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Gender in the Space industry

An analysis of the status of female entrepreneurship in European space startups

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Abstract

The following thesis aims to provide an overview of the condition of the space industry and contextualize, in this frame, the state of gender inclusion among founders of space-focused startups across some of Europe's major innovation centers: UK, France, Germany and Italy.

The analysis will start by providing a general introduction on the state of the art of the Space Economy, as well as prospects and projected scenarios of the market, accounting for economic growth, potential disruptive opportunities and overall impact. A further focus on the subject will highlight the effort of the public and private sector to support innovation and competition in the market.

In this scenario, a deep dive in the value of diversity in the entrepreneurial ecosystem will help to properly put into perspective the gender dimension on a foundational level. A brief overview on the European VCs' inclusion of female founders' status will close the framing of the themes in scope.

A quantitative analysis will then be presented: as both the data sampled and the criteria in use are defined, a proper deep dive will investigate the landscape of the startups, accounting for territorial density, venture dimensions and funding status, both on a general and gender-based level. A founders' profiling will follow: they will be classified based on age, educational background and possible affiliations. This data reframing will allow to properly compare the gender issue in the space startup industry against other markets and analyze, both on a European and country level, the progression of inclusion efforts. A last bit will narrow the focus on Bavaria: the objective is to investigate the strategy that had led the region to emerge has one of the most renewed areas in the space industry for both Germany and Europe, as well as one of the highest growing inclusion centers in this market segment.

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Introduction

Historically relegated to the realm of military and governmental intelligence applications, as well as to limited scientific applications with partial innovative spillovers, the space economy has been the object of an interest surge by companies looking to penetrate and dominate a future trillion-dollar market, with a yearly growth rate of 9%, a value not only twice the 5% of GDP projected growth in the following decade, but even higher than the 6-8% annual growth rate estimated for semiconductors market [1].

The New space economy considered here is far from the segregated applications that have stemmed from the use of entirely governmental-funded studies, generally aimed at warfare betterment and space exploration, despite some spillovers having completely disrupted the way interaction and communication is carried out, like satellite technology. The current approach is more permeable: the rising commercialization of the space sector has led to new players being involved.

The power asset is slightly shifting. Despite the public sector being the biggest actor in terms of investments, private players have started to significantly impact the market with autonomous launches of privately funded products and collaborations with governmental agencies for global scale initiatives, like provision of internet connectivity in war zones, support for humanitarian purposes or development of mechanical components for interplanetary exploration.

Advancements in space technology have opened access to more players, unlocked new use cases, and positioned space technology as a concrete resource to help address significant global priorities. International and cross-sector collaboration has occurred in several areas.

In the last 15 years [2] is satellite telecommunication that has paved the way for traditional financing methodologies to enter the space industry and penetrate the market: business angels, public and private partnerships, PE firms, VC firms, banks and corporations. In this new context, the public sector is called to overcome the fragmented landscape of regional and private entities and regulate the market in order to ensure

sustainable growth. Active governmental legislation and coordination of international objectives are essential to fine tune challenges and safety measures for an industry that is, by nature, global.

1. The Space Economy

Defined by the OECD as *the full range of activities and the use of resources that create value and benefits to human beings in the course of exploring, researching, understanding, managing, and utilizing space* [3], the Space Economy is a steadily growing sector that is juxtaposing its technology to a wide variety of commercial applications and social necessities.

As the scope of possible applications of space-related innovations has started to expand, moving from niche usage to a faceted series of solutions that integrates into society and economy, the interest of experts and investors has risen. Collateral products and services of research and development are being used in areas such as meteorology, energy, telecommunications, insurance, transport, maritime industry, aviation and urban development.

Evidence-based analysis have predicted that the industry has the potential to become, as projected by the World Trade economic forum [1], a trillion-dollar mine by 2035, if properly managed in terms of current development and transformation. Despite traditional space industry still being the bulk of revenues, the market is becoming more competitive and uncertain due to an exponential rise of private investments coming from space ventures and private funds. The reasons behind this surge of incoming players may be summed up in a few points of interest: growing revenues of the space industry, potential disruption for a variety of sectors and a so-called Blue Ocean market where an increasing number of actors are trying to penetrate in hope to become its new incumbents.

1.1 Economic impact, potential application and disruptive opportunities

As for now, the market operates on a dichotomy between an upstream and a downstream value line. While the upstream sector is focused on research and applicative for space operations and launches, the downstream one is operating on products and services deployed on Earth, but that heavily rely on satellite data and signals to function.

Moreover, a new middle ground of applications that stems from space-delivery activities, but are self-reliant in their functioning, are appearing on the market. They can be identified as all the products and services derived by technology and knowledge spillover. This growth prospect will have a significant impact on adjacent and apparently unrelated industries.

With a market size of 450 billion dollars by 2035 [1], supply chain and transportation will be two of the most impacted segments of economy on a global level, through space data usage and satellite technology for connectivity purposes. Supply chain improvement in tracking and vehicle management through IoT integration will optimize the information flow and, subsequently, operative routs, while mitigating risks. In this context, food and beverage industry will reach a market cap of 330 billion dollars [1] thanks to the boost in precision and efficiency granted by on-ground space technology applications. Overall, last-mile delivery will be significantly refined. But data services will not be relegated to logistics only. This fine granularity of information collection will also be the base of applications that include weather forecasting, navigation systems and geospatial information systems. This commercialized network of satellites will cross-impact all the activities that involve detailed Earth mapping and observation.

Moreover, the globally widespread usage of commercial satellites will significantly impact telecommunications in remote areas, but also media, entertainment and sports industry, enlarging the reach of users through different platforms and applications. The technology will enable vast new areas to engage in streaming, media and retail consumption through high-speed internet.

For what concerns manufacturing, not only in terms of production of satellites, explorative spacecrafts and space-related equipment, but all the technology in the retail, electronics and customer goods directly and indirectly derived from space application, will represent a significant share of the prospected growth. More specifically, these last applications will account for 170 billion dollars by 2035, a net 10% increase with respect to the 2023 value [1].

On a strategic level, the biggest impact will be on defense: self-reliant space-based communication, intelligence and surveillance will become almost instant, boosting the efficiency of internal processes, from operations to decision-making. Within this contest, strong emphasis is placed on sensors' producers and AI companies to collect and significantly link the data harvested. On top of this 250 billion $ market segment [1], State efforts will also be redirected to civil applications.

Other spillover effects may generate applications out of the scope the current global situation allows to deduct, while completely new frontiers like space-mining and in-space manufacturing are still highly theoretical. The economic potential of these technologies could be impressive, as well as the sustainability advantages they retain.

1.2 Current Trends and Growth Prospects

The economic impact of space technology is already substantial, with significant future potential for disruption and innovation. Current trends indicate a robust expansion trajectory, with diverse applications and markets emerging globally. The figures provided frame the significant economic contributions and growth prospects of the sector, highlighting their importance as a key driver of future economic development.

As the World Economic Forum has highlighted [1], two are the main approaches towards the future of the sector (Figure 1).

On one hand, the upside range prospect will be fueled by a wide availability of data harvested in space and leveraged for a plethora of prospects and opportunities that come with space tech and cost curve advancements. This leads to an evaluation of the

market of about 2.3 trillion dollars by 2035, a figure that stems from the series of opportunities the prospect is attached to: widespread data availability and usability will be at the forefront of new revenue streams, as well as the acceleration of the entire industry, due to a generalized reduction of costs across the whole value chain. This reduction will imply lower entry barriers and subsequent hastening fueled by fiercer competition. The biggest part of this increase will be captured by downstream players working on software and analysis products provision.

Upscale operations will require an increase in risk management to effectively assess in-orbit activity. The downside range, which focuses on terrestrial alternatives linked to space economy, might significantly reduce this risk. Therefore, for the segment, based on current estimates, the cap value sits at 1.4 trillion dollars by 2035. It will pose an alternative to space-based solutions, satellite navigation and communication.

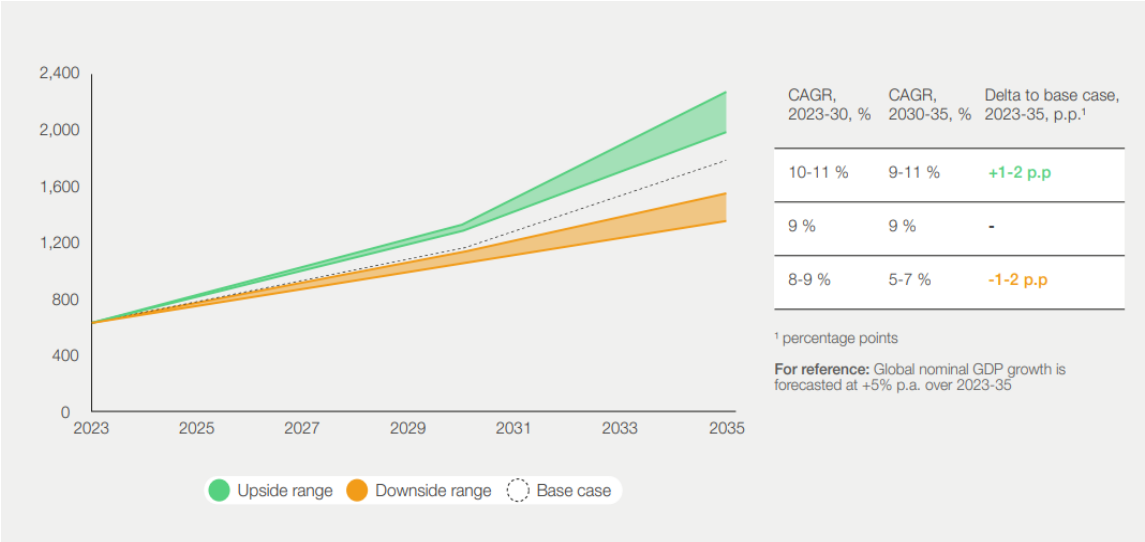


Figure 1: Range of space economy outcomes up to 2025 (from." Space: The $1.8 Trillion Opportunity for Global Economic Growth Insight report", April 2024).

With lower barriers to entry, an increasing number of private investors will try to penetrate the market: enhanced and optimized value chains and reusable technologies will bring down the launching costs and will allow an increase of both the complexity degree of the projects and the scale of their outputs. An accelerated rate of capital flow will especially focus on the prospects offered by satellite technology and digital communication aimed at providing services that require high-speed connectivity and space-based

Internet, which will increase the geographical scope of operation for internet services provision in areas currently underserved.

1.3 Funding

As already stated, the space economy is experiencing rapid growth thanks to technology improvements fueled by an increasing private sector involvement, supportive government policies and various financing projects. Here a brief prospect on these two funding dimensions and their stake at play.

1.3.1 Private sector

The space market has seen a steep growth in commercialization, with the downstream services coming to include different arrays of applications.

Private funding has become a significant driver of progress and innovation, with key figures and trends highlighting an increasing decisional and strategical relevance. According to McKinsey, in 2021 only, the funding coming from both private and public markets has reached the 10 billion dollars mark [4]. The involvement of private investors has significantly contributed to both the raise of capitals and the pace at which this acceleration has taken place.

This crucial role becomes even more relevant if enclosed in the funding historical data spectrum: space economy funding has experienced an impressive expansion. Starting from 2012, where the total cumulated yearly investment was blocked at 300 million dollars [4], the value has peaked in 2021, an historical high for investments. Despite the decrease in subsequent years, starting from 2022 the values have stabilized around the upper echelon of the range, confirming the trend as a solid growing sector, rather than an inflationary bubble. But the sector applications have not yet by-passed the dichotomic peak of inflated expectations and trough of disillusionment typical of the Gartner's Hype cycle, establishing themselves, as for now, along the first half of the curve. Thus, a relevant effort has to be applied in order to avoid estimation overshoot and the subsequent disillusionment in the technology.

If the economic injections are driving innovation, the dynamism surrounding this market segment is attracting an ever-growing number of investors, involved in private-funding rounds or collaborations in the attempt to be first movers and retain the competitive advantages that an early market entrance carries. The pace of new entrants is driving competition up and the disruptive nature of these technologies forces market incumbents to keep the rate of innovation extremely high, in an attempt to firsthand lead the disruption and new paradigms.

The most common types of investments include Venture capitals, which accounts for the largest fraction of the total private funding invested in the space sector [5], allowing startups with less defined business models and embryonal state products to focus on R&D. This effort is more relevant if considered in a context where, despite governmental capital being by far the bulk of the economical effort, its growth is slow and is often difficult for young startups to hold the credibility required to get it awarded.

Private equity and corporate investments hold a relevant role in the economic growth of the sector, especially from market incumbents and global technology leaders, while business angels and crowdfunding for early-stage investments are extremely important for new companies or highly innovative, thus risky, projects.

Another form though which privates are present in the market are spin-offs, innovative child companies of greater parent ones, created to operate with greater degree of independence, but with the insurance of being backed up by the funding and resources of the parent company.

Established companies with enough liquidity may opt for in-house R&D financing to internalize the required know-how necessary to keep up with the market pace.

This way space ventures can deploy the raised capital to pull forward innovation and produce development.

1.3.2 Public sector

The interest for New Space does not come from privates only: public investments represent the core of funding in space activities, with governmental investments in the

orders of billions each year [6]. To foster a new generation of entrepreneurs and nourish a dynamic and diverse landscape of companies, European countries have steadily sustained investments aimed at addressing opportunities arising from different markets. More extensively, the scaffolding behind this effort constitutes itself of:

- Startup ecosystems, a mosaic of incubators and accelerators, research institutions and public agencies that operate in the field
- Clusters and networks, to improve knowledge transfer, idea contamination and resource pooling
- Regulatory framework, an extensive collection of prescriptions on a local, national and European level that these companies have to consider in an optic of legal compliance (eg DPO, transportation regulations and many more).

This national and international effort on governments side (like Figure 2 shows) is linked to the strategic role space industry covers in security and governance objectives, as well as the widespread public impact that some technological advancements will have at a socio-economical level.

The worldwide rising public interest for space activities is fundamental for the possibility of financing research, especially on a basic level, something few private investors would pursue, due to its extreme riskiness with respect to the lump sum required. Thus, despite the willingness of investors in terms of creating a fertile field for development and evolution, state effort still holds a fundamental role in innovation. On the other hand, with the public sector involvement, civil and military customers are shifting towards a more commercial model, in the form of IP leverage, in order to gain an edge on private actors.

Governments are both at the giving and receiving end of this value creation chain: feeding the scientific development, starting from fostering the generally unprofitable base research to financing marketable products on the beginning of the spectrum and being one of the biggest customers of the industry outputs.

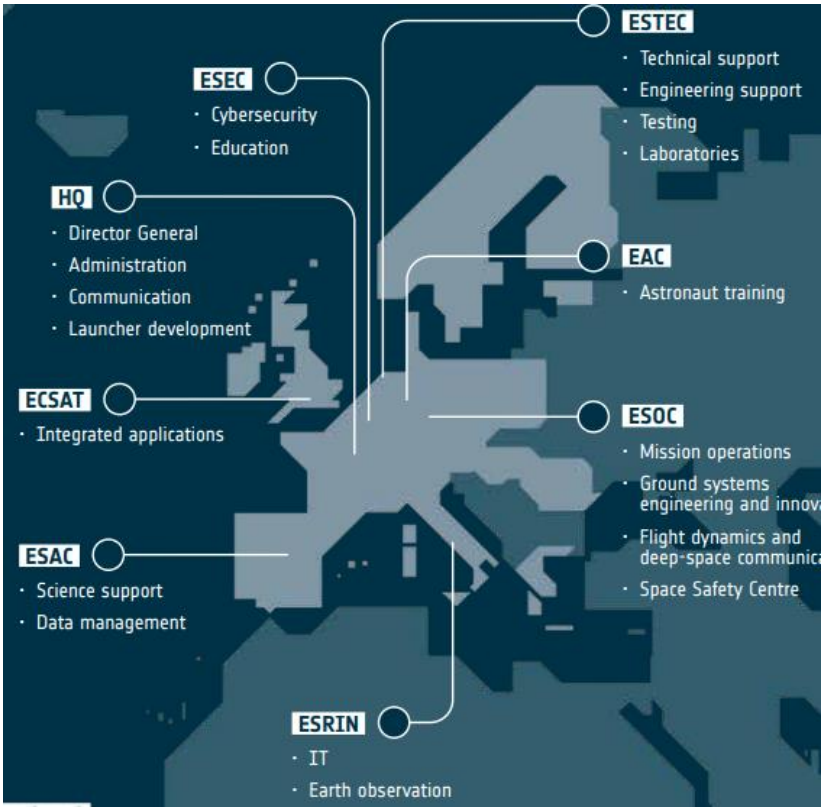


Figure 2: National centers of ESA (from ESA annual report of 2022).

The neuralgic role of public players involvement derives from the multitude of impacts space activities that can be yield. The difficulty still depends on the impossibility of defining the actual impacts, on both economy and society. Thus, the importance of international collaboration, a collective effort to assess impacts, support entrepreneurship, identify risks and internationally shared policies of conduct to regulate the market.

2. Gender diversity in European venture capitals

Among the variables accounting for innovation's success, gender diversity is widely recognized as an asset. Despite its common accepted relevance, a proper quantification of the added value and business benefits of gender variety among workforce and apical positions is extremely difficult. Even more difficult is to properly account for its value within innovative processes.

A variety of studies have attempted to reframe this need in numerical terms. As the Harvard Business Review [8] has tried to highlight, the added value of diversity directly correlates to end users: the higher the variety within team members, the higher the likelihood of the team being able to cater to a wider variety of needs. The research conducted has taken into consideration two types of diversity: inherent traits and acquired ones (coming from cross industry expertise or international experience, among others). These variables among apical figures, correlated to market performance, have resulted in a 45% probability of increase in market shares for 2-D companies (companies that enjoy both inherent and acquired diversity) and 70% higher likelihood of penetrating in a new market. Moreover, diversity also fosters bottom-up innovation, thanks to an environment that encourages ideas coming from workers, not exclusively from the board.

A cross-study between BCG and TUM (Technical University of Munich) has further elaborated on the positive correlation between companies' innovation pace and diversity in terms of gender, culture, industry, career path across the higher ranks of a company, adding a new relevant element to the gender picture: innovation performance is not linked to the mere existence of diversity. A minimum threshold has to be met within management ranks (more than 20% of the total) in order for diversity to have a statistically relevant impact across innovative projects. To quantify the indirect impact of this variable, the study has shown how, by plotting the *innovation revenues*, derived from new products and services launched within a 3-year time window, against the diversity score of each company considered, it can be inferred that innovation rate is

directly correlated to the degree of diversity. Specifically, the study shows how companies with the highest diversity in terms of gender (with a quota of 8 women out of 20 managers), peak at 34% of innovation revenues, while in less gender diverse ones (1 female manager out of 20) innovation accounts for only 25% of total revenues. Gender diversity significance emerges in other relevant ways: a *high percentage of female managers is,* also, *positively correlated with disruptive innovation* [9].

The conclusions drown on gender diversity impact must be segregated: its value has been proven for significant values of female representation in apical roles only. Companies' overall gender diversity holds no statistical significance in innovation processes. In this context, the gender identity of founding profiles emerges in all its relevance as a pipeline to higher and C-level management positions.

These data points are relevant to consider when factoring growth opportunities for markets historically underserved in terms of gender diversity and currently characterized by high degree of disruption, such as the space industry.

2.1 State of the art of European gender diversity among startups

To have a proper idea of which role gender currently plays in innovation and growth across Europe, a brief analysis will provide an overview on ventures with proved market potential and a take on how gender interplays in such scenario. In order to do so, here an excursus on the condition of female founded scaleups, medium sized startups with high growth projection, based on *The landscape of women founders scaleups and investors in Europe* study conducted by Dealroom [10].

Within the entrepreneurial context, the female presence in European VCs has seen relevant variations across time. More specifically, in a time-window of 10 years (from 2014 to 2024), the share of venture capitals founded or co-founded by women has reached the 9.6% quota by 2023, while in terms of investments, the funding raised by women founders in Europe has doubled [10].

The entity of this value strongly varies on a country level. But contrary to expectations, as shown in Figure 3, at the forefront of this growth there are rarely the biggest startups ecosystems of Europe. UK, Germany, France and Switzerland don't emerge among others and often fall short with respect to unexpected countries like Ukraine, which shows similar, or even higher, raised founding with respect to the Nordic , traditionally the best in class in terms of gender inclusion.

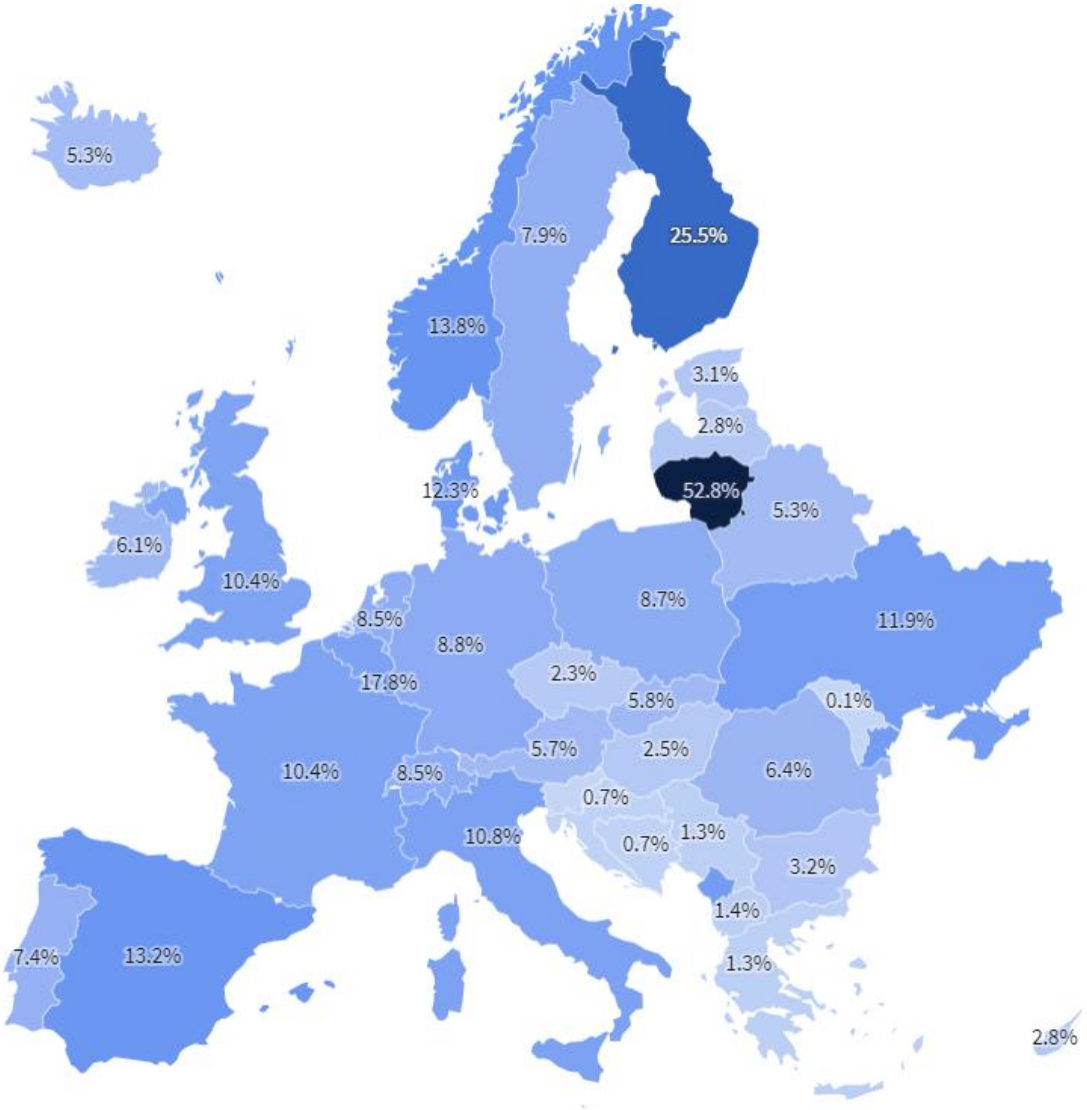


Figure 3: VCs' capital amount invested into female founded startups as % of country total investments (from 2019 to 2023, from "Women-founded startups: Europe", Dealroom, 2024).

The values may, in some cases, be skewed by some unicorns. On this note, is worth observing that the number of unicorns founded by women has increased by a factor of

10 (35 unicorns), with a mean in Central Europe, while the overall number of ventures with female or gender mixed founders has reached the 600 figure [10].

As shown below, more on par with expectations, the number of female founders is noticeably higher in countries with a strong startup tradition: UK, France, Germany, Spain and Sweden. But this ranking strongly differs if the point of analysis shifts to the actual value of these ventures with respect to the national scaleups combined worth. In the top 5 none of the previous counties appear, despite their share being, still, higher than the average European level of 8% (Figure 4). Again, surprising are the positions of some of the countries with the highest DEI values: Norway, Denmark and Sweden.

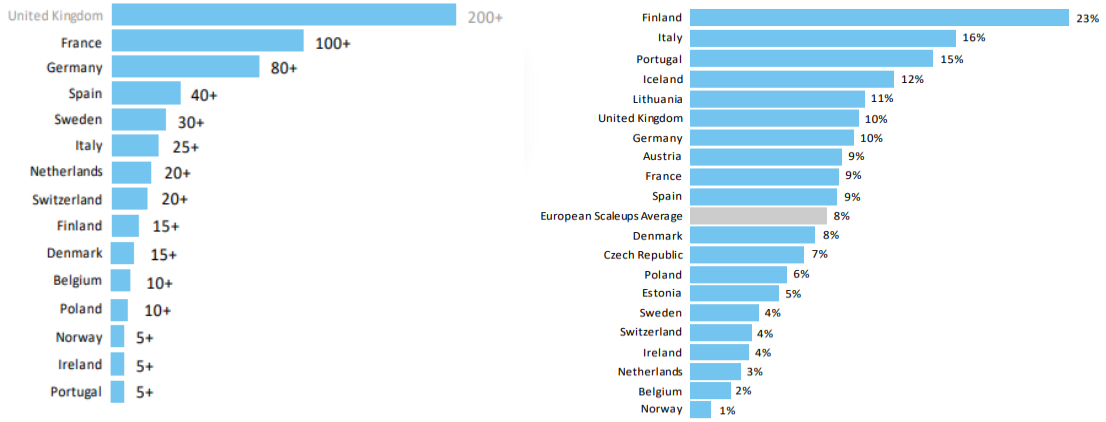


Figure 4: Number of women-founders in European scale-ups vs their combined enterprise value as % of their respective counties (from "Supernovas. The landscape of women founded scaleups and investors in Europe, Dealroom, data up to April 2023).

From a funding standpoint, despite the share of VC investment being raised by women has been doubled in Europe, the figure has been stuck at 10% max since 2017, as shown in Figure 4, despite the efforts to bridge the gap in funding percentages.

The entry barrier is placed at the start: there's a gap at seed level, later compensated by a stronger financing in Series A, which require, on average, shorter periods of time (30% of startups raise Series A within 48 months) to be awarder if compared to the average European level (benchmark is set at 20% of companies rising Series A in the same window time). Looking at Seed B and Seed C, the positive trend towards woman-based startups seems to persist: the percentage of funding to them awarded has been steadily

increasing from 2017. For more mature ventures, late-stage rounds have seen a steep increase from 2021, accounting for over 30% of the female-raised investments [11].

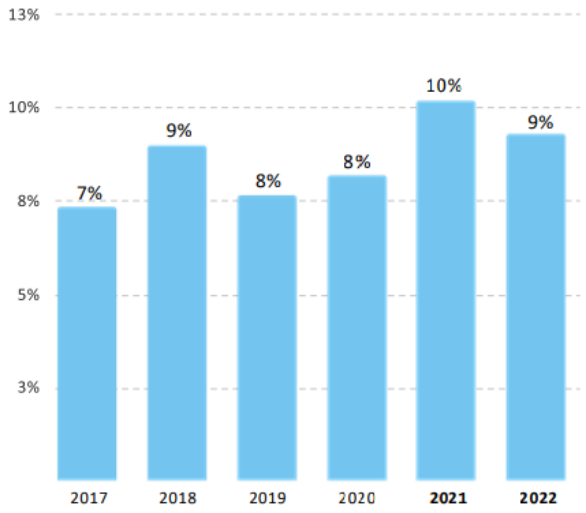


Figure 5: Share of VC investments raised by woman founded companies as % of VC investment raised all over Europe (from "Supernovas. The landscape of women founded scaleups and investors in Europe", Dealroom, data up to April 2023).

Looking at the funding by sector of activity, the amounts raised seem even more insufficient: the markets with highest levels of female founders show, in proportion, a significantly smaller share of financial investments.

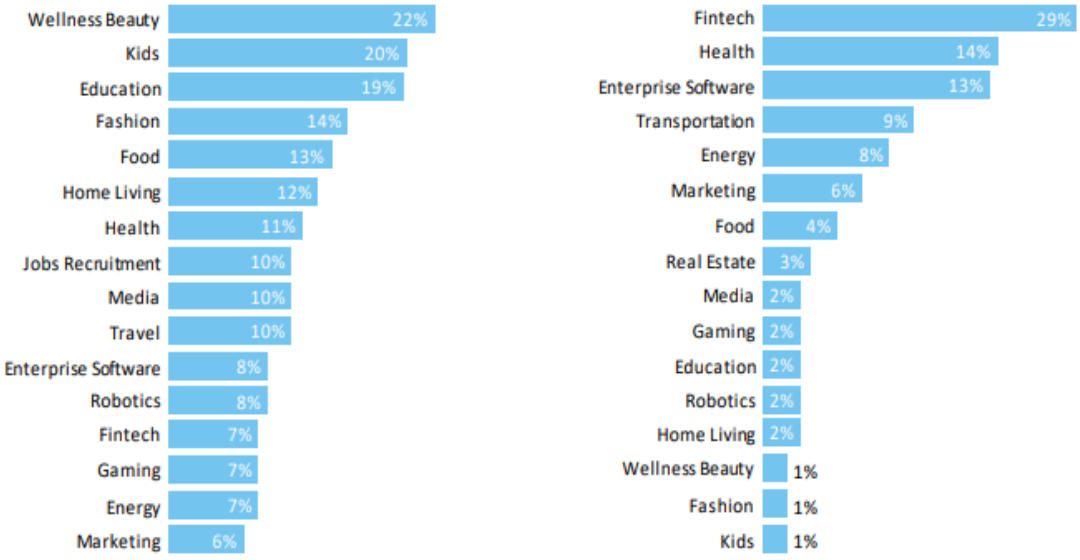


Figure 6: % of scaleups with at least one female founder and % of funding these are awarded against the total funding in the industry (from "Supernovas. The landscape of women founded scaleups and investors in Europe", Dealroom, data up to April 2023).

So, despite an encouraging trend, the disparity of representation is strong, especially for STEM focused industries, where the percentages of gender-mixed or female founders never breaks the 8% mark [11]. The gap in terms of financing is another bottleneck: the highest levels of investments are awarded to the same industries that display residual values of female presence.

3. Analysis

3.1 Methodology and data sampling criteria

Within this environment, the analysis will focus on the state of European space startups and the current state of gender inclusion among their founders.

The process of data harvesting concerning the main aspects of the startups, namely HQ location, total founding and investors among others, is based on data marked as *verified* on the platform *Dealroom*, an on-line data platform collecting info regarding startups and tech ecosystems.

The data reported are the ones related to European startups born in Italy, UK, Germany and France between the years 2011 and 2020, whether they're currently active or not. The general aim is to attempt a description in terms of geographical location, current state, state of business, collocation within the space industry and financing history.

ID_Startup: universal key that identifies the startup

Organization Name: Startup Name

Dealroom URL

Upstream: if the startup is *focused on sending objects into space and space exploration*

Downstream: if the activities implemented within the startup *utilize the research and technology from upstream in a range of different applications*

Organization Name URL: startup's URL

Headquarters City: Headquarters location [City, Region, Country]

HQ Province

HQ Region

HQ Country

Total Funding Amount: Amount of total funding rounds. The entirety of funding data refers to the information provided by Dealroom up until the first semester of 2023. Only data marked as verified are included in the reported values. Funding amounts are reported in the order of thousands (k)

Total Funding Amount Currency: Currency of total funding rounds (EUR/USD)

Operating Status: Actual status of the startup (Active/Closed)

Founded Date: The date when the startup was founded

Company Type: Startup purpose (For profit/Non-profit)

LinkedIn: Link to the LinkedIn page of the startup

Number of Lead Investments: Number of the hugest investments

Number of Founders: Number of founders of the startup

Founders: Names of the founders

Number of Employees: Number of the startup's employees. For not active startups it refers to the last recorded value

Number of Funding Rounds: Number of funding rounds

Last Funding Date: Date of the last funding round

Last Funding Amount: Amount of the last funding round

Last Funding Amount Currency: Currency of the last funding rounds (EUR/USD)

Last Funding Type: Round type of the last funding round.

But the scope of the analysis also requires a general prospectus of the founders of the startups taken into consideration and how, if so, their characteristics relates to the technological landscape of the aerospace startups. The reported data are collected through founders' official LinkedIn profile and integrated, if present, with their official websites or university pages.

Startup_Name

ID_Startup: Identification code of the startup (same as the one above)

ID_Founder: Identification code of the startup's founder

Founder_Name: First name and surname of the founder

Gender: Gender of the founder (M/F)

Age: if no official birth date is reported, age is estimated on the assumption that they were 18 years old at the beginning of their Bachelor, 24 years old at the beginning of their PhD. Based on this, age will be roughly estimated starting from the stated date of their BS's or PhD's first year. This kind of loose estimation can be possible since the aim of the study doesn't need cut sharp informations concerning seniority or age

Age_Note: Reported date of university/PhD start

Birth_Place

Birth_Country: Country of birth of the founder

University: University where the founder got the (highest) qualification

STEM (0,1): STEM qualification (0 = NO; 1 = YES)

MS(0,1): Master of Science or equivalents (for German universities Diploma corresponds to a MD)

BA (0,1): Bachelor's degree or equivalents (for German universities Doctor refers to PhD)

MBA (0,1): MBA qualification (0 = NO; 1 = YES)

Phd (0,1): PhD (0 = NO; 1 = YES)

Country_StudyBA: Country where the University of the BA degree is located

Country_StudyMS: Country where the University of the MS is located

Country_StudyPhd: Country where the University of the PhD is located

Country_StudyMBA: Country where the Institute of MBA is located

Linkedin: funder's LinkedIn profile.

The following analysis will start with a description of the general state of startups ecosystem in the counties taken into consideration, followed by a deep dive into the profiles behind the constitution of these economic realities.

3.2. The space startup landscape in Europe

For a baseline understanding of the current aerospace startup horizon in terms of size and scope, here a comprehensive breakdown of the dataset.

3.2.1 Overview of the landscape

The statistic pool has taken into consideration a total of 135 startups among a handful of countries.

The dataset shows the following HQ geographical distribution:

- **UK** > 46 startups, with a mean in Oxfordshire region
- **France** > 42 startups, with a mean in the Île-de-France region
- **Germany** > 32 startups, with a mean in the region of Bavaria
- **Italy** > 11 startups, with a more dispersed presence in the Northen area of the country
- **Swisse** > 2 startups
- **Spain** > 2 startups

To avoid any possible misrepresentation of the median aerospace startup in Spain and Swiss due to unproper size of the statistic sample and thus bypass difficulties in data availability for the countries, the last four startups has been set aside. Thus, the analysis will focus on the data provided by 131 startups located in **UK**, **France**, **Germany** and **Italy**.

3.2.2 Startup density

The sample shows a relative inhomogeneous distribution in terms of territorial spread, with a higher density in specific regions. In this sense, is worth noting what are the factors that may explain a strong geographical startup presence in specific areas.

An investigation of the most prominent locations for new ventures may shed light on startups' specific distributions and explain it through the existence of major hubs and network systems distributed across the sampled countries.

UK

Specifically, starting from the United Kingdom, 7 of the startups analyzed have their HQ in Harwell, Oxfordshire, bringing the total of the region to 12 out of 46 ventures (26%). A fair number in the context of extremely relevant centers of academic research and historical industrial complexes that operate in the area, immersed in a web of organizations like the Harwell Science and Innovation Campus**,** the most prominent UK collection of space startups and research institutions, which homes highly relevant space organizations, namely the UK Space Agency and ESA Business Incubation Center (ESA BICs), as well as companies like Astroscale or Oxford Space Systems (OSS). This last entity is a web of innovation clusters focused on both startups and business scale up and has a dedicated space cluster that includes 105 [12] space organizations across different fields of pertinence. Other relevant players include the Satellite Applications Catapult**,** another organization that supports startups focused on satellite technology in the region.

On the other hand, 11 of the companies (24%) are located in London, the heart of the UK and one of the global centers of startup innovation. The city is not only home to notable hubs fostering entrepreneurship, but also incubators, accelerators, co-working areas operating in the space area. Among them, relevant organizations are the Satellite Applications Catapult, Imperial College London's Space Lab, Seraphim Space Camp.

Despite not being as prominent as Harwell or London in terms of concentration of space-related organizations, Edinburgh (together with Glasgow), is an emerging region for satellite data analysis, climate research and basic research for future space applications and homes 5 of the startups included in the pool of analysis. Some of the entities that operate in this area are the University of Edinburgh and its commercial rib Edinburgh Innovations, the Edinburgh Space Data Analytics (ESDA), a data analytics company focused on satellite data applications for industrial and environmental applications and the Scottish Enterprise Growth Investments, a non-departmental co-investment public body fund that assists startups in sorting finance sources and secure investments.

The last region of interest is the Cambridge area, with a total of **5** startups (11%) located in its proximity. Known as the Cambridge Cluster or Silicon Fen, this region is, globally, a top three innovation ecosystem [13] and homes thousands of high-tech companies focused on software, electronics, and biotech. Attracting over 153millions in digital technology investments [14], it includes also space focused companies, encompassed in the Cambridge Space Cluster, a tech and innovation hub operating on space systems engineering, mission analysis and satellite communication. This area is a constellation of different realities born around leading research institutions (University of Cambridge and its research Departments), that operate in fields relevant and complementary to the space industry. They are, other than investors, actively engaged in space-based research and education. The growth of the subregion has been significant thanks to business networks (Cambridge Network), web of companies and researchers that enhance collaboration and knowledge spillover, on top of talent acquisition. Among noticeable investors, big corporations are actively invested in the 25 science parks that constitutes the area. The list includes massive companies, like Amazon, which is using the area for an experimental drone delivery technology developed with Apple's collaboration.

These flourishing areas are encompassed in the larger National Space Strategy**,** a long-term plan whom goal is to represent, by 2030, 10% of the global space-related economy [15]. In this attempt, the effort to pioneer space research and technology emerges as the base level objective, to serve to national and market interests. To achieve these goals, partnerships with government bodies, "*as well as advances in science and technology from academia*", will "*set the conditions for a competitive space sector and encourage a broad range of space companies to get involved"* [15]. This has led to a growing interest in funding accomplished companies and supporting new businesses across the country. They have physiologically flourished in neuralgic areas, characterized by the presence of academic institutions an established realities that operates in the space market, as for Fig. 7. This explains why almost 72% of the UK-based startups present in the dataset are situated in selected strategical regions (with a focus on Oxfordshire), characterized by low geographical spread, but high technological density.

Not surprisingly, these regions are renewed as big academic centers, where idea contamination and high technical knowledge is extremely dense, as well as areas characterized by a flourishing economy and an abundance of hubs and clusters. The close physical proximity of these dimensions and, thus, the low dispersion of networks and the possibility of high-pace info and resources exchange may have been a significant contribute to the development of these areas.

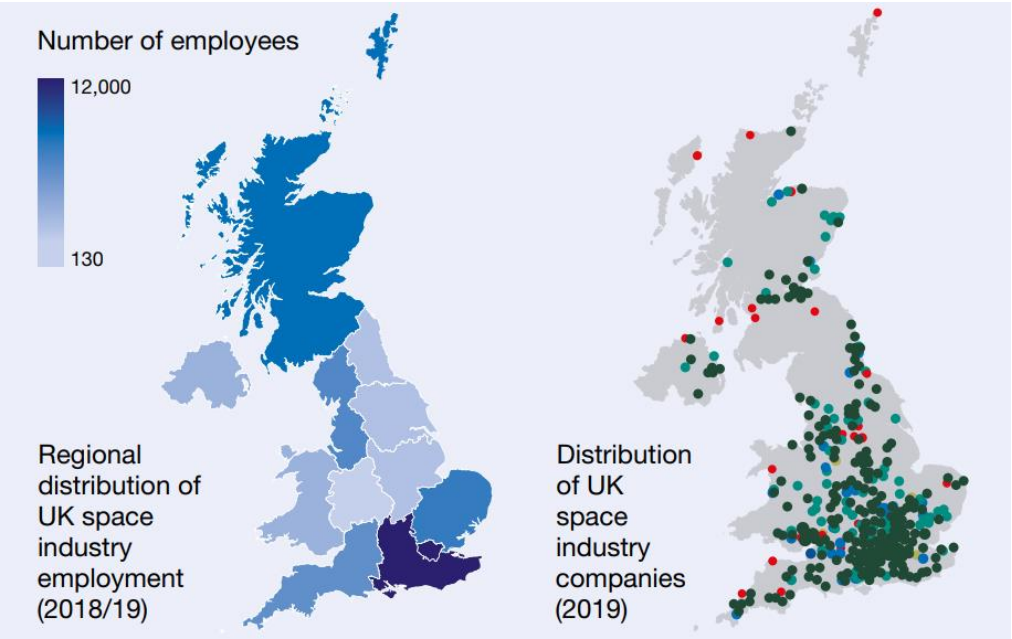


Figure 7: Landscape of UK's space sector companies in 2019 (from "National Space Strategy" report, September 2021).

France

For France, the scenery slightly differs from the one described above.

With a remarkable number of 11 startups (26% of the French pool) located in the Île-de-France region (10 in Paris), this area is a vibrant region for governmental agencies and research institutions that operate in space technology research and development with the support of ministerial planning. Besides University institutions (Institute d'Astrophysique de Paris, Observatoire de Paris, École Polytechnique), among the most

relevant players of the landscape, there are several national and international organizations: the CNES (the French Space Agency), which coordinates the national effort towards space activities, including satellite technology and space exploration, and the local division of the European Space Agency. Innovation hubs are at the forefront of innovation in the area. Among the most prominent ones,

- Paris&Co, an innovation agency that supports the startup ecosystem in Paris (including programs to attract international targets) and operates a series of incubators and accelerators, with a focus on aerospace and deep tech;
- Station F, the largest startup campus in the world, has an "Aerospace&Defence" division dedicated to resource allocation for startups focused on aerospace technology;
- Paris Region Enterprises, the economic development agency for the Île-de-France region, that supports companies or startups in the area. Pôle Systematic Paris-Region cluster covers the same scope, developing collaborative projects and promoting innovation through funding access to different realities, like CosmiCapital, an investment fund focused on providing funding, mentorship, networking opportunities to space startups and early VCs.

Industry associations and clusters in the region play a relevant role in the rich offer of opportunities for the space industry. Among the leading ones, it can be recalled GIFAS (Groupement des Industries Françaises Aéronautiques et Spatiales), a national association born to promote the interests of space industry all over France and Île-de-France Aerospace**,** an association that connects companies and organization of the sector operating in Île-de-France region in order to create a network aimed at increasing mutual collaboration, supporting and advocating for its members, providing funding, training and expanding to international markets.

The region also homes a local extension of a renewed Occitanie-based startup center, the Aerospace Valley. The attempt is to enlarge the pool of organizations, companies and agencies that fall into this aerospace cluster.

The **10** startups (24%) based in Occitanie (7 in Toulouse, 2 in Montpellier) are situated in a local network of organizations that allow to explain this regional density.

Toulouse, known as the Aerospace valley, along with Montpellier (Fig.8), is the heart of one of the leading regions for space development on a European level [16]. The homonymous cluster, which expertise encompass strategic sectors, aims at generating business opportunities for the organizations of both Occitanie and Nouvelle-Aquitaine, thus "*constituting the leading European employment pool in the field of aeronautics, space, drone sectors and embedded systems*" [17]. Such a massive cluster currently employs one third of the entire French aeronautic workforce, as well as 13 thousand students and 8500 researchers.

Figure 8: Aerospace Valley facilities distribution (from aerospace-vevalley.com).

Moreover, the region homes Airbus and joint ventures such as Thales Alenia Space, a manufacturing deliverer, focused on solutions for telecommunications, navigation, Earth observations, environmental management, orbital infrastructures and research. With Telespazio, one of the main profiles regarding navigation systems and satellite services, they have created the Space Alliance [18].

On the other hand, Montpellier hosts research institutions and universities that homes several programs in core fields (physics, aerospace, engineering). The influence of the

Aerospace Valley in the area is prominent, thanks to the expansion of its activity to the entirety of the region, supporting startups and researchers that operate in the field.

Another region that retains a considerable density of startups operating in the sector (4, accounting for 10% of the French ventures)) is Nouvelle-Aquitaine. On top of the Aerospace Valley local branch (mentioned above), the region hosts different organizations and governmental agencies that operates in the field and support startup landscape and sector innovation. Among them, Pôle Avenia, a competitiveness cluster, the Nouvelle-Aquitaine Aerospace Cluster, a network of companies and organizations operating in aerospace and defense, Cap Sciences, an innovation center that promotes STEM innovation, as well as Bordeaux Technowest, a cluster based on technology transfer and innovation that supports the development of space-related technologies.

As shown above, the startup distribution is focused in tree major regions of interest (Île-de-France, Occitanie and Nouvelle-Aquitaine). Despite the sheer concentration in the metropolitan areas of Paris and Toulouse (almost 40% of the French startups analyzed are located here), the landscape presents a more extended structure within the nearby territory. The overall picture highlights how an intensive academic and entrepreneurial presence in the above regions can lead to these two cities being the core of a potentially more widespread space sector thanks to active research and academic realities that are able to inject skilled workforce in an industrial landscape characterized by innovation and economic support for growing realities.

Germany

For what concerns Germany, the startups' density across its territory shows a higher degree of differentiation from the ones seen in the UK and France, thanks to the clear-cut hegemony of a specific region of interest.

24 out of the 32 startups taken into consideration are based in Bavaria. More specifically, 20 of them have their HQ in Upper Bavaria province (16 are in Munich).

This disproportionate concentration of startups in this region, which accounts for **75%** of the total German pool, highlights the absolute prominence of Bavaria as a reference point for newly established companies. This can be partially explained by the presence of a variety of factors that, in conjunction, account for region's prominent position in the industry.

Bavaria has been, historically, the German core of aerospace engineering and manufacturing. The technical heritage of the industry is preserved by the solid foundation provided by the local research centers of sector giants, like Airbus and MT aerospace, among others.

There's a variety of universities and research institutions, that strongly contribute to the supply of highly skilled workforce with mainly engineering and technological background. Bavaria is the center a long tradition in research and development, being an ideal location for aerospace research. *"9 state universities, 24 universities of applied sciences, renowned research and science institutions open up interesting cooperation opportunities for innovative companies. The significance of research and development can be seen in the Bavarian Innovation Strategy: the aim is to increase the share of total R&D expenditure to 4% of Bavarian GDP by 2030"* [19]. The aerospace research is fostered by Bavarian academia, like the Technical University of Munich, the Fraunhofer Institutes in Erlangen, the Max Planck Institutes for Astrophysics and for Extraterrestrial Physics, the European Southern Observatory (ESO). These centers constitute the BayernSat satellites, Europe's largest university department for aerospace. One of the world renewed facilities that operates in this area of expertise is the German Aerospace Center (DLR, the National Aerospace Research Center), that cooperates with industry players and international partners on space missions, among other projects. Other neuralgic research centers are the German Space Operations Centre (GSOC), the Galileo Control Centre (GCC) and the Galileo Competence Centre, located in Oberpfaffenhofen.

But innovation is also nourished through Space clusters (initiatives born within the Cluster offensive Bavaria initiative), like the Oberpfaffenhofen Aerospace Cluster (in Munich), that constitutes the largest aerospace cluster in Europe, or ArianeGroup, a

leading manufacturer of launch vehicles for rockets, satellites, space exploration. Their presence facilitates cross cluster collaboration and relationships among research institutions, companies, governmental agencies.

This network is supported by highly functional infrastructures, an efficient transportation structure that includes the Munich Airport, one of the largest airports in Europe and an important hub for international air traffic, as well as the special airport Oberpfaffenhofen, "*which is also used intensively for research flights and operates the TUEF (test field for unmanned and electric flight), and numerous other local airfields"* [20].

The economic scaffolding of this system is based on both big corporations, for whom innovation programs are frequently utilized to create local buy-ins, and strong governmental support**.** Authorities have recognized not only the strategic relevance of the sector, from both an economic prospect of growth and job creation, but also on a national interest perspective. That is why it has been providing incentives, funding programs, policies and initiatives such as the Bavarian Space Strategy to strengthen the Bavarian position in the international landscape. With an investment of 700 million euros (2018) in financing funding, is promoting a strategy of public investments for regional industrial advantage as well as urban development [20].

The heritage of Bavaria as one of the most important aviation and aerospace locations globally and the strong presence of major aerospace companies, research institutions and governmental support has created a fertile substratum for a thriving startup-creation landscape.

On the other hand, despite the large transit of financial resources and opportunities for economic support, as well as the existence of clusters and networking opportunities, is striking the difference, with respect to the other capitals, on how, with only one of the startups located in there, not neuralgic Berlin is. This peculiar frame can't certainly be caused by the lack of research institution, innovation centers, entrepreneurship drive or financing opportunities, abundantly present. It could be more related to the almost exclusivity detained by Bavaria on airspace culture, that consequently attracts most of

the resources in the field, despite the general landscape of Berlin's innovation being a striving environment for startups. Then it can be safely inferred that disposable founding and innovation centers don't necessarily translate into strong numerical results.

The Bavarian model, founded on a capillary academic presence and an established industrial complex (the economic research institute IW Cologne classified it, in its 2020 *Industrielle Standortqualität Bayerns im internationalen Vergleich* study [21], as a top location for industries characterized by cooperation between research, industry, efficient logistic systems and IT infrastructures (Fig. 9) can explain this density distribution? It will be useful to analyze how founders position themselves academically and detect if possible technological innovation in the industry and knowledge spillover can confirm these data.

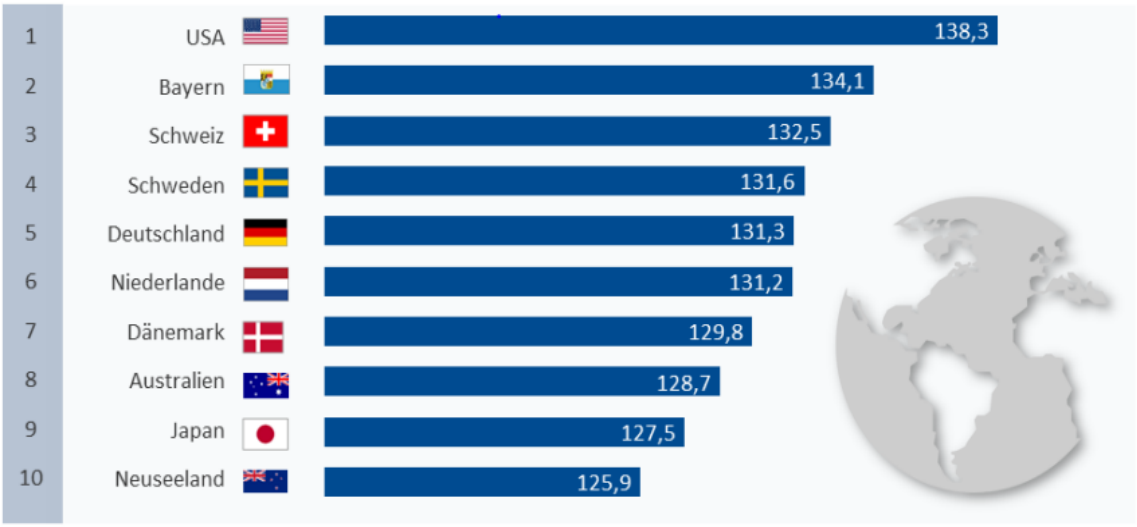


Figure 9: Bavaria industrial positioning among the best global competitors based on a qualitative scale evaluating industrial assets (Industrielle Standortqualität Bayerns im internationalen Vergleich, August 2020).

Italy

Lastly, Italy presents a smaller pool to carry on the analysis, which makes more difficult to draw any proper conclusion on the geographical density spread. Moreover, the regional distribution doesn't allow a clear-cut identification of flourishing centers of interest. But, on a national level, it can be observed that the presence of startups

operating in the space industry is intensely skewed towards the northern area. 8 out of 11 ventures are located within 5 regions, with a slight predominance of Lombardy (3). This gap can be explained by the presence of leading companies, institutions and universities in these areas. More specifically Turin is home to academic institutions (Polytechnic of Turin, among others) and prominent aerospace companies, like Thales Alenia Space and Avio, Lombardy hosts a network of innovation hubs, research centers, universities and companies involved in aerospace tech applications. Lastly, Veneto comes in the picture as the home city of University of Padua and Ca' Foscati, both centers of aerospace research, as well as of companies involved in aerospace components manufacturing.

The dimension of the Italian landscape is clearly smaller with respect to its European counterparts, despite a not dissimilar economic magnitude on a global level. It's not clear if such an environment is caused by a lack of innovation pull, not properly developed infrastructures to nurture new ventures or many potential startups competing for scarce resources, putting a strain on the ecosystem's capacity to support all ventures effectively.

3.2.3 Startup scale

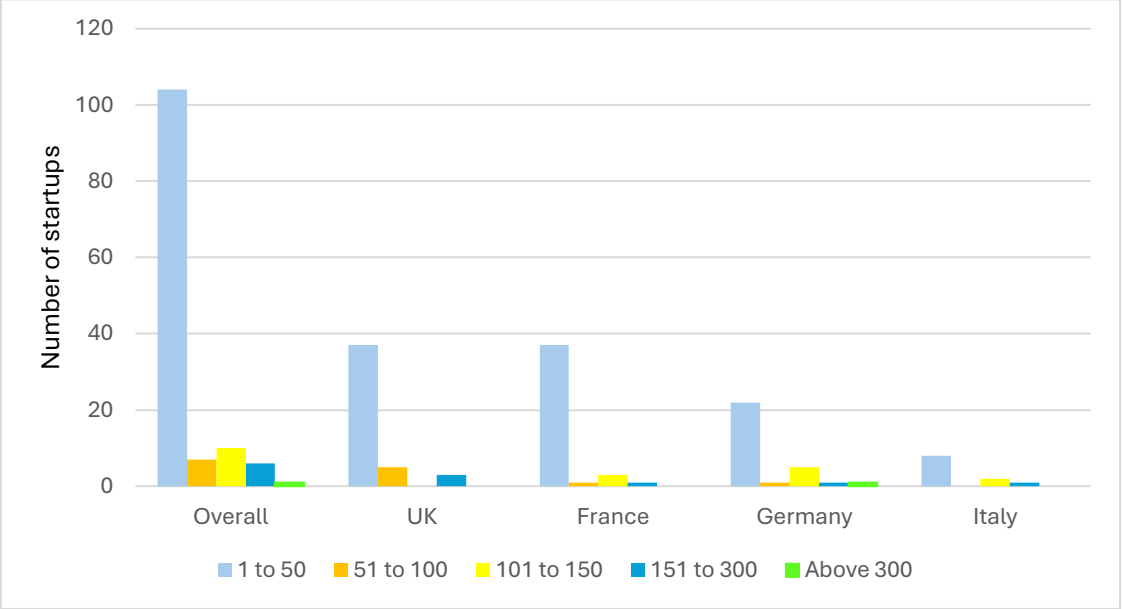
The scale of startups can be inferred through different elements: funding and workforce dimension, among others.

In an attempt to analyze the trust of the market in such realities, both the number of funding rounds and the amount of the last funding may be adequate indicators.

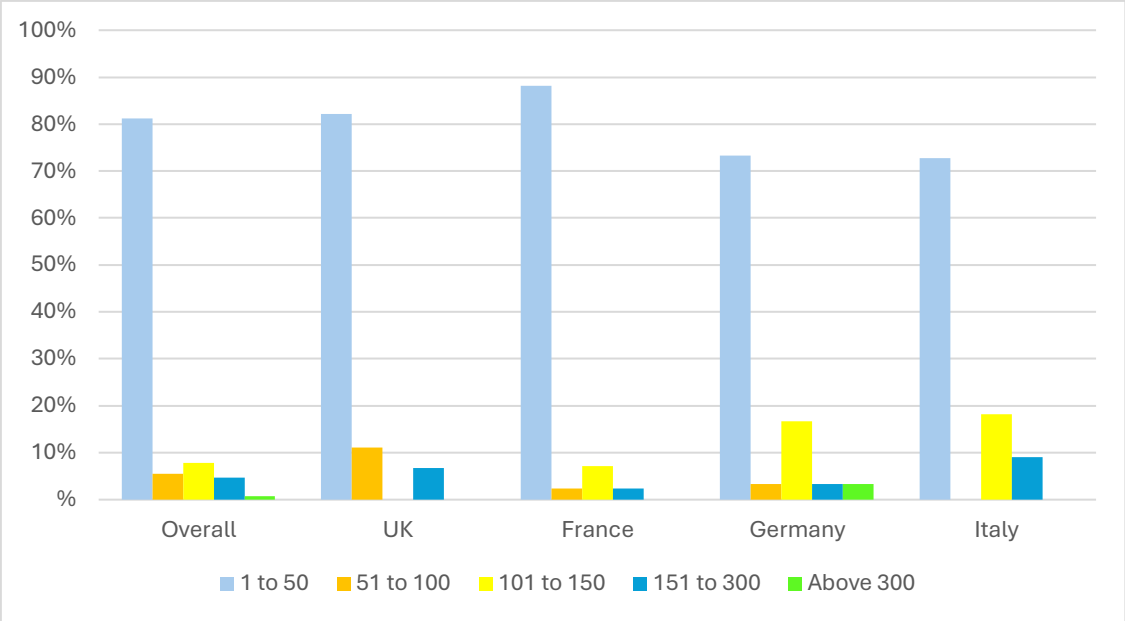
To properly conduct the analysis, it must be specified that, out of the entire pool profiled, only one startup is a non-profit company. Thus, it can be safely stated that all the conclusions one may draw, if so, will be referred to for-profit organizations, being, as signaled before, the data on non-profit ones marginal.

Size-wise, as shown in Graph 1, the median value in terms of people employed is heavily skewed towards the 1 to 50 employees' bracket for all the countries analyzed. Being the

magnitude of the number of startups object of study significantly different, rather than in absolute terms, it would be more useful to look at the data in proportion to the size of the pool analyzed for each country. By doing so (Graph 2), it's confirmed the overall dominance of small startups, which constitute, around 80% of the total landscape considered. What emerges as a new data point is the not negligible presence of startups of medium dimensions (101 to 150 employees), with relevant percentages for both Germany and Italy.



Graph 1: Startups' number distribution based on the number of people employed (by country).



Graph 2: Startup dimension as a function of the number of employed workforce (adjusted for sample dimension).

But to gauge the scale and growth trajectory of these aerospace ventures, also the funding status must be properly investigated.

As a premise to this examination, the pool will exclude, from the adjusted percentages, all the startups for which no confirmed data was available, restricting the pool to 114 companies.

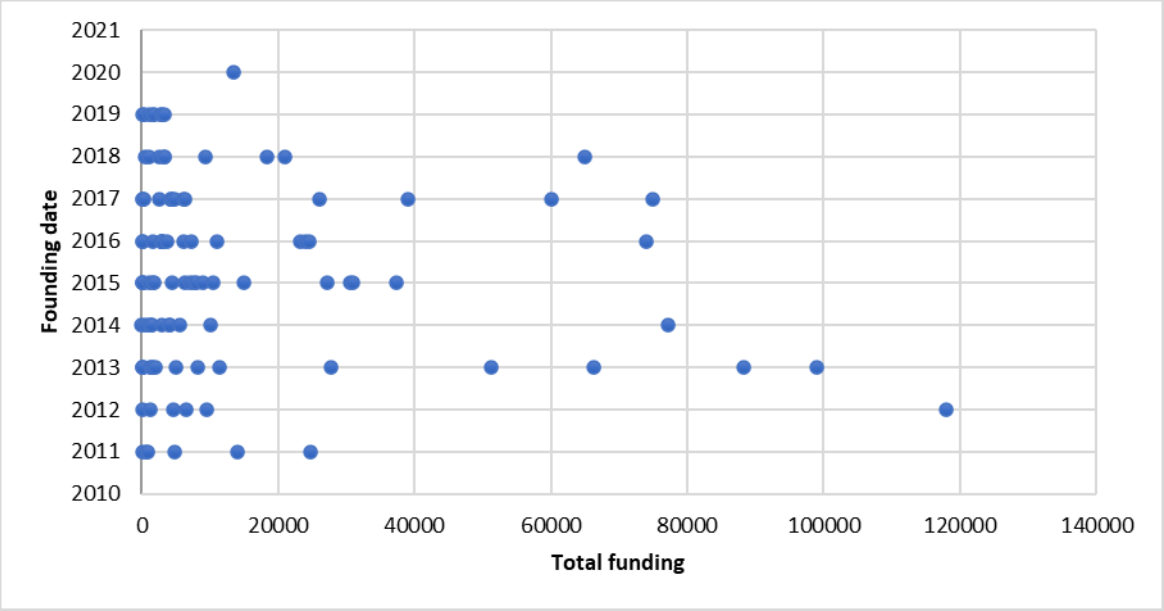
The observations that can be withdrawn starts from the lack of correlation between funding rounds and company's age: no significant correlation can be inferred between the number of funding rounds and the time bracket of activity of the company.

The same seems to be apparent for the relationship between employee-heavy startups and funding rounds. More specifically, there seems to be no direct proportion between workforce density and number of funding rounds. What emerges is that the bigger ones (above 150 employees) all have at least 4 funding rounds. The same rule does not apply for small-medium sized ones (above 50 employees).

If the lower limit on the number of funding rounds for bigger ventures may hint to a minimum threshold being necessary for ventures to scale at a certain employee-density,

the lack of more extended data for higher-employing startups and the counterproof presented by the data related to midsized companies still align with the general assumption that denies the dependence between number of funding rounds and employee presence. Within this frame, is a safe assumption to deem the number of funding rounds an unfit descriptive value to infer a company's dimension. A more detailed analysis on the trajectory of the funding rounds' values compared to the variation of human capital in the company may reveal more info on the growth prospects, but it is an out-of-scope investigation.

Looking at funding, no defined patter can be detected for their distribution if related to the founding year. Intuitively, the age of the startup may be expected to be one of the variables responsible for the entity of fundings, as the startup is expected to scale in terms of size and scope overtime. But as shown in Graph 3, where total startup fundings are plotted against their founding date, it is not possible to detect any time sensitive trend or direct link between the total funding amount and the lifetime of the venture, making the date an unreliable variable to accurately predict companies' growth patterns.



Graph 3: Total funding of each startup (k of euro) against their founding year.

On the other hand, speaking of growth potential, what can be deducted from the data retrieved concerning the type of funding (traced only for the last round) will better help to assess the general economic status of the ventures.

As per Table 1, with a value of 12%, acquisition seems a viable prospect for French startups. This properly fits the startup scenario described by their territorial distribution: in a scheme of established innovation hubs, companies and governmental expansion, to properly compete on an international level, a satellite system of startups has been established and is slowly being incorporated in major industrial structures in order to organically feed research and innovation companies' arm. Within this frame, it makes sense that all the acquired companies operate in the downstream domain. On the other hand, this doesn't explain the low acquisition rate presented by Germany, specifically Upper Bavaria. Given the dimension of the space industrial complex in the area and the abundance of downstream startups (15 out of the 20 startups operating in Upper Bavaria fall under the downstream flow), following the reasoning proposed above, the number of companies that leverage on innovation through acquisition should be higher than the only Munich-based company acquired present in the dataset. A partial explanation can be the high level of Early VCs, a signal of very young companies that haven't had the opportunity to establish their presence and define a profitable and efficient business model to proficiently commercialize space tech. This properly aligns with a younger demographic of founders and startups.

Debt is extremely low, across all countries. It is a positive sign for highly risky companies such as startups. It allows them to enjoy a financial flexibility that a debt repayment, being the cashflow prone to unpredictability and often limited, would put in strains. An overall reduced financial distress risk and no debt obligation appear to be even more attractive to venture capitalists and equity investors, who aim at investing and avoid suboptimal business decisions that prioritize immediate returns over long-term growth.

Seed funding, the initial capital provided to a startup to help it develop a viable business idea, typically the first formal round of financing that a startup in its development phase, accommodates the high risk associated to ventures at this stage. Being awarded at a very

early phase, it can be concluded that a relevant fraction of startups (**20%** overall) is in its ideation or development phase. This funding will allow ventures to build a prototype to test the market and gather initial user feedback, to refine and re-caliber the business' objectives. Being the startup in its constitutive phase, key initial employees or co-founders are typically the ones being instated. This scenario is confirmed by the employee number encompassed in the analysis: 20 of the 21 startups who got a seed granted fall within the 1 to 50 employees' bracket, with a skew towards the lower end (18 are below the 25 employees' threshold). Lots of the investors, falling within the Venture capitalist's realm, are providing both needed strategic support and mentorship in exchange for equity.

Early VCs represents 40% of the total number of last fundings forms, composing, by far, the largest demography. This entails that for the most part the dataset is a cluster of startups with increasing valuation and growth potential. Given the pool being focused on fairly young companies that are, for the almost totality, still operating in the market (only two of them classify as non-active), the popularity of such financing type aligns with a landscape of startups potentially ready to scale their operations and grow significantly in the future. This explains the bigger order of magnitude of the financing provided, as well as the higher average number of resources employed at this stage. Moreover, the abundance of young ventures is a positive signal in terms of innovation ferment and entrepreneurial strive in the industry.

Late-stage VC funding is numerically less prominent, with Italy reaching the highest percentage (14%). Occurring when a startup is more established, typically after having demonstrated a viable business model, consistent revenue streams, and significant growth potential, the outcome data seems to reinforce the above conclusions, which presents a landscape of mostly early stage and growing companies, rather than more established ones. Seems inherently plausible that fewer startups will succeed long enough to pursue upscaling and expansion, surviving a competitive bottleneck that filters only the most viable and innovative companies. On top, the relatively small-time

window of the investigation here addressed imposes, at the current moment, a cap on the pace of growth the analysis has been able to detect.

Despite not being as prominent in terms of figures, another relevant form of financing appears to be grants, used by governments and organizations to stimulate economic growth and fuel innovation at various stages of a venture development.

Targeted at small businesses and startups to help them start and grow, the startups impacted are for the most part (14 out 16) of modest dimension (from 1 to 50 employees).

Being a type of funding provided by government bodies, non-profit organizations, foundations, or corporations, which do not require repayment, the data shown fit the effort, on a national and European level, to fuel the space industry. This prospect aligns with funders' profiles that, among the most prominent, include the European Innovation Council.

On a more detailed level, the entirety of the companies funded with Grands operate within the Downstream segment of Space economy**.** As for the objective validated by the ESA Member States to expand the space value chain and the governmental ambitions for exponential growth through incumbent technology as a mean of economic strengthening and competition upkeeping, investments on space operations for terrestrial use and products leveraging satellite technology are a given in the strategic approach adopted. This becomes even more relevant considering the impact the technology can have for public interest. On this last note, non-diluting funding seems the fittest solution to serve projects with relevant public externalities (eg. battery analysis, flight maintenance, mobility applications are among the topics covered by startups in question).

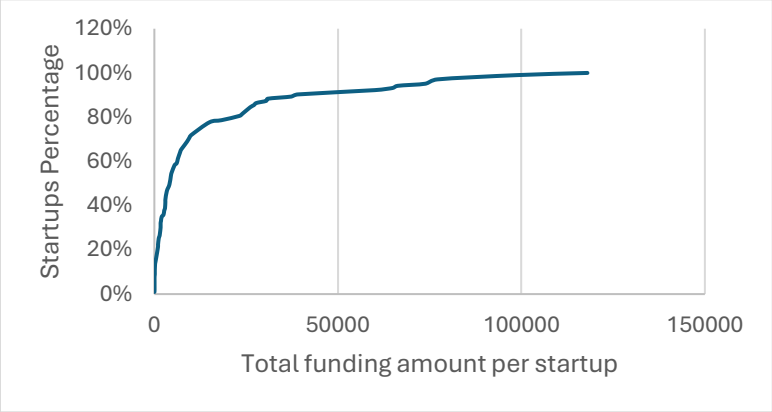
Funding type	UK	France	Germany	Italy	Overall
Seed	26%	21%	4%	29%	20%
Early VC	38%	29%	38%	17%	40%
Late VC	5%	3%	4%	14%	5%
Debt	2%	0%	4%	14%	3%
Acquisition	2%	12%	4%	0%	6%
Grant	10%	18%	21%	14%	15%

Table 1: Last funding round type adjusted for the percentage of companies with available data, both on a national and aggregated level.

Others forms of financing have not been object of further in-dept analysis due to their residual frequency.

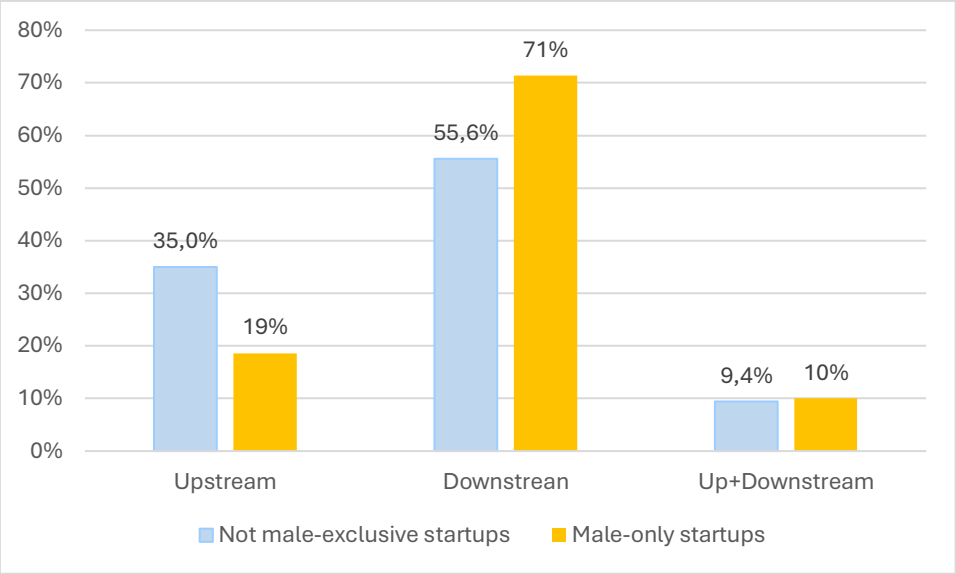
In terms of funding amount, rather than simply looking at each gross value, it has been deemed more relevant to proceed with a cumulated function that analyses the entity of the funding rounds against the fraction of startups for which that amount has been poured in the project.

The output of such analysis, displayed by Graph 4, shows how, for the most part, a smaller segment of the overall funding has been awarded to 80% of the pool. Deductively, a handful of big startups are diverting the biggest part of the capital invested.

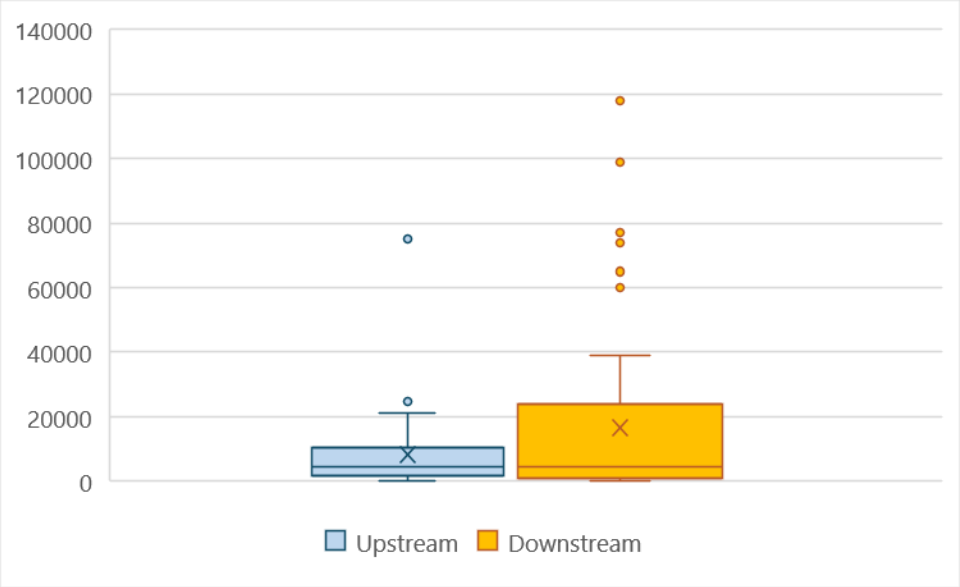


Graph 4: Cumulated function of startups' percentage with respect to the total funding awarded to each (K of euro).

To offer an ulterior prospect on the resource distribution across the value chain, would be proper to conduct an examination on how these companies locate themselves along the market's segment and confront this value against the funding the reference section is attracting. As per data presented in Graph 5, there is a skew in favor of Downstream startups. In Graph 6, it can be seen, as further confirmation of the conclusions deducted from Graph 4, that despite the investments on Downstream section, the gap in funding allocation is strongly misaligned by a handful of outliers. Thus, the Upstream segment has not been underfunded to the extent shown in the graph. Outlier removal leads to a less biased prospect.



Graph 5: Startups' funding distribution across the space value chain (Upstream vs Downstream) for male-exclusive and gender-mixed startup segments.



Graph 6: Gross funding distribution (k of euro) for Upstream and Downstream startups.

So far, the analysis has shown that the average startup profile constitutes of a company at its early life stage with an employee density that is set in between 1 to 50 employees, located in an area with a strong and well-established industrial complex.

The picture presented is a dynamic and active entrepreneurial ecosystem, with many individuals entering innovative ventures supported by a network of organizations, including accelerators, incubators, co-working spaces, mentorship programs, networking opportunities, academic support. The proximity to already established infrastructures and academia favors the spillover of knowledge, while the innovation pace may attract talents from different fields.

On the other hand, it can be asserted that Business angels, VCs, seed funds, governmental agencies and other investors are willing to overlook the general high failure rate of the startup ecosystem and take on the physiological risks that new ventures carry by providing substantial capitals. This confidence is crucial for startups' growth and development. The positive externalities created (economic growth, job creation, significant technological advancement, development) by such an environment are also a feasible way to feed this virtuous cycle.

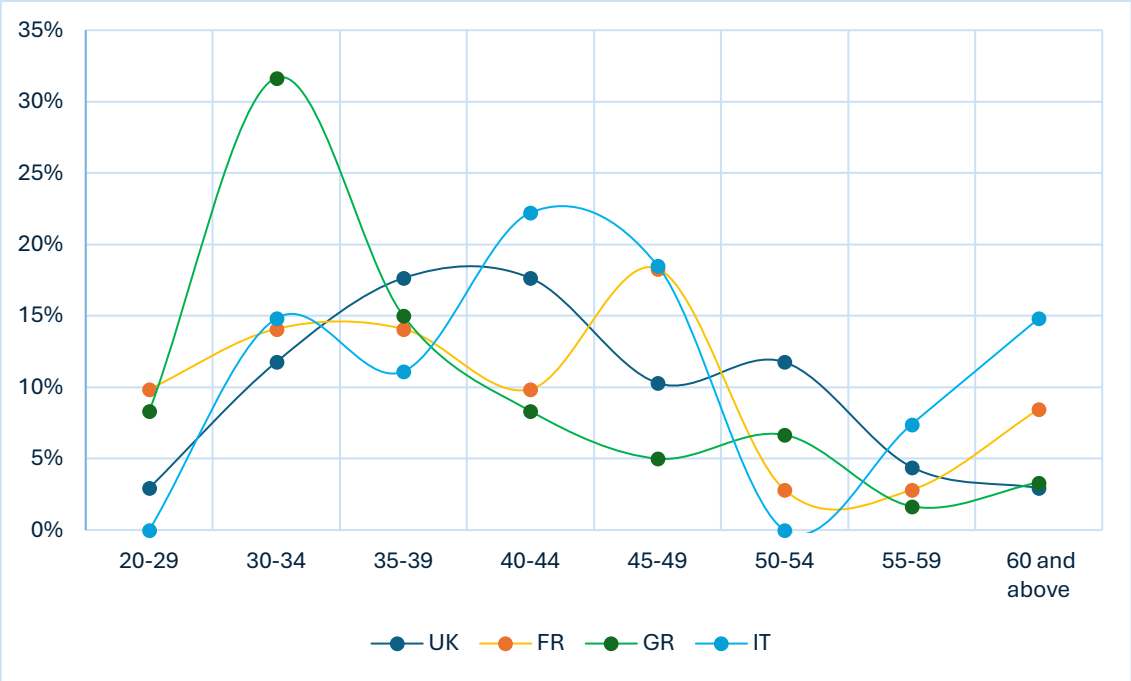
3.3 Profile of founders

So far, the analysis has been aimed at properly describing the environment in which these startups develop and evolve. Within this picture, is now important to identify a general prospect of the founders' profile so as to describe their main characteristics, evaluate if the case for gender underrepresentation has a stand and which are the main points of divergence, as well as the economic and growth limitations such a stratification may cause.

Out of the 131 startups analyzed, the set includes a total of 251 profiled funders. Below the prospect that can be derived from the input data.

3.3.1 Age distribution

To identify possible generational trends or specific dynamics at play, an analysis of the age demographics of founders has been conducted.



Graph 7: Age distribution among founders.

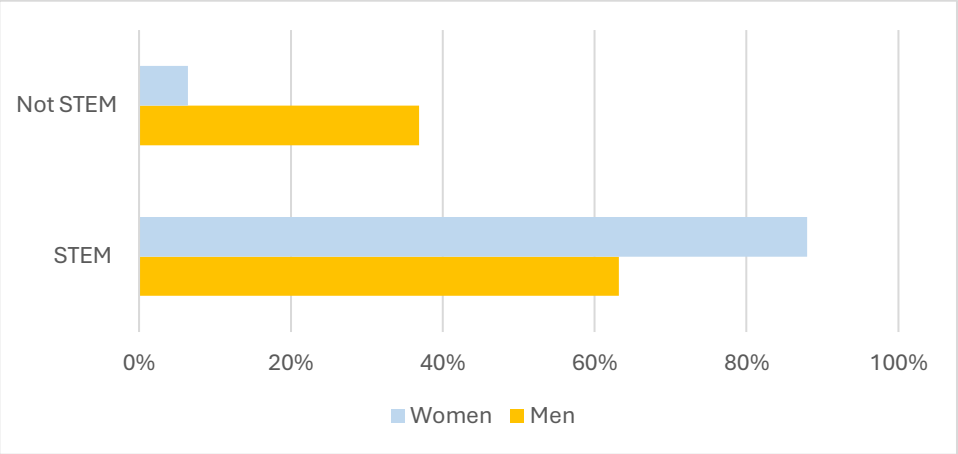
As seen in Graph 7, different age distributions emerge among founders. More specifically, the younger demographic is represented by German-based ventures, with a peak of 19 founders (32% of the German ventures' founders) in their early thirties and a 15% of them being in the 35-39 bracket. Both the youngest demographic (below 30) and the middle aged one (40-44) sits at 8%. The elderly presence is limited in absolute terms (2 founders fall in the category), even if compared with other countries. At par with this percentage (3%), there is the UK, where the main demographic is older: most founders fall within the 40-44 (18%) and 45-49 (18%) age categories. There is a more even distribution among age brackets with a less prominent peak. The lowest values concern not only the elder group, but the youngest as well (both at 3%).

Regarding France, no specific age trend among founders can be identified, but values seem stable among the younger age groups, with a significant drop in the 50s decade. On the other hand, Italy shows an older demographic distribution: on top of having the highest percentages founders between the ages of 40 and 49, it has the highest percentages of both founders between 55 and 59 (7%) and over 60 y.o. (15%), while no under 30 entrepreneur is present.

3.3.2 Educational background

To identify the skillset and expertise brought in by each profile, a retrospective on their educational background will assess the technical know-how of founders operating on a substratum of knowledge (aerospace) that falls within the STEM cluster.

Overall, as shown in Graph 8, STEM education prevails among founders. The almost totality of men has been educated in STEM fields (88%), while a significant share of women appears to own higher education degrees that falls outside this are of competence (37%). Whitin this percentage, the most prominent area of study is economics.



Graph 8: Distribution of founders among educational fields.

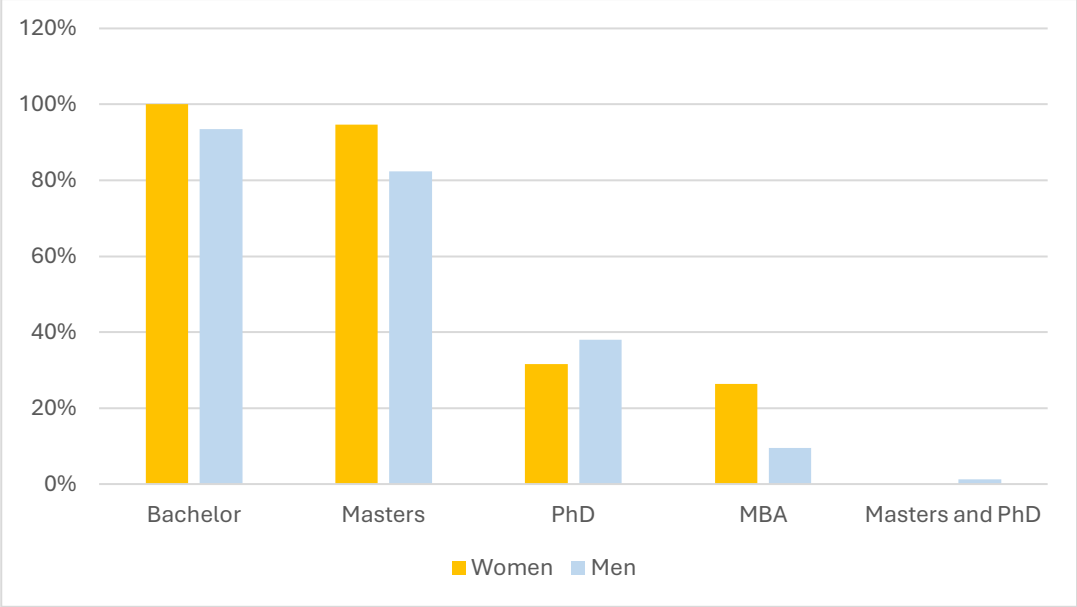
On average, women retain a numerical advantage in terms of bachelor's and master's degree. All of them have, at least, an undergraduate title, while 6% of their male counterparts do not. The gap increases to 13% when looking at graduate ones. Investigating further specializations, men show a higher share in PhDs (6% difference with female profiles), as well as MBAs (17% gap).

Overall, as shown in Graph 9, women are on average more educated, due to a higher share of master's degree. On the other hand, a higher number of men has proceeded

through a PhD, generating a prominence of male founders at this academic level. As for now, the delta in favor of women with MD is at 13%, while the one related to male PhDs sits at a positive 6%.

On the other hand, a higher number of male PhDs can partially stem from a higher percentage of male being involved in hard science fields. On this note, a stronger academic disproportion is shown at MBA level, with a 17% gap among the two groups. Despite women displaying a higher presence in non-STEM disciplines (37% of them does not fall in this category, versus a 6% of males), they represent the lower stake of MBAs.

An even smaller fraction (1% of the exclusively male founders) of the pool got both a PhD and an MBA.



Graph 9: Distribution of educational levels among founders (as proportion of the total number of male and female founders, respectively).

Regarding the counties where these degrees have been completed, the picture presented is quite scattered: looking at the Graphs 10 and 11, there's a predominance of German institutions for both male and female founders.

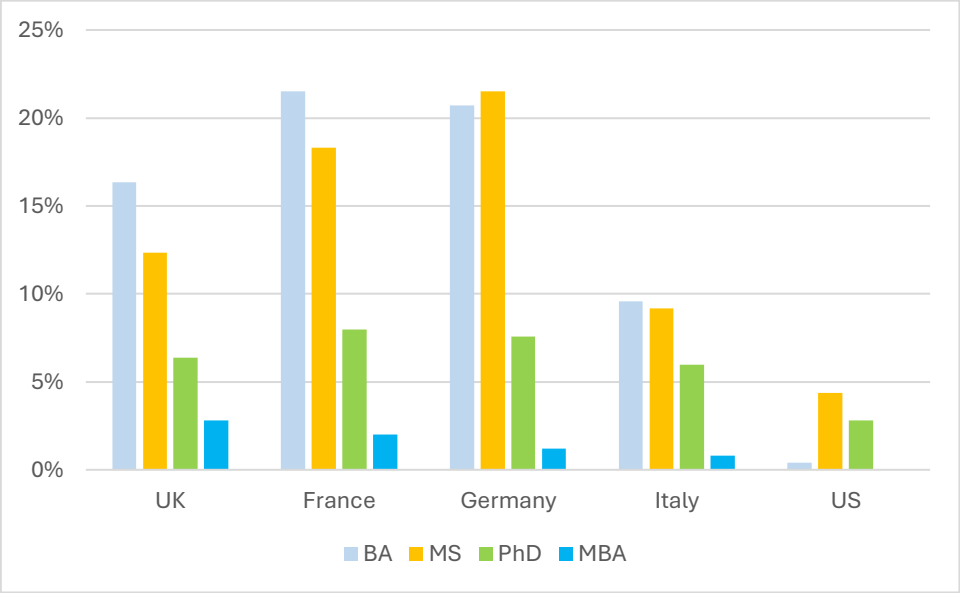
For what concerns the other countries in scope, the trend seems to deviate: France is at par with Germany for male founders' values, while the male UK share, despite the high

fraction of BAs, falls shorter with respect to this first value. Compared to the female corresponding data, both countries significantly reduce their contribution to female founders' education.

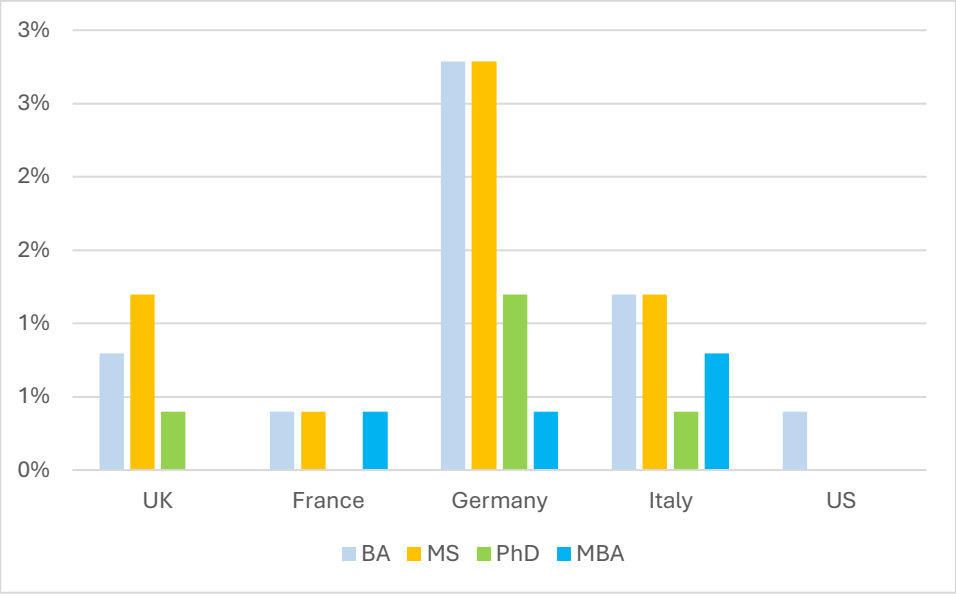
On the other hand, in Italy, despite the limited fraction of founders and the different magnitude of the segments of female and male quota, there's a substantial equilibrium in terms of funders' educational distribution at BA and MS levels. The only value that explicitly differs from male to female data is the MBA: in proportion to the percentages emerged for each level of education, the gap is lower for females.

The US presents different situations, based on the segment. Male founders have attended MS and PhDs, female ones BAs. No MBA is accounted for in the region.

Other foreign institutions are part of the input data, but considering their modest frequency, no further analysis will be pursued in this sense.



Graph 10: Percentage of male founders' highest academic title by University country (with respect to the total number of founders).



Graph 11: Percentage of female founders' highest academic title by University's country (with respect to the total number of founders).

3.3.3 Engagement and institutional affiliations

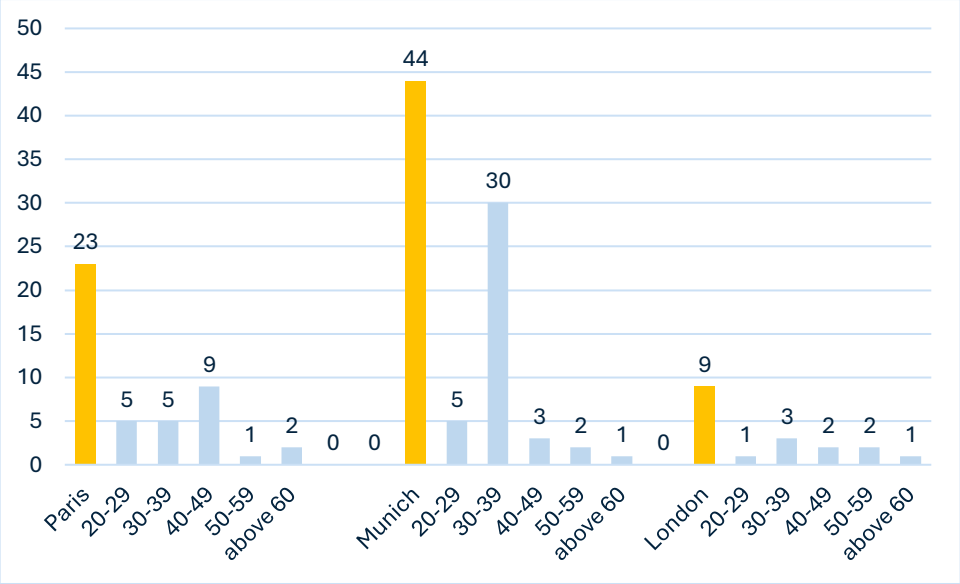
Considering the institutions attended by founders, it would be useful to look at how they position themselves within this frame. More specifically, in order to identify patterns, clusters of founders or affiliations among them that could have resulted in contamination or collaboration, the focus was put on a cross analysis of both the university of the highest degree obtained and the most plausible age bracket they fall into in order to narrow down the pool of founders that have, with a reasonable probability, created an affiliation thanks to their educational trajectory and the institution they've been part of. Moreover, the analysis has also taken into consideration founders of comparable academic degree of specialization.

This approach has been deemed more effective in terms of descriptive efficacy to identify dynamics and clustering trends among founders, rather than the sole formal examination of the age demographics on itself.

Based on these criteria, the result shows that, overall, 61 out of the 251 founders' relationships (24%) appears to have been fostered by the academic environment (the percentage includes founders of a same startup that have studied in the same institute

in comparable periods), while among startups with female founders the proportion is 18 founders out of the 53 total founders of mixed-gender startups (34%). This allows to conclude that the educational background, especially for what concerns gender-mixed startups, seems to be relevant not only for know-how acquisition, but also for networking and innovation purposes. This environment is often the first opportunity to generate entrepreneurial ideas an pursue them, especially for the younger demographics that seems to be involved in the process in higher percentages.

On a local level, up to three big clusters of academia proliferation for funders can be identified, as per Graph 12:



Graph 12: Distribution of founders, by age (if available), in the clusters identified in Paris, Munich and London.

The most prominent is the Munich one, where 44 founders have gotten their highest degree (representing almost 18% of total funders). Among the ones which age was known, the neuralgic university is by far the Technical University of Munich. This institute has formed 100% of the German-based founders aged 20 to 29 and 90% of the ones aged 30 to 39. 5 of the startups analyzed present multiple founders formed within

the university. Overall, thanks to the high level of age and geographical proximity, Munich is a catalyzer of young entrepreneurs.

Paris has been the base for the education of 23 of the founders. Out of the 5 youngest founders, 4 of them has studied at IPSA, école d'ingénieurs de l'air et de l'espace, while 40% of the ones aged 30 to 39 has attended the Université Paris-Saclay. As visible from the graph, the age of the cluster members is skewed towards the younger spectrum, but peaks at 40-49. A further point of attention is Télécom Paris: 4 of the oldest founders have attended the school in the span of 5 years.

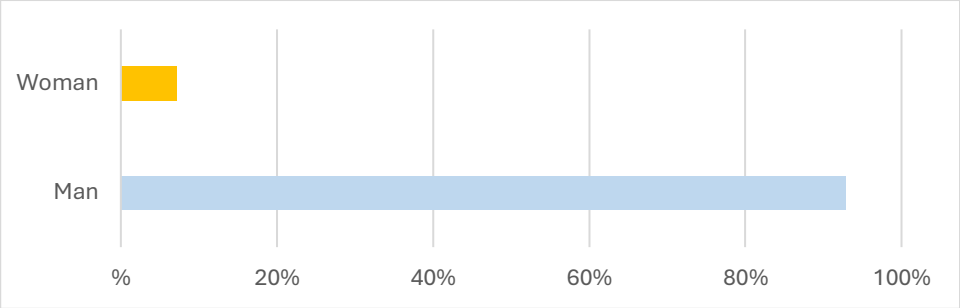
London cluster is more modest in its dimension, with a mostly even age distribution which peaks around the ages of 30 to 39. Thus, possible affiliations generated within the academic environment seems fainter.

3.4 Gender disparity in the startup industry

To properly evaluate the representation of women among space startups and identify the variables which interplay contributes to a disparity founded on gender, the analysis will start with a retrospective on the gender distribution within the venture environment and will then proceed to identify the main disparities and communalities on a sector-specific level.

3.4.1 Gender distribution

To have a term of comparison, the landscape referring to gender composition of funders across all startups being profiled is cut through: 92,4% of the profiles are man, as shown in Graph 13.



Graph 13: Gender distribution among funders.

Moreover, it can be observed that:

- All startups that present a female quota are still Active (so far, only 3% of startups have been closed) and fall in the for-profit commercial classification;
- There is one female-only startup (accounting for less than 1% of the total);
- Mixed-gender startups present, at most, a minority of female founders (accounting for 13,7% of startups);
- No female only teams: among the ones with multiple founders, at maximum two females are present within the funding board, accounting as part of gender mixed teams.

This prospect is already relevant as a face value data, but a comparison with the state of the market of different industries would shed a light on the space industry gender-integration pace.

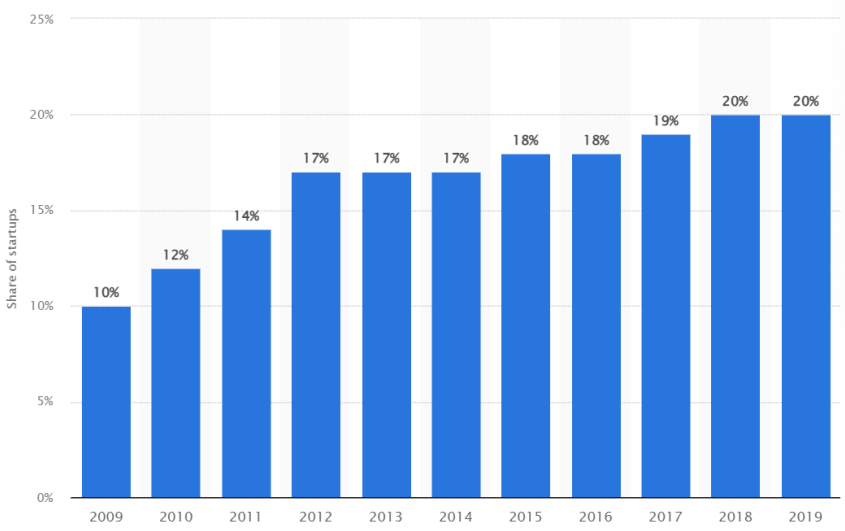


Figure 10: Worldwide proportion of startups with at least one female founder (between 2009 and 2019, Statista,2019).

First, looking at the global picture, an historical underrepresentation of female-led startups is quite clear. With numbers being, on average, higher than the ones shown at European level for the space industry, the fraction investigated is still a minority component of the overall picture, despite the values displayed being inclusive of industries with a higher female ratio. But as for (Fig.10), a rising trend can be detected. The figure relative to female presence has doubled in the span of 10 years, with a slowing but still positive pace.

Restricting the stage of analysis, four years of reports by BCG and SISTA (*4th SISTA x BCG barometer on gender parity for startup creation & funding, covering 5 European countries: France, UK, Germany, Spain, Sweden*) have highlighted how the overall women-founded startups in key European markets accounts for only 10% of startups created, 7% of fundraisings carried out and only 2% of funds raised in 2022 [23]. As per the analysis, the scenario presented is one where female stake in startups is gradually growing: France, UK and Germany show "*as only 10% of startups created in 2022 have been created by women-only teams, 12% by gender-mixed teams*".

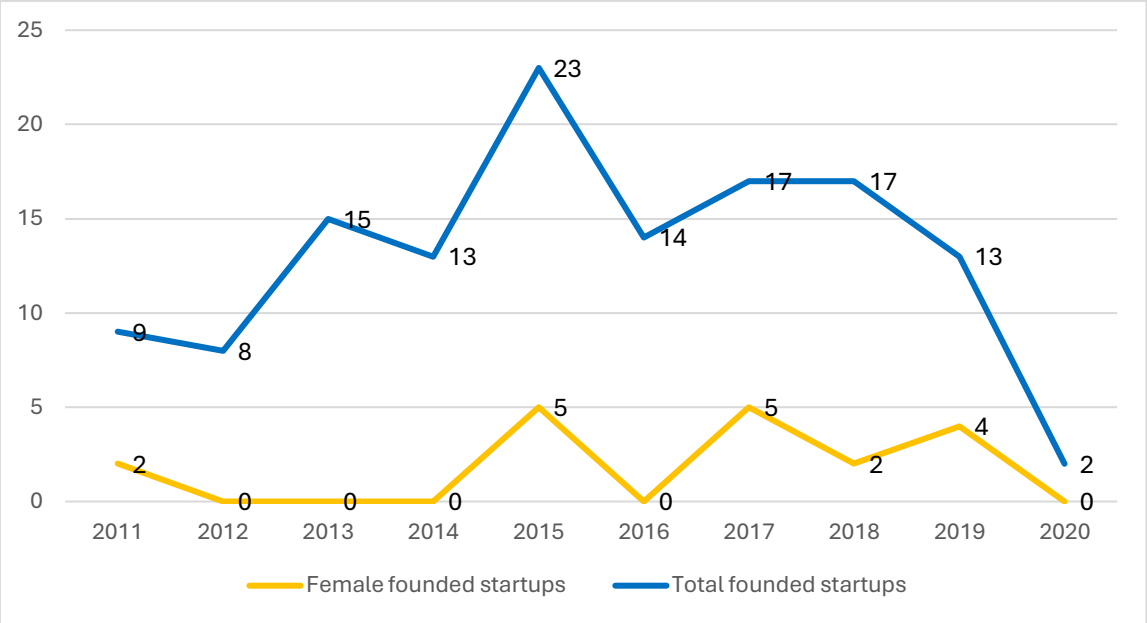
The choice of comparing the historical data harvested to 2022 figures has been deliberate: numbers referred to 2020 and 2021 would have been too skewed due to the pandemic and post-pandemic scenarios. In 2022 the damage caused by the pandemic in

terms of volumes of new startups and funding has partially been offset and the physiological trend has been recouped, generating value comparable to pre-pandemic levels. Meanwhile, also private investments have seen a stabilization after the 2021 peak.

The scenario that emerges from the tech startup ecosystem is an output where less than 1 in 4 startups created in 2022 includes a woman as founder, with only 10% of them being women-only founded and 12% being gender-mixed teams [23]. A strongly uneven scenario, despite the inclusion of Sweden, the de-facto best-in class equality head of Europe (where 1 startup in 3 includes one woman). This disproportion worsens if compared to the total 7% of non-male startups detected in the data set, including both female-only and mixed-gender startups, as it can be seen from Graph 14. Among the startups considered, the highest ration of ventures with female funders and overall companies founded touches the 31% in 2019, after a modest nonlinear and nonmonotone trend. To explain this disproportionate datapoint, two main elements must be taken in consideration:

- An actual timid increase in female presence among founders
- A shrink in the number of new startups founded.

This does not disqualify the overall positive slope of the tendency with respect to 2011, but significantly reframe the percentage entity and properly aligns it to the overall startup industry dimension.



Graph 14: Total number of startups founded against the number of new ventures with at least one female within the founders' group, by year.

3.4.2 European level

In 2022, on a European level, women-founded startups account for only 10% of startups created, for 7% of fundraisings carried out and for only 2% of funds raised [23]. Women raise significantly less than men even in industries with higher shares of women founders, with men-based startups absorbing a fraction of funding going from 77% to 91% of the total funds raised. Gender-mixed teams account for 7% to 22% of the amount, leaving women-only ventures covered by the residual percentage (1% to 5%) [23]. This gap between male-only and nonmale-only startups appears to spread over time, exacerbated by the latter ones reaching a founding cap after 6 years of the startup raising funds and by the former thriving over time and leading to a gap of 1 to 10 in funding awarded [23]. This scenario presents a state of the art where no gender parity seems to exist for startups among the countries object of study.

Shifting the focus on the data collected, out of the subset considered for the space industry, 5 out of 18 startups doesn't report any confirmed funding info.

As shown in Table 2, historically funding distribution appears to be extremely modest. The proportion between the funded percentage of startups with female founders and the entity of the funding to them redirected doesn't properly align. For instance, in 2011, despite female ventures constituting 11% of the companies founded that year, the funding amount to them awarded accounts for 0,11% of the total amount of the total financial resources given to companies founded in 2011.

With time the commercial potential of non-male exclusive startups seems to have been increased, causing them to absorb a bigger percentage of fundings.

The funding allocated to more recent female-based startups seem to be larger in proportion: both in 2018 and 2019, the percentage of financing awarded to startups which include female founders with respect to the total resources awarded to companies established in these two years is significantly higher with respect to past values, implying higher proportions of economic resources being awarded to the single entities of interest (the non-male exclusive ventures).

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
% of financed female startups wrt tot startups	11%	0%	0%	0%	13%	0%	29%	25%	15%	0%
Net funding on female startups (K)	50	0	0	0	8850	0	24000	42600	3110	0
Net funding for all startups (k)	45196	139950	363914	108273	161250	184250	233550	124306	14010	13400
% of funding raised for female startups	0,11%	0,00%	0,00%	0,00%	5,49%	0,00%	10,28%	34,27%	22,20%	0,00%

Table 2: Historical record of funding differentiated by startups founders' gender.

In terms of different industry sectors, as shown in Figure 11, despite the awareness and call out for efforts to tackle the issue, the female presence in the startup dimension is still, for the most part, very modest. The distribution here presented displays a stronger

female presence in the fashion industry and lifestyle sector (home, alcoholic beverages, wine).

Given the numbers emerged above, the space scenario analyzed falls, in terms of numbers, among the lowest ranks of this proportionality spectrum. This trend is mirrored in the transportation and industrial market segments, the ones generally more affected by knowledge and idea spillovers generated by the space industry.

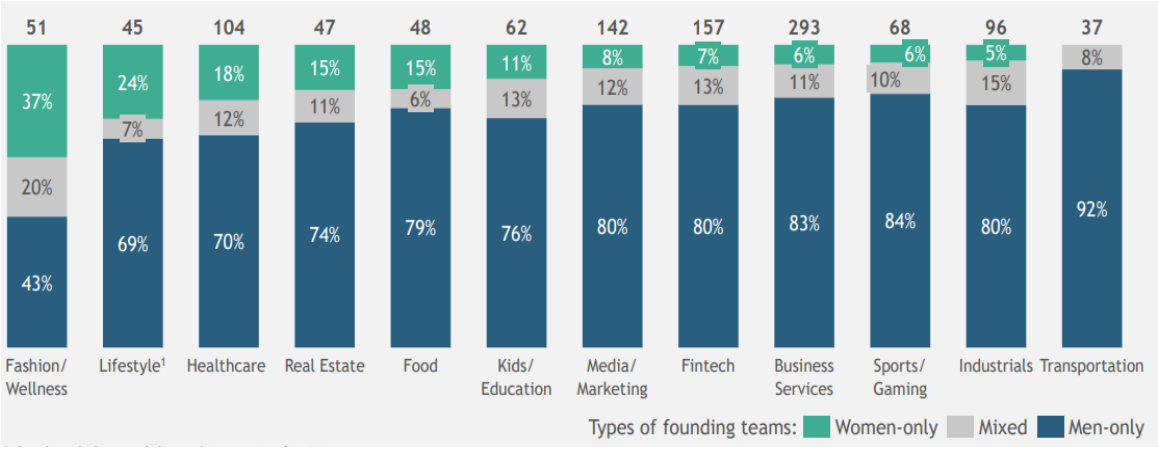


Figure 11: : Percentage of startups created in 2022, by industry (4th SISTA x BCG barometer on gender parity for startup creation & funding, covering 5 European countries: France, UK, Germany, Spain, Sweden,2023).

3.4.3 Country level

If the general European trend is the one described above, by analyzing the overall startup environment at a country level, the UK is confirmed as the best match between female company creation and funding, with a track record that ranks the country almost systematically in the Top 2 positions for both gender mixed and women-only teams ventures [23].

Less virtuous is the case of France, where women-only teams appear to struggle, while gender-mixed teams appear to cope better. Funding's distribution has been addressed directly at funds level, redistributing the invested capital more evenly, but entry barriers

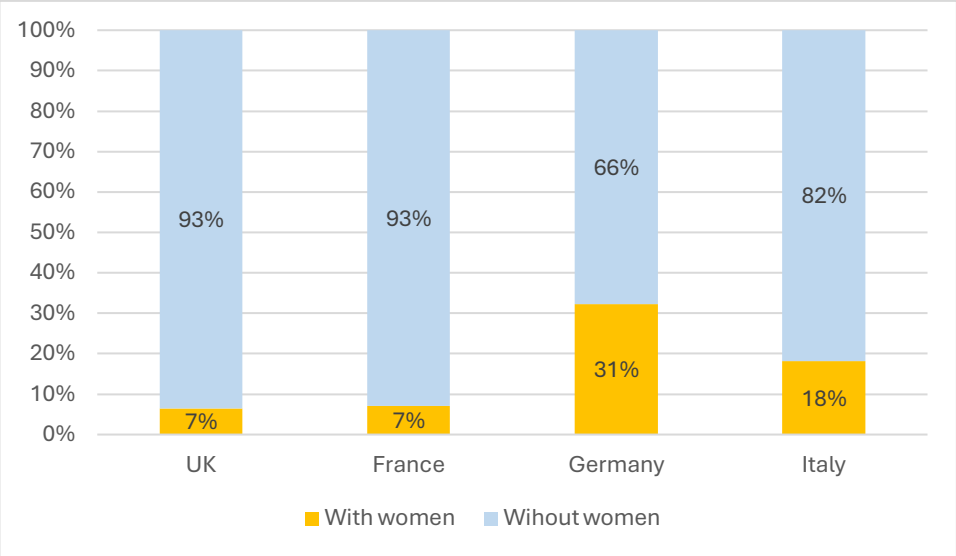
do not continue to cease: women are the least likely to start a business solo (25%), while the ones participating in gender-mixed teams face the lowest parity.

In Germany the issue of funding impacts both female and gender-mixed teams, with men-only teams are absorbing 77% of fundraisings capital [23].

Overall, women tend to choose men as partners to bypass the disadvantages that come from raising, on average, 30% less fundings due to lack of male involvement. As the SISTAxBCG study highlights, only 1 in 10 men partners with a woman to start a business, while 1 in 2 women partners with a man. This disparity stems from the concrete evidence that women raise, on average, 12 million euros when partnering with men and only 4 million euro as part of women-only teams. This scenario translates into men-partnering as the only feasible solution to grow and scale up their projects.

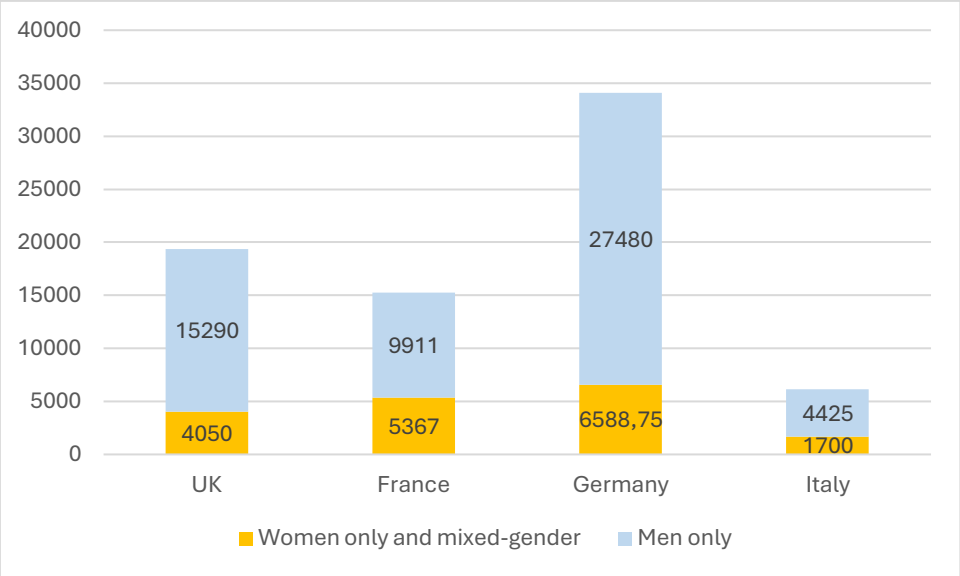
In terms of space sector only, on a country level, the distribution of startups shows a different structure with respect to the general prospect presented above. Looking at women-only and gender mixed startups as a cluster, the volume and share of women-founded ventures varies widely and seems to defeat expectations.

A more mature ecosystems like the UK, which has been proven to be at the forefront of female company creation and funding prospects, falls short to successfully implement the same schema within this market. Despite having had, for several years, a strong record as a lead for women founders on a startup level, a zoom on the sector of interest has shown a prominence of both Italy (18%) and Germany (31%), with a strong highlight on Bavaria province, as per Graph 15. Meanwhile a 7% figure emerges for France, stuck below its country medium value.



Graph 15: Distribution of startups with or without women within the founding board.

Looking at the quota of funding raised by women and gender-mixed startups (Graph 16), the scenario seems less cut through: despite the percentages referring to founded startups being for the most part an extremely low fraction of the pool, the overall average funding value shows a lower gap based on gender. Startup founders with female quotas account, as a whole, for almost 24% of the funds raised by startups, despite representing less than 15% of the founded startups. The highest share of funding is awarded to French startups, while Germany loses its leading position in breaching the representation gap, despite the higher gross value of its financing. Moreover, France and Italy show a lower stake in terms of startups founded with respect to Germany, but a higher economical support for that handful.



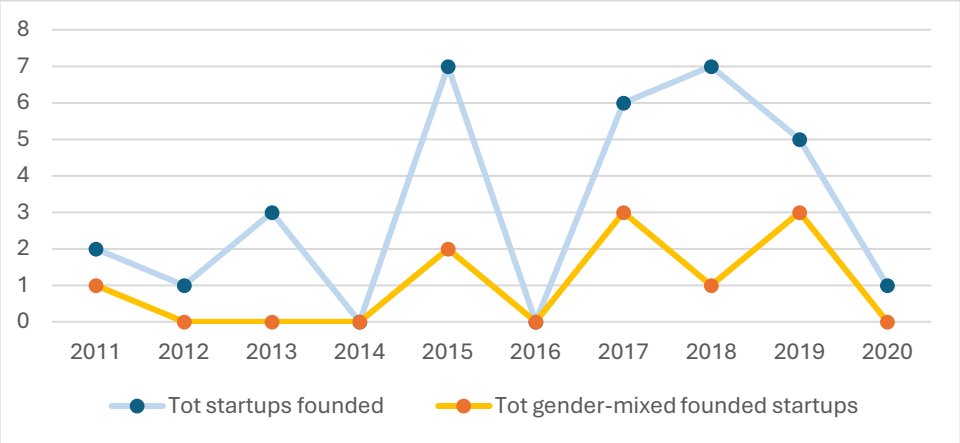
Graph 16: Average funding (K of euro) raised by startups with and without women funders.

Overall, the data distribution highlights a significant trend for three of the countries analyzed: UK, France and Italy. Despite the low percentages of non-male ventures (respectively 7% at par for UK and France, 18% for Italy), the capital allocated to these subsets is proportionally higher, with vales at 21% for the UK, 35% for Frace and 28% for Italy, constituting a significant advantage on gender-mixed startups and signaling a higher trust of investors on their growth. Thus, the general startup scenario on a country level seems to differ from the space one.

The prospect seems to partially hold for Germany: despite a significant level of diversity recorded, the values of capital founding are aligned to the county average (81% of space-destined fundings awarded to male-based startups against a market value at 77%). It is relevant to stress how, by integrating these data within a frame of mostly young founders creating gender-mixed startups, as the German one, the gap with respect of the other countries is partially scaled back.

3.5 A case for Bavaria

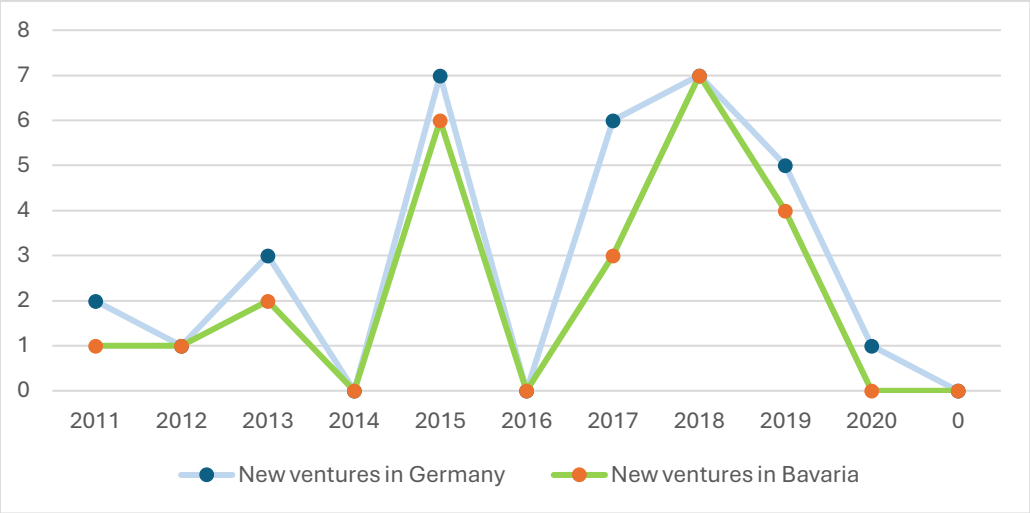
Among the several measures undertaken to foster innovation and bridge the gender representation gap in space startups, the case of Bavaria is the strongest result wise. Bavaria is the lead region in terms of gross financing and female presence in the startup space industry (as shown in Graph 17).



Graph 17: Total vs non-male startups founded in Germany, per year.

More specifically, the area homes 50% of the startups with female presence in the board (9 out of 18), all still operating. It seems relevant to investigate the comprehensive framework that had allowed these figures to emerge and the policies and initiatives that had impacted the region with such effectiveness.

Looking at the general distribution of startups in the German territory, as pointed out in the analysis of the density distribution of ventures across the country, Graph 18 clearly shows the predominance of the Bavarian area at the core of the German space startup industry, thanks to a diversified research landscape offering advantageous conditions for industrial applications in the aerospace dimension and an historical predominance of the sector within the region.



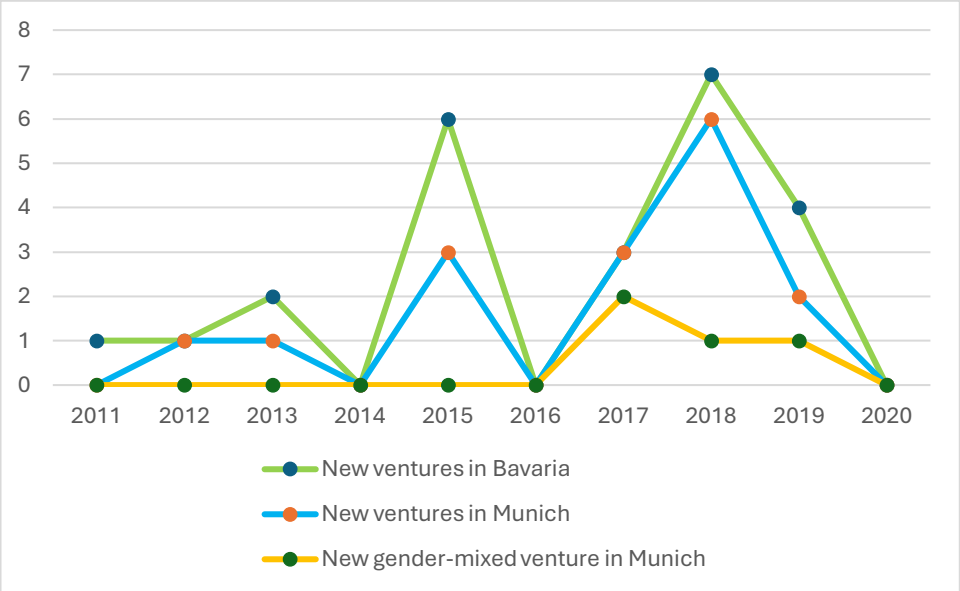
Graph 18: Historical prospect of new ventures in Germany vs Bavaria, per year.

Bavaria's gross domestic product of 716,8 billion euros (2022) overperforms 20 of the 27 EU member states [24]. This implies big disposable capitals for funding, thanks to an economic output far above the German and European average and governmental investments for 700 million euros (announced in 2018 by the Minister of Bavaria [24]). This is reflected in the funding comparison across the counties investigated, which displays Germany as the biggest investor. Between 2010 and 2020 the regions' GDP has risen by 70% and the region has attracted thousands of qualified workers [24]. These massive results have been translated into innovation fostering, leading to a 30.8% of Bavarian share on patent applications of the entire country [24].

With the aim of innovation, Bavaria is investing in young companies and innovative entrepreneurs. *Since 2009, Bavaria has […] been supporting the Business Incubation Centre (ESA BIC Bavaria) at the European Space Agency (ESA), a space-focused business start-up centre. The ESA BIC programme in Bavaria is the most successful space incubation programme in Europe. In the period from 2009 to 2020, the Bavarian Ministry of Economic Affairs and the ESA have supported 144 start-up companies in the process. These companies had created around 3,500 high-tech jobs in Bavaria by 2020 and are therefore an important driver for the development of the "new space economy" in Germany* [25].

The main points of attention for an organic development in the region have been identified in networking, startup for innovation drive and research. Bavaria has strongly invested on such aspects. Across them, training in cutting-edge technologies is a top priority. Numerous are the training facilities that are forming generations of experts in the aerospace sector: the Technical University of Munich, Ludwig Maximilian University Munich, Universität Erlangen-Nürnberg the University of Würzburg the Bundeswehr University Neubiberg and many others.

This organic strategy seems to have paid off especially in Munich, as shown in Graph 19. Thanks to a network of incubators, co-working spaces, accelerators, constant interchange with universities, established companies and collaborations with research labs and industry players, a positive trend of new startups has been set since 2011. A trend that has led the Global Start-up Ecosystem Report to define the city, in 2018, as *the top German location of global importance in the world's most important start-up ecosystem study. […] Thanks to strong sales market in the immediate vicinity, young firms work profitably in Munich much faster than in other ecosystems* [26].



Graph 19: Historical prospect of the number of new ventures founded in Bavaria vs Munich vs by gender-mixed members, per year.

Among the entities behind this regional development, of great interest for the analysis is the Technical University of Munich (TMU).

Founded in the spring of 2018, the Faculty of Aeronautics, Astronautics and Geodesy (LRG) of the University is the undisputed leader in the field in Germany and is rising on the international landscape. It is set to become the heart of the Space Valley of Munich, as well as to account for about 50 % [25] of the total university-based aerospace research output in Germany, thanks to the funding of the Bavarian Ministry of Science.

TMU, other than a leader in research, is also a partner of the Munich Aerospace e.V., a cluster of scientific partners that include, among others, the Bundeswehr University Munich, the University of Applied Sciences Munich, Bauhaus Luftfahrt e.V. and the German Aerospace Centre. This entity, in addition to the local Bavarian government, supports the Ludwig Bölkow Campus (LBC), an international hub fostering innovation and new ways of thinking the aerospace industry by gathering the scientific and technical expertise of academic and industry-related research. The magnitude of the project has attracted several industrial partners, such as Airbus, Siemens and IABG, while its direct contact with hubs has created a highway for talent mobilization in the region.

This prominent role in the national and international aerospace industry, as well as its neuralgic positioning within core entities at the forefront of innovation, align to the high number of startups born within its environment. Its position on talent clustering is especially evident by analyzing the founders' profiles: with a 33,6% of the total pool coming from Bavaria (which translated to more than 73% at German level) and more than 50% of the German highest academic titles being awarded by TMU, a strategy that is founded on fostering scientific communities whom members are engaged at an early stage seems to be the most efficient to organically grow innovative startups.

In *Understanding regional innovation cultures: Narratives, directionality, and conservative innovation in Bavaria* (Pfotenhouer, 2022), the authors attempt at explaining why such a success may be possible, by introducing the idea of innovation cultures, a concept that encompasses *the unique ways in which regional innovation*

initiatives and technology developments (their goals, meanings, material organization, and actor constellations) are being brought into alignment with local identity, socio-economic legacies, and unique political cultures [27].

Bavaria enjoys a so-called *regional advantage* [27], which explains its innovation performance not in terms of best-practice implementation, but by looking at the organization of firms, inter-organizational networks, and the forms of regional social life emerging around them as the main agents responsible for the transformation of entire regions into innovation hubs. Bavarian innovation culture is typically founded on *a corporatist political culture based on strong coordination between a small group of institutional actors* [27]. Many innovation initiatives feature the usual mosaic of actors: Bavarian Ministry, governmental bodies, a municipality, a federal research organization and a Bavarian university such as TMU.

The role of networks, diversity and resilience, as well as people and companies they attract are the elements that scholars have identified as the main propellers of such an advantage.

In this framing, a biunivocal correlation can be identified. On one hand, initiatives aimed at inclusivity advancement directly promoted by big players, especially within universities, may partially explain the higher representation of female entrepreneurs in the field. On the other, the growth prospects and the reliability of a startup system that has been able, as the numbers laid above suggest, to withstand and out-do international competition, has at its base a diversity of approach, points of view and methodologies that only gender diversified environments can develop.

Despite women being still a minority among founders, an improving trend has been set. To raise awareness, the *Female Founders Monitor* yearly study aims at reframing the gender gap problem in terms of figures, facts and advancement losses to stimulate relevant discourses around the significant importance of female start-up founders.

Moreover, lots of organizations and initiatives (Fig. 12) promote and support other female founders in Bavaria to overcome personal biases or reticence to successfully gain a foothold in the tech industry. The goal is to create opportunities, promote the female

founder's scene, create, advise and support networks of fellow successful businesswomen, exchange job and financial opportunities.

Figure 12: Partners that collaborate to the UnternehmerTUM initiative, dedicated to foster female presence in startup industry.

The most prominent initiative for the context analyzed is the Women Start-up at UnternehmerTUM, an open project that focuses on female involvement in technology and entrepreneurship. The goal is to provide a broad-spectrum mentorship: support for business definition, provision of right qualifications to establish a start-up and consulting rounds. To do so, training sessions offered to female students, PhD students and future female founders have been set in place, as well as a plethora of events, talks, coaching programs and pitch events.

A testament to the practical utility of such initiatives are the successful startups that this effort has contributed to found. Kewazo, one of these ventures object of analysis, has been fostered by this reality.

These projects are not only mentorship programs, but also useful feedbacks on how many women would like to embark in a project and how few act upon this goal: around 33% of visitors to the 2018 *herCAREER* fair harbored the desire to create a business [27].

Nonetheless within the work to foster entrepreneurship among women, the biggest change has to come from the degree of trust towards women existing at environmental level: to this day, as the figures presented in the chapter *Gender disparity in the startup industry* section, female founders often have a harder and longer time gaining access to necessary resources, potential investors or growth financing, essential steps to build a successful startup.

4. Conclusion

This thesis had the aim to present an exhaustive description of the European aerospace startup realm and which role female entrepreneurship plays in it.

The topic framing has been conducted through the auxilium of governmental reports, scientific papers, M&A software platforms, strategy firms' and global organizations' reports.

Within this ecosystem, the dataset backing up the thesis has been the starting point for a deep dive on the profiling process of the startups considered. After an investigation on the geographical distribution of the ventures and their links to local, national and international organizations, the perimeter of analysis has come to include their scale, funding type and status, in an attempt to derive an exhaustive picture of the startup panorama investigated.

As emerged, the sample is characterized by the surge of high-density regions where a network of private and public actors operating in the space industry intertwine, allowing to infer a connection between regional ferment and innovative venture fostering. Another relevant info extracted concerns funding: the analysis has detected a high volume of startups receiving seed and early-stage VC funding (accounting for a cumulated 60% of last funding round's types), sign of a healthy and dynamic startup ecosystem. Paired with sustained volumes of capital injections, the pictured that can be derived is one of robust investors' confidence paired with supportive territorial infrastructures, leading to significant innovation degree and economic potential. Despite the high-risk correlated to innovative venturing, investors' trust and the allure of an early penetration in a growing market where competition for resources and market share is not as fierce are positive indicators of economic vitality and technological progress. In absolute terms, it has emerged that the majority of fundings has been awarded to less than 20% of startups, which aligns with a less consolidated venture segment of mostly young ventures and a fraction of bigger, more structured and highly funded startups.

An ulterior distinction on a value chain level has shown a higher presence of downstream startups, which retains 71% of total fundings, with significant outliers partially skewering the distribution.

A subsequent focus on the startup founders has allowed to identify the main characteristics of the group: for the most part under 40, STEM educated with a Masters' degree as the highest academic title. To identify centers of entrepreneurial innovation, looking at age and academic location, three clusters of founders have been identified in London, Munich and Paris, with a strong prominence of funders between the age of 30 and 39 and educated in Munich (with a peak registered among TUM alumni).

With the inclusion of gender as an analysis variable, the first step has been to assess the existence and the actual entity of the gender gap among founders. Despite having only 1 female-only venture and less than 8% of startups presenting gender-mixed founders, a yearly breakdown of the historical number of ventures founded has highlighted a positive, even if modest, surge in female presence. This trend is mirrored in recently growing funding, a sign of a higher degree of trust coming from investors with respect to the early records. But still, when compared to other markets, the space segment remains a niche in terms of female presence.

At a country level, the highest values concerning female representation has been detected in Germany (31% of ventures include at least one woman among its founders) and Italy (18%), which score better with respect to France (7%) and UK (7%), despite them being mature and established startup ecosystems. As seen from the data, the status of evolution of the overall innovation system is not necessarily mirrored in the funding structure of its startups. Funding wise, it's been highlighted how Germany shows lower level of financing for non-exclusively male founded ventures, while France emerges as the best-in-class.

Overall, despite fluctuations at country level, a predominance on both numerical representation and funding magnitude skews the results in favor of male founders, but a slow-paced positive tendency is emerging in favor of gender gap reduction on both areas.

Throughout the analysis, Bavaria has emerged as a neuralgic region on many levels: aerospace market, innovative startups and female representation within these startups. This has led to a focused analysis aimed to identify the reason behind its success and its predominance over other in-state global innovation centers like Berlin or international hubs like Harwell. These results seem to stem from an admixture of strategic factors: a regional advantage in the industry, strong governmental support and funding, a well-established network of clusters, innovation hubs, industry giants and academic formation centers. Despite being elements that, with different magnitudes, have been detected in specific regions in the countries analyzed, one data point emerges as an *unicum*: the proximity of funders. The analysis has shown how 100% of under 30 and 90% of under 40 German founders have been educated in the same university (TUM). And from Munich are also 5 of the female founders (26%) of the sample.

If on one hand talent proximity seems to foster innovative entrepreneurship (in the form of new startups), on the other the juxtaposition of such proximity, involving also female alumni, with mentorship from both academia and fellow founders, seems to be a propellent for inclusion.

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