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About this document

This document is part of Intellectual Output 1 (O1) of **AEERO: Aerospace Engineering ECVET Resources Online**. The project AEERO is co-funded by the European Commission through the ERASMUS+ programme, KA2.

Following the methodological guidelines and tools provided by the leader of O1, the results of primary and secondary data collection and analysis of each partner country (UK, Italy, Portugal) are compiled in a National Report. National Reports will be the basis for the Global Report with the main conclusions of O1. Research, Contextualisation and Needs Analysis, which aims at providing background and contextualisation for the project and ensure quality; ensure that the platform, the learning objects and the content are fit for purpose, relevant to the market and of a high standard.

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1. Introduction

Long considered a European powerhouse for innovation and design, Italy is well respected on the global stage as an industry that holds these proficiencies as a necessity above all else. Italy is one of the most advanced countries in aerospace economic sector. In this sector, Italy has fostered important relationships with both European and non-European nations and as such is a partner on most major international aerospace and defence programmes. Looking to turn over, Italian aerospace industry is the fourth at European Level and the seventh at global one. One of the most important features linked with this performance, is the relevance of export, as it represents 7 out of 13 billions of euro of total income. At national level, the total turnover is 10 billions of euro and the weight of Aerospace industry is the 1% of national GDP. Enterprises belonging to Aerospace industry employ up to 60.000 workers of which one third are engineers involved in research and productivity. With a long history in mechanical engineering alongside innovation and research supported by the many institutions and universities, Italy's aerospace industry demonstrates vast capabilities. Among the large players and SME network it is possible to find competences across the entire aeronautics value chain and in every aspect of space activity, from components and services to data collection and handling.

At national level, Aerospace Sector is characterized by the presence of several clusters and regional districts. Industrial and technological knowhow of these aggregations is wide and is built on local excellences covering from fixed and rotating wing systems, software, propulsion and engine, fuselage components, projecting and installation of specific parts (made of aluminium, titanium and other composed materials), steel, mechanics and electro mechanics production as well as plastic, rubber and other high standards materials for complex applications. In this sense, the trend, in recent years, shows the increasing of regional inter-cluster, with the aim of rationalize the supply chain and link local competencies with universities and research centres. The most productive aerospace poles are in Varese (with a turnout of 1.8 billion of euros and 6.262 workers), in Naples (1.09 billions of Euros and 6721 workers) and in Turin (982 millions of euros and 7135 workers)

Aerospace industry is now facing, a series of contrasting challenges; if on one side, commercial sector is in a period of growth and its forecast seems to grant it for the future, on the other side, governments, and this is particularly applied to Italian one, are limiting investments especially in military field. This tendency is leading to strong pressures on supply chain, this has to be added to the volatility of fuel prices as well as general weakness of Western economies. Nevertheless, global and local market trends are:

- long term positive growth
- recovering of profitability for airlines
- increase and development of new “green” technologies

At military level, the identified trends are:

- Continuous pressure on public deficit and spending
- Degradation of military supplies
- Increase of fusions and company acquisitions
- Increase of use for virtual trainings and simulations

In Italy the most substantial financial contributions to space activities come through the Italian Space Agency and European Space Agency, with some further investment from private entities and other ministries, such as the Ministry of Defense. However, although there is a large amount of investment into space programs, a substantial amount of these funds is focused internationally rather than on national development. Because of the large scale of many programs, much of the funding also tends to be focused on the large players.

2. Market size and characteristics

Aerospace Sector represent a relevant industrial catalyst for High Technology also able to generate positive effects for cross fertilizing adjacent industries. Italy is investing significantly on development of new technologies in this sector both on products and process (up to 12% of total R&D expenditure for the country) but this is well justified by its results: one euro invested in R&D generates up to 7 euros of GDP and 10 billions of euro create 300 new jobs. Aerospace industry was always able to provide better performances than the whole national manufacturing sector even during economic crisis periods.

While the market demands high quality products, cost efficiency is becoming increasingly important, and many companies are trying to reduce variables such as development cost and time-to-market. Since the cost of payloads correlates directly to their weight, lighter materials and more compact and efficient systems are a key area of focus. End users are looking to their suppliers to reduce weight, cost and delivery time at every step of the process.

National companies share relevant position on the market, both autonomously and in a framework of structural cooperation at European and International level, developing and managing critical technologies in the light of national security. Among the most important players are:

- **Leonardo Group** (once Finmeccanica, under control of Italian Defence Ministry, first shareholder of the company) - the most important company at national level and in the top ten at global level
- **Avio Aero**, leading company for projecting and production of aerospace propulsion components and systems
- **Piaggio Aerospace** (owned by Mubadala Development Company, Abu Dhabi government agency) one of the leading company for components and engines for civil aerospace sector.

The large part of manufacturer avails on a consolidated network of distribution, integrating all correlated services such as installation, maintenance and post sales assistance.

Among the principal stakeholders, Italy can count also on **CTNA** (Aerospace Technological National Cluster) an association gathering, among the others, Leonardo, Avio Aero, Campania Aerospace Technological District , Regione Lazio Financial regional agency , Promoting Committees for Aerospace industry in Lombardia and Piemonte Regions, Italian Space Agency (ASI), Italian Federation of companies in Aerospace, Defense and Security and CNR – National Board for Research. This stakeholder is currently developing strategic plans for the development of Italian sector CTNA is the key organization unifying all different actors within the aerospace sector, from the various regions, large companies and SMEs, to academic institutions and other entities.

Moreover, there is a wide presence of small and medium enterprises, universities and research centres. Many companies have been able to draw on their experience in other sectors, transferring knowledge from the automotive industry in particular. Small and medium enterprises cover 10% of the whole workforce in Aerospace sector but avails also on an extended network of specialized subcontracting companies (focusing on selected fields, such as precision mechanics, optic, advanced materials, etc), all contributing the whole national aerospace economy. Due to their smaller size and market presence, SMEs face strong competition and challenges that larger companies overcome more easily. The speed at which the aviation industry is evolving, and the obstacles that national SMEs are facing, are forcing them to look abroad for business opportunities. Many believe that their capacity to survive will depend on whether they are able to enter the European and international markets or not.

Universities and research institutions play a very active role in the overall development and innovation of Italian industry. From skilled vocational training and niche specialized engineering programs to independent and collaborative research projects, Italian universities are a key component of the industrial sector. Well integrated into the surrounding industry, many universities conduct applied research in conjunction with companies and participate in programs at a national and European level.

Because of the close relationship with local enterprises, it follows that the activities of each university and research institute will reflect the local capabilities and specialize in these specific areas accordingly.

Faculties that offers bachelor and master degrees in Aerospace engineering in Italy are:

- **Università “La Sapienza” di Roma**; in addition to courses the university houses CRAS, an inter-departmental center for aerospace research.
- **The Polytechnic University of Turin** in Turin offers undergraduate (bachelor) and graduate (masters) programs in the field of Aerospace Engineering
- **Università degli Studi di Bologna –branch located in Cesena and in Forli**. The University of Bologna (UNIBO) in Bologna, Italy is the oldest university in Europe. The Faculty of Engineering at the Bologna University offers undergraduate (bachelor) and graduate (masters) programs in the field of Aerospace Engineering.
- **Università degli Studi di Napoli “Federico II”**
- **Università del Salento**
- **Università degli Studi di Padova**, offers undergraduate and graduate programs in the field of Aerospace Engineering.
- **Università di Pisa**, offers undergraduate and graduate programs in the field of Aerospace Engineering.**Seconda Università degli Studi di Napoli**
- **Politecnico di Milano** in Milan, Italy is the largest technical university in Italy.

Other important research centres in Italy are:

- **CIRA**
- **IMM (part of CNR)**
- **Italian Space Agency - Space Geodesy Center**
- **Politecnico di Bari**
- **Institute of Italian Technology (IIT)**
- **University of Rome Tor Vergata**
- **University Del Sannio**
- **University of Salerno**

More than 8,000 students are enrolled in aerospace programs in Italy and universities offer high quality courses that pave the way for the necessary internationalization of the industry. Even if the Aerospace sector is becoming more and more relevant in these here the use of BIT in Italy is quiet low.

In fact, even if there are many Higher Education institutes and universities that are interested in this field there is a very low information on this matter. As it will be exposed in the next chapters, in many classes of master degrees are inserted exams regarding industry and management, but are not focus on aerospace in particular; many professors that were interviewed underline the superficiality and inefficiency of these curricula.

It appears that SMEs are more advanced and prepared on this field, probably due to the necessity of always being updated and competitive in order to keep making improvements to production and manufacturing processes.

3. Training offer and routes to market

The apparent asymmetry and fragmented structure of the Italian aerospace industry is a peculiarity when compared to other national markets, which have seen a greater amount of consolidation and therefore are home to fewer niche companies. Compared to other countries, Italian companies are more accustomed to relying on private capabilities and investment, and the country system has allowed the industry to develop in this way. As highlighted and demonstrated in previous chapters, in Italy there is an increasing interest in Aerospace field; nevertheless being Business Improvement Techniques (BIT) a not very known and diffused definition, it is difficult to reunite all the cases under a unique category. Below are collected and explained multiple high level Italian realities.

3.1 Training courses and certification

Higher education

As stated, in Chapter 2 in Italy there are many universities that offers this kind of courses. The curricula will be better and fully explained in the Annexes, but they have a common methodology that is based on: face to face, workshop and stages and labs classes to have a deeper understanding of the subject. Usually the aim is acquisition of a high level of competence required to carry out innovative research and/or state of the art advanced applications in: industries, research centres, universities and service companies operating in the aerospace industrial and research area, including all fields having any connection with aerospace. The level of the programmes should allow graduates to compete successfully in both the European and International aerospace environment.

Sadly, in the aforementioned universities, it is not possible to assess if Business Improvement Techniques are explicitly or implicitly addressed within the Aerospace field. During the interview's process, professors stated that contents regarding BIT are part of master degrees such as Mechanical Engineering, so they are provided but a bit superficial and generic.

Executive education

Executive education refers to academic programs at graduate-level business schools for executives, business leaders and functional managers. These programs are generally non-credit and non-degree-granting, but sometimes lead to certificates. Once again, they are not necessarily exclusive of the aeronautic sector, but they have the possibility to be customized for each company, depending on its need.

Also, in this case, the part regarding universities (especially private ones) is very relevant, since they are important for Lean organization, but not closely related to the sector. Some interesting examples are:

- the Università Bologna¹ : Offers an interesting contribute - the Master in Supply Chain and Operations, which aims to support the strategic positioning of a business and to improve operations and supply chain management by favouring a systemic view of the activities related to the product and the process: from supplying materials to delivery of products
- SDA Bocconi - EXECUTIVE PROGRAM IN OPERATIONS & MANUFACTURING MANAGEMENT², Addressed to people covering industrial positions (Operations Director, Plant Manager, or Young High Production Leaders). The intervention, structured on multiple technical modules, contains a large part on management, economic and relational elements, with great attention on Lean production.

¹ <http://www.bbs.unibo.it/hp/master-executive/supply-chain-and-operations/?gclid=CNjhvvKGvdQCFUOfGwodLaQEmQ>

² <http://www.sdabocconi.it/it/formazione-executive/executive-program-operations-manufacturing-management>

VET providers

As shown above, Universities can be considered VET providers. Since there isn't a very strong distinction in the categories explained, as it isn't easy to distinguish where it starts the vocational training and finishes the stage. Usually professors follow their students through their professional path and address them to companies. More specifically an interesting case is **UNAVIA**. It is a free, no profit, association established in 1946 by the main aeronautical manufacturers and the Ministry of Defence (via Costarmaereo) for standardization in the aeronautical sector. Nowadays the Association has expanded its activity into aerospace and defence sector and its members are the Ministry of Defence (via Armaereo), the Ministry of Economical Development, ENAC (Italian Civil Aviation Authority), UNI (Italian National Body for Standardization) and AIAD (Italian Industries Federation for Aerospace, Defence and Security). UNAVIA operates in three different fields: Standardization, Training and Non-Destructive Testing Personnel Qualification (ITANDTB).

UNAVIA training, taking advantage of its competence in Standardization Area, participates in development and supports continuous improvement of organizational policies in order to provide qualified services to organizations. Particularly, it has identified in training, focused in Quality Management Systems involving the entire company and the relationships between customers and suppliers, the specific tool to create an adequate culture and a solid base for operational activities. UNAVIA training, strictly related to its standardization activity, according to the standard requirement in aerospace and defence field, designs and provides training courses focusing on regulations and standards and on quality management methodology.

UNAVIA is accredited by the national body (CBMC) from IAQG (International Aerospace Quality Group) as a Training Provider and then is one of the few training institutions in the world authorized to provide special courses of the aerospace scheme.

In order to provide a priority service more practical and more appreciated, UNAVIA, which is expanding its training, acts with highly significant partners in specific areas. For that is high significant the agreement with Plexus Systems Management, Italian issue of Plexus International, the company chosen by IAQG to design and deliver the course aims to optimize the training of auditors of the aerospace and defense.³

IMEX.A is an engineering company that was founded in Turin in 2009 to deal with space design applications and design. Thanks to a network of highly specialized collaborators, in the years, it spread to other areas in which it still operates, such as aeronautics, space, automotive, industry. For all sectors, iMEX.A offers consulting, training and design services in the mechanical and structural fields, fluid dynamics, electrical and electronic fields. In particular, iMEX.A is able to support the customer from the early stages of definition and design, through technical and economic feasibility studies, to the final product completion, through definitive design and supplier management.

Quanta Composite Learning & Training is the first output of the CSD (Composites Skills Development) network: a vocational training school, created from the involvement and cooperation of highly qualified partners and thanks to the connections with higher institutes and university faculties that allow the identification of young talents and enable the organization of informative internships at school time to guide vocations and expectations. It is a highly specialized advanced vocational training course for individuals and companies. It provides customizable courses, that by analyzing the training needs and the processes that are used (or are to be acquired) in the client companies. The needs analysis is conducted directly by the technical / teaching staff of Quanta Composite Learning & Training at the production sites of the contracting companies and on the production operations of the customer.

³ <http://www.aiad.it/en/unavia.wp>

In addition to those VET providers We can also include a wide array of industry operators, with more or less articulated dimensions, which stand as support elements for purely business training processes. The main key operators in funded education and in the main funding medium, that is Fondimpresa⁴ are

- Adecco Formazione srl
- Assoform Romagna scarl
- Civita srl
- Conform Consulenza Formazione e
- Management scarl
- Consilia CFO
- Consulman spa
- Consvip s.c.ar.l.
- ECOLE – Enti Confindustriali Lombardi per l’Education Società consortile arl
- Ergon Srl
- Eulab consulting
- E- Work
- Forema
- Form & Atp
- Formamentis
- I.F.O.A. Istituto Formazione Operatori Aziendali
- Istituto Italiano Saldatura
- Il Sole 24 ore
- Insi SPA
- Poliedra
- Protom Group
- Randstad
- Riconversider
- Risorse in Crescita srl
- Saip formazione
- Servizi e Promozioni Industriali
- Sistemi Formativi Aziendali srl
- Soges
- Solco Srl
- Step Srl
- STOA’ S.C.p.A. Istituto di Studi per la Direzione e Gestione di Impresa
- Talentform spa
- Tecfor
- Unindustria Servizi&Formazione Treviso Pordenone scarl

These bodies also have training catalogs recognized by the fund, among which there are training elements related to BITs. As a mere example, Consilia⁵ and ECOLE – Enti Confindustriali Lombardi per l’Education Società consortile arl⁶, offer specific classes on Lean. Although not specifically designed on

⁴

http://www.fondimpresa.it/images/documento20130611/regolamento_qualificazione_proponenti/Elenchi_agg.07.06.17/riepilogoSoggettiProponentiqualificati_agg07.06.2017.pdf

⁵ <http://www.consilia.net/catalogo/schedacorsoincatalogo.php?idcorso=238>

⁶ <https://www.myecole.it/doc/wp-content/uploads/2015/03/Catalogo-ECOLE-2015-MILANO-LODI-2.pdf>

the aerospace industry, courses are directly applicable in different operating environments and the fund also finances contextual adaptation activities.

3.2 Target groups

Training, as highlighted in Chapter 5, is directed to every worker in the industry, obviously in different ways. As far as apprentices are concerned, there are mainly two tools. Firstly, the so-called Vocational Training Centers. A vocational training centre (in Italian Centri di formazione professionale, abbreviated to CFP) in Italy is an institute that help young people and adults to perfect their vocational training and help them enter the work environment or improve their job. Courses can be of four main types:

- professional qualification courses: they are commonly aimed to students that are finishing the compulsory school; they have a duration of two to three years and end with an examination that declares the achievement of the professional qualification.
- specialization courses: they are aimed to young adults and/or adults who, having already obtained a professional qualification, intend to deepen their knowledge and skills in the professional sector of their interest; they generally have a duration of one year.
- post-graduate courses: they are aimed at people who have, through a state exam, a high school diploma and want to complete their vocational training; they generally have a duration of one year.
- higher education and technical training.

The Vocational Training Centers are run by training bodies who have their work controlled by the Regions or, in certain cases, are directed by the Region itself. Alongside the CFPs, it is envisaged, at regional level, to create specific training and apprenticeship training courses by private training institutions, generally through public calls based on market research and training needs.⁷

The initiative is often combined with the definition of emerging training elements from companies entrusting training bodies to care for the organization, staffing, guidance and training / job placement.⁸

For both modes, although there are no specific courses for the Aerospace industry, the issues discussed and the skills on which they work (especially at production techniques) are compatible. Instead, there is no link with the BITs. In both cases support is given to job placement (or reinstatement if you are unemployed/over 50) by means of specific financial measures or partial tax exemption on workers. As far as apprentices are concerned, a three-year period of work placement is envisaged, in which there is a training obligation for the company to improve the worker.

The financial resources associated with apprenticeships, especially those related to regional initiatives, come from the European Social Fund.

With regard to training for "established workers", besides the formalized courses, the role of inter-professional funds is very important in Italy.

The National Interprofessional Equal Funds for Continuing Education are associative organizations promoted by the companies representing the Social Partners through specific Interconfederal Agreements concluded by employers 'and employers' most representative organizations at national

⁷ https://www.laformazioneprofessionale.it/formazione_professionale.html

⁸ <http://www.regione.liguria.it/argomenti/conoscere-e-vivere-il-territorio/istruzione-formazione/occupazione/apprendistato-professionalizzante-e-contratto-di-mestiere.html>

level. There are currently 19 Funds (of the 22 authorized by the Ministry of Labor) of which three are dedicated to Executives. The funds receive directly from the companies' part of the contributions paid to their employees (0.30%) and manage them by financing corporate, sectoral and territorial training plans, which single or associate companies will decide to implement for their employees. They may also finance individual training plans, as well as additional preparatory activities or related to training initiatives, and from 2011 (Law No.148 of 14/09/2011), training plans may also involve apprentices and project workers. The most important fund is Fondimpresa, by number of workers and businesses. It receives approximately 50% of the total annual payments made by companies registered in the Interprofessional Funds for Continuing Education. From 2007 up to now, it has enabled the training of over 4,500,000 workers. 175 million companies join in for a total of 4.4 million workers.

Interprofessional funds are the main tool for vocational training especially for small and medium-sized companies. In this sense, interventions tailored to individual training needs are defined on company' initiative or on the initiative of the training body involved. As regards the certification of courses and the implementation of European tools for vocational education and training, especially for professional courses, the catalogue of national professional profiles (29 profiles) is identified as described in the Inter Ministerial Decree 7 September 2011, laying down general rules on ITS diplomas and relevant national reference figures, verification and certification of competences, as supplemented by the Ministerial Decree of 5 February 2013 (Decree 82/2013)⁹. These professional profiles were subsequently implemented and adapted in all Italian regions becoming characteristic elements for certification (through specific examinations and procedures established for each Region) of professional courses or courses of shorter nature (working, in that case, on some skills which define the whole professional figure).¹⁰.

At present, the ECVET, even though is not widely known from companies, it' spreading in Italy and it's facing the challenge of introducing a common methodological framework.¹¹

3.3 Training resources available

As stated in the previous paragraph, some reports are available to show the current situation in Italy. Sadly, it cannot be stressed enough the fragmentary of resources in this field. Surely researches and materials have been previously prepared inside regional and national report but are either too generic, of not updates, or uncompleted or too specific.

⁹ Relazione sull'istruzione e la formazione professionale (IFP) in Italia, Cedefop, 2014

¹⁰ https://atlantelavoro.inapp.org/repertorio_nazionale_qualificazioni.php

¹¹ <http://librettocompetenze.isfol.it/validazione-delle-competenze.html>
<http://www.programmaleonardo.net/ecvet/download/Leaflet%20ECVET.pdf>

4. Good practices

As mentioned, before it is possible to find some good practices inside Italian companies related with BIT, although no company in the country refers to these policies, methods or procedures as BIT. Since the cases were gathered with the support of a engineering consulting society, we were not given the permission to publish the name of customers. That is why just the consultant company/consultant will be reported by name.

4.1 Multinational aerospace manufacturing company

The company, located in Genoa Area develops, constructs and maintains aircraft, aero-engines and aircraft structural components. It has a subsidiary in the United States, located at West Palm Beach, Florida. A global provider of excellence, the company is dedicated to cutting edge aviation technology. Among the leading industry players to design, develop and support unmanned aerial systems, business, special missions and ISR aircraft and aero engines this company is an industry leader in business aviation and Defence and Security.

The company decided to move toward a Lean manufacturing address, in order to comply with a low investment cost and a high return in terms of production efficiency and customer satisfaction.

METODI Engineering S.r.l. an engineering company operating in aeronautic, aerospace, automotive and railway fields and for the development of industrial production tools since 1985, was selected to guide the process. The support from Metodi Engineering was concentrated on applying Lean production operating to existing context and productive tools.

The focus was then placed on

- Okuma Lathes: standardisation of the turning operations to allows the employment of a single worker per shift
- Morando Lathes: Recovering of productive capacity on Morando Vertical Lathe 615-415/418 by eliminating wastefulness
- High Vacuum Furnaces: standardization of work operations optimizing the bathes to avoid producing non requested stocks
- MRO Department: 5s integration activity and operation to set a visual department
- Breton Machinery: Detailed Analysis for workflow to standardize the operation in order to improve production capacity
- TIG Welding Robot: average set up and welding process time reduction

After a period of support/consultancy the results achieved are

- Okuma Lathes: decrease of process time (-18,5%), decrease of worker per shift (-50%), improvement of available space (m² + 18%)
- Morando Lathes: decrease of set up time (-79%) and diminution of average process time (-21%)
- High Vacuum Furnaces: definition and implementation of a standard work and elimination of non requested stock production

- MRO Department: improvement of available space (+ 9 m²), definition and implementation of a standard work , rationalization and replacement of tools (+ 40%)
- Breton Machinery: still in progress
- TIG Welding Robot: average set up and process time – 60% (min – 84%)

4.2 Flight critical products company

This company is a diversified global provider of highly engineered innovative flight critical products to the aerospace and defence industries. Specialising in flight control and utility actuation and environmental control systems utilising state-of-the-art technologies. System integration capabilities give the company the possibility to offer turnkey system solutions meeting the most challenging requirements.

The company decided to move toward a Lean manufacturing address, in order to comply with a period of financial difficulties as well as the new management approach linked with the American ownership.

Lean production approach was provided in the three productive sites in Italy.

- MRO CRU Cell– Site 2
Time Observation Standard Work definition for MRO activities on CRU devices, KPI, transit time reduction and spaces rearrangement.
- Machinery Bodies Cell - Main productive site:
Standard Work analysis for a redistribution of the loads on machinery with an increase on efficiency. Kanban system implementation. KPI, TAKT production program, WIP to SWIP.
- PCM Cell – Site 3
- setting up of a spare area outside the PCM cell where to stock monthly needs freeing the working area from WIP and warehouse from PCM stocks. Daily collection (and construction) of PCM.

Results achieved were:

MRO CRU Cell– Site 2

- average process time – 24%
- average p/n movement – 64%
- p/n transit time - 40%

Machinery Bodies Cell - Main productive site:

- work in process – 40%
- on time delivery + 45%

PCM Cell – Site 3

- average process time - 21%

4.3 Engineering private company

The company is a high-tech private engineering SME based in Genoa, Italy. Due to its experience in Aerospace, STAM¹² has decided to invest resources in the active debris removal field and, in order to

¹² <http://www.stamtech.com/>

support these activities, has established a business collaboration with Mr Franco Malerba, the first Italian astronaut, in order to maximize the visibility of the project and push the developed technology to the market. The business innovation coaching (Funded through EASME - Executive Agency for SMEs, under the SME Instrument) strengthened the capability to deal with growth, and aspects such as strategy, organisation, management, financing and resource development.

The total number of hours was 96 divided as presented below:

- 4H: **Assessment of business development strengths** Meeting with company managers, discussed the space debris capture system, designed a preliminary methodology to assess market value and potential customers; decided paths to connect with potential partners and customers.
- 4H: Articulation of a **vision and a mission**
- 8H: Business architecture and market segmentation
- 36H: Connect to potential partners and customers
- 10H: Preparation of negotiations with partners
- 10H: Estimation of sales and business potential -
- 24H: Support in the development of detailed business development plan

The connections developed through this coaching helped the company to prepare new proposals and to reach new targets.

5. Needs Analysis

Our researches focused on Business Improvement Techniques (BIT), which monitor and improve production and manufacturing processes. Competences developed through BIT are currently under-used in the aerospace industry although they are key for aerospace engineering apprentices and workers. In the context of the project, BIT is a term used comprehensively, to include any systems or techniques adopted by organizations to improve services, increase efficiency and productivity,

We invited multiple stakeholders and organization to participate in AEERO survey to collect views on the features and needs of the aerospace manufacturing sector.

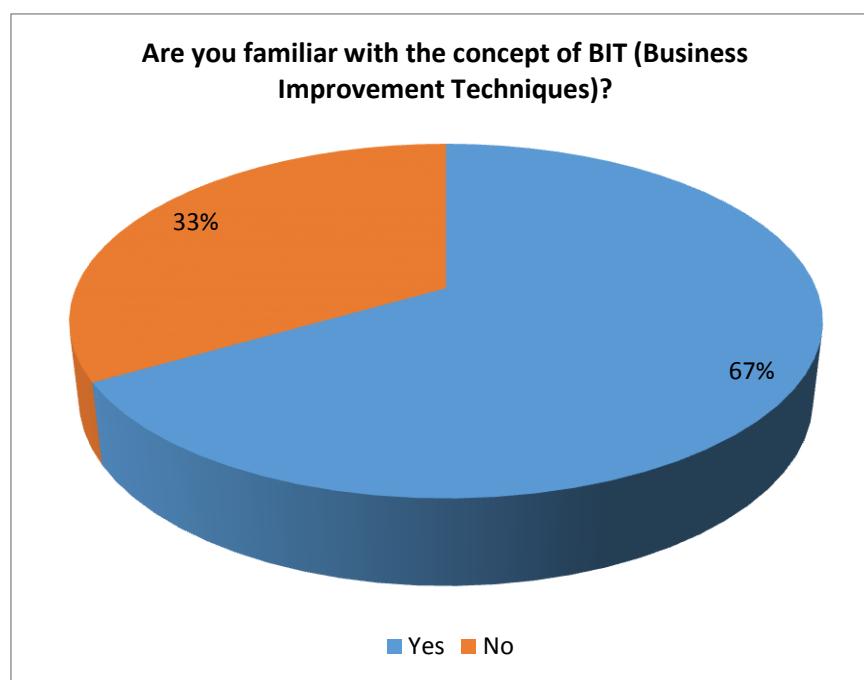
5.1HEI

As previously highlighted, a big part of education and formation in Italy is performed from Higher education institute. The questionnaires and interviews gave back more or less the same response.

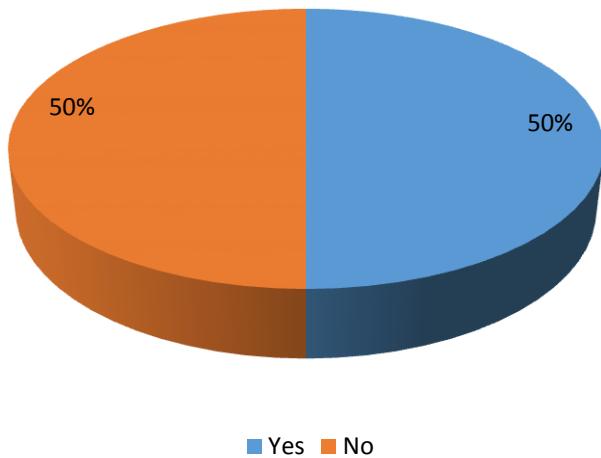
- Most of the interviewed/questioned institutes have dedicated courses on Aerospace
- The student's number is slightly increasing in the last few years
- The main aim of the institutes is to create a contact among the students and the enterprises, so there is a great collaboration with sector enterprises
- The percentage of graduate students that enters in Aerospace sector is very small (around 1%). The number is stable, since the Italian companies working in this sector are not so many and the turn-over is quiet low.

Main envisaged challenges:

- technological development
- development of the competences of workers
- lowering of costs
- Transfer the knowledge of new tools for design, production and organization of work.



Are there any related BIT or similar courses / related courses (Lean, Six Sigma, etc.) as part of the curricula offered by your institution?



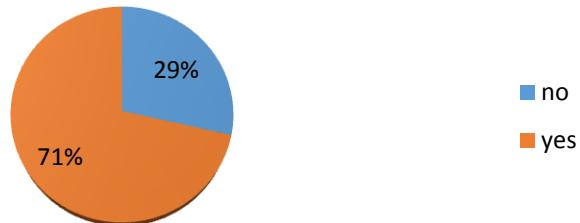
As previously underlined, the contents of many of the courses included in the Master's Degree in Mechanical Engineering - Energy and Aeronautics refer to the industrial sector in general and are therefore not focused on the aerospace industry. For this reason, some issues are treated superficially.

5.2VET Providers

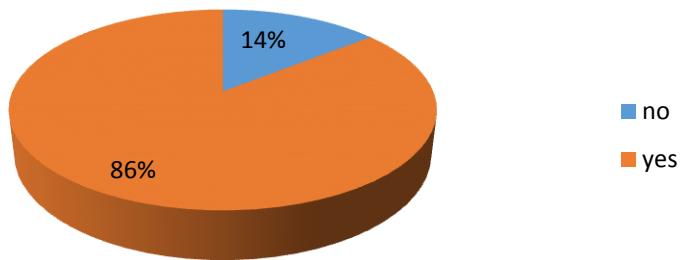
Training organizations play an important part in promoting the development of aerospace companies and, more importantly, in the spread of BITs. In this sense, although not always known under the name of BIT, Lean Production or continuous improvement, these themes are well known by training bodies (not just those involved in interviews / questionnaires) that often offer more or less customized training interventions on these topics to industries. The data highlighted during our desk research have been validated during the VET Providers involvement phase.

The VET providers involved all have deep experience in enterprise affiliation and definition of targeted interventions, and are widely credited for courses, with a large portfolio of Aerospace clients, more than 70% of respondents. Knowledge of the ECVET system is wide but its application - as discovered during our desk research - is not active.

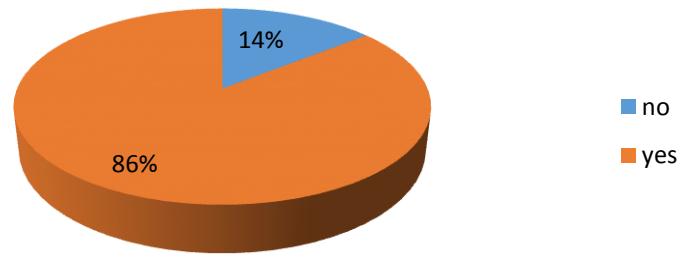
Does your organization provide training for the aerospace sector?



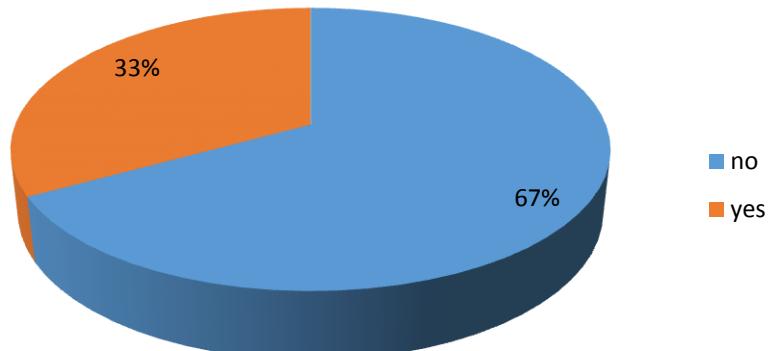
Are you accredited by a certifying authority to provide any specific course(s)?



Are you familiar/have you heard about the concept of ECVET – European Credit System for Vocational Education and Training?



Does your organization use this system?

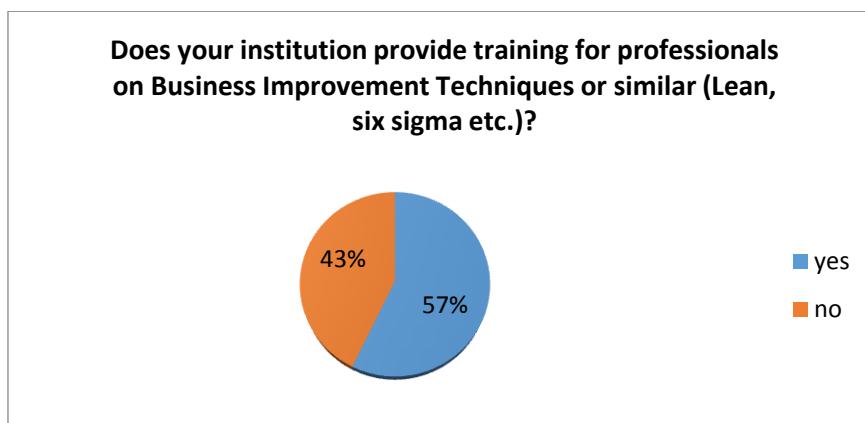


They offer courses on a wide range of issues: innovation in the organization (part of it regards BITS), digitization and technical production skills, business start-ups, and emerging activities from specific

business demands. The target groups of these training actions are practically all workers, obviously taking into account both the business size and the type of courses. In this sense, since SMEs are the main focus of intervention for these bodies, often the whole workforce is involved in training processes. A reflection immediately becomes clear. In less formalized contexts (i.e. without large hierarchy schemes, staffing offices and executives for the definition of human resource policies), the direct involvement of the entrepreneur is crucial for the definition of BIT related interventions.

The customization of training courses also offers a very jagged view of the duration of targeted training campaigns for industry companies, even though the trend is to have either a limited time-to-action (generally headed by managers / executives) or different windows of activities with the participation of a large percentage of corporate population (sometimes 100%) in more complex projects. No instances of reward for participation in training have been reported

As far as the BIT techniques are concerned, practically all VET operators are aware of them but with little direct application, while the total number of respondents who does not offer initiatives on these issues, considers their eventual development useful.

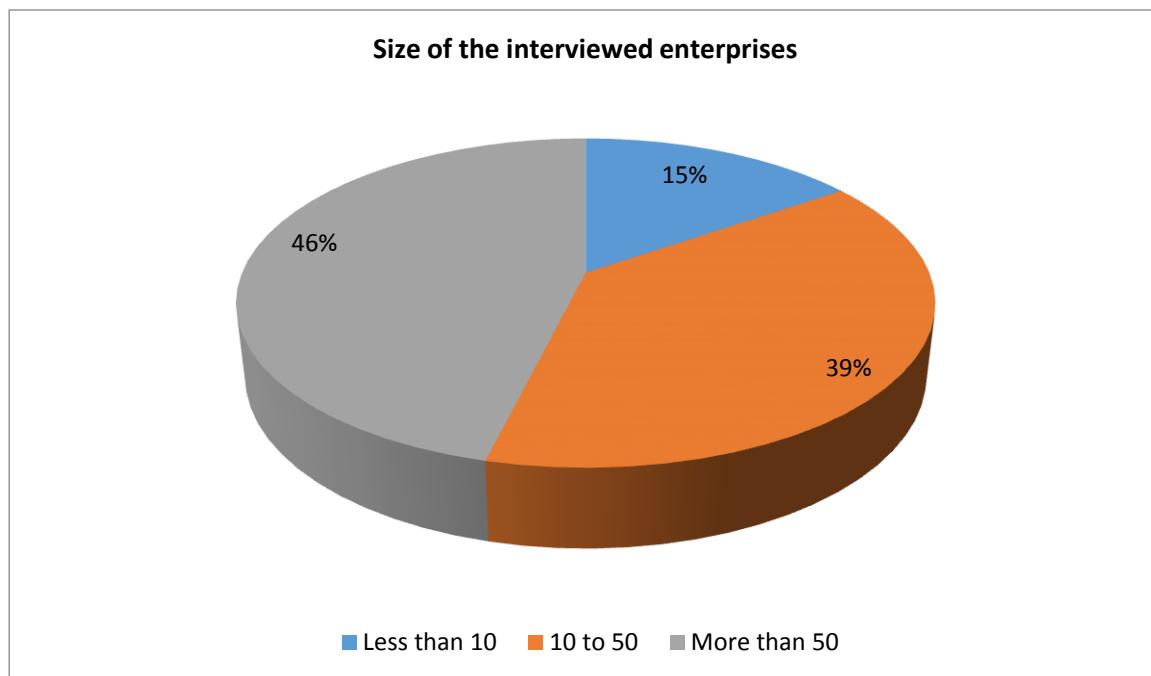


Regarding the BIT courses promoted by VETs involved, they generally arise on direct customer business initiatives, often with independent trainers and, above all, with a high customization of the interventions. The most recurring theme is that of the Lean Organization in its application in the context of the medium-sized company both with spot and multi-art campaigns, lasting several months and specific training sessions on the job and of support.

5.3 Aerospace Manufacturing Enterprises

The majority of enterprises stated that they consider useful for all employees to take advantage of BIT courses, perhaps with different duration and depth depending on the role.

Questionnaires and interviews saw the participation of companies in the sector of various sizes (especially SMEs, but also large companies) and with different areas of intervention, ranging from real production to design, consulting and engineering to the chain, with companies active in the production of industrial valves, sheet metal, radio and telecommunication equipment, defense systems and electronic systems and specific software.



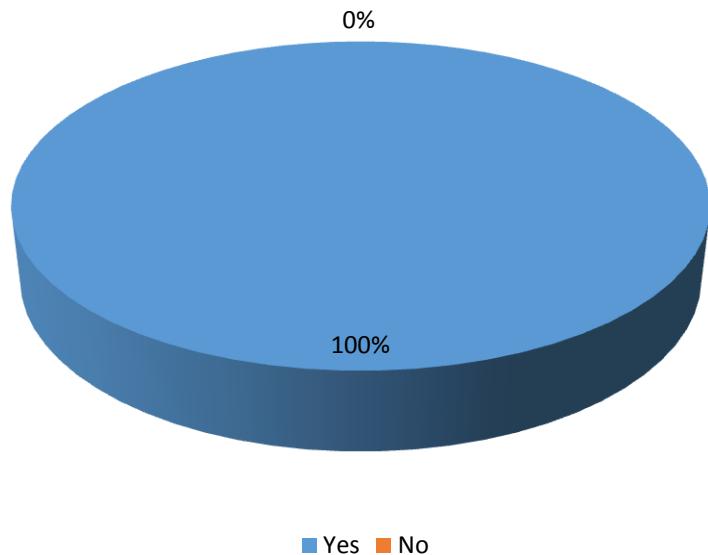
Above is shown the size of the interviewed enterprises. The majority of enterprises stated that the main challenges for the future are:

- deeper research for greater efficiency in production
- reducing production costs
- competition from abroad
- maintaining competitiveness and innovation
- structure reliability
- remain competitive in a downward market,
- Improving business potential

By synthesizing, the message that seems to come out of these feedbacks is "Maintaining and improving competitiveness by curbing technological innovation and management by reducing costs while maintaining quality".

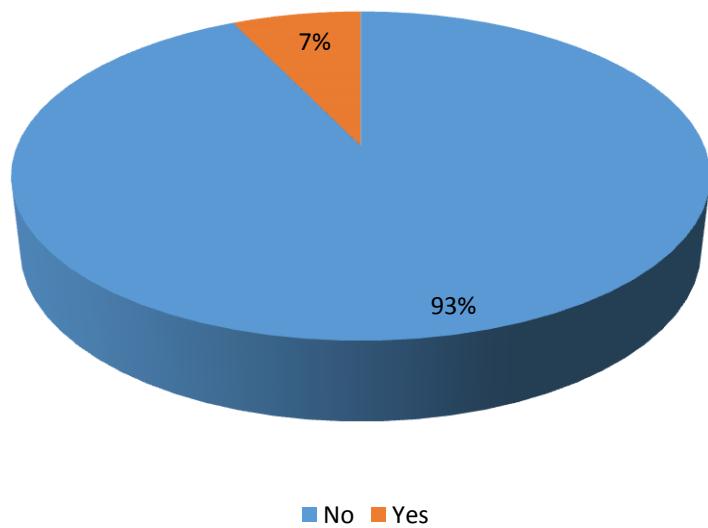
The major need is the ability to adapt to the European market and to predict technological and operational trends before they become consolidated and need rapid adaptation.

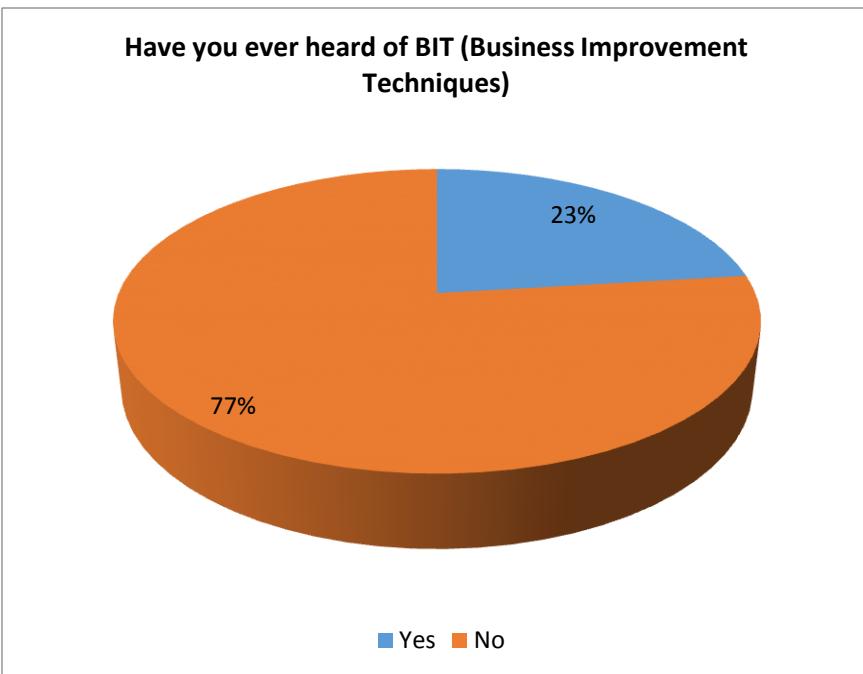
Are there internal training campaigns for your company's employees?



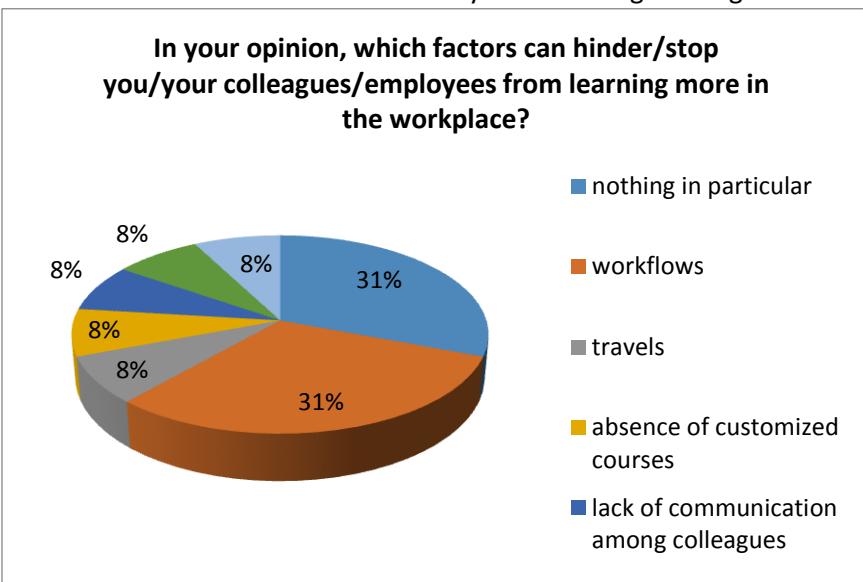
For this reason it was interesting to discover that 100% of the interviewed enterprises answered positively to the question: "Are there internal training campaigns for your company's employees?", but only the 7% aware of ECVET and only 23% had heard about BITs.

Have you ever heard of the concept of ECVET?

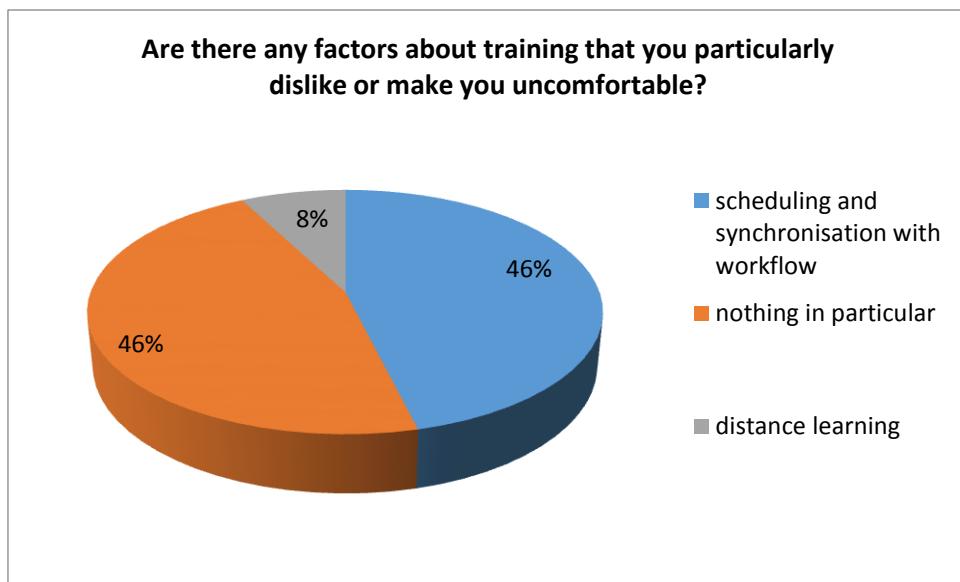




As far as the factors that can block workers in learning more at work, many respondents have focused on either the absence of real causes or the difficulty of combining training and working rhythms.



Similarly, synchronization problems with workflows are reported as potentially negative factors related to training



The answers that emerge from questions related to the training campaigns carried out in the company give very different results, however some relevant factors emerge. Firstly, it appears to be of little relevance the certification/accreditation of courses; instead it's underlined the importance of direct applicability of learnt competences.

Likewise, VET results also reveal heterogeneous feedback regarding the workers involved in these campaigns that may be executive resources (especially for limited interventions) or all workers in the company. Even in this case, there is little presence of training reward systems.

With regard to attending Lean courses only in one case there is a direct experience, linked to Lean production in particular. Most respondents find it useful to have a BIT-related training program, with a mixed teaching approach and with limited duration work (especially between 20 and 50 hours) and available for a long period of time.

5.4 Sectoral Organizations, Clusters, Industry and Trade Associations, Certifying Authorities, Regulators and other Bodies

The **sectoral organizations, clusters, industry and trade associations, certifying authorities, regulators and other bodies** gave a very heterogeneous response, due to different experience and categories reunited in this chapter.

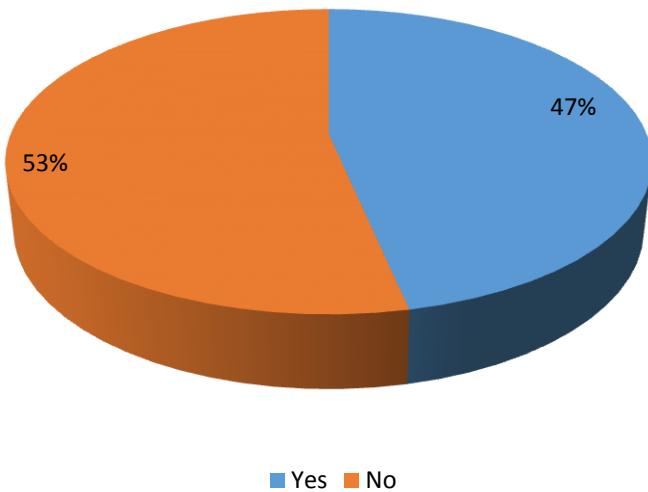
The main envisaged challenges that were reported were the ability to adapt to the European market and to anticipate technological and operational trends before they become consolidated and need to be swiftly adapted.

The key drivers for innovation that has to be targeted are

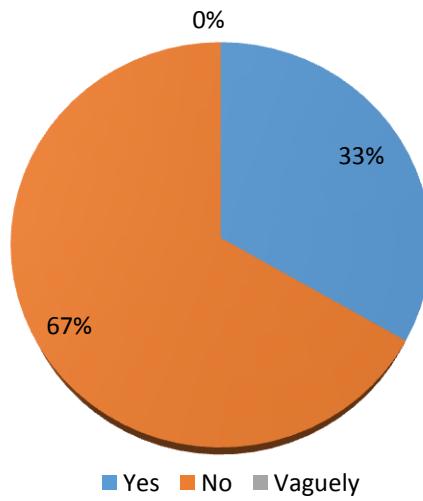
- better operating efficiency of production
- Development, market analysis and partnership research
- a higher level of technological mastery
- Constant technological analysis
- reduction in resources required for development
- spin off

- credit access
- Different commercial policies, open to SMEs
- Environmental impact and safety
- In your experience, have you ever encountered the concept of Business Improvement Techniques (BIT) or similar concepts?

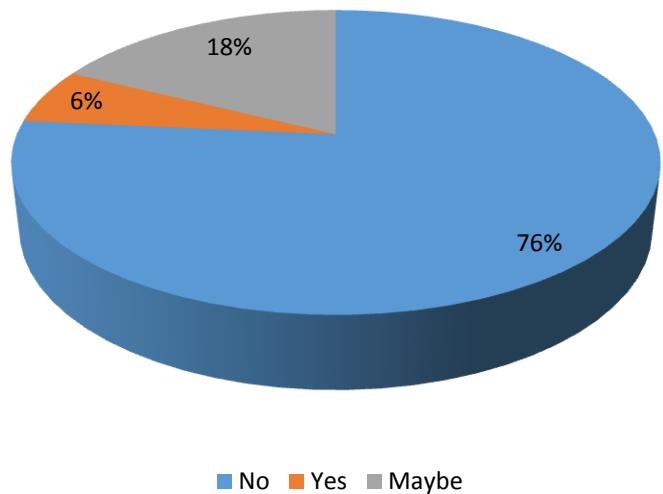
In your experience, have you ever encountered the concept of Business Improvement Techniques (BIT) or similar concepts



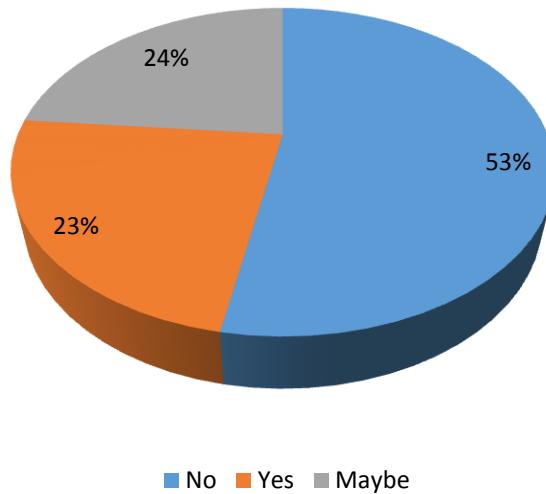
Are you familiar with Business Improvement Techniques?

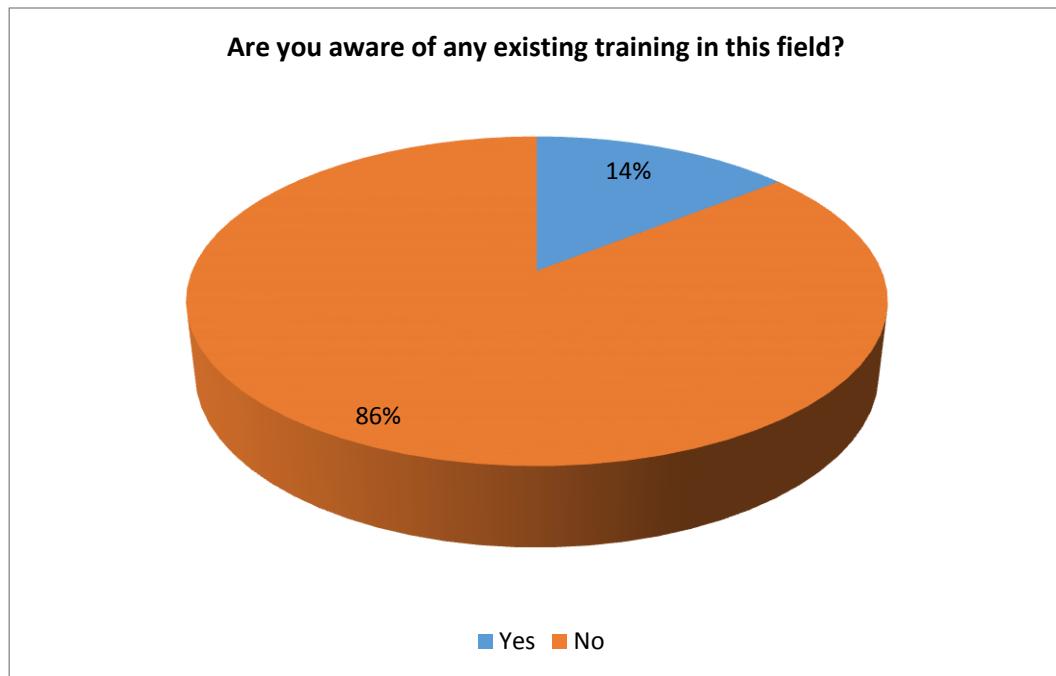


Does your organisation have any initiatives related to these practices?



Would you say that BIT is an interesting/important field for innovation in the production process?





It has to be specified that the main challenge for small companies is related to the availability of resources, financial reach and scope of specific knowledge available. Competing with the larger companies is no easy task, and SMEs must focus on how to allocate and channel their limited resources correctly. As it can be seen above, the interviewees highlighted a little knowledge on BITs; the courses are not considered suitable for context, and a stronger academic support would be required. If this should happen there would be the possibility to maintain higher qualitative standards, that also would be replicable and reliable, in accordance with the requirements and the competitor's level.

6. Conclusions and recommendations

As stated in Chapter 1, Italian aerospace industry is the fourth at European Level and the seventh at global one. This makes difficult giving a complete and exhaustive overview; in order to avoid an excessively simplistic work, we focused on key points and qualitative analysis of the information we had collected. We kept a strict connection among chapters (especially regarding Chapter 2 and 3) and reported only relevant information, keeping more specific ones for Annexes. For sure we consider Chapter 5 the most crucial part of our work. During our interviews one of the points that was stressed multiple times, especially from SMEs, was not only the reduced number of courses, but also the low accessibility and diffusion.

Italy's airspace requires ongoing modernization to continue to service the growing demand from commercial air transport, the Military and general aviation and new fast-growing user groups such as unmanned aerial vehicles. As well as enabling growth, airspace modernization also offers opportunities to:

- reduce and remove risk factors from the existing airspace and introduce new concepts that support the safety critical tasks of pilots and air traffic controllers.
- tackle hotspots of congestion within the current airspace network.
- improve the resilience of the airspace network to bad weather and other forms of disruption.
- better manage the environmental impacts of aviation, especially aircraft emissions and noise per flight.

Key organisations from across the Italian aviation sector are already investing significantly in airspace modernization initiatives to meet the growth in demand for flights, whilst enhancing safety, resilience and environmental performance. In recent years, many significant projects have been implemented, and others are being developed by the ANSP, Airlines and Airports working in close collaboration.

In Italy, graduates in STEM disciplines (Science, Technology, Engineering and Mathematics) are only 13.5% of the total compared to 19.1% of the EU average. The Aerospace, Defense and Security (AD&S) sector can be the main point of reference for the formation of skills appropriate to the new labor market, thanks to the innovation produced and the highly qualified work: in this case the ability of AD&S companies to become the leader of a new model of skills training for Industry 4.0, depends strictly on the relationships that they will be able to establish with the national university and institutes.

To this end, Italy must:

- Strengthen the specialized training offer for the AD&S sector, integrating it with the specific development needs of companies in the sector, through the establishment of a Work Table in which the Industry, MIUR and the university system participate, aimed at implementing a long integrated training system along three main axes (university centers, large companies and SMEs) to make the offer of higher, university and post-graduate education updated with respect to the specific needs of the sector (definition of curricula and teaching of transversal skills such as cybersecurity and ICT).
- b. Use the Industry 4.0 Competence Centers as "open laboratories" in which the companies of the AD&S sector can dialogue with students and researchers on opportunities offered by industry and by technological and transformation trends relevant in dual use logic.

- Start a communication strategy on the factors of attractiveness of the sector. Italian AD&S to attract the best talent (in Italy and abroad).¹³

Since the Aerospace sector has the absolute need to maintain the most reliable and replicable quality and operational standards, given the required level of precision and above all considering the security levels necessary to ensure the product / service on the international market that is increasingly competitive. These methods can represent the differentiator between the competitors.

Many of the interviewees underlined that such initiatives should be pursued in order to maximize the diffusion and sharing of knowledge, technologies, challenges to be overcome and goals to be achieved. The greater is the ability to spread knowledge and know-how, the greater will be the number of people and businesses that become able to approach the Aerospace industry and contribute to it.

The greater is the ability to give visibility to technology, the greater will be the new applications and the success of these technologies in all areas. The rise of the audience of interested people from all nations can increase the solution proposals and the multiplication of synergies, so a clear communication that can offer great accessibility is of enormous importance.

The training offer should be layered on multiple levels to allow easier access and access by individuals with different levels of knowledge and thus progressively enhance cultural, scientific and technical knowledge.

While the search for production effectiveness, as well as for economic efficiency, are among the most recurrent market trends detected by our research – giving therefore a strong appeal to Business Innovation Techniques – there is a lack, under a VET point of view, of provision of sector specific training courses and outputs. In this sense, looking also to favourable interest in VET providers for a promotion of these initiatives, a structured framework of training focused on the implementation of BIT in Aerospace sector should be well received in project target groups. This is even more valuable when dealing with apprenticeship: while VET entities are offering low-specialized training measures (targeted mostly on technical issues) a new approach linked to BIT could bring benefits both to direct employability as well as easier inclusion in enterprises dynamics for young workers.

Certification routes seems relevant to some of stakeholders but what is really emerging from the gathered feedbacks is the practical aspect of training outputs: in this sense, the direct applicability of promoted training should be one of the milestones to achieve in order to obtain successful and attractive training offers.

Due to the complexity and heterogeneity of the sector, that requires highly specialized knowledge, a useful approach suggested was an even tighter collaboration between Industry and Institutions (in particular academia), in order to optimize the training of highly specialized personnel in the fields where there is greater demand. This is confirmed by two main aspects, underlined by the research. First of all, a wider involvement of SMEs (by the means of its entrepreneurs) is requested: Institution (especially clusters, industrial associations and stakeholders) should focus their strengths to promote efficiency policies to SMEs in order to stimulate the adoption of techniques that, as we record in our research, are needed but not fully known or understood. Secondly, VET operators should be more and more focus on

¹³ "La filiera italiana dell'Aerospazio, della Difesa e della Sicurezza" Essay realized from The European House – Ambrosetti in cooperation with Leonardo, 2018

https://www.leonardocompany.com/documents/20142/3072461/body_Ricerca_La_filiera_italiana_dellAerospazio.pdf/c9922522-6581-c409-5002-8393ab1383e9?t=1549547426546

an evolution: their role of external guidance should be stressed when promoting BIT training (especially for SMEs) availing also on external expertise for more effective activities.

Under a methodological point of view, feedbacks both from enterprises and from VET providers, suggest us some main features to be considered when providing training:

- Wider implementation of training in development policies in enterprises: this means that efficiency and effectiveness of industrial production should be supported by training campaigns, working also on entrepreneurs' awareness on BIT
- Higher level of customization for training offer, both for different enterprises context and for different internal targets (from young workers to executives)
- Availability of training in the long term
- Direct applicability of training outputs: if the training is easily adaptable to workflows, its impact is higher and more recognizable for enterprises decision makers.
- Mixed training provision: audience should be followed and engaged with a more integrated approach availing on one to one training, training on the job and specific digital features. This is even more relevant if we acknowledge that one of the most recurrent factors preventing training felt is the lack of complementarity with workflows.

7. Annex

See separate documents:

Annex 1 – Sources

Annex 2 – List of stakeholders

Annex 3 -