SPACE FOR SKILLS

Skills for the Aerospace Economy



WHITE PAPER
Analyses and scenarios in the
Emilia-Romagna region and North-Eastern Italy

COESIONE ITALIA 21-27
Co-funded by the European Union
ART-ER
RETE ALTA TECNOLOGIA EMILIA-ROMAGNA HIGH TECHNOLOGY NETWORK
TECNOPOLO FORLÌ-CESENA
CLUST-ER INNOVATE INNOVAZIONE NEI SERVIZI
CLUST-ER MECH MECCATRONICA E MOTORISTICA

Vincenzo Colla,
Regional Minister for
Economic Development
and Green Economy,
Labour, Training of the
Emilia-Romagna Region



"We are working on creating an ecosystem by leveraging public-private partnerships and the contribution of the university. We will invest an enormous potential in vertical supply chains. We aim to double the turnover of aerospace in Emilia-Romagna in the next five years'."

This White Paper and the event that gave rise to its reflections are part of a 'masterclass' programme on the Space Economy with which we would like to accompany regional companies and businesses in north-eastern Italy towards the development of innovation in connection with the frontiers of the new space economy.

The event of 13 April 2023 in Forlì promoted by Tecnopolo Forlì-Cesena, Clust-ER Innovation in Services and Clust-ER Mechatronics and Motor Engineering, Forum Strategico Aerospace, the Chamber of Commerce of Romagna and Fondazione Nord Est laid the foundations for a snapshot of the territory's current needs and opportunities in terms of strategic skills for the aerospace sector. Since then, various moments of reflection and in-depth analysis have been developed with stakeholders' sub-groups, through interviews and surveys that have led to the drafting of this tool, a book in the making, open to future additions.

I CURATORI DEL WHITE PAPER

ELISABETTA BRACCI



Manager Clust-ER Service Innovation of the Emilia-Romagna Region

Investing in talent and enabling skills, without which the use of technology is ineffective, is a key focus for growth in the aerospace sector, as in any other high-tech sector. And it is even more important to break down the silos between those who produce value in downstream and upstream aerospace, so that these worlds are synergetic in creating an integrated approach to the entire supply chain. Clust-ER Innovation in Services therefore focuses its efforts on activities involving local, national and international stakeholders representing the corporate world, as well as research and education, facilitating the breaking down of silos and encouraging the emergence of joint activities and projects.

FEDERICO CAPUCCI

Manager of the Clust-ER Mechatronics and Automotive Clust-ER of the Emilia-Romagna Region



Within Clust-ER MECH, we deal in particular with aspects related to mechanics and advanced manufacturing in general. We have a specific working group dedicated to the fields of aerospace and aeronautics - made up of companies, research centres and training institutions - in which we identify project lines with a view to collaboration and cross-fertilisation with other fields. And it is precisely in the context of working groups and discussions with our stakeholders that we have realised how much the system has a continuous need for moments of analysis and concrete initiatives to ensure that technological and business development is sustainable also through the adaptation of the necessary skills.

LORENZO CIAPETTI



Innovation special projects consultant, Tecnopolo Forlì-Cesena

The Forlì-Cesena Technopole supports the path of the Emilia-Romagna regional ecosystem towards the development of an aerospace value chain that will make it possible to increase the participation of the region's *big industrial players* in the opportunities opening up with the new season of commercial space stations and the evolution of *downstream* service platforms for earth observation and satellite data analysis. Tecnopolo's action has also always been aimed at exploring the potential for innovation and investment that opens up in the space and aerospace economy for the SME system and the traditional automotive and mechatronics supply chains in Emilia-Romagna.

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INTRODUCTION: GLOBAL TRENDS AND THE AEROSPACE ECONOMY

In just a few years, the **'Space Economy'** has become not only a highly specialised industrial sector with a developed global value chain, but also a **driving force for possible cross-sectoral innovation in several areas of manufacturing and services.**

This change in perspective is certainly the result of acceleration and convergence.

THE ACCELERATION is related to the impetus given by **public innovation programmes**, such as that of the European Space Agency (ESA) aimed at promoting advanced manufacturing technologies in space, and by space exploration programmes financed by **private capital**, as is happening in the USA for the investment that Axiom is supporting to relaunch the international space station under a new push of private participation in exploration and research conducted in space orbit.

CONVERGENCE is the child of the 'deep tech' era, the fourth technological wave that makes it possible, thanks to the enormous expansion of digital knowledge, to come up with state-of-the-art solutions and applications capable of tackling never-before-solved innovation problems and, above all, problems of energy, environmental and climate sustainability.
Emblematic of this convergence is the RNA vaccine revolution that defeated covid.
From this perspective, the space economy is a huge **container of 'deep tech applications',** i.e., solutions that have already been tested through research, exploiting space environments of microgravity or other conditions that allow testing of solutions and resistance parameters.

> **ACCELERATION AND CONVERGENCE COMBINE TO MAKE THE 'SPACE ECONOMY' A TRUE FRONTIER OF INNOVATION, WITH THE APPARENT PARADOX THAT IT IS A FRONTIER THAT IS ALSO OPEN TO MANUFACTURING AND SERVICE SECTORS THAT DO NOT DEVELOP PREDOMINANTLY 'SPACE' ACTIVITIES.**

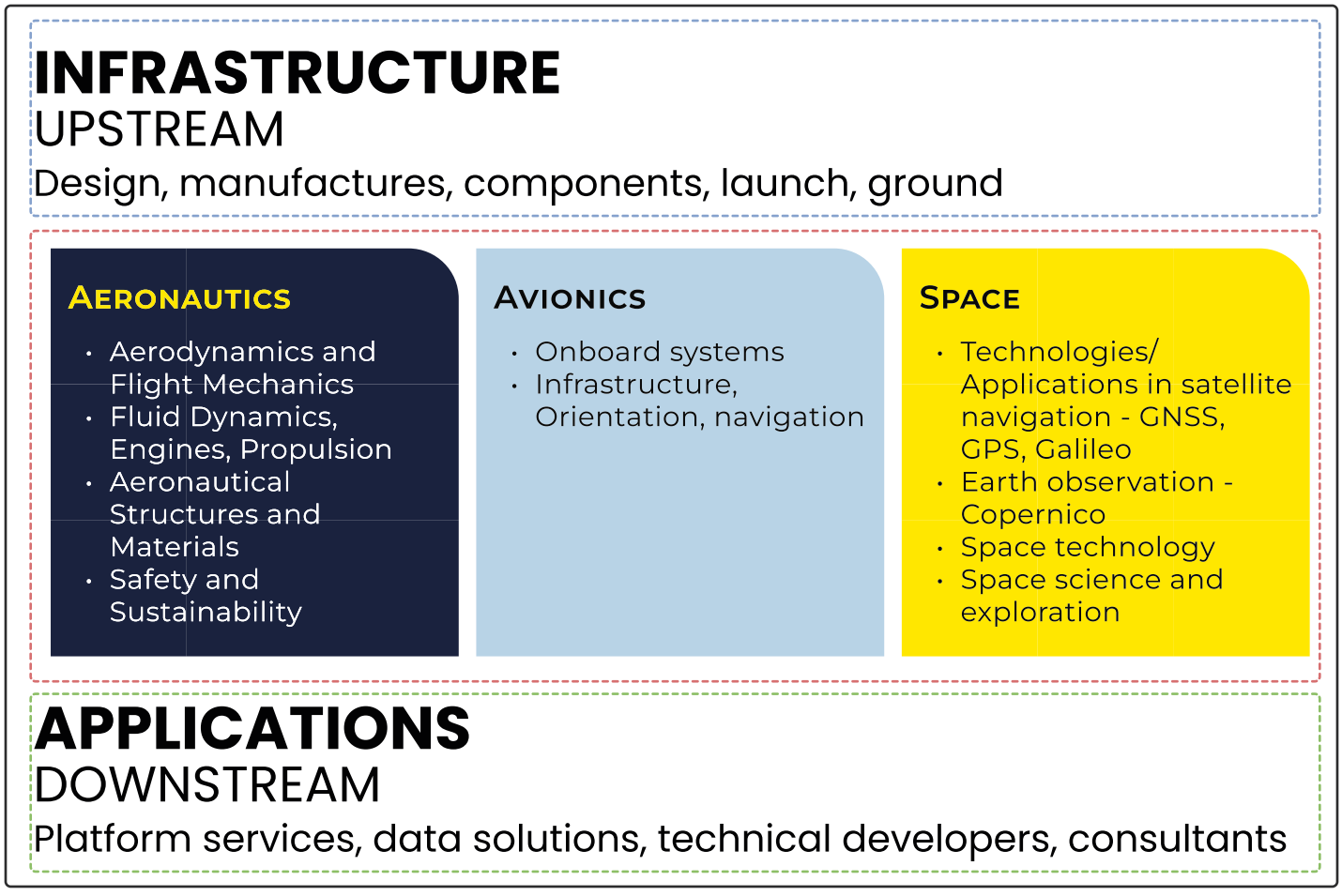
The space economy, from a value chain perspective, develops components, infrastructure and solutions both upstream and downstream. From an R&D and enabling technology perspective, the space economy can be further distinguished between aeronautics, avionics and space (Figure 1)

The presence of aeronautical specialisation, as in the case of the Emilia-Romagna sector, the subject of our exploration, suggests using the broader term 'aerospace economy'.

In **Aerospace Upstream**, a distinction has to be made between a traditional aerospace economy (that of designing and producing components and systems for aircraft and satellites) and a 'new space economy' that brings, as in the case of ESA's 'advanced manufacturing' programme, the frontier of manufacturing literally 'into space'.

In **Aerospace Downstream**, the new space economy makes use of Big Data and artificial intelligence management technologies to analyse and interpret satellite data for the purposes of land monitoring, climate risk prevention, and advanced georeferenced services. Here again, the 'new' space economy leads to calculation and analysis solutions directly 'on-board data processing' on space platforms.

In Europe, the downstream segment has a market value of around 60 billion, eight times the upstream value, but growing at a faster rate (source: ESA).



Map of the space economy (Figure 1)

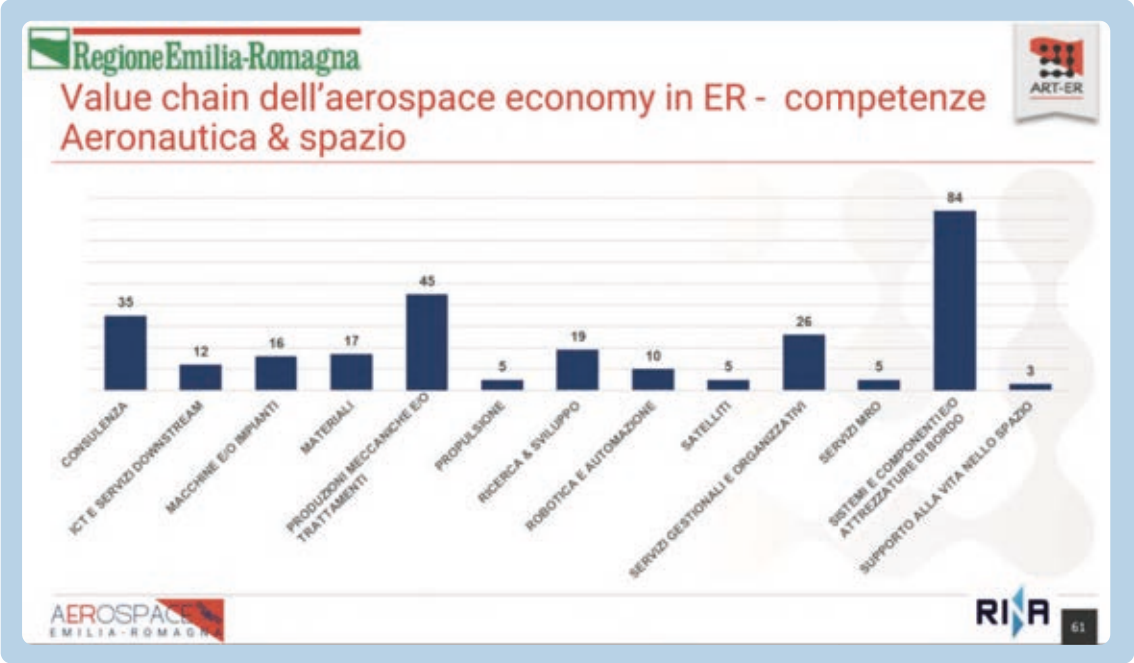
REGIONAL MAPPING OF THE AEROSPACE ECONOMY

Globally, there is a **growing contamination between patent generation for aircraft, drone and satellite components and climate risk mitigation solutions related to new materials and surface treatment**. Further growth in this area of research and development is to be expected. After all, this is the frontier set by the European Space Agency with its advanced manufacturing programme.

The industrial perimeter of the aerospace economy is difficult to classify with classical product taxonomies.

A double mapping exercise conducted by the **Strategic Forum for Aerospace in Emilia-Romagna** by **ART-ER** and an in-depth study carried out by **Antares-Tecnopolo of Forlì-Cesena** highlight an **EMILIA-ROMAGNA SUPPLY CHAIN COMPOSED OF OVER 170 COMPANIES.**

Forum map by ART-ER and the consultancy RINA (June 2023) highlights a deep-rooted value chain for both aeronautics/avionics and space technologies in the 'components, production and testing' segment, with particular expertise in mechanical production, treatment and on-board equipment.



Map of the specialisations of the aerospace economy in Emilia-Romagna

The use of innovative mapping methodologies offers the best guarantee that the development potential of aerospace technologies within the ecosystems and manufacturing districts of the Northeast is also being analysed. Of interest for further investigation is, for example, the **methodology based on web scraping**, in which algorithms are trained to identify combinations between products and technologies and the three R&D areas 'aeronautics', 'avionics' and 'space' on companies' websites. In the case of Emilia-Romagna, this exercise delivers a map of the main specialisation products, and through an application one fact is significant: although the space economy is moving towards a considerable differentiation of applications, products and business models upstream from downstream, there is a class of complex products (e.g. drones, engines for aircraft and critical screws) that

[1]Il report aggiornato è disponibile al link https://www.art-er.it/2023/07/aerospazio-in-emilia-romagna/

arise from a 'hybridisation' of knowledge on the R&D side, between aeronautics, avionics and space and digital technologies.

On the other hand, the Antares-Tecnopolo map of Forlì-Cesena, with a sample of 65 companies, photographs an index of specialisation through the range of 'complex' products created by companies whose research involves skills in aeronautics, avionics and space technologies. These are **products** that could be defined as **'fully aerospace'** (figure 2) such as drones, critical screws, aircraft systems, fixed and rotary wing aircraft engines, and aerodynamic structures. These are very specialised and complex productions resulting from R&D activities that are simultaneously related to aeronautics, avionics and space technologies.

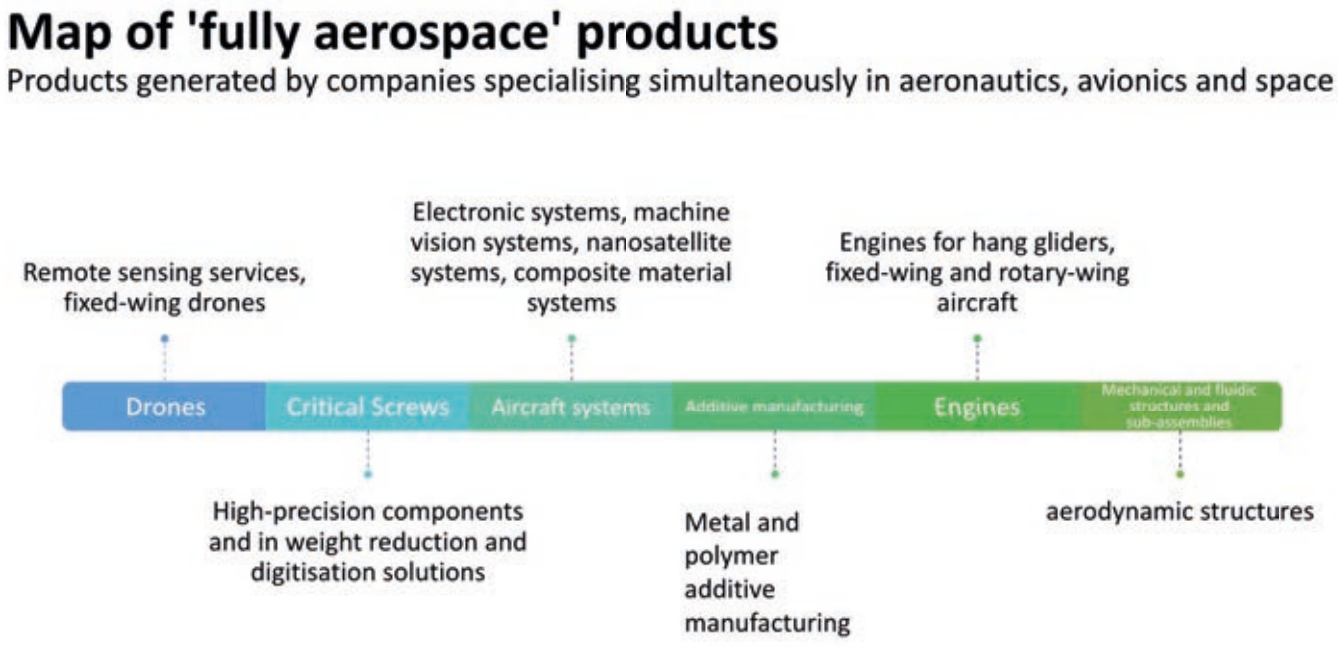


Fig. 2 - Map of 'fully aerospace' products in Emilia-Romagna (65 companies)

Aeronautics Technology Area: the link network for the aeronautics technology area is the one with the highest density of links, demonstrating a strong root of specialisation in aeronautics structures for the Emilia-Romagna aerospace economy.

In particular, the technology area of special materials, additive manufacturing and surface treatment is the one in which the most expertise is concentrated in the region.

Space Technology Area: within the 'space' specialisation, there is still little potential for satellite data analysis or decision support system technologies. We know, in fact, the enormous potential that the 'downstream' part using artificial intelligence will play in the development of the space economy. The challenge for the 'downstream' is to bring the high-performance computing typical of earth observation activities to have a direct impact on solving data management problems, e.g. for climate change mitigation by the public administration. Another frontier is the development of artificial intelligence for 'on-board computing' activities on orbiting stations for more accurate forecasting models to address climate change and risk management.

REGIONAL MEASURES FOR TALENT ATTRACTIVENESS

The Emilia-Romagna Region, which has always been attentive to the issue of talent and skills, has developed several tools to attract, train and retain talent.

One of the most effective initiatives is the **Regional Multistakeholder IT-ER Table**.

ART-ER Attractiveness Research Territory, on behalf of the Region, has launched a series of actions to attract and facilitate the presence of international talents in the region, in the interest of Universities, Research Centres, as well as Clust-ER Associations, Technopoles, the High Technology Network, through the identification and testing of replicable intervention models. It is in this context that the IT-ER - International Talents in Emilia-Romagna platform was set up, dedicated to foreign students and researchers, as well as to young people from Emilia-Romagna, either by birth or training, living abroad. IT-ER accompanies and orients international talents interested in investing in their training and career in Emilia-Romagna by offering guidance on how to fit in properly: from the visa application to relations and on the territory.

Moreover, in 2023 the Emilia-Romagna Region approved **Regional Law 2/2023** entitled **'Attraction, permanence and valorisation of highly specialised talents in Emilia-Romagna'**, the first Italian regional law created to put in place concrete and systemic measures to attract and retain talents in the territory.

COMPLESSITÀ AND COMPETENCES

The above-mentioned acceleration and convergence contribute to determining **COMPLEXITY** in terms of technology and skills.

If one looks at the generation of knowledge on a global level, through the lens of patents, one realises how in the last twenty years there has been a convergence of purely aeronautical technologies with new frontiers of research and development such as in the case of climate risk mitigation technologies with particular reference to the technology area of materials, thermal processes and electronic equipment.

At the level of knowledge generated in Italian territories over the last ten years, with reference to aeronautics systems, there is a centrality of patents dedicated to the topic of fastening systems, to the frontier of digital information transmission that includes edge computing, and to technologies related to climate change mitigation.

It is interesting to note that artificial intelligence contributes to the overall knowledge generated in the field of digital technologies and is related to propulsion technologies and the construction of aircraft and helicopters.

FROM THIS PERSPECTIVE, THE AEROSPACE ECONOMY IS THE TRUE FRONTIER OF THE NEW TECHNOLOGICAL COMPLEXITY BECAUSE IT TENDS TO 'RECOMBINE' DIFFERENT INNOVATIONS WITH A VARIETY OF APPLICATION AREAS.

This level of complexity seems to be projecting the future of the aerospace economy, as has happened in the automotive sector, towards the need to guarantee technologies and, above all, knowledge that allow infrastructural components to increasingly dialogue with software and ICT.

Skills related to software and digital technologies (including artificial intelligence) no longer appear to be relegated to the downstream segment alone, increasing the need for software engineers and data managers also for electronics embedded in upstream products

This is an interesting trajectory on the future of skills in the sector. The challenge awaiting manufacturing companies in the North-East and Emilia-Romagna is therefore, even in the case of the aerospace economy, one of increased skills and further advanced technological specialisation, especially on the digital side.

This new digital complexity could generate, over the next five years, the evolution of a completely new business segment based precisely on the advanced integration of avionics in aeronautical infrastructures and components, also with advanced ICT and artificial intelligence solutions. An example of this can be seen in the case of urban air mobility, which represents a high challenge of generating a true 'flight design, implementation and control ecosystem'.

This will be a 'disruptive' evolution with respect to the development trajectory of a supply chain such as that of Emilia-Romagna, which up to now has been very much tied to 'legacy' aspects of automotive and mechatronic products and processes. Probably the business model itself could suffer as it is less 'demand-driven' than what happens now with large public bets for aerospace systems.

THE QUESTION BECOMES:

ARE THERE, ESPECIALLY ON THE SME SIDE, ADEQUATE BUSINESS MODELS EVEN IN A SCENARIO OF REDUCED DEPENDENCE ON PUBLIC PROCUREMENT AND TECHNOLOGICAL ACCELERATION ALONG THE GLOBAL UPSTREAM AND DOWNSTREAM VALUE CHAINS?

THE SKILLS ECOSYSTEM IN EMILIA-ROMAGNA

On the skills side, especially to build greater participation of regional SMEs in the global value chain of the aerospace economy, there is a challenge of upgrading and training for quality and safety standards suitable for Tier-1 supply, and a further challenge of developing integrated 'ecosystems' for the sustainability of new air transport modes such as those conceivable with urban air mobility solutions.

KNOWLEDGE AND SKILLS ON SAFETY AND QUALITY STANDARDS ARE THE CORE SKILLS OF THE AEROSPACE ECONOMY IN A CONTEXT OF HIGH INTERNATIONAL COMPETITIVENESS COMBINED WITH STRINGENT SUPPLY AND PRODUCTION STANDARDS

The right professional figures to meet these challenges are complex professional profiles requiring a higher level of qualification at university level (with engineering skills to manage complex processes and projects) and an advanced level of professionalization of a post-secondary nature such as that achievable with ITS academies.

This white paper refers to a subsequent phase of mapping the training paths existing in the Emilia-Romagna region and in Northern Italy that converge, even partially, towards the aerospace economy . In order to give an account of an articulated training chain, we mention here some secondary, post-secondary and university training levels.

The training ecosystem of the Emilia-Romagna Region covers the needs of students in a very wide range, from 14 to 30 years of age. In the Forlì area, which hosts a Technological Aeronautical Pole of excellence, it starts with the F. Baracca Aeronautical Technical Institute, a high school for aeronautical technicians, and proceeds to the University of Bologna, where students take a Bachelor's degree, a Master's degree, a PhD and the SPICES Master's degree dedicated to the field of space missions and satellite data analysis.

There are also training courses for maintenance personnel held by Isaers and courses for air traffic controllers held by Enav. È there is also a school for professional pilots run by Professione Volare, and an advanced training course for geospatial data analysts will be launched at the beginning of 2024.

This system, in terms of care and thoroughness, is unparalleled in Italy and is geared to developing projects and creating synergies with companies, so as to carry out industrial research projects, develop demonstrators and encourage the creation of spin-offs and start-ups. In fact, the manufacturing sector, combined with the development of skills and the strength of research centres, ensures the territory concrete projects and a wide margin for growth in competitiveness.

IT SEEMS CLEAR THAT TRAINING SKILLS FOR THE AEROSPACE ECONOMY REQUIRES A TRAINING CHAIN IN DIALOGUE WITH THE INDUSTRIAL SECTOR AND ARTICULATED ON DIFFERENT LEVELS OF PROFESSIONAL COMPETENCE

In the region, there are many training programs that, although not included in an "aerospace training district," develop skills in specific technological aspects of the aerospace economy (for example, training programs on advanced materials). For instance, one of the latest advanced training projects that originated following the first part of the "Space for Skills" program and promoted by Centoform is the course titled "Technical Analyst Programmer with a focus on satellite data analysis and processing." The training to obtain this qualification was designed based on the data gathered from the program and through direct consultations with some SMEs operating in the downstream sector.

THE CHALLENGE FOR THE COMING YEARS IS TO THOROUGHLY MAP AND COORDINATE REGIONAL AEROSPACE TRAINING PROVISION TO INCREASE THE GENERATION OF ADVANCED SKILLS AND ALSO INTRODUCE QUALIFICATION PATHWAYS DESIGNED FOR THE AEROSPACE ECONOMY.

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AEROSPACE ENGINEERING (LEVEL I, II, AND III) MASTER SPIECES

ISAERS FORLÌ ACADEMY AVIOLAB

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PROFESSIONE VOLARE

PROFESSIONAL PILOT COURSES

enav

ENAV ACADEMY - AIR TRAFFIC CONTROLLER TRAINING

Centoform

Advanced Training For Geospatial Data Analysts: Geographic, Satellite, And Sensor (IoT) Data

THE ROUTE: DATA AND INFORMATION FROM THE TERRITORY

The aerospace industry, a dynamic and rapidly evolving sector, is currently facing significant challenges related to talent acquisition and skills development. The research carried out during the focus groups and subsequent surveys therefore aims to offer a comprehensive analysis of the professional skills required in the aerospace sector, focusing on both technical and managerial profiles.











METHODOLOGY AND BRIEF ABSTRACT OF RESULTS

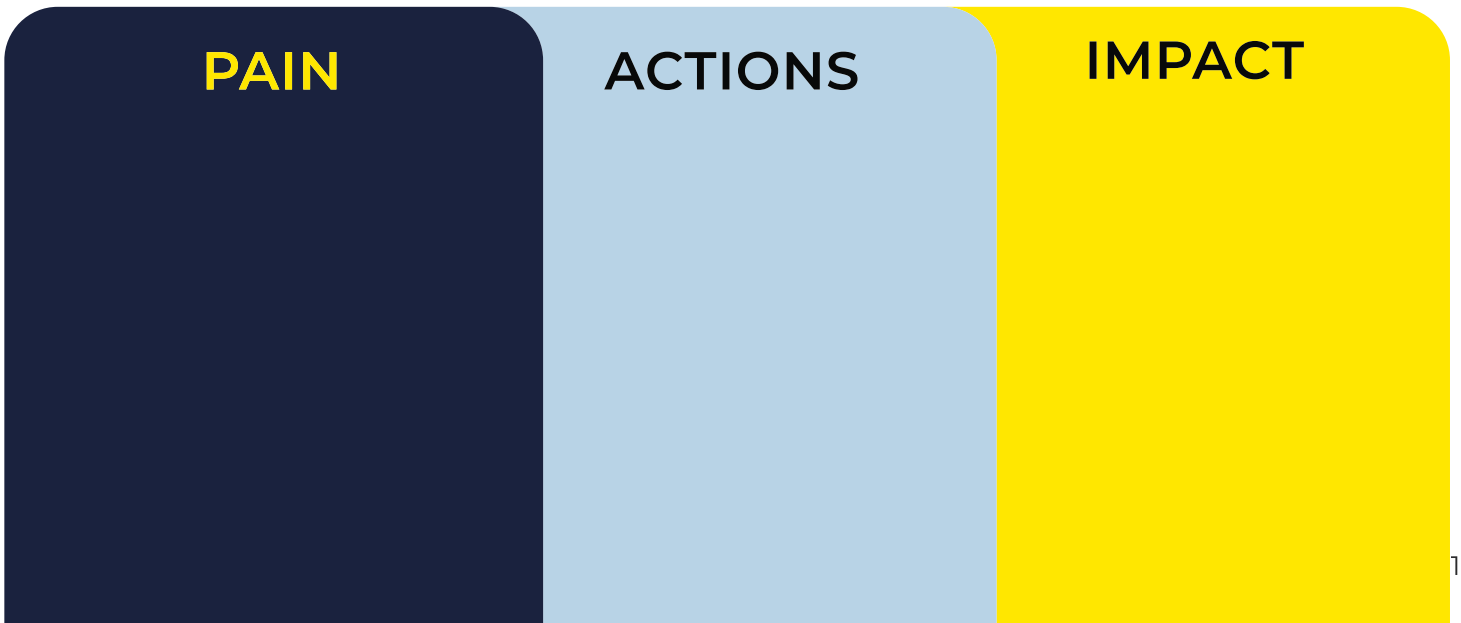
The analysis was conducted through structured workshops with experts in the field, coordinated by facilitators who developed the work according to canva designed for the individual event. Each canva defines a work area, a visual tool that provides a structure to guide the generation of ideas. These tools segment ideas into specific categories or blocks and the segmentation ensures that brainstorming is complete, covering all aspects of a topic or issue. Instead of a chaotic swirl of ideas, participants are guided to think in specific channels, ensuring that no area is overlooked.

Lorenzo Ciapetti, Elisabetta Bracci and Federico Capucci, supported by Luca Arcangeli and Deborah Morgagni, developed surveys and coordinated working tables, where stakeholders from downstream and upstream shared ideas, needs and development hypotheses.
Drawing on their expertise and experience, facilitators guided participants through the process, stimulating deeper exploration, challenging assumptions and ensuring that ideas were innovative. Their guidance then ensured that the brainstorming remained focused on the set topics and that the ideas generated were actionable and relevant.

One of the main advantages of this canvas-based methodology and facilitation is the advanced data extraction during brainstorming sessions. With the use of canvas, ideas are not simply shared, but categorised, simplifying the collection, analysis and interpretation of data after the session. This structured data collection thus ensures that information is easily accessible and can be put into practice without the need for extensive post-workshop deciphering.

Furthermore, this methodology promotes collaborative thinking: participants can graphically see the evolution of their ideas and how they fit into a larger picture, promoting a sense of collective ownership and collaboration. This visual representation also helps to identify gaps or overlaps in thinking, ensuring a more complete brainstorming result.

The first strand of this research was structured around three main areas:



PAIN

This section asks participants about the three main urgent challenges they are facing related to talents and skills in the aerospace sector or for employee training in organizations operating in this sector.
The most pressing issue highlighted is the shortage of suitable profiles in the job market, both at the junior and senior levels. Factors such as inadequate specialization, a lack of focus on the aerospace sector, and the perceived gap between academia and the industry contribute to this challenge.

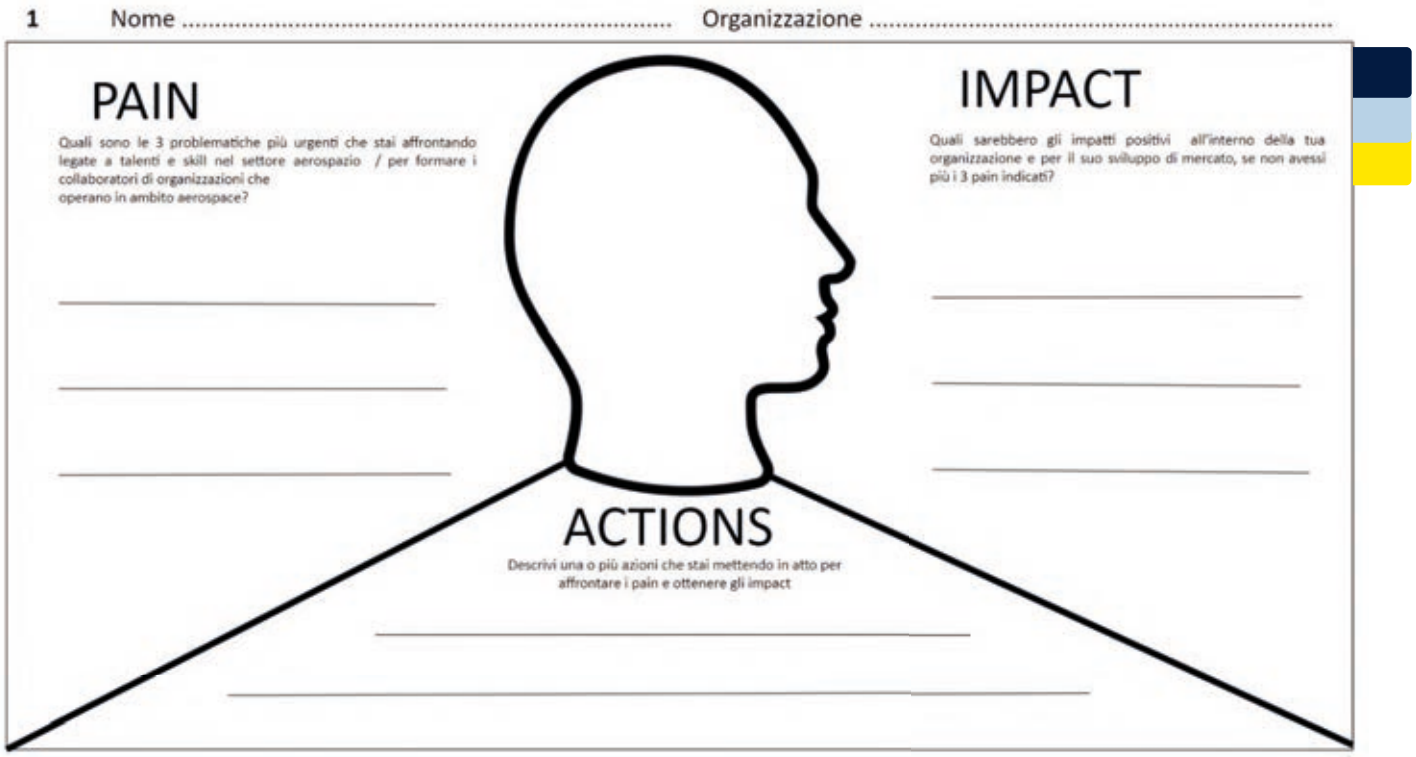
ACTIONS

Encourage participants to describe the actions they are taking to address the challenges and achieve the desired impacts. Organizations believe that resolving these issues can accelerate innovation, enhance competitiveness, and promote a stronger connection between educational institutions and the workforce. The goal is to create a virtuous cycle in which regions generate more value in terms of capital and innovation, making them more attractive for talent acquisition.

IMPACT

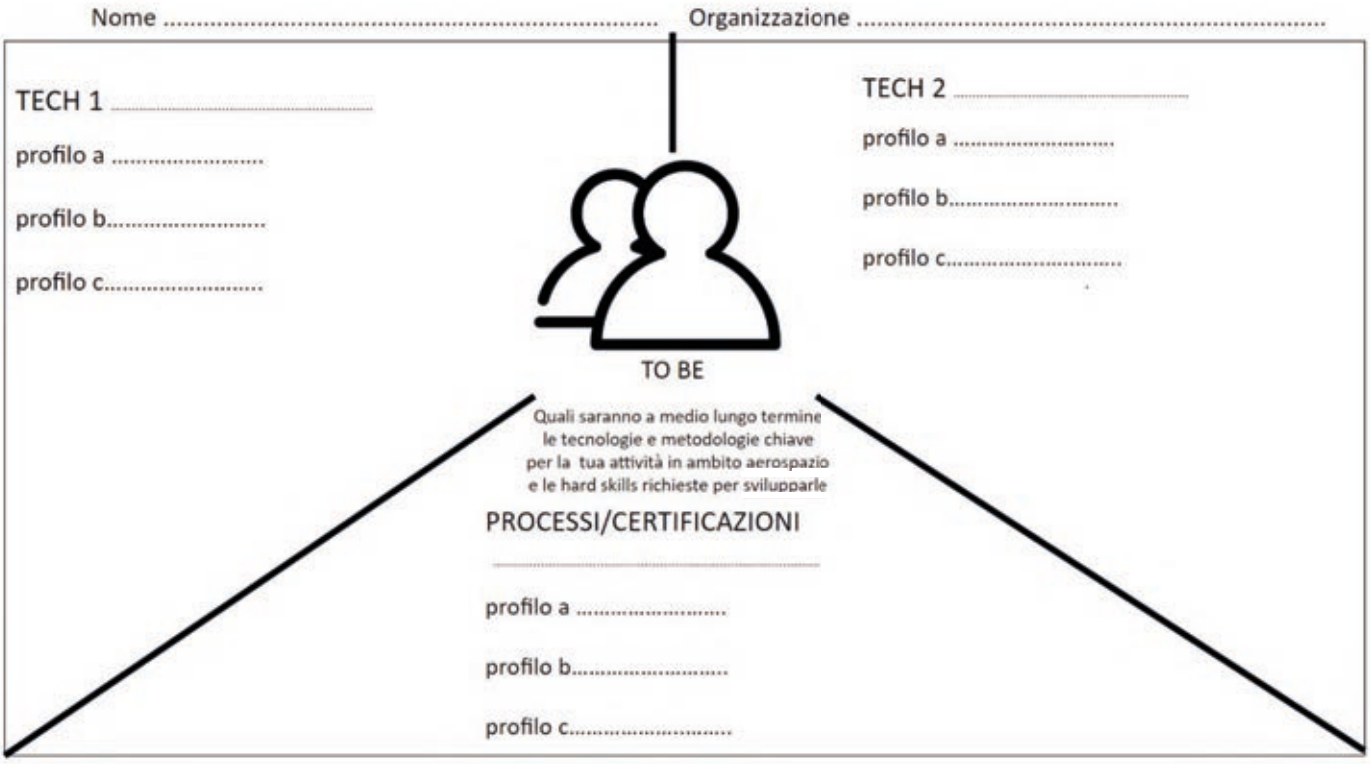
The section asks participants about the positive impacts within their organization and its market development if the identified problems are resolved.
Organizations are taking proactive measures to mitigate these challenges. Actions include forming partnerships with recruitment agencies, universities, and training institutions, participating in national and international networks, and introducing new recruitment paradigms like remote work and co-design with end-users. Continuous training, coaching, and mentoring are also emphasized

Throughout the research, several crucial skills are highlighted for both technical and managerial roles, ranging from creativity and problem solving to time management and innovation. The overarching theme is the need for flexibility, adaptability and a forward-looking approach in an ever-changing complex aerospace landscape.



Canvas pain-actions-impact

Other important canvasses were devoted to the analysis of technical professional profiles in aerospace: those needed today and those expected to be strategic in the future. Questions were asked about the current key technologies and methodologies used in aerospace and the technical skills needed to develop them. Subsequently, workshop participants were asked about the technologies and methodologies that will be key in the medium to long term.



Canvas hard skills

The analysis workshops dedicated to the hard skills needed in the aerospace sector highlighted the extreme relevance of data analysis: the importance of data analysis skills in the aerospace sector cannot be overestimated.
Firstly, the aerospace industry generates large amounts of data every day, from flight telemetry to production processes and maintenance records. The analysis of this data ensures that operations run smoothly. For example, predictive maintenance, based on data analysis, can predict potential equipment failures before they occur, ensuring safety and reducing downtime.

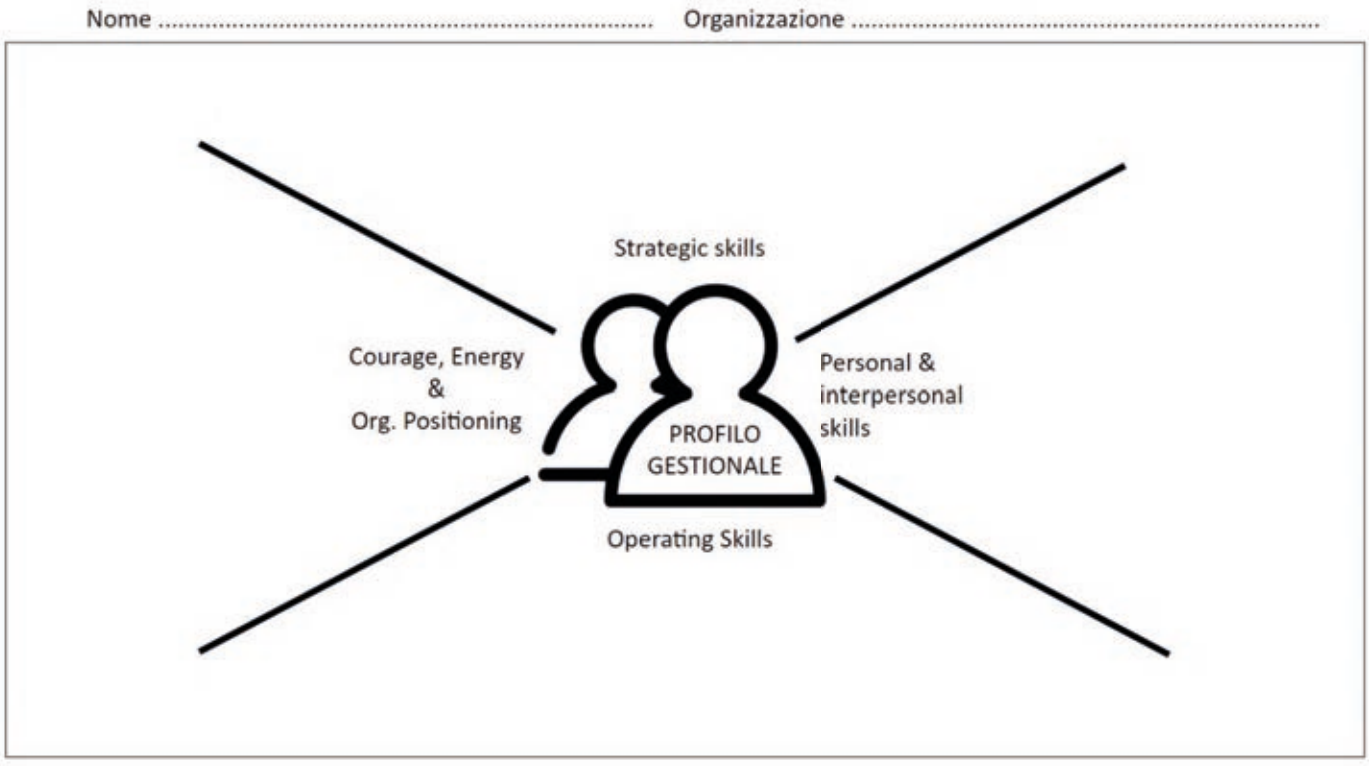
In addition, data analysis plays a key role in design and innovation. By analysing data from various sensors on aircraft, engineers can make informed decisions on design changes, improving aircraft performance and overall safety.

In addition, the aerospace sector is heavily regulated to ensure safety and compliance. Data analysis helps monitor compliance, ensuring that all operations meet the stringent standards set by regulatory bodies.

Finally, at a time when sustainability is a global concern, data analysis can help aerospace companies in their green initiatives. By analysing relevant data, companies can develop strategies to reduce their carbon footprint.

Lastly, soft skills were analysed using a canvas divided into four competence categories:

1. **Strategic competences**
2. **Personal and interpersonal skills**
3. **Operational capabilities**
4. **Courage, energy and organisational positioning**



Canvas soft skills

Thanks to this work, we are able to provide a detailed examination of the essential soft skills for both technical and managerial profiles within the aerospace sector. The analysis is structured around four distinct competence clusters: strategic, personal and interpersonal, operational, and energy and organizational positioning.

The set of soft skills chosen to provide participants with a basis for reasoning is the Lominger Competencies, a model used by HR teams in various organizations to understand how employees behave in certain situations. This model serves as a competence management system that evaluates 67 competencies, primarily focusing on talent management and key leadership.

In a historical context, Lominger's competencies were established by Robert Eichinger and Michael Lombardo in 1991. Each of Lominger's competencies identifies specific skill sets and characteristics. Interestingly, what sets Lominger's questions apart is that they do not have a specific right answer. Thus, the answers lead to numerous possible combinations, making it easy to create profiles that are very different from each other, much like within a puzzle.

Annex A contains definitions of all 67 competencies



Allegato A - Competenze Lominger

PAIN, GAIN & ACTIONS

PAIN

The most highlighted pain highlighted is related to the **scarcity of profiles available on the labour market**, both at junior and senior level. This issue is central to the following keywords which summarise the results of the analysis:

- **Specialization and Skills:** the profiles on the market have a much lower level of specialisation and skills lower/distant from the profiles actually needed in the organisation. This is the list of the main categories of skills that are sought after but complex to identify:
  - Engineering
  - Managerial/organisational
  - R&D
  - HDO (Human Development)
  - Focused on the identification and management of funding calls
  - Commercial / Business development
  - Interdisciplinary, transversal, connecting aerospace to other related sectors

- **Orientation:** it is reported that there is little orientation and approach of resources to the world of aerospace, which is often seen as a niche market or as a work environment far removed from our territory. This pain is reflected both in the company and university, where there is a shortage of profiles of PhD students and researchers in the field, for example, earth observation
- **Interaction between the worlds of education and work:** the lack of contact between the two worlds, which is closely linked to orientation, is reported and which in turn generates a lack of skills and profiles

Organisations operating in aerospace are therefore poorly known by the local community (which impacts the orientation and presence of of profiles onl market) and struggle to compete, given their size, with the majors in the sector (or adjacent sectors) which drain the best profiles. Companies therefore feel unattractive, despite their efforts, both from the point of view of growth and career, and from the salary point of view. Another aspect highlighted is **the location of the companies, which is often decentralised** and therefore less inviting for candidates and their families than other proposals

Added to this scenario are reports on regulatory shortcomings and reduced of subsidised finance funds.



Word-cloud pain

PAIN, GAIN & ACTIONS

IMPACT

The most prominent impact is related to the broadening of business scenarios and the speed of response to the market through the resolution of Pain. These concepts are linked to the following keywords, which answer the question: 'What happens if the critical issues in skills procurement are resolved?

- **Strengthening of the organisational model and accountability:** the increased availability of expertise enables organisations to better structure the governance system and thus the work.

- **Accelerated innovation:** more capital available and organisational improvements enable organisations to invest more time and resources in research and development.

- **Competitiveness:** improving responsiveness and innovation enables organisations to strengthen their global market presence.

- **Attractiveness and interaction between the worlds of education and work:** as a consequence of the previous points, organisations in the area are more attractive to talent and the education-university-work chain is strengthened. In fact, the development of aggregative systems/poles is facilitated.

Organisations operating in the aerospace sector believe that tackling the skills issue can have a positive knock-on effect on the entire supply chain, being able to generate a virtuous circle in which the area produces more value in terms of capital and innovation, becoming more attractive and creating a multiplier effect on available skills.



Word-cloud Impact

PAIN, GAIN & ACTIONS

ACTIONS

The actions that respondents are implementing are mainly aimed at creating partnerships and interactions along three axes:

- with **RECRUITMENT COMPANIES**, which are currently not proving fruitful due to the shortage of professionals in the labour market
- with **UNIVERSITIES AND TRAINING INSTITUTES**, collaborations primarily focus on bachelor's theses, doctorates, and internships
- through participation in national and international **NETWORKS**, with a particular preference for multidisciplinary ones, among which Clust-ER is mentioned

Companies are also setting up **new recruitment profiles**, based on **HR mobility and smart working** paradigms, including openness to remote working and the identification of specific benefits by profiling individual needs. The practice of **codesign with end-users** is also being sponsored, allowing them to work closely with the end customer by applying models of leadership and widespread responsibility, with a strong motivational impact on employees.

Finally, systems of **continuous training and mentorship** by senior figures are strengthened and incentivised and solutions/structures for internal upskilling, such as the activation of company academies. Similarly, experiments are underway on welfare and new corporate benefit solutions, with the aim of making companies more attractive.

In order to create a more hybrid figure that can cover several areas, some of the interviewees are also testing projects of interaction between upstream and downstream specialists, but the results are not yet apparent.



Word-cloud Actions

SPACE PERSONAS
HARD SKILLS

In the area of hard skills, many points of conceptual overlap were noted between the needs of Upstream and Downstream representatives, especially for engineering, patenting and certification. On the other hand, the hard skills that impact materials and production methodologies, as opposed to data analysis and model development, are very different. Let us see them in detail grouped by type.

The most sought-after engineer positions are as follows:

- Computer Engineer
- Electronic Engineer
- Telecommunications Engineer
- Mechanical Engineer
- Materials Engineer
- Data Engineer
- Cloud Engineer

The figures of the Data Engineer and the Cloud Engineer indicate profiles that are not yet well developed by canonical university education and instead find increasing space in postgraduate and master's degree courses.

These figures are flanked by **technicians capable of analysing data**, required only by the downstream world, such as: Data Specialist, Data Analyst, System Administrator, Computer Vision Specialist and Geospatial Data Analysts. These figures are mostly trained directly in the company, as there is no talent available on the market that is fully trained in these subjects. This therefore implies a considerable corporate investment in the training of junior and medium-skilled profiles, with the risk of losing them to international job offers or to multinationals in the sector. This is why, in these cases, the retention of junior and medium skilled profiles becomes a strategic factor for SMEs.

These technicians and engineers must have strong skills in

- Artificial Intelligence
- Machine Learning
- Cybersecurity
- Big Data
- Machine Vision
- G.I.S. Geographical Information System
- Image processing
- Automation of data analysis

The skills that Downstream stakeholders want to focus on for future developments are:

- HPC (high performance computing)
- Real-time satellite data analysis

On the other hand, the hard skills most wanted in Upstream include:

- Embedded systems
- Precision component machining
- Opto-mechanical design/production
- Design/processing of components in composite materials and innovative materials in general
- Drone design and droning
- Sensing
- design/development of thermal engineering solutions
- Testing/Evaluation/Characterisation
- 3D printing
- Solutions for autonomous driving
- New propulsion solutions
- Artificial Intelligence

The skills that stakeholders in Upstream want to focus on for future developments are:

- Cybersecurity
- Implementation of new design and system integration solutions
- Automation skills in component processing

The only point of contact between the most sought-after hard skills for Downstream and Upstream is AI and cybersecurity, which are increasingly transversal skills.

It is very interesting that there is a growing understanding of how non-technical engineering figures are crucial in aerospace. We are talking about **patent experts and experts in certification systems**. In particular, the certification systems that are most widely applied in the upstream and downstream sectors at present are the following:

- ISO 9001
- ISO 9100
- ISO 27001
- ECSS Standards
- Lean Manufacturing
- IEC 15288
- SDT-MIL 810 and 461
- AWS Solution Architecture
- GCP Solution Architecture

The areas of certification that one would like to introduce in the company in the future are NadCap and FEMCA Analisys.

A final point of great importance, raised by both types of stakeholders, is the need for **experts in the field of public funding** for simplified and clear access to public funds for tenders and incentives. This profile was highlighted more than that of business developer or marketing strategist, reflecting the fact that a large proportion of the SMEs involved develop a significant part of their business thanks to public funding, and not only thanks to private capital.

SPACE PERSONAS
SOFT SKILLS

The analysis of skills relating to technical and managerial profiles is central to mapping the needs of organisations and understanding in which direction to implement possible intervention policies. The analysis focused on two "ideal types" of professional figures, one of a technical nature and the other of a managerial nature, identifying the competences considered fundamental regardless of the specific tasks that these figures will hold in the specific organisations. Each figure was analysed on four different clusters of competences: strategic, personal and interpersonal, operational and organisational positioning.

In this case, we did not differentiate between Upstream and Downstream needs, as both stakeholders saw the same needs and desires.

TECHNICAL PROFILE

STRATEGIC COMPETENCES

As far as the strategic competences of the technical profile are concerned, *chart 1* shows that the highest rated competence is **creativity**, followed by **problem solving**. Technical-functional skills are only mentioned in fourth position, tied with the ability **to learn on the fly**. This result shows us that for the organisations surveyed, a strong technical profile is only functional if it is endowed with a strong flexibility, adaptation to the context. The ability to adapt and revise one's technical knowledge with respect to a changing scenario is considered more strategic than simply possessing technical knowledge.



chart n. 1

PERSONAL AND INTERPERSONAL SKILLS

Among the personal and interpersonal competencies (chart n. 2), the competence of customer focus was voted for by a majority. Here again, the organisations involved emphasise the need for technicians not to close themselves within the limits of their specialisation, but to be able to dialogue with customers and understand their needs.

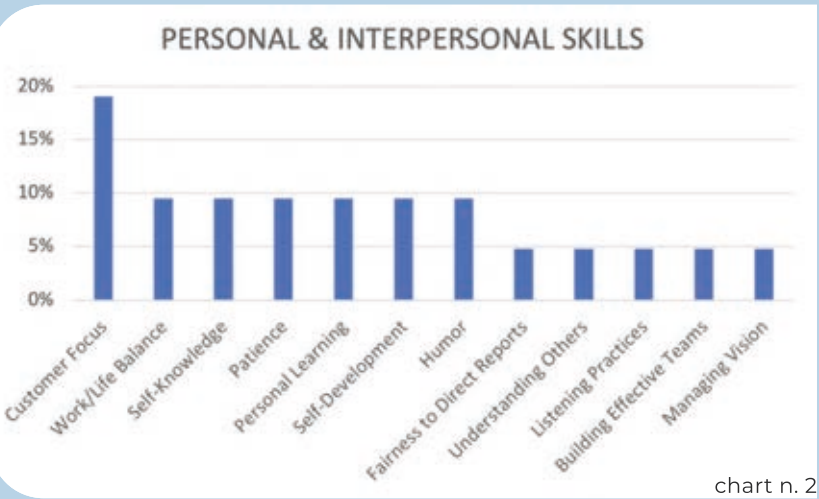


chart n. 2

OPERATIONAL SKILLS

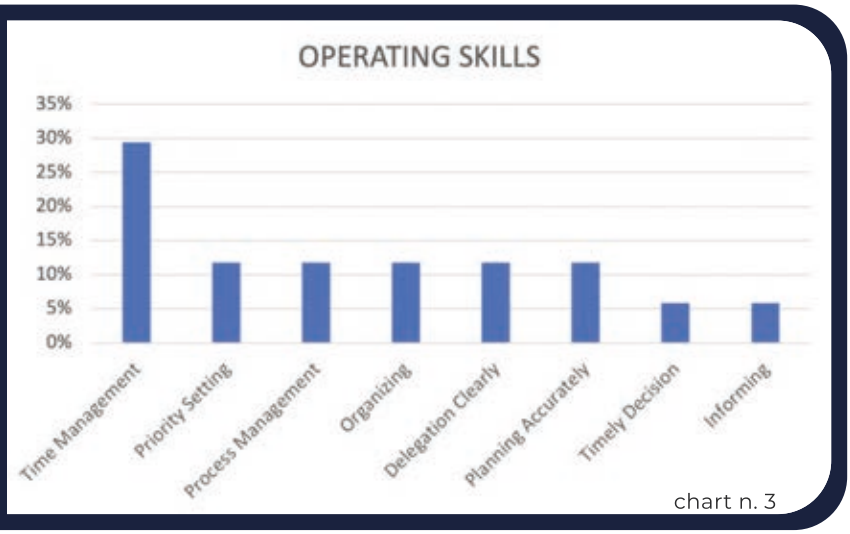


chart n. 3

In the group of operational competences, the most appreciated competence was the ability to manage time. Within complex and dynamic scenarios, characterised by scarce resources, a judicious use of time, a limited resource par excellence, is required.

SKILLS RELATED TO COURAGE, ENERGY AND ORGANISATIONAL POSITIONING

Chart n. 3 is strongly related to chart n.. 4, where among the competencies related to courage, energy and organisational positioning, the focus on achieving results is the most chosen. This competence is strongly intertwined with the ability to manage time with a view to achieving organisational goals.

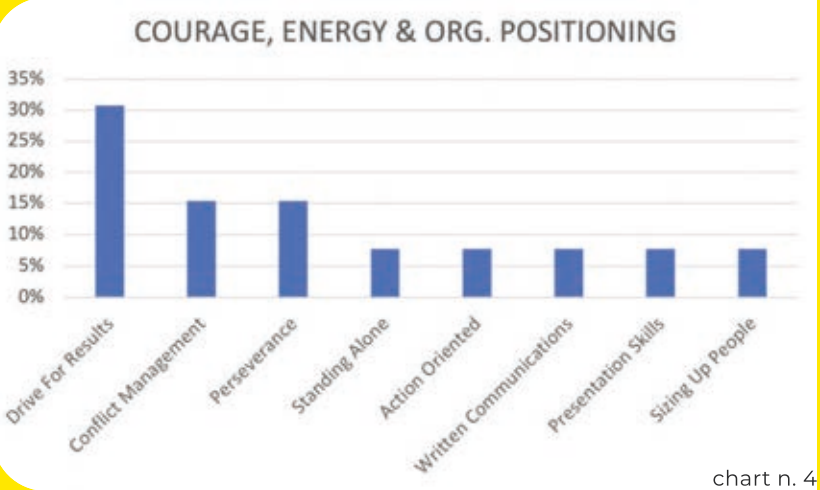
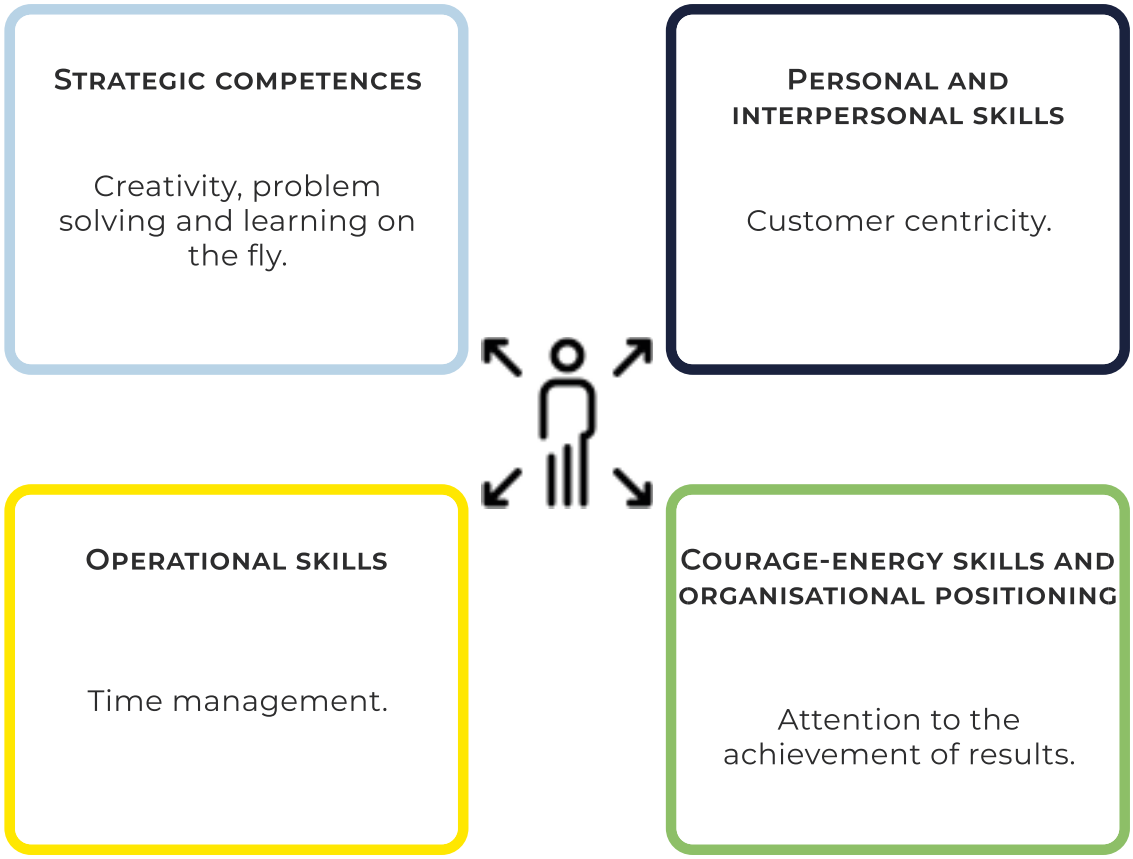


chart n. 4

SUMMARY OF THE TECHNICAL PROFILE



MANAGEMENT PROFILE

STRATEGIC COMPETENCES

With regard to the strategic competencies of the managerial profile, chart N. 5 shows that the highest rated competence is **innovation management**. This result is closely reminiscent of the analysis of the technical profile, which highlighted creativity as a key competence from a strategic point of view. This reinforces the idea that for organisations, managerial profiles should also be trained in the culture of innovation, not adopting the usual formulas with respect to new problems.



chart n.5

PERSONAL AND INTERPERSONAL SKILLS

Among personal and interpersonal skills (chart n. 6), the competence to **motivate others** was voted by the majority. It is crucial for organisations that a managerial profile is able to create a positive climate of cooperation and involvement around him/her. Not surprisingly, in second and third place are the competencies of patience and understanding others, typical virtues related to empathy and acceptance.

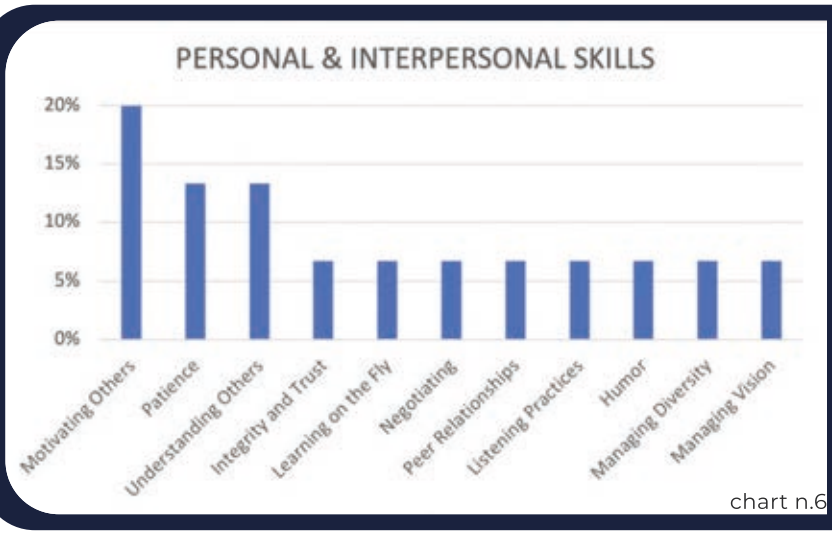


chart n.6

OPERATING SKILLS

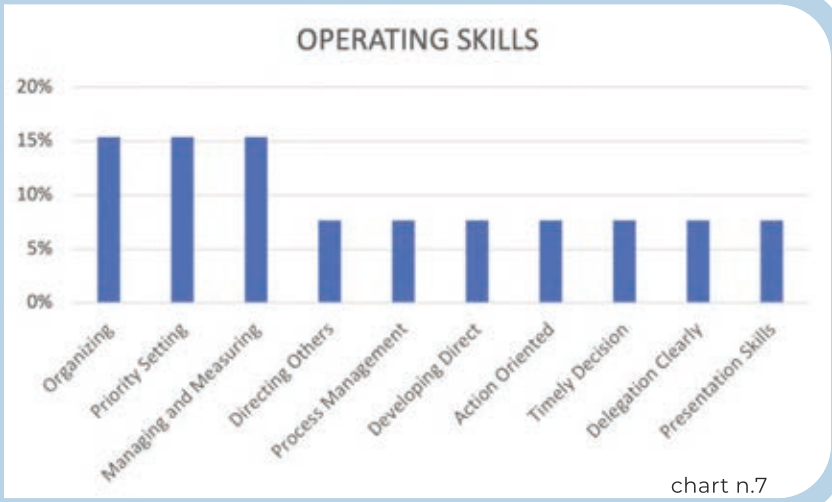


chart n.7

In the operational skills cluster, the top three most valued skills are related to **organisation, priority management and the ability to manage and measure work with clear criteria**. Clearly, these skills are complemented by the time management skills highlighted for the technical profile. Organisations need employees who are able to manage work in a dynamic and versatile manner, with a strong focus on results, avoiding in any way organisational dispersion that generate drops in productivity.

SKILLS RELATED TO COURAGE, ENERGY AND ORGANISATIONAL POSITIONING

Chart N. 8 shows that the highest rated competence is '**managerial courage**': organisations do not need 'Yes Men' but managerial profiles capable of a positive and direct leadership style that is not afraid to go against the tide if necessary.

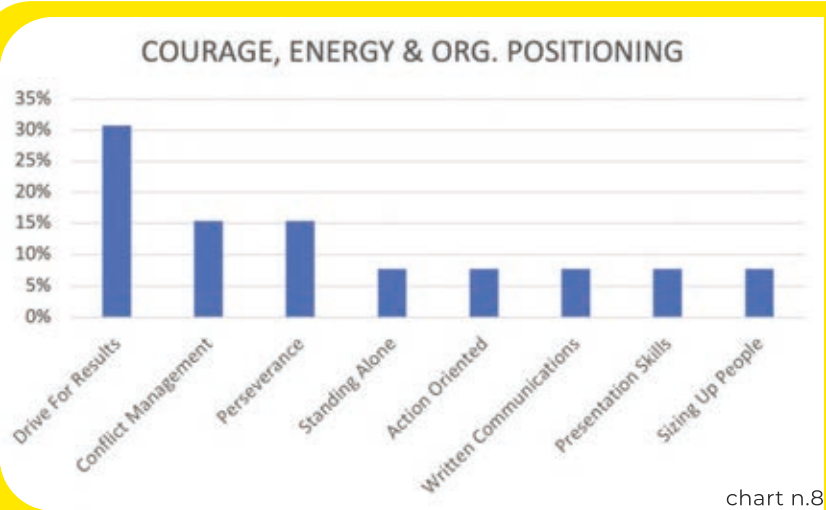


chart n.8

SUMMARY OF THE MANAGEMENT PROFILE

STRATEGIC COMPETENCES

Innovation management

PERSONAL AND INTERPERSONAL SKILLS

Motivating others



OPERATIONAL SKILLS

Organisation, priority management and the ability to manage and measure work with clear criteria

COURAGE-ENERGY SKILLS AND ORGANISATIONAL POSITIONING

Managerial courage

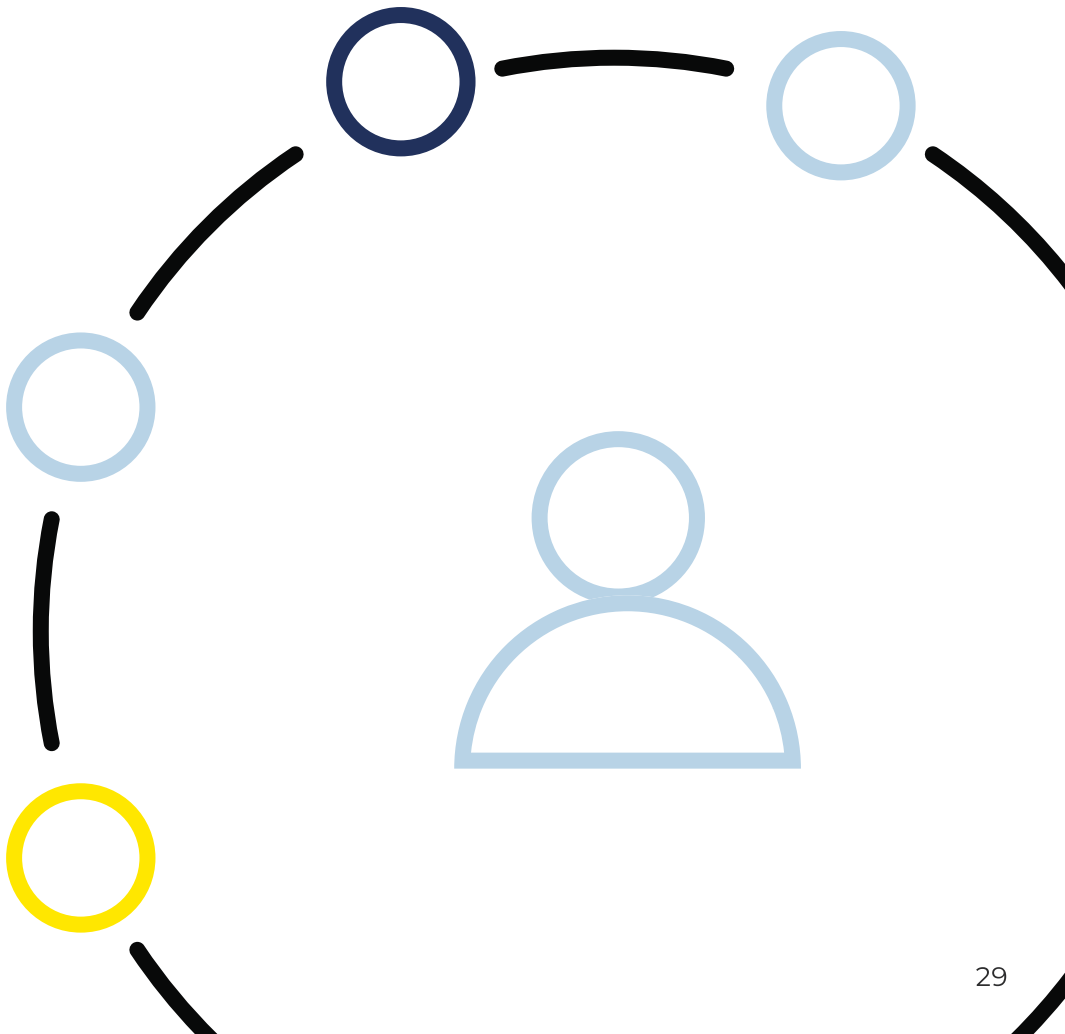
IDEAS FOR THE FUTURE OF THE REGIONAL EDUCATION SYSTEM

Among the ideas that could be implemented in the future, the Stakeholder Group focused on inter-company academies and collaborative training networks. The **Collaborative Training Network** is a new type of dual training. Dual training is a system that allows apprentices to receive training both in training centres and in a work environment.

As a plus, this system allows students to learn a trade both theoretically and through practical training in the field.

As a minus, this system has some weaknesses: both skilled apprentices and companies may be faced with certain skills shortages and companies often prefer 'not to ally' because they perceive the possible harm as a competitor more than the benefit of educational collaboration.

In fact, the Collaborative Training Network is a way of conceiving of dual training that involves a collaborative training programme, which allies at least two companies, allowing for greater complementarity of activities for the learner, to cover all the skills required by the field of application. This type of system exists, with some variations, in Germany, Austria and Switzerland, three countries that are considered models for dual training.



THE EXPERTS' POINT OF VIEW

PRESENT AND FUTURE OF AEROSPACE RECRUITMENT



Interview with Andrea Spiriti, President & Co-Founder Italian Aerospace Network

The aerospace sector presents a challenge in terms of skills. This is evidenced by the current human resources market and the role to which *head hunters* are called.

The specific competences for qualified profiles in the aerospace sector are very complex because they combine *hard skills* with management and coordination skills for complex projects.

The skills challenge for the aerospace sector does not only call into question the training and skill levels of managers, but opens up a challenge of an organisational and *business model* nature.

Aerospace, also in a perspective of advanced components for aircraft or satellites, introduces a considerable scale of complexity in business project management. The traditional model of organisational evolution of an SME entering the aerospace sector, making its way with additional orders to its core business, appears outdated. Aerospace demands an organisational evolution towards complexity management. However, the condition for a decisive shift by Italian SMEs towards complex *business models* such as those required in the aerospace sector is not yet ripe.

Thus, in the face of an accelerating interest in the space economy from a strategic and industrial point of view, there is a considerable dynamism in the labour market towards the search for qualified profiles for the sector. However, a challenge opens up on the organisational side and in terms of business models.

NEW PERSPECTIVES OF BUSINESS MODELS

Interview with Mattia Pianorsi, SEE Lab SDA Bocconi



In the space sector, cost efficiency is a key achievement for the private sector, enabling it to compete for government funding for research and development. Space companies aim to become suppliers for governments, producing goods and services that can contribute to the achievement of national interest objectives.

However, despite their innovations, the commercialisation of goods and services in private markets is crucial for the sustained growth of the space economy. In particular, the challenge lies in transforming the strategic value of goods and services for governments into economic value through innovation in business models.

The challenge, especially for SMEs, is the coexistence of complementary business models to ensure economic sustainability. Given the scarcity of financial resources and the uncertainty related to the technical and market aspects underlying space technologies, especially for exploration, it becomes essential to create synergies between companies in an ecosystem perspective, promoting economies of complementarity.

COMPLEXITY AND SPACE ECONOMY: RELATEDNESS

Interview with Gianluca Toschi, North East Foundation



The economies that grow in the long run are those that are able to develop complex products and services, i.e. those that are difficult to imitate, as developing them requires diverse and sophisticated, if not rare, skills. This is the key to growth and competitiveness. The industrial and economic complexity of an area can therefore be measured by the distinctive ability of its companies to develop 'unique' services and products, since they are made through a specific endowment of technologies and skills that are often typical of that area.

The space economy is the child of the deep tech frontier, the advanced technologies that revolutionize the innovation paradigm, precisely because they bring technological complexity in search of new markets and new industrial solutions.

However, companies, like little monkeys jumping from branch to branch, from tree to tree, cannot take too long a leap, otherwise they risk falling, and so they must carefully ponder their actions and the steps necessary to innovate and compete. That is why a key factor is 'relatedness', i.e. development by proximity. Economic systems evolve by producing new goods and services, which require knowledge, skills and know-how that are developed from or near existing capabilities. The monkeys jump from the branch they are in to the one that is most attainable.

The concept of relatedness is thus based on the idea that knowledge has an architecture based on similarities and differences in the way different types of knowledge can be utilised. Hence, North-Eastern Italy has a very high relatedness index because skills are dense and with them the potential for growth in aerospace.

NETWORKED SKILLS: THE ECOSYSTEM FOR THE SPACE ECONOMY

Alessandro Curti - Curti SpA, Value Chain Fly-ER, ANSER Consortium



I think it is necessary to start by defining the Space Economy, because in my opinion in this context we are often in danger of forgetting about aeronautics, i.e. what flies below 100 km altitude, which then accounts for a large part of the turnover generated by this sector for Italian companies.

And we must also remember this because to be sustainable and to generate employment, business must refer not only to unique projects, such as an orbiting station, but also to products that have a certain repeatability over time. In short, we have to deal with the market.

To do this, it is essential to foster active collaboration and integration between the companies themselves and with universities and research centres, and it is necessary for both parties to look up from their own projects or products and look together at what the market really wants.

We must, in short, network as best we can. And we with the Anser network are trying to do this; we started with the objective of approaching the Middle East market together, now we are thinking about setting up a consortium between these 25 companies that can propose common offers and that can solve key issues for this sector, such as those related to certification.
And to be competitive on the global market, training absolutely plays an important role.

In this respect, I am convinced that it is necessary to work on advanced profiles, which are always in step with the times, but we must never forget how important basic training is: we also struggle to find maintenance technicians, industrial experts and not just engineers.

In particular, I would like to point out two avenues that can be worked on to improve the approach to training: orientation for families, to make parents and students understand what the various courses on offer consist of and how they differ, and the opportunity to study and investigate how they operate in other territories or contexts, to try to understand where and how other initiatives have been successful.

EMILIA-ROMAGNA'S PATH TOWARDS SPACE: THE STRATEGIC FORUM

Leda Bologni, ART-ER and Regional Strategic Forum for the promotion of the aerospace industry



The Emilia-Romagna Region currently considers the Aerospace Economy and aerospace as one of the most promising value chains for the development of the region.

This is also borne out by the fact that two years ago it was included in the regional Smart Specialisation Strategy as one of the production areas with high development potential and that since then, numerous initiatives have been activated at both local and international level.

Among these, I would particularly highlight the establishment of the Regional Aerospace Strategic Forum. The main objective of this instrument is to recognise a community of players, not only entrepreneurial but also research and institutional, who share a common goal and who have the potential to make the most of this common goal and to be able to qualify it appropriately at international level too

As part of this activity, we carried out an analysis that allowed us to identify a number of subjects that in our opinion represent the characteristic feature of this territory and that have both aerospace and aeronautics as a possible destination, current or potential.
The interesting thing is that in this set of subjects, they cover all positions in the value chain, from training to research to a significant number of companies.

This analysis also gives us the measure in our territory with respect to this sector. The part of traditional mechanics, which is the part that produces components, systems and subsystems, is the predominant part and this is an important aspect: it means that the largest part of our manufacturing economy can really find an outlet in this sector.

It also emerges that in this region we have several technologies that can enable products and services, among which I would particularly mention data management technologies, which are becoming particularly important in this region. The areas of advanced materials, automation and robotics should also be emphasised.

Finally, at the Forum, we analysed the technological prospects for the coming years, both globally and in relation to our region.
In the latter sense, there is significant activity on advanced air mobility, a futuristic but extremely promising concept, as well as investment and the presence of companies dealing with downstream, i.e. the use of satellite data for advanced services.

THE EDUCATIONAL PATHWAY IN THE AEROSPACE FIELD - THE CASE OF UNIVERSITY OF BOLOGNA

Paolo Tortora, PhD, Professor in the Department of Industrial Engineering (DIN), Director of the Interdepartmental Center for Industrial Research in Aerospace (CIRI-AERO), Alma Mater Studiorum – University of Bologna



The University of Bologna is one of the seven major universities in Italy to offer a complete educational pathway in the aerospace field. The teaching of Aeronautical Engineering at UniBO began in 1937-38 with the introduction of the Aeronautical Constructions course in the Mechanical Engineering and Transport Engineering programs at the Bologna campus.

In 1989, Alma Mater, previously confined to the Bologna region, initiated a decentralization project in Romagna, which is also the most significant ever undertaken by an Italian university. In this context, the Diploma (three-year program) and subsequently the Five-Year Degree in Aerospace Engineering were established.

In 1999/2000, the University of Bologna implemented the Bologna Scheme, which included two levels, introducing the Three-Year Bachelor's Degree and the Master's Degree in Aerospace Engineering. In Forlì, the University of Bologna became part of the so-called Aeronautical Technological Pole, located near the "Luigi Ridolfi" Airport, alongside the Alma Mater Engineering campus and its state-of-the-art laboratories. This area also houses ENAV Academy, the first Aeronautical Technical Institute in Italy (ITAer "Francesco Baracca"), flight schools for civilian pilots, not to mention the former Caproni Workshops in Predappio and numerous other industrial and research entities connected to Mechanical and Aerospace Engineering. The current educational structure was achieved in the academic year 2013-2014, with the Bachelor's Degree in Aerospace Engineering (taught in Italian) and the Master's Degree in Aerospace Engineering (taught entirely in English). Since April 2018, the Aerospace Engineering program at the University of Bologna has been a member of PEGASUS (Partnership of a European Group of Aeronautics and Space Universities). In the academic year 2020-21, a new Doctoral Program in "Aerospace Science and Technology" was launched, completing the educational pathway dedicated to aerospace with the third level.

The latest evolution of the Aerospace Engineering program is the introduction of two different curricula, one focused on aeronautics and the other on space, starting from the academic year 2021-22.
I am convinced that the strong growth in the number of our students (130 new enrollments in the bachelor's program, approximately 75 new enrollments in the master's program, and about 5 new doctoral candidates every year) is due to three determining factors:
(a) the quality and modernity of our educational and laboratory facilities, (b) the highly rigorous nature of the educational content in our courses, especially in the master's program, where only topics in which the instructor conducts their own research activities are taught, and (c) the presence of top-level research groups in the international aerospace field.

FOCUS ON GENDER EQUALITY IN AEROSPACE

Interview with Angela Corbari, Co-Founder StudiomApp and Mentor Space4Women



LET'S START WITH A FOCUS ON YOUR PERSONAL GROWTH: HOW YOUR PASSION FOR SPACE CAME ABOUT

It sounds like a cliché, but I too belong to those little girls who dreamed of being an astronaut as a child. My father gave me Mc Call and Asimov's book 'Man in Space' and I started to fantasise about space adventures with my Lego and robot cartoon friends. Space never bores you and even today I think it is one of the most interesting, promising and impactful areas for mankind.

HOW DID YOU GO FROM A PASSION TO A SKILL? TELL US FROM AN EDUCATIONAL PERSPECTIVE HOW DID YOU GROW AND HOW DO YOU CONTINUE TO STAY UP-TO-DATE AND EDUCATED?

I have a degree in natural sciences and initially specialised in earth observation by doing a master's degree in GIS and remote sensing. Later, I worked as a technician in a public administration and there I used geographic information systems with remote sensing images. I witnessed the rapid development in this field such as the arrival of Google Earth and the launch of the Sentinel satellites of the Copernicus constellation.

My natural science background has given me an understanding of how to use remote sensing data for applications in a variety of areas, including land, natural resource and anthropogenic activity monitoring. Having this generalist background was and is a plus in understanding the operational needs of customers.

As far as specific skills are concerned, I did specialised courses on remote sensing, online courses, but above all I developed research and tested the solutions in my head on a personal level. This I still do to this day.

WHAT ABOUT THE SOFT SKILLS PART?

For the soft skills development part, I have developed them over the years by keeping them in the entrepreneur's 'toolbox': problem solving, emotional intelligence, negotiation skills, creativity and vision, financial intelligence. Many of these skills have grown through participation in start-up training events, but I would say that the best school was definitely direct experience with clients, participation in important European funding calls, and obviously an innate part that has gradually been refined. Doing business is not for everyone, you need a personal aptitude that you cannot build through training courses. Courses help to hone it.

What skills did you have to add to your 'toolbox' to become an aerospace entrepreneur?

Aerospace is an extremely technical and constantly evolving field. Therefore, the need to always be up-to-date and work on frontier areas implies constant attention, curiosity and the ability to then transfer these innovations into the technologies that my company develops in order to always be at a state-of-the-art level.

The next step is to include project management skills to obtain research and development funding and then implement the above. A key skill is to build a solid competence in managing a research project, understood at all stages of its cycle: from proposal to implementation. To this must be added the ability to manage contingencies, financial management and human resources. And that is no small thing!

What are the skills you look for in your collaborator?

Our hiring process involves, even before checking the technical or specific skills for the role we are looking for (which have been checked upstream anyway), a verification of the alignment of values and our corporate culture with the person. This is the most important necessary condition for joining the team and working together.

Values such as integrity, transparency, mission sharing are at the core.

Having verified this, we enter the technical area where we test hard skills in simulated operations. In addition to that, it is essential for us to have those soft skills I mentioned earlier: constant attention, curiosity, problem solving and the ability to work together and remotely, as Studiomapp is a remote first company.

What would change in your business if you 'magically' had all the talent you needed?

The success of a company is the result of the entrepreneurial skills of its management and the talents that work within it to develop services of excellence.

Having many more talents would mean speeding up certain processes or opening up new fronts/business lines. However, growth must be sustainable on many fronts (economic but also resource management) and an increase in numbers does not necessarily correspond to an increase in quality.

Your thoughts on 'gender and skills' in aerospace

I don't really like to differentiate between women and men in the workplace. It is, however, a fact that starting from education, the number of girls attending STEM faculties is significantly lower than that of boys (UNOOSA data: women enrolled in STEM faculties are 35% of the total).

Several studies have been conducted on this phenomenon, which is called 'pipeline leakage'. Girls at a certain point in their growth lose interest in scientific activities and/or are not encouraged to pursue a career in science or particularly in aerospace. UNOOSA research

shows that already at the age of 6, girls consider boys to be brighter and more suitable for STEM activities, a fact that leaves one speechless.

There is a lack of role models and in opposition there are conservative cultures that foster a lack of confidence instilled in girls' self-esteem and their ability to do 'typically male' jobs.
Another sore point: the attitude to risk that women often lack. Again thanks to UNOOSA research, we know that only 19% of CEOs in Aerospace and Defence are women, a real shame.

It should also be emphasised that aerospace, and in general everything that is nowadays referred to as the 'New Space Economy', will have massive needs due to generational turnover, and that this turnover does not only involve professionals with degrees in engineering. Imagine a not too distant future where our species will be the first interplanetary species, and this will involve new societies and cultures living in space.
To achieve this incredible feat will basically be to expand the role of the female presence (as of today, only 22% of the aerospace workforce is female, UNOOSA data) and to add more and more professionals not necessarily STEM to the work teams.

In your opinion, what would it make sense to do to attract more women to this sector and retain them in the company?

I think the basis of attraction and retention is obviously equal pay for men and women, complemented by corporate welfare tools and growth paths.

One of the most difficult challenges is balancing family/work and this also involves safeguarding one's emotional well-being.

To support those who have chosen to have children or are caregivers for their families, earned income should be complemented by concrete instruments, such as vouchers for babysitting or home care, medical and psychological support.

Studiomapp has implemented a welfare system with a strong focus on support for women and their families: we have a birth allowance, medical support for the entire pregnancy diagnostics so that they can live this period peacefully, post-birth medical support in the event of the child's illness, vouchers for crèche and/or babysitting, and much more for the care of the person and their loved ones.

Finally, the valorisation and growth of talent must be supported through a clear path on the evolution of everyone's role within our society.

What is the Space4Women network and how can it concretely support gender equality in aerospace?

UNOOSA with the Space4Women programme encourages women and girls to pursue education in science and technology areas, defined in English by the acronym STEM (Science, Technology, Engineering, Mathematics), and to share their experiences and knowledge about career opportunities.

Space4Women aims to raise awareness among individuals and institutions about the importance of women's empowerment and gender equality in these fields. According to the UNESCO Institute for Statistics, only about 30% of researchers and 35% of STEM students are women. The programme provides mentoring by experienced mentors in the aerospace sector to enable women who are just starting out in that world to meet professionals in the field and be mentored for a period of 6-12 months.

What is the role of a Mentor and how can they concretely help other women in the network?

In the Space4Women network there are many women working in academia but few female entrepreneurs. This is why I applied to be a Mentor. My role is therefore to provide support to those who want to become entrepreneurs in aerospace, to those who want to take risks to build something big. I provide support to founders on business creation, business models, market and competitor analysis, HR management, strategic vision, partnerships, legal and IP issues, financial planning and founding strategies. I try to give all this from the heart, imagining that I am that ideal mentor I would have liked to have met when I started.

Why be part of a women's network and what do you seek/find in this network?

Actually, I am not looking for something specific but it is the membership of the network itself that gives sharing of information, opportunities and experiences. This is the biggest plus: the comparison. Among other things, being a worldwide network, it is interesting to have different cultures and nationalities represented and therefore a great wealth shared.

CONCLUSIONS

Building and designing competencies for a rapidly changing technological environment is a major challenge.

This document has begun to chart a useful course for the aerospace economy and in perspective for other technological fields characterised by acceleration, technological contamination and complexity.

The main considerations that this paper introduces are:

- the need to foster an **evolution of the skills and of the organisational models** of SMEs that already participate in the aerospace economy value chain and that could further benefit from an increase in the value of this market segment in the coming years;

- the need to foster, on the skills side, a diversification towards **business models based on the development of collaborations between companies, start-ups and the research world** (clusters and networks) in order to generate new products and services without remaining tied to public demand for aerospace components and systems;

- the need to put in place **articulated paths that recognise and certify formal and informal training** and that help generate complex competences, which must gather both soft and hard skills;

- the need to introduce **qualification pathways** leading to advanced skill sets in the areas of safety and quality in aerospace economy production and services, according to the real needs of SMEs in the area and beyond;

- the need to **break down silos by bringing the upstream and downstream segments closer together**, in terms of training and skills, in anticipation of an increased role of ICT and artificial intelligence in the design and construction of flight and space components and infrastructures, in order to achieve natively integrated hardware systems with artificial intelligence and cybersecurity systems;

- **Orientation** to students and families, making Aerospace more attractive to young people and families;

- **Increasing the regional attractiveness** for international talent by strengthening existing programmes such as IT-ER and collecting best practices through study tours and twinnings with other universities and territories;

- Develop **pathways that foster gender quality in STEM** (science, technology, engineering and mathematics), bringing girls and young women closer to aerospace;

- Supporting companies in setting up **Collaborative Training Network** projects.

SUMMARY

SOFT SKILLS

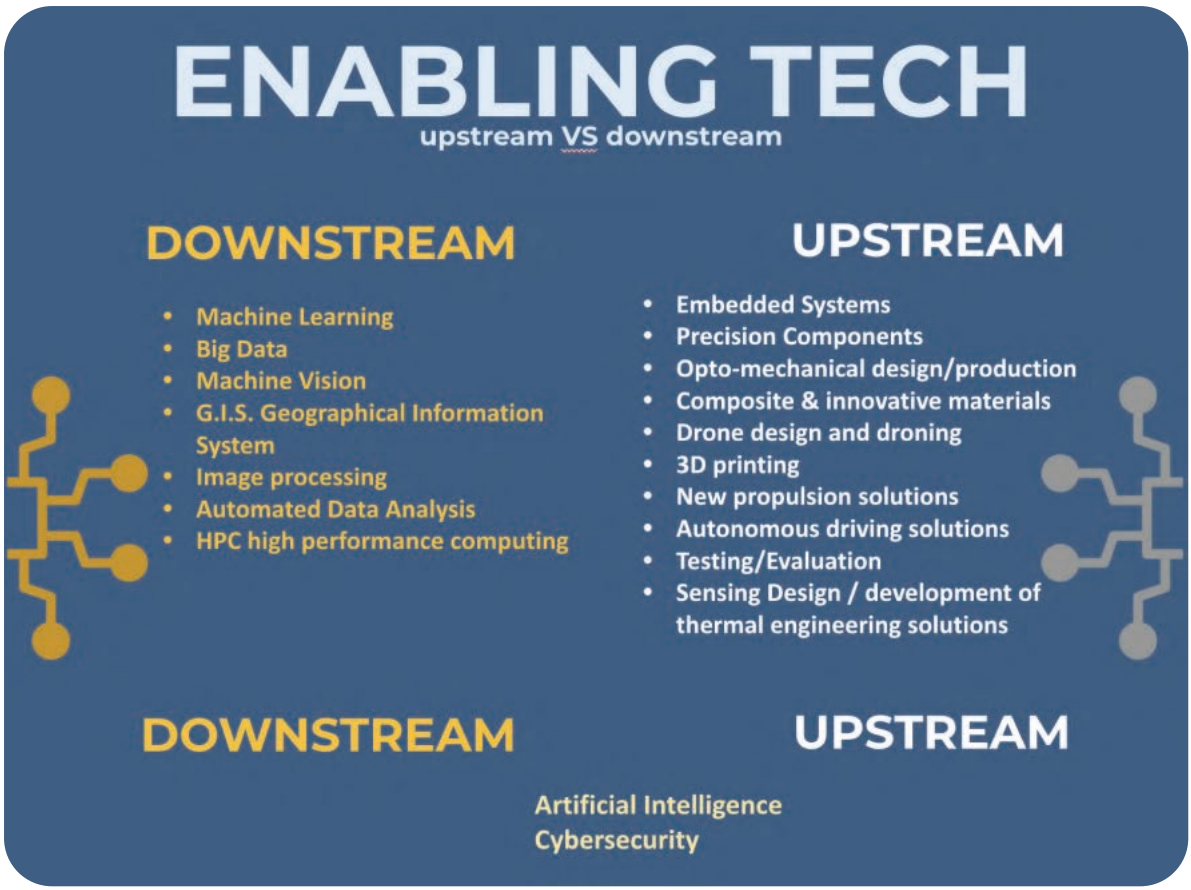
The analysis of soft skills has revealed an overlap between the downstream and upstream domains but has shown a significant differentiation based on roles (managerial vs. technical).



ENABLING TECH

Before discussing hard skills, we questioned the most sought-after enabling technologies in both downstream and upstream areas and found a marked difference between the two sectors, except for technologies related to Artificial Intelligence and Cybersecurity, which proved crucial for both.

This disparity highlights how these two sectors are complementary and underscores that the process of breaking down silos has only just begun.



HARD SKILLS

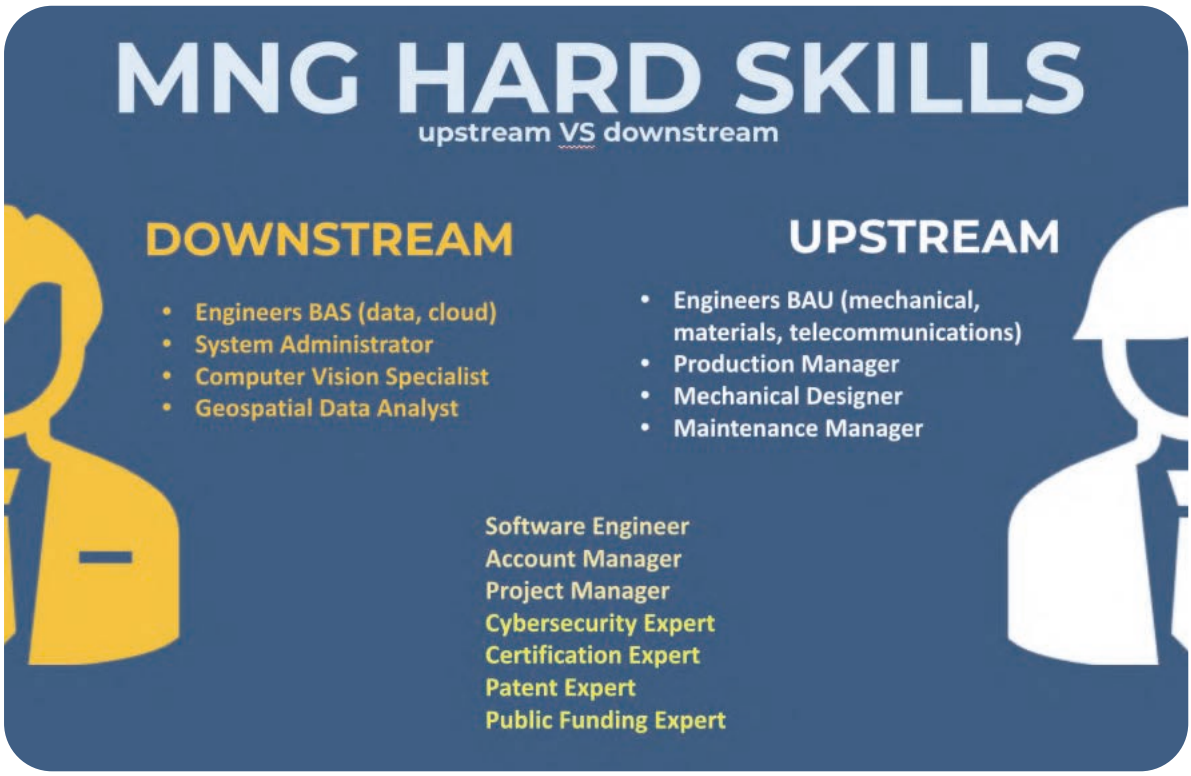
Finally, we delved into the hard skills requirements, and both representatives from the upstream and downstream worlds preferred to categorize them based on the profile (managerial vs. technical). Hard skills reflect most of the identified enabling technologies in the previous panel.

It is immediately evident that the hard skills in the upstream domain largely mirror those of advanced mechatronics. This is justified by the fact that most of the industries participating in the study approached the upstream aerospace domain from advanced mechatronics sectors.

As for the requirements in the downstream domain, there is an emphasis on the need for advanced and cross-functional profiles that do not always have dedicated training paths at the moment and are therefore developed through specialized training courses and on-the-job training.

It is very interesting that there is a growing need for roles not strictly tied to technical or engineering fields but becoming increasingly strategic in the aerospace sector: experts in patents, experts in certification systems, and experts in the realm of "public funding" for simplified and clear access to public funds, grants, and incentives. These profiles were reported more frequently than business developers or marketing strategists, confirming that many of the involved SMEs develop a significant portion of their business thanks to public funds, not just through private capital.

MANAGEMENT PROFILE



TECHNICAL PROFILE



ANNEX A
LOMINGER COMPETENCIES

ANNEX A – LOMINGER COMPETENCIES

Below is a list of the 67 soft skills-related competencies that have been examined for the development of focus groups and surveys.

1) **Action Oriented**
Enjoys working hard; is action oriented and full of energy for the things he/she sees as challenging; not fearful of acting with a minimum of planning; seizes more opportunities than others.

2) **Dealing With Ambiguity**
Can effectively cope with change; can shift gears comfortably; can decide and act without having the total picture; isn't upset when things are up in the air; doesn't have to finish things before moving on; can comfortably handle risk and uncertainty.

3) **Approachability**
Is easy to approach and talk to; spends the extra effort to put others at ease; can be warm, pleasant, and gracious; is sensitive to and patient with the interpersonal anxieties of others; builds rapport well; is a good listener; is an early knower, getting informal and incomplete information in time to do something about it.

4) **Boss Relationships**
Responds and relates well to bosses; would work harder for a good boss; is open to learning from bosses who are good coaches and who provide latitude; likes to learn from those who have been there before; easy to challenge and develop; is comfortably coachable.

5) **Business Acumen**
Knows how businesses work; knowledgeable in current and possible future policies, practices, trends, and information affecting his/her business and organization; knows the competition; is aware of how strategies and tactics work in the marketplace.

6) **Career Ambition**
Knows what he/she wants from a career and actively works on it; is career knowledgeable; makes things happen for self; markets self for opportunities; doesn't wait for others to open doors.

7) **Caring About Direct Reports**
Is interested in the work and non-work lives of direct reports; asks about their plans, problems, and desires; knows about their concerns and questions; is available for listening to personal problems; monitors workloads and appreciates extra effort.

8) **Comfort Around Higher Management**
Can deal comfortably with more senior managers; can present to more senior managers without undue tension and nervousness; understands how senior managers think and work; can determine the best way to get things done with them by talking their language and responding to their needs; can craft approaches likely to be seen as appropriate and positive.

9) **Command Skills**
Relishes leading; takes unpopular stands if necessary; encourages direct and tough debate but isn't afraid to end and move on; is looked to for direction in a crisis; faces adversity head on; energized by tough challenges.

10) **Compassion**
Genuinely cares about people; is concerned about their work and non-work problems; is available and ready to help; is sympathetic to the plight of others not as fortunate; demonstrates real empathy with the joys and pains of others.

11) **Composure**
Is cool under pressure; does not become defensive or irritated when times are tough; is considered mature; can be counted on to hold things together during tough times; can handle stress; is not knocked off balance by the unexpected; doesn't show frustration when resisted or blocked; is a settling influence in a crisis.

12) **Conflict Management**
Steps up to conflicts, seeing them as opportunities; reads situations quickly; good at focused listening; can hammer out tough agreements and settle disputes equitably; can find common ground and get cooperation with minimum noise.

13) **Confronting Direct Reports**
Deals with problem direct reports firmly and in a timely manner; doesn't allow problems to fester; regularly reviews performance and holds timely discussions; can make negative decisions when all other efforts fail; deals effectively with troublemakers.
14) **Creativity**
Comes up with a lot of new and unique ideas; easily makes connections among previously unrelated notions; tends to be seen as original and value-added in brainstorming settings.
15) **Customer Focus**
Is dedicated to meeting the expectations and requirements of internal and external customers; gets first-hand customer information and uses it for improvements in products and services; acts with customers in mind; establishes and maintains effective relationships with customers and gains their trust and respect.
16) **Timely Decision Making**
Makes decisions in a timely manner, sometimes with incomplete information and under tight deadlines and pressure; able to make a quick decision.
17) **Decision Quality**
Makes good decisions (without considering how much time it takes) based upon a mixture of analysis, wisdom, experience, and judgment; most of his/her solutions and suggestions turn out to be correct and accurate when judged over time; sought out by others for advice and solutions.
18) **Delegation**
Clearly and comfortably delegates both routine and important tasks and decisions; broadly shares both responsibility and accountability; tends to trust people to perform; lets direct reports finish their own work.
19) **Developing Direct Reports**
Provides challenging and stretching tasks and assignments; holds frequent development discussions; is aware of each direct report's career goals; constructs compelling development plans and executes them; pushes direct reports to accept developmental moves; will take direct reports who need work; is a people builder.
20) **Directing Others**
Is good at establishing clear directions; sets stretching objectives; distributes the workload appropriately; lays out work in a well-planned and organized manner; maintains two-way dialogue with others on work and results....
21) **Managing Diversity**
Manages all kinds and classes of people equitably; deals effectively with all races, nationalities, cultures, disabilities, ages and both sexes; hires variety and diversity without regard to class; supports equal and fair treatment and opportunity for all.
22) **Ethics and Values**
Adheres to an appropriate (for the setting) and effective set of core values and beliefs during both good and bad times; acts in line with those values; rewards the right values and disapproves of others; practices what he/she preaches.
23) **Fairness to Direct Reports**
Treats direct reports equitably; acts fairly; has candid discussions; doesn't have hidden agenda; doesn't give preferential treatment.
24) **Functional/Technical Skills**
Has the functional and technical knowledge and skills to do the job at a high level of accomplishment.
25) **Hiring and Staffing**
Has a nose for talent; hires the best people available from inside or outside; is not afraid of selecting strong people; assembles talented staffs.
26) **Humor**
Has a positive and constructive sense of humor; can laugh at him/herself and with others; is appropriately funny and can use humor to ease tension.
27) **Informing**
Provides the information people need to know to do their jobs and to feel good about being a member of the team, unit, and/or the organization; provides individuals information so that they can make accurate decisions; is timely with information
28) **Innovation Management**
Is good a bringing the creative ideas of others to market; has good judgment about which creative ideas and suggestions will work; has a sense about managing the creative process of others; can facilitate effective brainstorming; can project how potential ideas may play out in the marketplace.
29) **Integrity and Trust**
Is widely trusted; is seen as a direct, truthful individual; can present the unvarnished truth in an appropriate and helpful manner; keeps confidences; admits mistakes; doesn't misrepresent him/herself for personal gain.
30) **Intellectual Horsepower**
Is bright and intelligent; deals with concepts and complexity comfortably; described as intellectually sharp, capable, and agile.

31) **Interpersonal Savvy**
Relates well to all kinds of people, up, down, and sideways, inside and outside the organization; builds appropriate rapport; builds constructive and effective relationships; uses diplomacy and tact; can diffuse even high-tension situations comfortably.
32) **Learning on the Fly**
Learns quickly when facing new problems; a relentless and versatile learner; open to change; analyzes both successes and failures for clues to improvement; experiments and will try anything to find solutions; enjoys the challenge of unfamiliar tasks; quickly grasps the essence and the underlying structure of anything.
33) **Listening**
Practices attentive and active listening; has the patience to hear people out; can accurately restate the opinions of others even when he/she disagrees.
34) **Managerial Courage**
Doesn't hold back anything that needs to be said; provides current, direct, complete, and "actionable" positive and corrective feedback to others; lets people know where they stand; faces up to people problems on any person or situation (not including direct reports) quickly and directly; is not afraid to take negative action when necessary.
35) **Managing and Measuring Work**
Clearly assigns responsibility for tasks and decisions; sets clear objectives and measures; monitors process, progress, and results; designs feedback loops into work.
36) **Motivating Others**
Creates a climate in which people want to do their best; can motivate many kinds of direct reports and team or project members; can assess each persons hot button and use it to get the best out of him/her; pushes tasks and decisions down; empowers others; invites input from each person and shares ownership and visibility; makes each individual feel his/her work is important; is someone people like working for and with.
37) **Negotiating**
Can negotiate skillfully in tough situations with both internal and external groups; can settle differences with minimum noise; can win concessions without damaging relationships; can be both direct and forceful as well as diplomatic; gains trust quickly of other parties to the negotiations; has a good sense of timing.
38) **Organizational Agility**
Knowledgeable about how organizations work; knows how to get things done both through formal channels and the informal network; understands the origin and reasoning behind key policies, practices, and procedures; understands the cultures of organizations.
39) **Organizing**
Can marshal resources (people, funding, material, support) to get things done; can orchestrate multiple activities at once to accomplish a goal; uses resources effectively and efficiently arranges information and files in a useful manner.
40) **Dealing With Paradox**
Can act in ways that seem contradictory; is very flexible and adaptable when facing tough calls; can combine seeming opposites like being compassionately tough, stand up for self without trampling others, set strong but flexible standards; can act differently depending upon the situation; is seen as balanced despite the conflicting demands of the situation.
41) **Patience**
Is tolerant with people and processes; listens and checks before acting; tries to understand the people and the data before making judgments and acting; waits for others to catch up before acting; sensitive to due process and proper pacing; follows established process.
42) **Peer Relationships**
Can quickly find common ground and solve problems for the good of all; can represent his/her own interests and yet be fair to other groups; can solve problems with peers with a minimum of noise; is seen as a team player and is cooperative; easily gains trust and support of peers; encourages collaboration; can be candid with peers.
43) **Perseverance**
Pursues everything with energy, drive, and a need to finish; seldom gives up before finishing, especially in the face of resistance or setbacks.
44) **Personal Disclosure**
Shares his/her thoughts about personal strengths, weaknesses, and limitations; admits mistakes and shortcomings; is open about personal beliefs and feelings; is easy to get to know for those who interact with him/her regularly.
45) **Personal Learning**
Picks up on the need to change personal, interpersonal, and managerial behavior quickly; watches others for their reactions to his/her attempts to influence and perform, and adjusts; seeks feedback; is sensitive to changing personal demands and requirements and changes accordingly.

46) **Perspective**
Looks toward the broadest possible view of an issue/challenge; has broad-ranging personal and business interests and pursuits; can easily pose future scenarios; can think globally; can discuss multiple aspects and impacts of issues and project them into the future.
47) **Planning**
Accurately scopes out length and difficulty of tasks and projects; sets objectives and goals; breaks down work into the process steps; develops schedules and task/people assignments; anticipates and adjusts for problems and roadblocks; measures performance against goals; evaluates results.
48) **Political Savvy**
Can maneuver through complex political situations effectively and quietly; is sensitive to how people and organizations function; anticipates where the land mines are and plans his/her approach accordingly; views corporate politics as a necessary part of organizational life and works to adjust to that reality; is a maze-bright person.
49) **Presentation Skills**
Is effective in a variety of formal presentation settings: one-on-one, small and large groups, with peers, direct reports, and bosses; is effective both inside and outside the organization, on both cool data and hot and controversial topics; commands attention and can manage group processes during the presentation; can change tactics midstream when something isn't working.
50) **Priority Setting**
Spends his/her time and the time of others on what's important; quickly zeros in on the critical few and puts the trivial many aside; can quickly sense what will help or hinder accomplishing a goal; eliminates roadblocks; creates focus.
51) **Problem Solving**
Uses rigorous logic and methods to solve difficult problems with effective solutions; probes all fruitful sources for answers; can see hidden problems; is excellent at honest analysis; looks beyond the obvious and doesn't stop at the first answers.
52) **Process Management**
Good at figuring out the processes necessary to get things done; knows how to organize people and activities; understands how to separate and combine tasks into efficient work flow; knows what to measure and how to measure it; can see opportunities for synergy and integration where others can't; can simplify complex processes; gets more out of fewer resources.
53) **Drive For Results**
Can be counted on to exceed goals successfully; is constantly and consistently one of the top performers; very bottom-line oriented; steadfastly pushes self and others for results.
54) **Self-Development**
Is personally committed to and actively works to continuously improve him/herself; understands that different situations and levels may call for different skills and approaches; works to deploy strengths; works on compensating for weakness and limits.
55) **Self-Knowledge**
Knows personal strengths, weaknesses, opportunities, and limits; seeks feedback; gains insights from mistakes; is open to criticism; isn't defensive; is receptive to talking about shortcomings; looks forward to balanced (+'s and -'s) performance reviews and career decisions.
56) **Sizing Up People**
Is a good judge of talent; after reasonable exposure, can articulate the strengths and limitations of people inside or outside the organization; can accurately project what people are likely to do across a variety of situations.
57) **Standing Alone**
Will stand up and be counted; doesn't shirk personal responsibility; can be counted on when times are tough; willing to be the only champion for an idea or position; is comfortable working alone on a tough assignment.
58) **Strategic Agility**
Sees ahead clearly; can anticipate future consequences and trends accurately; has broad knowledge and perspective; is future oriented; can articulately paint credible pictures and visions of possibilities and likelihoods; can create competitive and breakthrough strategies and plans.
59) **Managing Through Systems**
Can design practices, processes, and procedures which allow managing from a distance; is comfortable letting things manage themselves without intervening; can make things work through others without being there; can impact people and results remotely.
60) **Building Effective Teams**
Blends people into teams when needed; creates strong morale and spirit in his/her team; shares wins and successes; fosters open dialogue; lets people finish and be responsible for their work; defines success in terms of the whole team; creates a feeling of

belonging in the team.

61) **Technical Learning**

Picks up on technical things quickly; can learn new skills and knowledge; is good at learning new industry, company, product, or technical knowledge; does well in technical courses and seminars.

62) **Time Management**

Uses his/her time effectively and efficiently; values time; concentrates his/her efforts on the more important priorities; gets more done in less time than others; can attend to a broader range of activities.

63) **TQM/Re-Engineering**

Is dedicated to providing the highest quality products and services which meet the needs and requirements of internal and external customers; is committed to continuous improvement through empowerment and management by data; is willing to re-engineer processes from scratch; is open to suggestions and experimentation; creates a learning environment leading to the most efficient and effective work processes.

64) **Understanding Others**

Understands why groups do what they do; picks up the sense of the group in terms of positions, intentions, and needs; what they value and how to motivate them; can predict what groups will do across different situations.

65) **Managing Vision and Purpose**

Communicates a compelling and inspired vision or sense of core purpose; talks beyond today; talks about possibilities; is optimistic; creates mileposts and symbols to rally support behind the vision; makes the vision shareable by everyone; can inspire and motivate entire units or organizations.

66) **Work/Life Balance**

Maintains a conscious balance between work and personal life so that one doesn't dominate the other; is not one-dimensional; knows how to attend to both; gets what he/she wants from both.

67) **Written**

Communications Is able to write clearly and succinctly in a variety of communication settings and styles; can get messages across that have the desired effect.

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