework on intermediaries, institutional policies, and the creation of the “New Space” market. There were seven (7) aggregate dimensions that were formed on: i) *innovation policies*, ii) *mission-oriented policies*, iii) *intermediaries*, iv) the “*New Space*” *entrepreneurship*, v) *the entrepreneurial discovery*, vi) *the obstacles in the “New Space” market*, vii) and the *Public-Private-Partnerships*. A summary of the research process is depicted in Fig. 4, while in Fig. 5 the data analysis process is shown, where the concepts, constructed themes and aggregate dimensions is presented in Table 3.

The conclusion and contribution to the theory is going to be drawn from the continuous matching of the raw data and the theoretical framework. The end goal and core objective of this study is to construct a theory and contribute to the mission-oriented policy framework. In order to have a guide regarding the theory construction it is useful to know what a theory is. According to Cornelissen, et al. (2021) a theory:

- I) **creates an understanding** based on the explanation and interpretation of the world views found in the raw data
- II) **frames a particular topic** as an act of conceptualization
- III) **helps us see the world differently or better** by connecting undiscovered dots that existed already, but were not brought to the surface

The data analysis focused on the three (3) above-mentioned dimensions of theory construction to secure a deep and thorough understanding of the participants’ world which enabled the contribution to the existing mission-oriented policy framework where the intermediaries’ role was so far overlooked.

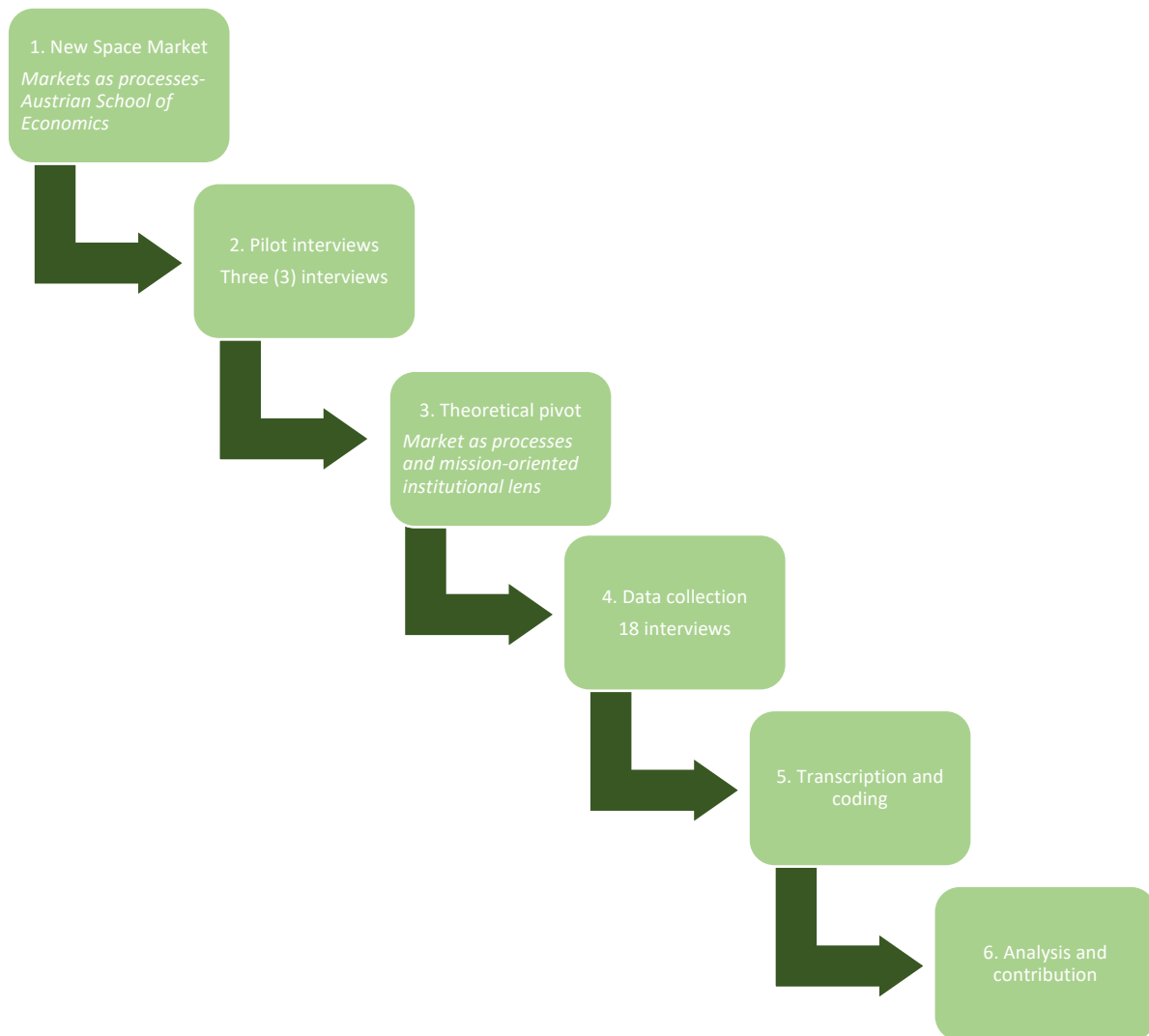


Figure 4. Summary of the research process



Figure 5. Process of data analysis for the research study

1 st Order concepts	2 nd Order Themes	Aggregate Dimensions
▪ The space industry is primarily driven by technology ▪ It is a niche and difficult industry relying on evolving governmental regulations and policies that have not caught up with the market yet ▪ Innovation is in the centre of the industry as it is a high technology environment and can be impeded by public procurement policies	Institutional policies are lagging behind in the new space market	Innovation policies
▪ It is very difficult to start a company in the new space market compared to a .com company ▪ There are a lot of barriers both physical, and financial to start a company in the space industry as technology is involved that needs to be sent up in space ▪ It requires high capital investment, long lead times and there is a high chance of failure	Physical and financial barriers to starting a company in the new space market	New Space entrepreneurship

1 st Order Concepts	2 nd Order Themes	Aggregate Dimensions
▪ The space industry includes many verticals and involves almost any business ▪ The space ecosystem includes research and technological organizations, especially universities, SMEs, start-ups, along the whole value chain on the ground and up ▪ Any business that wants to be innovative and do things better	The New Space business ecosystem	Innovation intermediaries
▪ The space sector is blossoming, and the past 10 years the space industry is growing at a very fast pace ▪ The start-ups got the opportunity to grow fast and become competitive, having support from governmental agencies such as the DLR, ESA, etc. ▪ Small- sat and the decreasing launching costs opened up the opportunity for new players in the space sector ▪ The technology does not have to be “flight proven” to start a start-up. That gives the opportunity to the private sector to enter the space sector without a finalized product	High number of opportunities in the “New Space” market	Entrepreneurial discovery
▪ Lack of established regulatory and legal framework ▪ Communication barriers due to lack of understanding and awareness of the space sector and classified information ▪ Political recognition and having the state as an anchor customer	Regulatory framework and stable customer absence	New Space entrepreneurship market barriers

1 st Order Concepts	2 nd Order Themes	Aggregate Dimensions
▪ Establishing an industrial baseline and incentivize growth in the space market while driving standardized policies for the commercial players ▪ Enabling networking, and offering initial financial support ▪ Establishing a long-term road map of space strategy that can be translated into specific technologies	Governmental role in the New Space market should focus on standardized, long-term strategy road map that gives the commercial market clear guidelines and incentives	Mission-oriented policies
▪ Private partner should take the risk and develop new technologies and have a clear business model that solves a major and burning issue ▪ Public sector should guide the path of regulations that incentivize the growth of the space market and fund the high technology innovation environment. Furthermore, they should secure that innovation is not hindered by incumbents in the market by creating a free and competitive market	Private players should take the risk and innovate high technologies and the public sector should fund and create a free and competitive market.	Public-Private-Partnerships

Table 3. The data analysis process from the 18 semi-structured interviews

3.7 Quality of Study

During the whole research process summarized in Fig. 4, the quality of each process was in the center and for each step of the research study the reliability, validity and transferability of the findings was ensured. In qualitative studies the quality assessment is not yet well established compared to the quantitative studies, and traditional criteria can miss the features of qualitative studies. The quality of the data for this research study is discussed through the common measurements of reliability, validity, and transferability (Flick, 2018).

3.7.1 Reliability

Reliability refers to the study's quality of measurements (Trochim & Donnelly, 2008). The pilot interviews were conducted to ensure the focus of the questions and improve the interviewer skills. The diverse participants' selection ensured the richness and variation of data sources with the goal to improve the validity of the findings. As a researcher when the point of data saturation is reached then a saturation of data is reached, which enhances the reliability of the findings (Merriam, 2009).

3.7.2 Validity

The inductive approach results in reliable and valid findings by providing a systematic set of procedures for analyzing qualitative data (Goddard, 2004); however, the general inductive approach might lack the strong analytical toolset for a theory or model development, but it equips the research with a direct analysis approach to construct a theory, based on focused evaluation questions, which originated from a qualitative study (Lodico, et al., 2010).

3.7.3 Transferability

Korstjens & Moser (2018) describe transferability as the extent to which the findings of the research study apply to other contexts with different participants. They argue that transferability is achieved through detailed description of the context and the behavior of the participants' experiences, so that they can be proven useful to outsiders. The inclusion of detailed description is ensured in the findings to guide the readers to evaluate to what extent the findings are useful to their respective context. Furthermore, transferability was achieved through the diverse participants' selection, where participants from different countries and organizations took part. This allows the transfer of the findings in all geographical markets (Merriam & Grenier, 2019).

4. Empirical Findings

The aim of the study is to understand how institutions can bolster the “New Space” market by utilizing mission-oriented policies targeting the intermediaries in the ecosystem. This section presents the empirical findings from the research study and is divided into five parts that offer a descriptive account on the role of intermediaries and policies in the “New Space” market. The first part (4.1) presents the characterization of the space industry and shows which variables are most pivotal in the space sector. The second part (4.2) discusses the boundaries of operation of the “New Space”, its ecosystem and how it is defined. The third part (4.3) presents the obstacles that the “New Space” market is facing. Finally, the fourth (4.4) and fifth part (4.5) examine the role of the government and the policy framework for the “New Space”.

The participants’ quotes are used to give a voice to their views and experiences.

4.1 The Key Characteristics of the Space Industry

The data show that all participants, both from the founder and governmental side perceived the space industry as exciting, and characterized it as a blue ocean, full of opportunities that can result in a very fast-growing sector. The main driver of the space industry is the R&D component (referred to as the upstream sector) as all participants mentioned that it is an industry that is heavily dependent on technology innovation, with the main driving fuel being the launching capabilities and their re-usability. The high-technology innovation environment acts as a catalyst to provide solutions that lead to the growing and exciting business opportunities found and taken advantage of, in the downstream sector. The participants referred to the trend of increasing integration of satellite data in ground technologies. This integration is powered by Artificial Intelligence (AI) platforms found in the daily business operations in almost every industry. The word “*opportunity*” was the main word that the participants were mentioning during their answers. The explanation behind it was that the technology innovation was enabling new and fast-growing business functions.

“Opportunity”, “Technology”, “Growing”
- All participants mentioned one of these three words

We could summarize the “New Space” industry in one line equation that is shown in Fig. 6.



Figure 6. The “New Space” market equation from the eyes of the participants

A deviation from the existing data in the findings regarding the key characteristics of the space industry came from participants 11 and 14, where the use of the word “conservative” was used. They motivated their choice of word on the following characteristics that the space sector is based on: “technologically driven”, “capital intense”, and “prone to failure with limited repair accessibility”. They continued further to explain the oxymoron of the space industry being one of the most innovative industries, but at the same time, being one of the most conservative ones. The explanation they gave was that the accessibility to space is limited and hard, given the high costs of launch and the difficulty of access to repair something that is defective. Hence, the hardware technology that is used in satellites and any other space technologies is not advanced and is much less powerful compared to the technologies we have on the ground.

“Conservative, because things in space must work as there is limited opportunity to fix something in space if it does not work. The computers that are in space are much less powerful than our mobile phones now”
- Participant 14

All participants directly or indirectly mentioned that the the space industry has close ties to the political agendas from the respective governments. The space sector is a sector that heavily relies on governmental support and directives. It has been mentioned in multiple occasions among the participants’ answers that the space agendas set by the respective political representatives can act as a trigger to signal the market and increase the growth of business opportunities. The participants mentioned that governmental support through grants, competitions or awards can ignite the excitement, by inspiring society with new technologies where the citizens can expand their creativity and imagination to break the technological status quo and create new areas of innovation and technology.

“Since the political standing of space activities experienced an outstanding rise in the last couple of years, it truly is no bold claim that the whole industry and the “New-Space” one in particular will grow in the upcoming years”
-Participant 9

“The space ecosystem enables the development of extremely innovative technology as we are witnessing the development of micro-launchers, reusable launchers, integration of AI in satellite data analysis or communication, quantic technologies; that inspired the society to thrive for more and better “
- Participant 17

Based on what has been mentioned above, the participants’ answers about the key characteristics of the space industry can be summarized under three common pillars, shown in Fig. 7: *high technology environment, politically driven, and inspirational for our society*. High technology is a key pillar of the space sector and the driving force of it as it enables the development of extremely innovative technologies such as the development of micro-launchers, and reusable launchers. Furthermore, space is of strategic importance in the European Union as participant 18 from the European Commission stated. The latest geopolitical conflicts have enhanced the strategical

importance of the space domain. As far as the inspirational component is concerned, the participants emphasized the united humankind in 1969, with the Apollo mission, where millions of people got inspired by it. Modern missions were mentioned by the participants as well and included the plans of key figures in the “New Space” market, such as Elon Musk and his plans for the first human civilization on Mars. Furthermore, some participants stated that the space domain has always and will always be a source of inspiration; there is tremendous evidence in the entertainment industry with a plethora of movies featuring space technologies and the accomplishments of astronauts.

“Space is of strategic importance for the European economy, security and defense and the EU has the tools to increase EU non dependence and resilience in the space domain”
- Participant 18

“Space has always been a source of inspiration to our society- from Apollo in 1969 where 600 million viewers globally watched the event live, to talking about Elon Musk now and his plans to expand human inhabitation on Mars”
- Participant 5 (similar comments made by other participants too)

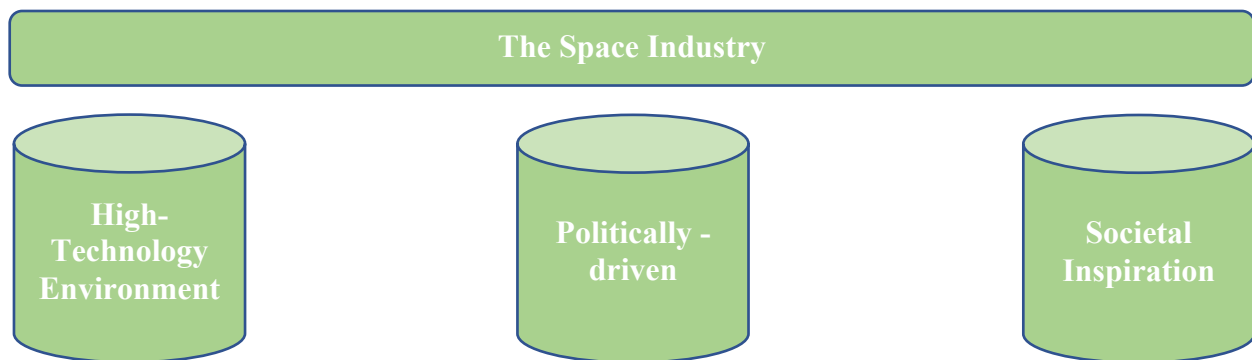


Figure 7. The three pillars the characterize the “New Space” market from the eyes of the participants

Following the characteristics that the participants linked to the space sector, several participants referred to the space sector as hidden, and not well understood by the public and investors. Participants from the UK, for example, expressed their disappointment regarding the recognition of the “New Space” market by the current political figures. They see most of the times surprised and confused private and public actors when they come across anything related to the space industry in various business verticals. Moreover, some participants expressed their worries about the general market ignorance and characterized the space industry as increasingly overheated by investors not knowing the market and creating, in the end, a bubble that will eventually burst.

“I think very few people actually understand we actually have a space industry in in the UK, a space sector therefore by definition I think it's niche and kind of unknown.”
-Participants 1 (similar comments made by other participants too)

“There's a danger of the space sector overheating in the eyes of the private equity investment community. I mean the go to example is obviously you know the .com boom and I think there are some emerging signs there that the space sector could be in danger- becoming too frothy”
- Participant 4 (similar comments made by other participants too)

4.2 “New Space” Definition Boundaries and the Ecosystem

4.2.1 “New Space” definition boundaries

All the participants referred to the growing commercialization trend of space technologies such as CubeSats, and small satellites as the defining framework of “New Space”. The “New Space” is mainly driven by decreasing costs of launching services (referred to as the upstream sector) and the vast availability of data generated by satellites (referred to as the downstream sector). The boundaries of the “New Space” market do not have a clear frame since the majority of the participants referred to the “New Space” sector as an “onion” with many layers in its value chain and many integrated verticals. The reason for that was that space technologies are used directly or indirectly in our everyday lives and in almost all businesses.

“I would say that any business is a space business since we are using space technologies either directly or indirectly in our everyday lives. I think of the space industry a bit like an onion- you can put these layers that come away from the main core business”
- Participant 1

“I do not like calling companies space companies as it crosses so many different verticals and is integrated in many different industries”
- Participant 4

Some participants had clear definitions of “New Space” linking it to the data generated from satellites and the ground equipment. The space sector for them includes mainly the core and heavy industry business of building and launching satellites (upstream sector); a sector described as “Old Space”.

“The space industry consists of a vast variety of companies and stakeholders of all sizes and different business models. “New Space” is the increasing business opportunity found in the data generated from the core “Old Space” business”
- Participant 6

“I'm old enough and old fashioned enough to think of the space industry as being about building satellites and launching satellites, so called the “heavy industry and Old Space””
- Participant 8

A few participants referred to “New Space” as the era of space commercialization, and the era of great and huge business opportunities. These main business opportunities are in the downstream sector which were enabled by the upstream one. The upstream sector is defined by the launching capabilities that were built from the “Old Space”. The more traditional and known business models have enabled a great number of new business models, powered by the data generation of satellites in areas such as forestry, agriculture, and finance. These new growing business models have been given a name by many participants, and that name is “New Space”.

“Everyone is talking about the space market being commercialized and it's growing very fast- it's just crazy- it is just the “New Space” era”

- Participant 5

“In the New Space we have come up with some categories such as upstream and downstream. Upstream normally is dealing with the satellite manufacturing and also launch service and then downstream applications are the ground stations, the use of satellite data which you could apply in agriculture, forestry, finance, for natural disasters monitoring, and so one, so the definition of “New Space” for me would be mainly driven by downstream applications that were made possible because of technological innovation of the upstream ones”

- Participant 15

Participant nine and one stated that the space sector is relevant to all businesses as there is no business activity that does not use any of the available space technologies directly or indirectly, because of the wide interconnectedness between the activities. The examples they brought up were based on the satellite value chain. There, every vertical is connected with each other, from the van that needs fuel for the delivery to the actual sky satellite dish manufacturing and installation.

“Then there's the entire value chain beyond the end of the satellite sector value chain e.g. data analytics companies that use Earth Observation (EO) data, but do not feedback revenue to the satellite value chain. In truth all of these are part of that space industry. But where do you draw the line? the Sky satellite dish - yes, that's part of the space industry. The dish installer? The dish installer's van? The fuel that goes in the dish installers van. All of which are a requirement to deliver a satellite service but not really part of the space industry”

- Participant 9

“I would say that any business is a space business, since we are using space technologies either directly or indirectly in our everyday lives”

- Participant 1

4.2.2 Ecosystem and the intermediaries

Ecosystem

All the founders mentioned the need to identify the players that are leading each part of the value chain in the “New Space” Ecosystem, and create an environment of awareness, opportunity, and mutual collaboration among them. The need of standardization in the industry is of great importance and has emerged as considerable pain point from all the founders of “New Space” start-ups. The standardization of infrastructure and operational processes is suggested by them as a business guide that they can consult for laying out their future operations. An operational framework will minimize the operation risk of the people involved in the value chain of the “New Space” market and will construct a concrete intermediary map where everyone in the value chain will be aware of it. This awareness of who is involved, at what level, and detail will increase the confidence of “New Space” business start-up founders. Unfortunately, the participants expressed their frustration on the lack of right methodology to construct such an intermediary network map.

“We recognized that we first require a foundation capable of supporting unknown business verticals to truly exploit space”

- Participant 11

“In a niche market such as “New Space” 80% of our focus is to first map out the relationships-to map out the market, to know all the stakeholders in the value chain. We are still trying... and nobody knows how to do it right and where to start and finish”

- Participant 10

Participant 13 stated the pivotal part that standardization brings in the ecosystem of different stakeholders in the value chain of any industry and emphasized the need of establishing such a standardization in the “New Space” market intermediaries, in order to create a scalable and commercially viable “New Space” business. The example that participant 13 made, which was shared directly or indirectly by the rest of the participants too, was the example of the daily applications we use in our mobile phones. We can communicate with each other and share our experiences through applications that were designed for a specific operating system, either iOS or Android. The value chain of such a standardized system is easy to construct and has allowed software engineers to engage confidently in market transactions and secure the success of their business. This standardization of the operating system was used as an example to promote the need of standardization in the business ecosystem for the “New Space” market, to increase confidence of business transactions.

*“A piece of software is useless unless you have a processor, the right sensors, the right people that will launch a satellite for you, etc. because we don't want to do everything by ourselves, and we cannot. A very important and interesting thing is again like there are **no clear leaders** in the processors people that are building them. There are **people in the ecosystem that need to be identified**. For example, if you look at your phone and its operating system such as iOS or Android. It is easy for someone to build apps that are deployed as we are using these two standard operating systems. I think it would be important to have **standardized operation of infrastructure** in the space industry as well, to scale”*
- Participant 13

Intermediaries

A few players were mentioned by the participants, but a full intermediary value chain map is still lacking. The lack of such a map was expressed by the participants as there is no clear mission to bring both the private and public players together and in consensus about the business operational framework. The players that were mentioned are the following: 1) the Business Incubator Centers (BICs) and the “Innovation Triangle Initiative- Call for Ideas” from ESA, 2) the CASSINI initiative for space-based entrepreneurship at an EU level, 3) various national and local initiatives from the European member states, such as the Space2Motion, and Space2Health initiatives from the German Aerospace Center (DLR) and the “France 2030” investment plan of € 1.5 bn dedicated to start-ups in “New Space”, and 4) “Innovate UK” from the United Kingdom (UK). In the UK there is a specific space cluster, the Harwell campus, focused on innovation and science. The UK’s innovation agency, through the Innovate UK-Knowledge Transfer Network (KTN) has created a space sector landscape map to connect the UK’s growing space community with different actors. These actors include industrial partners, research-based experts, investors, and grant providers. This is the first of its kind mapping initiative in Europe that is trying to bring awareness of all the intermediaries in the space sector. It is still under construction, and it requires further guidelines and work to be completed.

One important variable that needs to be considered for the space sector is that it is as the same time both global and national. It requires the effort, know-how involvement, and collaboration of multiple countries and/or local national regions with their respective stakeholders. The participants mentioned superficially the different segments of the value chain having as a yardstick the differentiation between upstream and downstream stakeholders. A representation of this value chain is depicted in Fig. 8.

“There are multiple initiatives in the ecosystem for support and networking: the European Space Agency and the national Space Agencies have multiple programs. Innovate UK, for instance in the UK, also offers consistent access to funding as well as open calls put out by the Defense and Security Accelerator. Furthermore, you have the downstream and upstream sectors with manufacturing, launch, the different services, and data generated.”
- Participant 15 (similar views expressed by all participants)

“I do not want to talk about the “New Space” business activity for only one country, as the space sector involves at the same time multiple countries and national regions”
- Participants 2 (similar views expressed by other participants too).

“At EU level, we are deploying a fully-fledged initiative called CASSINI to support space-based entrepreneurship across the board from idea generation to testing technology, entry into markets and finally yet importantly, access to growth finance”
- Participant 18

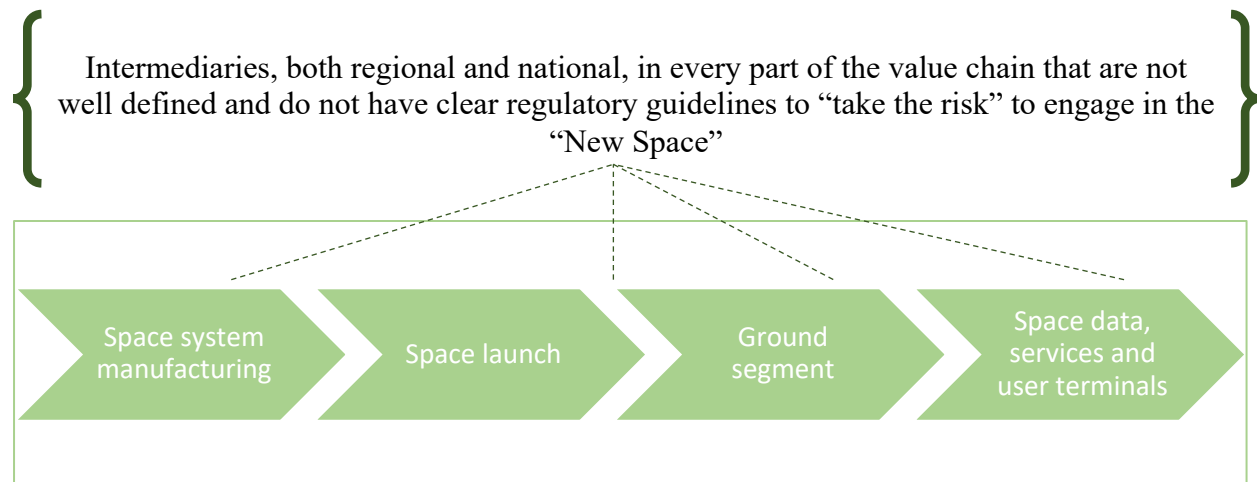


Figure 8. The value chain of the “New Space” market seen from the eyes of the participants

In Fig. 8, the value chain has been constructed based on the data gathered from the interviews.

4.3 The Obstacles of the “New Space” Market

The main obstacles in the “New Space” market are found in three main topics:

- i) regulatory framework
- ii) lack of recognition
- iii) market ignorance

i. Regulatory framework

The lack of established regulation and law governing new processes has been named as the main obstacle in the “New Space” market. The space sector is a capital intense sector that bears a very high risk and in urgent need of established space infrastructure. The lack of established regulatory and legal framework creates a non-business trustworthy environment where any transactions are seen with high skepticism. The importance of government agility and establishment of regulatory framework was seen as vital in the “New Space” market by the participants.

“Without a government open and willing to move quickly to take advantage of opportunities offered by niche industries the potential of innovative ideas is diminished and sometimes unachievable”

- Participant 6 (similar views expressed by other participants too).

“Space operations firstly are costly and there is a constant pressure to reduce the costs and in parallel we see this enormous increase in our dependency on space infrastructure.”

- Participant 7

ii. Lack of recognition

Both founders and governmental agencies mentioned the absence of recognition of the “New Space” start-ups by the government, and their unwillingness to act as an anchor customer for the “New Space” private players. The comparison between the US and EU was made where the EU comes with disadvantages of offering political recognition of the “New Space” players and unwillingness to engage in any customer relationship with them. The government behaves as a big obstacle in securing any commercial activity with new and small players in the “New Space” market as contracts favor incumbents and keep small players out with very demanding and unrealistic pre-qualification contract bidding conditions.

“The main obstacle especially for the European “New Space” companies is the political recognition. It’s difficult for them to compete against their American rivals, such as Space-X, that are funded adequately by state organizations like NASA. Without the state as a major client, that provides a solid financial base through its missions, it’s hard to offer inexpensive services for private clients”

- Participants 4 (similar views expressed by other participants too)

“We, as a newly founded start-up, are not being taken seriously to be commissioned a contract from a governmental agency- that is frustrating and disappointing as we are not treated equally with the incumbents, as it happens to be in the USA. The contract qualification conditions that they have here in Europe are unrealistic for small players”

- Participants 12, (similar views expressed by other participants too)

iii. Market ignorance

Further obstacles of not being taken seriously in the “New Space” market originate from the lack of understanding that leads to uninformed and indifferent intermediaries. These intermediaries come from both the financial and supply side. The education of the market is seen as a key variable in the “New Space” market equation and is seen by many as the fuel to increase business scalability, by increasing the business and market confidence that many intermediaries are requesting. A few participants said that they were struggling to find funding from private intermediaries since they were not aware of the market and its potential. On the contrary, the support from the governmental side through EU funding programs for highly innovative SMEs secured their survival and enabled them to grow with an above € 1.2 bn valuation. Furthermore, the need of education was apparent from some participants mentioning that market success is equivalent to mass adoption by the

consumers. In order to reach that level, the public and the right intermediaries need to be informed and get educated, especially in a market that is niche. Such a market relies on the correct translation of the technology and strives for the technology to be understood. An example that represented that well was the use of satellite imagery for agriculture, and trade; the past years there is an increasing trend of satellite imagery adoption in these industries and more stakeholders are becoming aware of the benefits in the business operations.

“I have seen a space-based start-up developing complete new in orbit technology struggling to be taken seriously by the financial intermediaries when they were seeking € 1-2 M to fine-tune their technology. After few years, this company is going to be listed on the stock exchange, valued by the market more than € 1.2 bn. They managed to get those few millions from the Horizon SME Instrument (an EU funding program for highly innovative SMEs) and worked hard not to miss a deadline to deliver their solution to the market”

- Participants 5

“Once you get to the level of massive adoption of a product is when you make that product very easy to understand like satellite imagery and translate it to insights that people can understand- then that is a game changer on massive adoption. You must teach the people of the benefits and it depends on how quickly it can be understood.”

– Participant 8

4.4 Governmental Role in “New Space”

All the participants mentioned that the role of the government is dual:

- i) incentivize growth in the market by creating a regulatory and legal framework by driving policy and guidance through its intermediaries. That will allow and encourage organic growth
- ii) to help establish an industrial baseline, by funding the R&D process, and stimulating the market with inspiration based on technology innovation

i. Regulatory and legal framework

Many participants emphasized the need for the government to set the rules and guidelines of the “New Space” business field. The establishment of a regulatory framework allows clarity and confidence, by providing an industry template that the different actors in the value chain can communicate and have a common understanding. This will lead to a collaborative work foundation. The existence of such a framework allows the private players to grow naturally and increases free and fair competition in a market that is dynamic and constantly changing based on the actions of its players. The participants that were founders of a start-up in the “New Space” market expressed the need to have clear legal and regulatory guidelines that allow the companies to communicate with each stakeholder in the value chain, by knowing already the liability and responsibility of each player in the market. This will allow them to negotiate and make transactions with confidence.

“The main role of the government for us is to provide a safe environment on the legal side for the companies like us and incentivize this environment to grow. There are so many aspects to be regulated which can give confidence to the private customers having a national space law or even international regulations, allocating the liability and/or responsibility, will guide also the insurance players”

- Participant 16

Participants from the UK mentioned that the government made the right decision to establish a space strategy with a long-term vision, in which the industry template and the key message was conveyed to the market: the space industry is strategically important. The information conveyed from the government created a confidence in the market and made known to everyone that the “New Space” is worth the investments and the attention. Participants from Germany stated that the need of a free and fair market which adapts quickly to market preferences is of vital importance in the “New Space” market, to allow it to grow and succeed.

“I think one of the things they have got right in the UK is that they were bold enough to put a UK space strategy going out to 2030 and that set down this long-term vision. I thought that was incredibly bold for a government that typically works on incredible short term time frames of how they get re-elected; to come out with a statement of this is how we see the space landscape, was incredibly useful because that thing gave industry a template to work towards and it also gave a framework by which we could then have sensible conversations with the investment community”

- Participants 1 (similar views expressed by other participants too)

“The public stakeholders should create a framework that enables the companies. By setting up a free and fair market, private shareholders can grow naturally. They as well may adapt quickly to preference changes on the market and provide creative solutions for the respective demands – both private and public”

- Participants 4

ii. Market stimulation by R&D funding

All the participants mentioned that the space industry is heavily dependent on R&D expenditure where the government should be the one focusing mainly on funding that domain to trigger inspiration and development of new innovative technologies. Some governmental participants operating in Germany stated that there are already many private entities that get co-funding from the public side. That should be the main role of the government. Furthermore, along with the funding support the start-up founder participants emphasized the need for the government not only to fund the new technologies, but also to play a more active role, by being the number one customer. Many participants expressed their frustration when it comes to closing the government as a potential customer, because they have unrealistic contract conditions for the new players.

The technologies developed in the space industry can be used by the government to show confidence in the market about the technology and allow the new player to establish a name and customer base of their own. If that is achieved from the governmental side, the participants strongly believe that there will be a sustainable future growth where the funding of the technologies is going to act as a signaling cascade of societal inspiration and new creation of markets. The inspiration to society is a fundamental element that the government should aim for, looking back to the Apollo mission in 1969, that was mentioned by the participants.

“Two things that the government should do: Financial support to develop the technology and be an anchor customer”

- Participant 5

“One of the roles of the government is to spend on R&D to bring the technology close to the market and be customer number one to provide commercial traction. Another role is to create the regulatory framework, of course.”

- Participant 8

“While looking at the European and the German market especially you see that it heavily depends on private corporations and initiatives that get co-funded by public sides, and that should be the main role of the government: fund the technologies. Of course, creating inspiration is fundamental to develop technological innovations.”

- Participant 4

4.5 The Policy Framework in the “New Space”

The policy frameworks in the “New Space” are mainly targeted to boost network and R&D development, but clearly lack a regulatory component of operations and market creation. Since there are no clear regulations about the “New Space” market, intermediaries in the value chain are unsure about the space infrastructure and what impact governmental regulations in the future will have on their business model and operations.

Governmental agencies such as the European Space Agency (ESA) act as policy advisor intermediaries for national governments and the European Commission. These intermediaries assist by informing the national and local governments of the current market trends and propose specific policy elements that should be adopted to increase market competitiveness. However, the final implementation and adoption decision lies on the national/local government side and the intermediary involved has limited power. This can be troublesome for a dynamic market, where the role of intermediaries in the “New Space” policy and regulatory framework has not found its place yet. The different governmental intermediaries emphasized that they play an advisory role, but they had no control over the legal and regulatory framework that impacts the businesses that they support with technology and network expertise.

“We, at ESA, advise them on policies and regulations on how to mitigate the creation of space debris, but we also have now a program for technology development- it's called “space safety program”- where we are actually now proposing to our member states the so-called competitiveness element as we see there is a market out there which is niche as you said, but the market has a problem going from prototypes demonstrations to bring them to market and conquering the market.”

- Participant 6

“The European Commission has not set clear regulations or directives on the space traffic management- we are considering that operators should provide proof that they are using a space surveillance system, for possible space debris collision and future accidents. Nothing is clear so we are not in a position today to define how the market will look like. It's a very essential market depending on governmental decisions, on regulations, and policies. We as an agency can only provide, and support technology- I can give you the technology, I can help you develop it, and I can be a customer for my operators, but we are extremely limited on the legal and regulatory part in the national requirements.”

- Participant 9

The “New Space” market is highly dependent on the policies that the respective national governments have. The right policies have not been established yet and any kind of regulatory and legal framework that exists is outdated and does not reflect the current market trends and needs for newly founded businesses. There is a need for the right policies to allow the market to be inspired and guide it to the development of new innovative technologies. Technological innovation is paramount in the space sector to stay competitive and bring value to our society through cutting edge technologies. Participants from Germany stated that the European Commission has established some guidelines in 2021 that aim to strengthen ESA politically and financially, with the focus of sustainability in the “New Space” market. However, these guidelines are vague and do not aim for action, but rather have a surveillant role.

“Hmm... I cannot say that we have any concrete policies for the new space era. The policy and legal frameworks are outdated and out of the current market reality. The development depends on the right policymaking and the development of a couple of cutting-edge innovations”

- Participant 3

“The current policies that exist in Europe were set by the European Commission in 2021, but do not define concrete actions. There are national space programs in European countries, such as in Germany with the aim to strengthen ESA politically and financially and focus on a sustainable use of space. They want to support the German space industry (especially SMEs) and identify ways to avoid and clean space-debris”

- Participants 4

The space sector is associated with the national defense of a country and is seen as key to our society to maintain peace and prevent war. The problem, however, is that the public agencies, including the national ministries of defense, are not familiar with working with start-ups and are too risk averse to consider working with them. Participants mentioned that policy intermediation does not exist to facilitate the process of working with a start-up in the “New Space” market and that hinders the progression of the “New Space” market growth and creation.

Participants expressed the desire of policies that boost the creation of the “New Space” market through governmental departments such as the Ministry of Defense (MoD). The current geopolitical conflicts in the world require increased attention from the governments via technological and digital enhancement of our societies against the threats of non-democratic nations. In order to achieve that, the right policies need to be designed and implemented to bolster business activity in the “New Space” market and allow technological innovation to be commercialized from new and small players that are willing to take the risk and are not afraid of failure.

“The public such as the Ministry of Defense (MoD) doesn't know how to engage well with startups - they do not know how to work with start-ups as there are no intermediaries to facilitate the process. The contract bidding then goes to the known established players.. it would be great if policies would allow for new players and benefit from the defense sector that is growing based on the current war situation in Ukraine.”

- Participant 5

5. Discussion

This section will analyze the empirical data through the theoretical framework and will be divided in three parts. The first part will touch the role of the government in the “New Space” market. The second part will discuss innovation intermediaries. The third part will combine the discussions of the previous two parts looking on how to create the “New Space” market with a focus on a mission-oriented policy framework from the government that strengthens the role of the intermediaries.

5.1 Governmental Role in “New Space”

The space sector as mentioned throughout this thesis is dependent on the government and is a capital intense sector where technology plays a very important role. The state is perceived to be the only institution that has the resources to shape the market and give economic guidance to address challenging societal issues. The goal is to achieve desirable outcomes that bring value to the public (Mazzucato, 2016). The means to achieve these outcomes rely heavily on innovation and industrial strategies that are used to define missions in various sectors, including the “New Space” one, and stimulate the production, distribution, and consumption (Mazzucato, 2018). The participants stated that the government should be acting as an anchor customer and increase the confidence in the market. Furthermore, it was mentioned that the distribution processes in some parts of the value chain are biased towards new market entrants and do not allow them to compete due to increased risk and favoritism to the traditional cost/benefit analysis.

The agile and dynamic government- regulatory and legal framework

The standard market failure economic framework used by the government may be useful in a steady market where the policies can be used to fix issues that appear, but in a dynamic environment when new markets emerge and are shaped, such as the “New Space” one it has major shortcomings and acts as an obstacle in the market creation (Wolf, 1998). All the start-up founders also mentioned that as an obstacle. Reflecting on what the empirical findings showed us and what the literature is stating, we can agree that the government needs to be agile in order to welcome new market entrants in the “New Space” market and embrace the dynamic character of the start-up environment. The markets, in real life, are dynamic and imperfect in which different actors play a role and seek for market opportunities constantly. In mission-oriented policies the missions require the consensus from the society where the government sets the directions (top-down) and the society engages in experimentation of various processes (bottom-up) which act as a feedback loop in the system (Miedzinski, et al., 2019). Many participants have expressed the need from the government to create a regulatory playbook in the “New Space” with dynamic policies and interactive guidance from both private and public stakeholders. The means to inspire both sectors is the technological innovation that is driven by establishing an industrial baseline. The main task from the government in this case is to fund the R&D process and stimulate the inspiration in the market that will transform it, and open the door for a progressive signaling in the “New Space” market. Moreover, many participants have mentioned that they see the government and its agencies as a network enabler where both top-down and bottom-up intermediaries will be able to discuss and act together in an agile manner. The government should also ensure that there is coherence

and consensus of the policies between various governmental agencies, organizations, and independent bodies, at different levels. Stakeholder alignment is key and can be achieved by letting the relevant stakeholders participate in the design of the policies, regulations, and laws. Their active participation offers more confidence in the market and ensures the respective commitment to fulfill the mission. A participant from ESA mentioned that they do not have any say about the legal regulations and policies, and act only as advisors to the national governments and to the European Commission. According to the mission-oriented policy framework they should be involved more actively in designing the policies and framing the regulatory environment.

The role of the government is to provide incentives as it has been discussed by the participants. The start-up founders stated clearly in the interviews that they want to see the government increasing the confidence in the “New Space” market by providing an incentivized environment with a legal and regulatory foundation where the different stakeholders are aware of the responsibilities and the liabilities of each other. This was a point that got mentioned by all the start-up founders in the interviews; they were expressing their disappointment when they attempt to engage with different actors in the “New Space” value chain and they are faced with skepticism, because of the non-existent legal and regulatory situation. This regulatory skepticism is not only concerned in their national market, but mostly in the international market because of the strong international character of the space sector. The participants were questioning the “New Space” business operations in a market that is closely tied to national and international laws and regulations in which people are faced with the following two questions: “Who is liable if something goes wrong?” and “Who bears the high costs if things go wrong?”

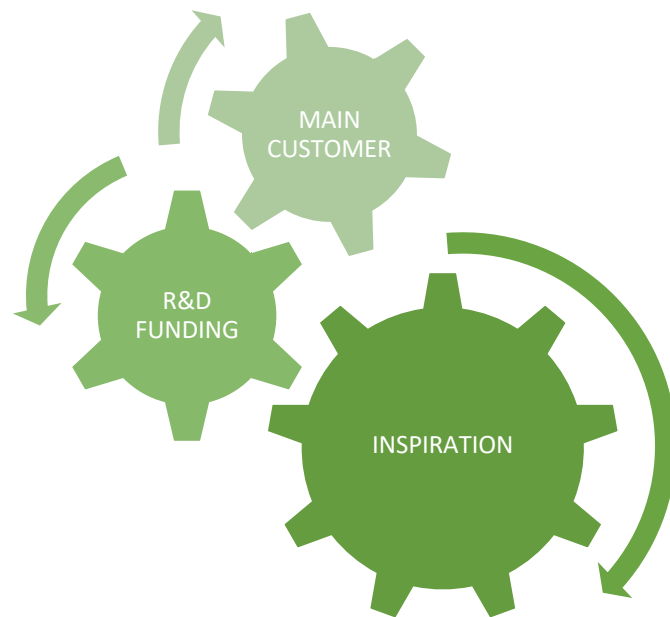
Market Incentivization

According to Mazzucato, innovation policies set from the government need 1) to incentivize the market actors to engage in the mission objectives, and 2) enhance the collaboration between the government and private actors. The focus is on cross-national and international collaboration in specific missions. The directionality of the mission set by the government is fundamental and can be achieved by clarifying the specific objectives and targets of the mission for the long term and in a specific timeframe. The participants based in the UK agreed upon one specific characteristic for the UK government: being bold. They explained why this attribute for a government was pivotal for the success of the “New Space” market and this explanation can be found in what Mazzucato refers to as directionality. The UK government established their space strategy agenda till 2030 and they have set the frame for the long-term. The normal time frame that a government is given is that of the new election date, which is a short time frame. The UK government gave the “New Space” industry a template with its space strategy and its long-term vision that allowed the start-up founders to engage in meaningful conversations with the investment community and the private sector. It is that confidence signaling in the market that the government believes in the “New Space” sector and will do what it takes to incentivize the market and create the market opportunities.

The mission-oriented policy lens for market creation transforms the government from a market fixer into a market creator and enables it to move away from the neoclassical cost/benefit analysis when evaluating new policies (Mazzucato, 2015). The “New Space” market is a transformative one and is powered by new technological innovation that is seen as too risky by the private sector. This market requires a public policy environment with directionality, right transformation indicators for evaluation and the right incentives to mitigate risk and allow the market to grow. The UK government realized that and started implementing directionality in their policies. Other participants mentioned that they would like to see some directionality in the member states in the European Union.

The European Commission has come up with idea generation and technology test initiatives such as the “CASSINI”, and “Call for Ideas” from ESA that inspire new technological innovations. Nevertheless, what has been observed from the findings between the participants in the UK and the EU member states is that the market conditions in the EU may act as an obstacle for newly founded business ventures compared to the UK. For example, initiatives such as the “Harwell launchpad” competition in the UK incentivized the potential founders with the prize of being given a considerable amount of money without having the product ready or a concrete business plan, but only securing money after having won the competition by private equity. They just aimed to inspire new technological innovations and set the direction by signaling to the market that the UK government finds the winner worth of funding. Last but not least, many participants mentioned the lack of having the government as a customer due to unrealistic contract conditions that they demand with new market entrants. If the government is an anchor customer for the “New Space” businesses, this will create an increasing market confidence and allow them to grow organically.

In Fig. 9 the role of the government in the “New Space” market is depicted.



MARKET INCENTIVIZATION BY CREATING A REGULATORY AND LEGAL FRAMEWORK
INTERMEDIARY POLICY GUIDANCE

Figure 9. The role of the government in the “New Space” market.

5.2 Intermediaries in the “New Space” and Innovation Policies

5.2.1 Intermediaries

The market in the mission-oriented policy framework is viewed as the result over time of the different actions of the public and private actors, as well the existing firms. The participants emphasized that the “New Space” market is an unmapped territory that needs to be explored further, to map the relationships of the intermediaries in the value chain. Both the upstream and downstream relations need to be understood and used as a target for directed policy innovation. The economic actions of each stakeholder are significant from the participants’ view in the “New Space” market and can be used to decipher the social and political implications. The “New Space” should be seen as the result of interconnected actions of diverse stakeholders and their societal impact. The focus on the human actions of each stakeholder in the “New Space” market can have a domino effect and enhance the social aspect of economic behavior where each individual wants to achieve their entrepreneurial goal using bold and imaginative processes, in a dynamic and changing market that requires actors to be alert for opportunities (Kirzner, 1997).

When asked about words that can characterize the space industry and its progression, all the participants identified the “New Space” unanimously with two words: “opportunity” and “fast growing”. In a market where there are exponentially growing opportunities the mission-oriented policy approach goes hand in hand with that, by emphasizing one of the most important processes in market creation: the market equilibration. The market equilibration is tilted towards specific goals, called missions. The way to achieve that is to create the right market means and opportunities for the “mission” to be fulfilled. These means take various shapes such as cutting-edge technologies, financial centers, firm support, regulations, tax incentives, and interdependent market collaborations (Miedzinski, et al., 2019). It was evident from the start-up founders that there is a need of standardized space infrastructure among the intermediaries and what is the defined role and purpose of each one of them. Looking from above on how this can be reflected upon, we should observe how mission-oriented policies have the main goal to transform systems throughout the entire value chain. For example, the Apollo mission to the moon: both high- and low- tech sectors were involved, together with top-down and bottom-up actors. The top-down actors set the vision, but the bottom-up actors stimulate and ensure the growth and success of the mission by experimentation processes involving different types of intermediary partnerships. These missions require consensus from both parties to be fulfilled with the use of transformative policies in the feedback loop system mentioned in the sub-section 5.1. For example, in Germany the “Energiewende” policy led to decrease in materials and increase in recycling in the steel industry (Hekkert et al., 2020). This policy got pushed from bottom-up movements which got understood by top-down actors. The “New Space” market is a market that involves many stakeholders: technological, political, social, and organizational ones.

The participants from the UK mentioned the Knowledge Transfer Network (KTN) that maps the different actors: industrial, research, and financial ones. Analyzing what they mentioned through the mission-oriented policy lens it is evident that for a market to be created the biggest challenge is to find the right variables and indicators that can be used to create the map of intermediaries that will allow the market to grow (UK Government, 2017). There needs to be more research done on that specific topic as it appeared in all the start-up founders' and venture capitalists' answers.

In section 4, Fig. 8 showed the value chain of the "New Space" market. Looking at that figure we can reflect on how this representation of the different stakeholders can be used to decide the right variables and indicators based on the mission-oriented policy framework and what Miedzinski, et al. (2019) stated as interdependent market collaborators. This representation is depicted in Fig. 10. There are three variables that can be used as a guide for creating the right ecosystem and constructing an intermediary map: i) the location of the "New Space" intermediaries, ii) the in-between intermediary relationships in the upstream and downstream sector, and iii) the bottom-up and town down players that can bolster the intermediary relationships. All three of these variables have a common constant: the one of directed policy innovation.

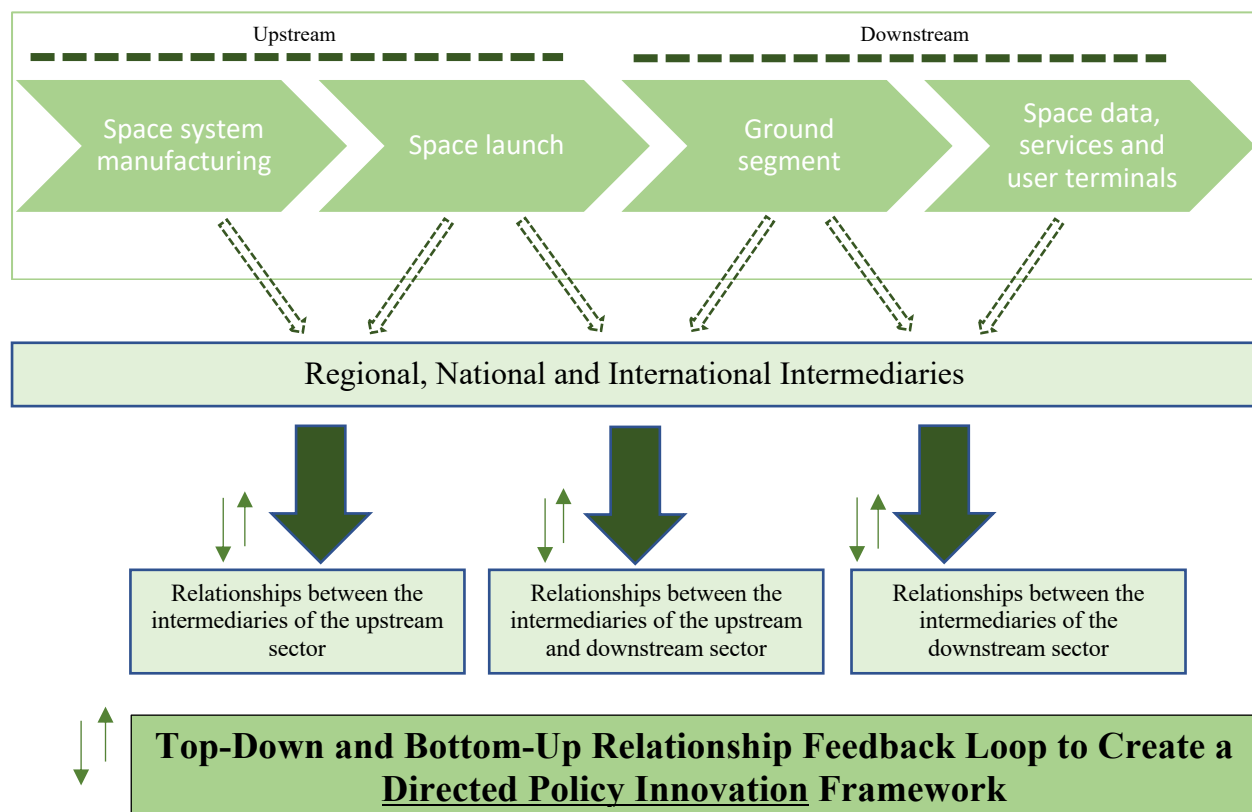


Figure 10. A representation of the variables to construct the intermediary map network

5.2.2 Innovation policies

Procurement and demand policies have been detrimental to the creation of new markets and technological diffusion (Dubois & Araujo, 2007; Georghiou, et al., 2008). It is of great importance that the policies should engage the public and attract investments from different sectors by being broad. The “New Space” is going to transform many industries and change their daily operations and business models. As said from some of the participants “Space is the new digital”. The “New Space” is going to disrupt almost all industries directly or indirectly and there is an emerging necessity of introduction of new innovation policies. These policies should be broad to attract cross-sectional investments and engage the public. The key words that these policies should aim for are: “stimulation” and “inspiration”. Missions are used to stimulate and inspire a wide variety of solutions to fulfill the objective (Edquist, 2019). Transformation policies can act as the “liberator” of the tight boundaries that incumbent firms have established to impede competition and free the market to allow fair competition (Shot & Steinmueller, 2018). The start-up participants mentioned that as one of the most important variables in the success and growth of the “New Space” market.

The components of the innovation policies and portfolios

The participants expressed their frustration that the existing policies are outdated and are not equipped for the agility and growth of a high technological sector, such as the “New Space” one. The key points of policy portfolios and instruments that are discussed by Mazzucato when it comes to building innovation and mission-oriented policies are the following: *selection*, *design* and *implementation*. The policy instruments that need to be selected, designed and implemented need to have as a pre-requisite that they will create the right environment that is necessary to complete the mission at hand (Robinson & Mazzucato, 2019). These instruments can include the direct financing of technologies as it was highly desired and mentioned by the participants to create the technological environment that is used as a means to complete a mission. The construction of policy portfolios needs to include the interdependent policy instruments in a way that there is a feedback loop of bottom-up experimentation and top-down inspiration, seen in Fig. 11.

There are various policy instruments that can be reflected based on the answers from the participants. A few of the policy instruments include the direct and indirect financial support. In the direct financial support, the public funding is included in the shape of grants, equity finance, university fellowships and postgraduate scholarships, while indirect ones are the corporate tax relief for technological innovation, and the households that use these innovative technologies. That is deeply reflected on the participants answers when they mentioned that there is an immediate need of policies that incentivize the growth of the “New Space” market on the consumption side. Furthermore, mission-oriented policies are fundamental in building the intermediary network that was mentioned in the sub-section 5.2.1. The right business incubation and technology transfer centers focusing on missions need to be established along with regional, national, and international network and collaboration clusters. It was mentioned by all the participants that the space sector involves both local and international intermediaries and there is a need for the establishment of such clusters and centers in the “New Space” market to allow it to grow. Finally, the “New Space” market needs a policy portfolio that transforms the regulatory and governance framework.

The creation of public bodies with specific missions and incentives for the work force need to be formed. Their role would be to increase the public awareness of the missions at hand (Bengtsson & Edquist, 2022). The latter is fundamental to allow the “New Space” market to be successful and grow. All the start-up founders expressed the pain that they need to educate their customers and convince them about the huge potential that their products and solutions offer. There is a need of policies that focus on technology public education and how these new technological innovations can be integrated in the public’s daily lives and for what reason.

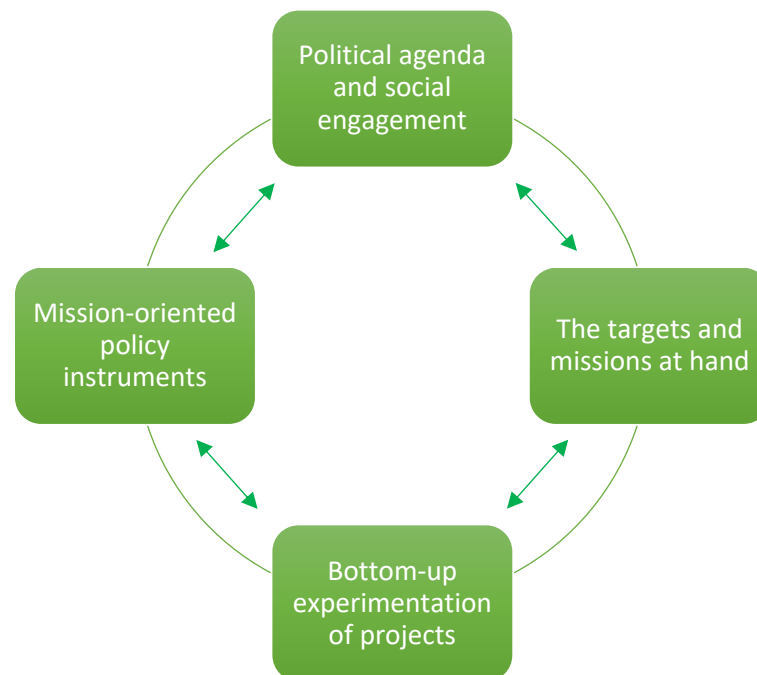


Figure 11. The construction of mission-oriented policy portfolios

5.3 The Role of the Public and Private Actors

The “New Space” market is a unique market that involves both public and private actors and requires the right regulatory environment to grow. In the two sub-sections above (5.2.1 and 5.2.2) the interdependent nature of these two actors was presented and analyzed using the mission-oriented policy framework. The “New Space” market needs these actors to take their role actively and initiate transformation, with the goal to create the “New Space” market.

The public actor (the government) should set clear standards in the “New Space” industry and utilize innovation policies to construct the “New Space” infrastructure for procurement and operational standards. Furthermore, they should incentivize the growth of the market by increasing public awareness and offering tax reliefs to both private consumers and corporations that embrace cutting edge technologies without letting the incumbents in the market interfere and hinder competition. Scott and Steinmueller (2018) mention that transformative innovation policies should allow experimentation and should not adhere to the boundaries set by the incumbents. A few of the participants mentioned that the incumbents are blocking the bidding process for new contracts

as the governmental agencies have set the bidding process requirements according to the incumbents' boundaries and not allowing any room for experimentation from new market entrants that are bold enough to experiment. The government should construct mission-oriented policy portfolios, presented in Fig. 11, to inspire new technologies and break its risk-averse nature by embracing the dynamics of the market and its different actors.

The market is interconnected through various intermediaries that can act as catalysts for innovation and growth of the "New Space" market. The creation of mission-oriented public entities that select, design and implement policies is fundamental in an emerging market, such as the "New Space" one, where the risk is high due to the capital intense and high-tech nature of it. The use of a mission-oriented policy roadmap for the "New Space" market is an important variable in its success and future growth. The policy roadmap needs to have a long-term timeframe, clear directionality, coherence and consistency of policy portfolios, along with both public and private actor alignment (Miedinzski et al., 2018). The private actors should embrace the high technology environment and use the direct and indirect financial opportunities to innovate and to not remain stagnant. Most of the participants mentioned that incumbent firms are too risk averse to embrace innovation in their technologies and instead of using innovation to compete they create obstacles in the "New Space" market entrants. The key message heard by the participants was the need of the private actors to be willing to take risk and get inspired.

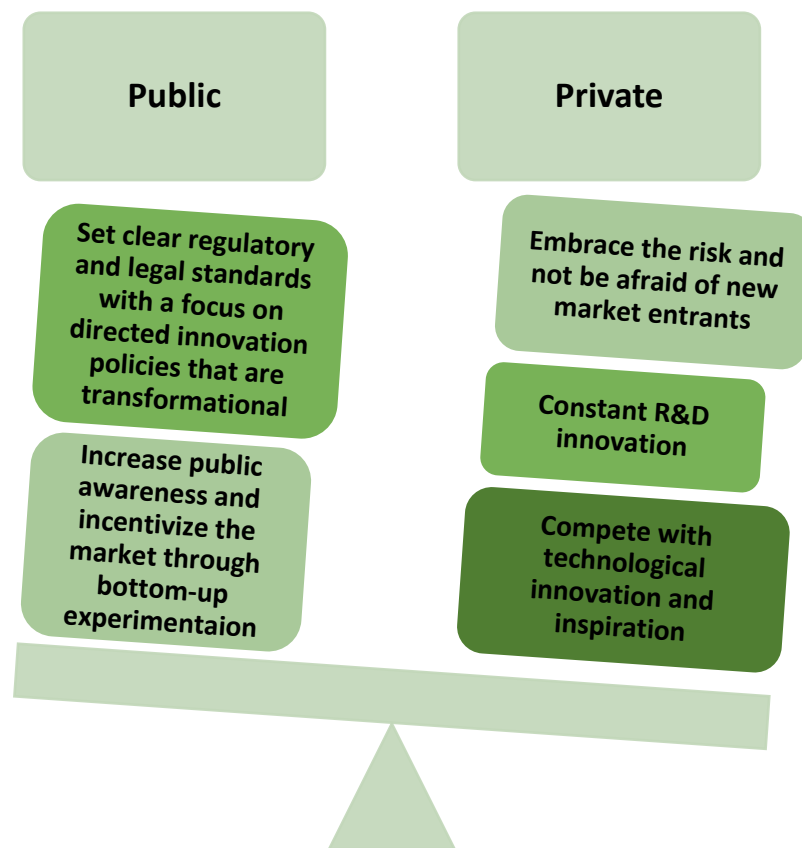


Figure 12: The role of public and private actors

6. Conclusions

This section addresses the research questions (6.1), followed by the theoretical contribution (6.2), practical implications (6.3), limitations of the study (6.4) and future research (6.5).

6.1 The Answer to the Research Question

The purpose of this thesis was to explore the creation of the “New Space” market and investigate the role of the public and private stakeholders in creating the “New Space” market. The objective of this explorative study was led by the following research questions:

How can policy frameworks strengthen the role of intermediaries in the new space market? And, in what ways do policy frameworks lay the foundation for a “New Space” market to take off?

The above research questions have been answered in depth through the analysis and discussion of the empirical findings in section five (5). The “New Space” market is a market that consists of many different intermediaries, both public and private ones. It has a unique combination of market variables because of its capital intense nature, driven by cutting-edge technological innovation, and governmental regulations and policies. The participants in the interviews provided to the study of the research questions valuable insights in addressing the role of intermediaries in the “New Space” market and expressed the significance of policy frameworks to bolster the “New Space” market. The policy frameworks proved to be the most valuable component in the creation of the “New Space” market where the role of the intermediaries is strengthened by them, by providing a standardized “New Space” industry template and infrastructure that increases the intermediaries’ market transaction confidence and increases market awareness. The selection, design and implementation of mission-oriented policy portfolios gives the “New Space” market a foundation of operation among the intermediaries and incentivizes the intermediaries with the goal to create a sustainable and successful market.

6.2 Theoretical Contribution

The purpose of this thesis was to address the academic gap of management and business creation in the “New Space” market utilizing the mission-oriented policy lens of market creation. The mission-oriented policy approach addresses the challenging relationship between government and businesses and questions the government status quo as market “fixer”, rather than a market creator (Mazzucato, 2016, 2018, 2021). Policy failure originates from this status quo and is the main obstacle to new, cutting-edge, and disrupting markets. Mazzucato refers to this framework as a solution to complex societal issues such as climate change, healthcare and gender equality. She briefly refers to the space industry and brings the Apollo mission in 1969 as an example of how the government mobilized different stakeholders to achieve one specific mission: win the Space Race during Cold War by landing

on the Moon. The mission-oriented policy framework does not capture the “New Space” market where there is limited academic work for its creation and business administration. This study contributes to laying the theoretical foundation of a niche market, such as the “New Space” one.

Furthermore, the mission-oriented policy approach states the importance of different policy instruments in fulfilling the mission, by utilizing directed innovation policies to construct a policy framework that allows the collaboration of the public and the private entities (Miedinzski et al., 2018). However, it has not provided a focused approach on how the intermediaries can strengthen the market creation and allow it to grow successfully. This study has contributed to the understanding of the role of intermediaries in the creation of the “New Space” market by focusing on the construction of mission-oriented policy portfolios.

6.3 Practical Implications

The findings of this study have many significant implications for practitioners, both in the public and private sector. The public sector practitioners are given the opportunity to understand what role they should take in creating the “New Space” market and focus on establishing mission-oriented policy portfolios with the aim to inspire technological innovation and allow the market to compete freely without any restraints from incumbent firms. The findings of the study showed that the government representatives can use innovation policies that are directed and have a long-term timeframe to target intermediaries. The way to target the intermediaries is by constructing a specific policy objective for them that allows market experimentation and dynamic and constant interactive communication of the public and private sector. Furthermore, by launching initiatives for increasing public awareness the government can use the innovation policies to incentivize the market such as tax reduction for consumers that use the current technological innovations, with the goal to create the “New Space” market. The private actors are informed that risk aversity to new innovations is counter-productive for the market and they should embrace a dynamic market where innovation is rewarded by specific incentives such as corporate tax relief and increased profits by staying technologically relevant in the long term.

6.4 Limitations

The main limitations of this study include the following areas: 1) geography, 2) industry size, and 3) expertise. Firstly, the “New Space” market is a global market that includes international collaborations, but the United States of America is the country with the biggest market share (around 50%) (Peeters, 2018). The study included only one participant from the U.S., while most participants originated from Germany and the UK. The respective countries that the participants came from might offer a limited market view as their experiences are limited only to their geographical boundaries. The “New Space” market is a global market, so the geographical limitation to only the European continent might be narrow for such a market. Secondly, the “New Space” market is an emerging and small market, where it can prove difficult to identify a specific industry in the “New Space” market and study it in detail. The small size of the sector allows for a more generalized study but lacks the specialization of a sub-sector that can be found in other industries. This has limited the in-depth detailed analysis of a specific sector in the overall “New Space” market. Finally, the expertise of the participants in the study can be a limitation as it is

challenging to find unbiased participants because of the small size of the industry. Most participants know each other and interact frequently with each other. The frequent interaction might skew the results into one direction as the sample size might not be as heterogeneous as in other industries.

6.5 Future Research

The author of this study aims to inspire future research within the field of “New Space” and raise awareness of creating the “New Space” market utilizing mission-oriented policies. The academic research on the “New Space” industry is quite limited, hence it would be beneficial to conduct in the future a much larger study including public and private actors from more countries such as the U.S., Japan, and China. The scope of further research would lie in investigating specific intermediaries in various sectors in the “New Space” ecosystem and identify the importance of regional, national, and international centers and clusters in the creation of the “New Space” market. This identification of such clusters could start with emerging sub sectors in the “New Space” market, such as the space debris market which increases in market popularity and recognition. It would be wise to continue further research with a case study in one of the space debris companies to investigate the regional, national, and international intermediary clusters within that company.

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8. Appendices

Appendix 1. Pilot Interview Questionnaire

- 1) If you take a minute to compare the space industry now and 10 years ago, how would you rate, from 1 to 10, its growth? 1 being no difference and 10 being a very significant level of difference.
- 2) Are there any specific areas in the space industry that caught your attention in the last 10 years? If yes, can you explain why they caught your attention?
- 3) Where would you place the space industry the last 10 years on a scale from 1 to 10 regarding innovation? 1 being not innovative and 10 being super innovative.
- 4) Do you think that the space industry is dominated by the public or private sector?
- 5) What are the challenges of the above question regarding the operations and future growth of the space industry?
- 6) Are you aware of any space initiatives regarding funding of new businesses in Germany/UK? (Respective to the origin of the interviewee). If yes, how many can you name?
- 7) Do you see the private or the public sector leading the above-mentioned initiatives?
- 8) What do you fear the most in space venturing?
- 9) How positive are you from 1 to 10 that the new space economy market will grow significantly in the next 10 years? 1 being very negative and 10 being very positive
- 10) Based on your previous answer what would be the possible enabler or hindrance to that growth?

Appendix 2. Main Interview Questionnaire

- 1) What three words come to your mind when you hear about the “space industry”?
- 2) Why do you think these three words come to mind?
- 3) What kind of businesses do you think belong to the space industry and why do you think so?
- 4) If you take a minute to reflect on your professional experience during the past 10 years how do you feel about the space industry’s progression and its shape? Could you identify three words that characterize this shape? Why did you come up with these words?
- 5) Do you have a story that you would like to share about any of your experiences (either personal or professional) regarding the obstacles that niche markets face? Why do you think they face these obstacles?
- 6) Based on your experience what is the role of the government when new markets emerge?
- 7) Are you aware of the current policies and funding initiatives initiated by the government in your country to enhance the creation of new and niche businesses, linked to the space industry? If yes, could you list them, please?
- 8) What does innovation mean to you and where does the space industry fit in your perspective?
- 9) Who do you see as being the main contributor to your national space industry market and why do you see them in this way?
- 10) What role do you see public and private stakeholders playing when a niche market is created?
- 11) Do you think the above-mentioned stakeholders’ role to be in balance?
- 12) How do you predict the growth of the space industry to be in the next decade? What motivates you to come to this conclusion?
- 13) What do you fear the most in space venturing and why do you fear it?