D.T1.2.1. MAPPING REPORT THE 9 ELEMENTS OF INDUSTRY 4.0 COMPARED TO SMES NEED IN EACH RIS3 REGION

D.T1.2.1 Mapping Report the 9 elements of Industry 4.0 compared to SMEs need in each RIS3 region

FINAL VERSION

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CNA ER, RE:Lab - LP, PP2 - Italy

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1.Introduction of the 4STEPS project

Objectives & Activities:

4STEPS project is addressing the main challenge of Industry 4.0 (I4.0) as tool towards a new, digital industrial revolution holding the promise of increased flexibility in manufacturing, mass customisation, increased speed, better quality and improved productivity and its development is supporting the RIS3 in the target regions in the different sectors. SMEs in the target regions are lagging behind in the adoption of innovative tools and solutions proposed by I4.0 revolution and need to increase transnational collaboration in facing this challenge.

The main project objective is to support the successful RIS3 implementation applying the I4.0 to all the industrial sectors identified by each region. The innovative elements of 4STEPS will be the methodology applied based on the involvement of all the actors of the quadruple helix, thanks to a bottom up approach. SMEs will be the main target and they will be involved via the CE network of the Digital Innovation Hubs (DIH)- including also the relevant stakeholders of the R&D sector, governance actors, society thanks to a holistic approach. 4STEPS will lead to an improved level of innovative productive methods and application of I4.0 thanks to a Catalogue development of main possible services offered, a Technology Maturity Level Index development, Transnational Action plan and the creation of the Digital Innovation Hubs, tested during the pilot actions. Within this approach of networking 4STEPS will include also a solution preparing the CE citizen towards the digital future during targeted workshop for digital skills improvement. The project approach developed within the 4STEP S project will consider the Industry 4.0 plans applied in CE countries which is are linked to the digitalised production system that will result in a wide range of changes to manufacturing processes, outcomes and business models.

The current Mapping Report (D.T1.2.1) is prepared in the framework of the first thematic work package (abbreviated as WPT1) of the project. WPT1, which is led by PP6 Pannon Business Network Association, includes identifying the different methodologies oriented to enable the approach of RIS3 small companies to the issues of Industry 4.0. These methodologies include mapping the contents of Industry 4.0,

focusing in particular on the priorities of the national and regional plans, as regards the needs of SMEs, i.e. a correlation among the **9 technologies of Industry 4.0** (**Big Data, Augmented Reality, Simulation, Internet of Things, Cloud Computing, Cyber Security, System Integration, Additive Manufacturing, Autonomous Systems**) and their redefinition as regards needs, prospects and scenarios of RIS3 business sectors.

1.1 Objective of this report

This current report **shall map and compare the SMEs needs** focusing in particular the priorities of the national plans, i.e. a correlation **among the 9 Industry 4.0 technologies** and their redefinition as regards needs, prospects and scenarios of SMEs.

The Lead Partner, PP2 and PP6-as WPT1 leader- preliminary developed a common structure to the current report, and this proposal was distributed among the partnership. Following that the partners provided some valuable feedbacks how to modify the report, and these inputs were integrated to the proposal, and then the **common structure of the mapping report could be finalised**.

Every partner (LP+PP2 are working together) will prepare a separate mapping report based on the results of their own SME involvement in their regions.

Since the quantification target of the Mapping Report according to the project requirement (D.T1.2.1) is 8, partners will be working in their own report document following the common structure, and the 8th document will be a transnational summary/comparison, which will present a comprehensive picture about all results in the partnership. This transnational summary will be prepared by the WPT1 Lead Pannon Business Network based on the separate results provided by the partners.

2.Introduction to the regional context

- 2.1.General context

According to the Regional Economic and Financial Document (DEFR 2020) published by the Emilia Romagna Region in November 2019, In 2018 the economy of the Emilia-Romagna Region continued to grow at a higher rate than the Italian economy overall. The latest estimates for 2018 indicate a growth in regional GDP of 1.4%. This would put the region at the top of the Italian growth table, alongside Lombardy.

Since in 2018 the Italian economy grew by 0.9%, the region achieved a positive growth differential of no fewer than 50 base points. The regional GDP growth rate has exceeded the national figure ever since 2011, but the difference has rarely been so high.

In 2019, Prometeia forecasts that the economy in the Emilia-Romagna Region will expand at a rate of 0.3%, much less than in 2018 but still growth and still higher than the perhaps optimistic national forecast contained in last April's Economic and Financial Document (+0.2%). The growth rate forecast for 2020 is 1%. Therefore, according to these data, Emilia-Romagna should continue to head the Italian regional GDP growth.

In 2018 the construction industry had still not returned to pre-crisis levels, although the Prometeia estimates indicate growth of +2.4%, while the Unioncamere Emilia-Romagna figures point to +1.7%. There was a recovery in the housing market, in particular. Home sales rose by 11.3%, and after 6 years of a downward trend a slight increase in prices was recorded.

Export is traditionally a strength of the Emilia-Romagna economy. In 2018 the trend in exports, although hit by the slowdown in global demand, still increased impressively, with growth of 5.7% compared to the national figure of 3.1%.

Looking at the breakdown of exports by product category, the macro-sector of machinery, equipment and means of transport was once again the biggest exporter, accounting on its own for about 40% of the region's exports. This was followed by the textile and fashion industry, with about 13% of the total, and food, which maintained its share of almost 9%. On the other hand, there was a fall-off in non-metallic mineral products (the category which includes the ceramics industry): however, this downturn (-3.1%) was the first after nine years of uninterrupted growth. The woodworking industry and the other manufactured goods category recorded the highest growth levels.

As far as the labour market is concerned, employment increased in 2018 (+1%), and, unlike the previous year, at twice the national average rate. This growth was due mainly to a rise in employed workers (against a drop in the number of self-employed), with a stronger employment market for more highly educated workers.

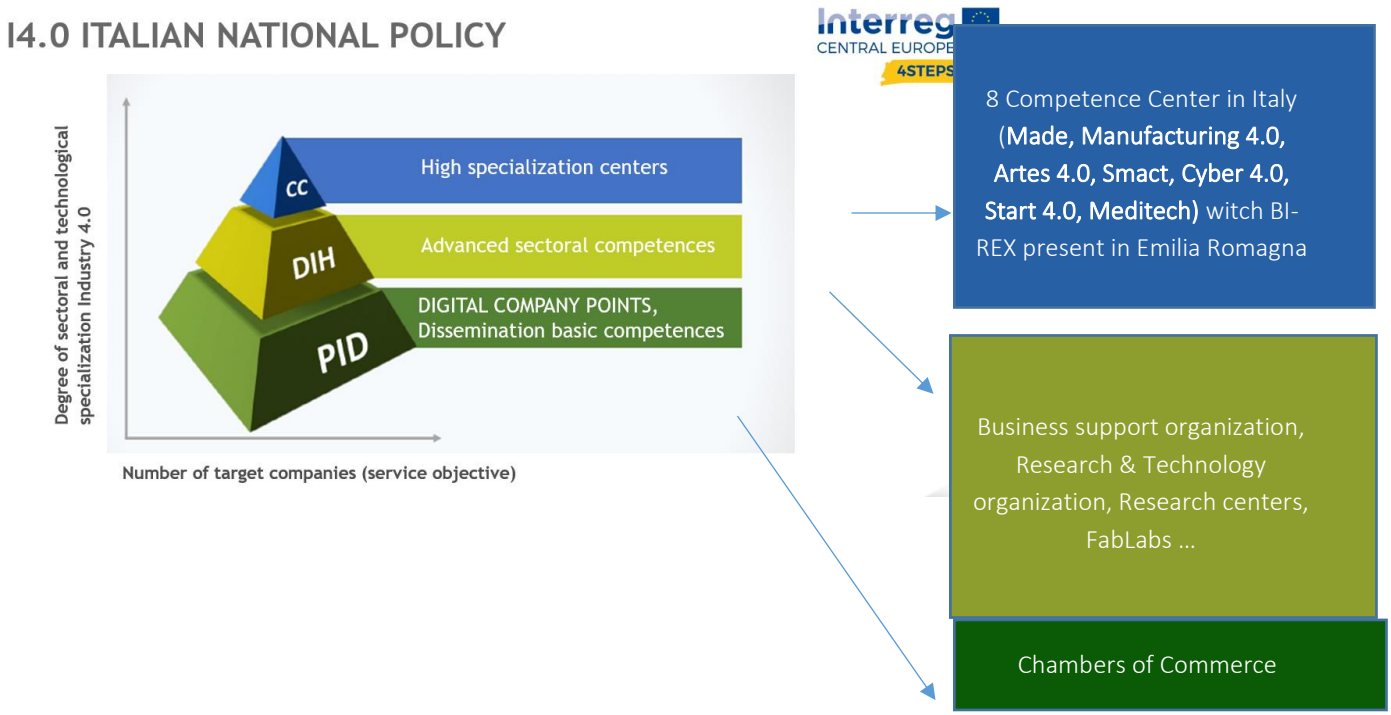
Overall, the employment rate (for the population of 20-64 years of age) was nearly 75% (74.4% to be precise), almost 11 percentage points above the national average.

The jobless rate fell compared to 2017, reaching a level of 5.9%, a value at which some industries usually start to experience a labour shortage. Here again, the value is significantly better than the Italian average (by no less than 5 percentage points). During the current year, the unemployment rate is expected to remain stable.

- 2.2.National and regional priorities regarding I4.0

The Italian National Industry 4.0 Network provides 3 levels of companies support: the Competence Center (CC), the Digital Innovation Hubs and the Digital Enterprise Points (PID) which constitute the tool of the Ministry of Economic Development (MISE) to spread the know-how about the real benefits deriving from investments in technologies in Industry 4.0. CNA Emilia Romagna is part of the DIHs.

What distinguishes the three structures is basically the different level of information, training and skills in the field of Industry 4.0.



- 2.3. S3 Strategy in the next programming period (regional level)

Emilia Romagna Industrial policy has integrated an increasing number of Universities and private industrial research labs within the High Technology Network (HTN) to foster regional enterprises innovation process. This approach has been put forward by a regional law and promoted through the Regional Operation Program and related ERDF. At national level, Emilia Romagna is leveraging through the HTN its operation inside the twelve National Technological Clusters. The HTN has been the main actor in the bottom up process definition of the Regional Smart Specialization Strategy, with an involvement of all relevant regional partners combined with a top down Regional strategic framework. The Emilia Romagna S3 is now the regional pillar policy based on three regional main industrial sectors: Agrifood, Construction and Mechatronics and two regional sectors that complete the strategy and have a high development potential such as Health & Wellness and Creative & Cultural Industries.

The strategy thus identifies the main technological and organizational factors that need to be addressed to ensure competitiveness and growth to the production system, key

innovation drivers based on new growth paths, also linked to the development of high intensity services of knowledge

The entrepreneurial discovery process individuated specific technological items to which orient projects and investment in the framework of the set of priorities individuated by the Region, of their match with KETs and digital technologies.

Strategic priorities individuated by the Region are:

1. Reinforcing leadership in the largest consolidated clusters of the region, in order to increase their competitiveness on the global market and maintain the relevant direct and undirect employment:
    - Mechatronics and Automotive,
    - Agri-food,
    - Construction.
2. Accelerating growth of new clusters with high growth potential and capacity of generating highly qualified employment:
    - Health and Wellness industries,
    - Cultural and Creative industries.
3. Orienting innovation processes towards the main drivers of change:
    - Sustainable development;
    - Information society,
    - Quality of people life.
4. Promoting service innovation, both for increasing competitiveness of the service industries, and for “servitization” of manufacturing industries and other traditional service industries, basically through advanced logistics, software and other knowledge intensive services.

The total amount of resources that can be computed for the implementation of the strategy, considering ERDF, EARDF, ESF, other regional, national and EU resorces, and private cofinancing is around €2.5 bn.

3. Description of the sample

-3.1 Criteria for the sample‘s selection

The 4Steps survey in Italy was conducted in the Emilia Romagna region by the LP CNA Emilia Romagna. CNA can count on a number of territorial officers who, being in direct contact with the local companies, could select the ones which were more in line with the general criteria established in the project (SMEs in the manufacturing sector) and representative of the region in terms of characteristics and approach to Industry 4.0. The survey was carried out through one-to-one personal interviews, personally visiting the involved SMEs.

Further to the 50 companies initially planned, CNA selected other 27, to reach the indicators set in the project, reaching a total of 77 companies in the Emilia Romagna region.

- 3.2 Economic sectors represented

As it was agreed by the partners in the 4Steps project’s framework, the interviewed companies were SMEs mainly pertaining to the Manufacturing sector. We can anyway identify more specific economic sectors represented within the sample.

As shown in Table 1 and Figure 1, half of the selected companies concentrate on metal products (except machinery), while the rest of the sample is divided among other sectors such as Wood and furniture, Construction of buildings / plants (both 6.93%), Engineering and architectural activities (5.94%), Plastics materials, Electrical equipment, Commerce & trade (all 4,95%), and a number of other sub-sectors such as Food or Automotive, counting between 1 and 3 companies as total.

Table 1 Emilia Romagna Sample: economic sectors

Industrial sector[1]	Frequency	Percentage
Food products	3	2,97%
Nautical industry, ships and boats	1	0,99%
Automotive	3	2,97%
Textile, clothing, footwear, fashion	2	1,98%
Wood and furniture	7	6,93%
Publishing activities	1	0,99%
Plastics materials	5	4,95%
Glass, ceramics, stone	3	2,97%
Engineering and architectural activities	6	5,94%
Electrical equipment	5	4,95%
Construction of buildings / plants	7	6,93%
Commerce & trade	5	4,95%
Chemicals	1	0,99%
Metal products, except machinery	50	49,5%
Machinery and equipment	2	1,98%

[1] Please note that: in the table we have not listed the sectors, mentioned in the questionnaires, that received zero answers; the total number of answers (101) is more than the total number of companies (77) because some companies chose more than one sectors (feeling they were at the intersection of several sectors).

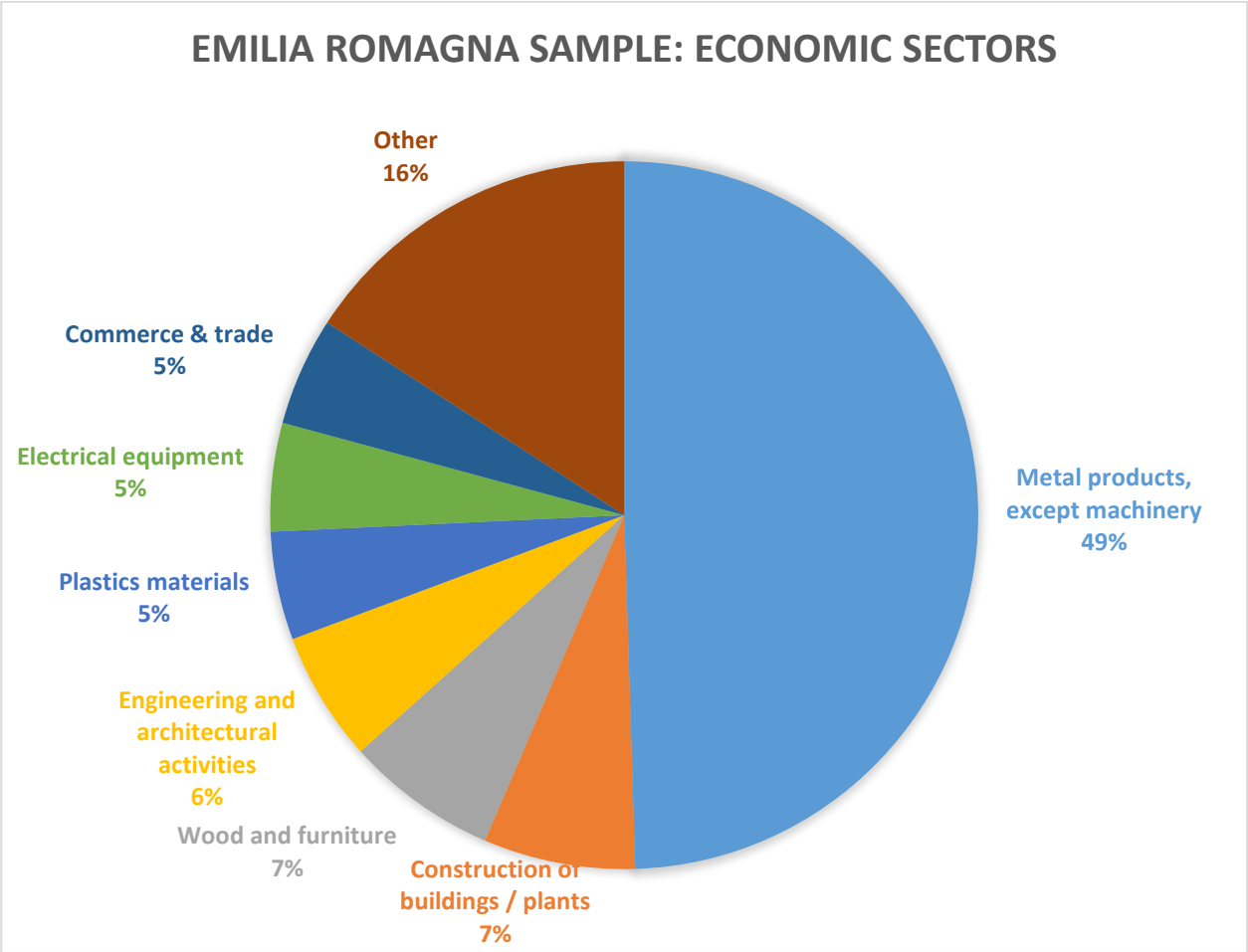


Figure 1 Emilia Romagna Sample: economic sectors

- 3.3.Size

As shown in Table 2 and in Figure 2, the companies selected in the 4Steps survey in Emilia Romagna are of small size, with the large majority (72%) counting between 10 and 49 employees, a number (17%) of very small companies counting less than 10 employees and only the 11% counting between 50 and 249 employees.

Table 2 Emilia Romagna sample: number of employees

Number of employees	Frequency	Percentage
up to 9	13	17%
up to 49	55	72%
up to 249	9	11%
Total	77	100%

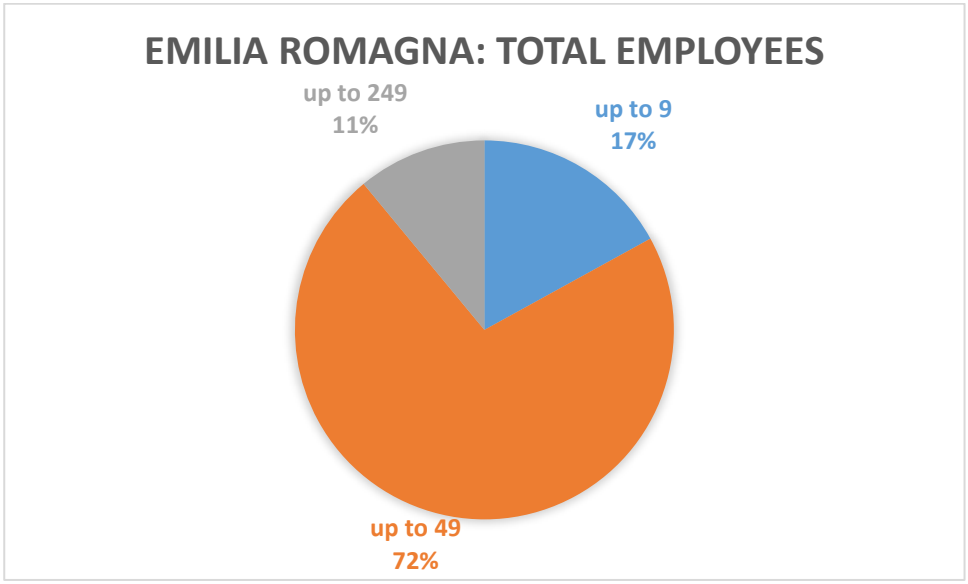


Figure 2 Emilia Romagna sample: number of employees

- 3.4 Geographic distribution

Almost all the local CNA offices were involved in the survey, which has covered the majority of the Emilia Romagna region.

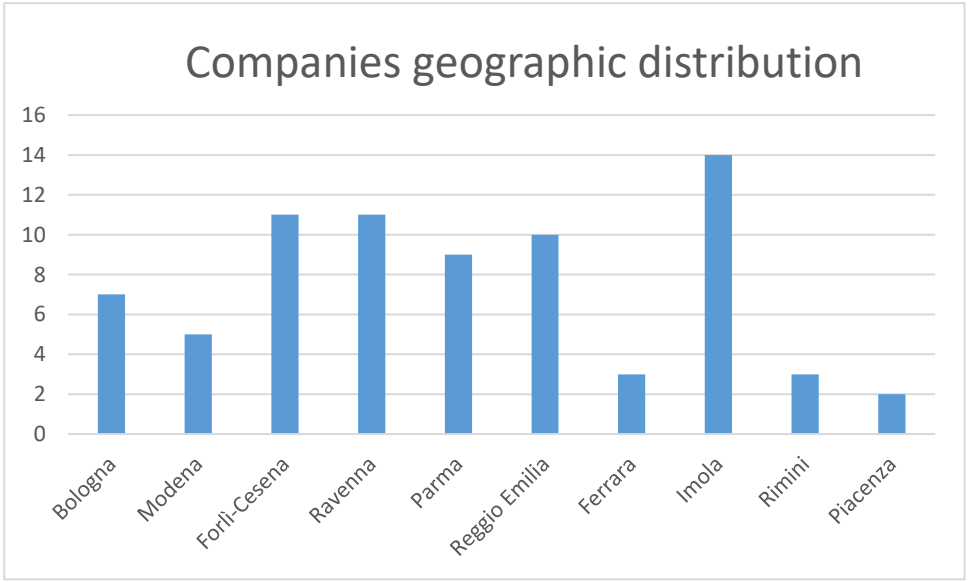


Figure 3 Companies' geographic distribution

4.The SMEs and the 9 pillars

4.1. In case of end users:

Among the companies selected in the 4Steps survey in Emilia Romagna, the end users amount to the 86% of the interviewed companies (67 in total).

Concerning the level of adaptation to Industry 4.0 methods and technologies, the interviewed companies are currently using several technologies: the 40% focuses on additive manufacturing, which are used by most in a good extent; also horizontal and vertical systems integration and autonomous robots are well represented in the sample (18% and 17% respectively).

Table 3 Current use of I 4.0 technologies and methods

Current use of Industry-4.0 methods & technologies	few usage	good extent	very intense use	Total	Percentage
autonomous robots	2	9	1	12	17%
simulation	2	5	0	7	10%
horizontal and vertical systems integration	2	9	2	13	18%
industrial internet of things	3	4	0	7	10%
Cyber Security	0	4	0	4	5%
cloud technologies	1	2	0	3	4%
additive manufacturing	11	18	0	29	40%
augmented reality	0	0	0	0	0%
big data and analytics	1	1	0	2	3%

As it concerns the motivation for digital transformation, almost all the companies declare that the main ones are the management of quality and robustness (92%) and internal innovation (91%); the emergence of new customers is also an important reason for the digital transformation (55%); the need to adapt existing products and services (56%) and the evolution of new markets and business (55%) are also among the main motivations.

Table 4 Motivation for the digital transformation

Motivation for the digital transformation	I partly agree	I mostly agree	I fully agree	Total	Percentage
Our business model changes	4	0	0	4	5%
We adapt existing products and services	10	14	19	43	56%
We offer new products and services	8	7	14	29	38%
New markets, new business areas evolve	5	4	33	42	55%
New customers occur	1	1	49	51	66%
Materials usage: The company reduces material consumption through product and manufacturing optimisation.	2	1	5	8	10%
Managing quality & robustness: Prevention and correction actions, product and service changes, transfer processes and manufacturing feasibility tests are all documented and feed into KPIs for new products, processes and services.	3	19	49	71	92%
We remove existing products and services from the market.	0	0	1	1	1%
Internal innovation (internal renewal, change and adaption) is fostered.	18	23	29	70	91%

As shown in Table 5, almost the totality of the companies declares that the Willingness of managers to realize Industry 4.0 and the implementation of an Innovation strategy are the main strategies for the digital transformation. Also an Investment strategy (81%) and Industry-4.0 technology strategy (68%) are mentioned as important by the interviewed companies. Furthermore, employee objectives to realised I 4.0 are defined for the 70% of the companies, and managers training for I4.0 available for the 71%.

Table 5 Strategy for digital transformation

Strategy for your digital transformation?	I partly agree	I mostly agree	I fully agree	Total	Percentage
Roadmap for Industry 4.0 realization available	0	2	0	2	3%
Central coordination of Industry 4.0 activities	4	18	0	22	29%

Financial resources to realize Industry 4.0 available	2	0	0	2	3%
Communication of Industry 4.0 activities ongoing	4	2	0	6	8%
Employee objectives to realize Industry 4.0 defined	10	33	11	54	70%
Risk assessment for Industry 4.0 available	1	0	0	1	1%
Willingness of managers to realize Industry 4.0	3	43	26	72	94%
Manager trainings for Industry 4.0 available	4	38	13	55	71%
Mastering the digital transformation: The digital transformation is managed and forms a part of the company's DNA.	3	1	0	4	5%
Rules, regulation and standards: The company actively deals with both existing as well as new rules, regulations and standards.	1	0	0	1	1%
Innovation strategy	13	19	40	72	94%
Industry-4.0 technology strategy	11	18	23	52	68%
Investment strategy including budget	4	25	33	62	81%

As it concerns the needs of the companies interviewed in the survey, most of the companies (36%) confirm the interest (already shown in the current use) for additive manufacturing and for horizontal and vertical systems integration (33%).

Table 6 Plan to use Industry 4.0 technologies and methods

Plan to use Industry-4.0 methods & technologies					
desired intensity of use	few usage	good extent	very intense use	total	percentage
1. autonomous robots	3	6	0	9	13%
2. simulation	2	9	0	11	15%
3. horizontal and vertical systems integration	6	18	0	24	33%
4. industrial internet of things	1	6	0	7	10%
5. cybersecurity	3	3	0	6	8%
6. cloud technologies	0	4	0	4	6%
7. additive manufacturing	3	21	2	26	36%
8. augmented reality	0	3	0	3	4%
9. big data and analytics	1	2	0	3	4%

Concerning the preparation towards digital transformation, almost all (93%) the companies agree that their employees are open to new technologies and one each four companies recognises competence with modern ICT.

Table 7 Preparation of employees for digital transformation

Preparation of employees for the digital transformation	I don't agree	I partly agree	I mostly agree	I fully agree	Total	Percentage
Openness to new technologies	13	5	49	0	67	93%
Competence with modern ICT	3	7	8	0	18	25%
Awareness of non-IT-employees for meaning and value of digital data	2	6	1	0	9	13%
Awareness of non-IT-employees for cyber security	3	5	0	0	8	11%
Willingness to flexibilize work arrangements	2	4	2	0	8	11%
Autonomy of shop floor workers	2	4	3	0	9	13%
Willingness for interdisciplinary work	2	3	3	0	8	11%
Willingness for continuous training, education and qualification towards industry 4.0	2	2	4	0	8	11%
We know our employees digital competences	3	3	3	0	9	13%

4.2 In case of suppliers

The 4Steps project is mainly focused on the use of I 4.0 technologies and methods and the Italian survey, reflecting this approach, concentrated on this aspect. Nevertheless, some of the companies of the sample are also suppliers of Industry 4.0: namely 9 companies – the 12.5% of the total.

The main offer (with 4 suppliers) revolves around products in the realm of horizontal and vertical systems integration, but the companies also produce in the area of simulation (2), additive manufacturing (2) and autonomous robots (1)

Table 8 Current offer of Industry-4.0 products and / or services

Current offer of Industry-4.0 products and / or services				
range of offers	few offers	good extent	wide range of offers	Total

1. autonomous robots	0	1	0	1
2. simulation	0	1	1	2
3. horizontal and vertical systems integration	0	4	0	4
4. industrial internet of things	0	0	0	0
5. cybersecurity	0	0	0	0
6. cloud technologies	0	0	0	0
7. additive manufacturing	0	2	0	2
8. augmented reality	0	0	0	0
9. big data and analytics	0	0	0	0

The companies which plan to offer I 4.0 products concentrate their interest in the same realms, with only one interested in producing in a technology not mentioned before - Big Data Analytics. Most of the planned products are already at an advanced level of development, with a TRL between 8 (1) and 9 (4). Three companies declare a TRL6 (technology demonstrated in real space environment), while only one is at the very beginning of the design (TRL2 - technology concept formulated).

Table 9 Planned offer of Industry-4.0 products & services

Planned offer of Industry-4.0 products & services				
desired range of products, services	few offers	good extent	wide range of offers	total
1. autonomous robots	0	1	0	1
2. simulation	0	1	1	2
3. horizontal and vertical systems integration	0	3	1	4
4. industrial internet of things	0	0	0	0
5. cybersecurity	0	0	0	0
6. cloud technologies	0	0	0	0
7. additive manufacturing	0	3	0	3
8. augmented reality	0	0	0	0
9. big data and analytics	0	0	1	1

5.Other enabling factors

In this chapter, we will briefly describe the attitude and behaviours of the interviewed companies with respect to some factors, such as the valorisation of human resources or the fundraising capacity, that can be considered enabling to innovation. These factors will be then analysed more in depth in our TML (Technology Maturity Level) analysis.

With respect to the approach to human capital, we can note (Figure 4) that skilled workers tend to be present with a 1:2 ratio in the R&D departments, while their presence in the technical offices (Figure 5) is much less developed, with an average of the 21%.

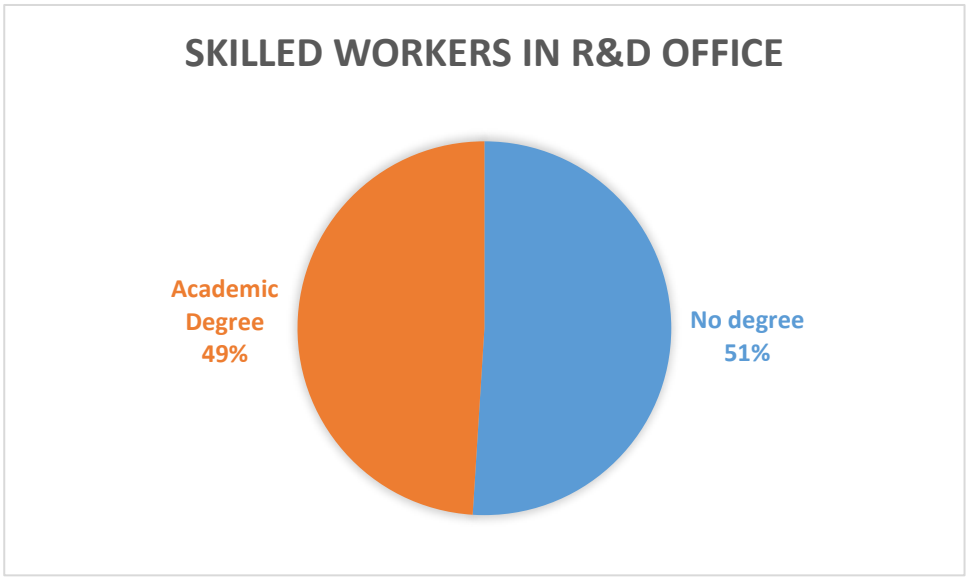


Figure 4 Average skilled workers in R&D office

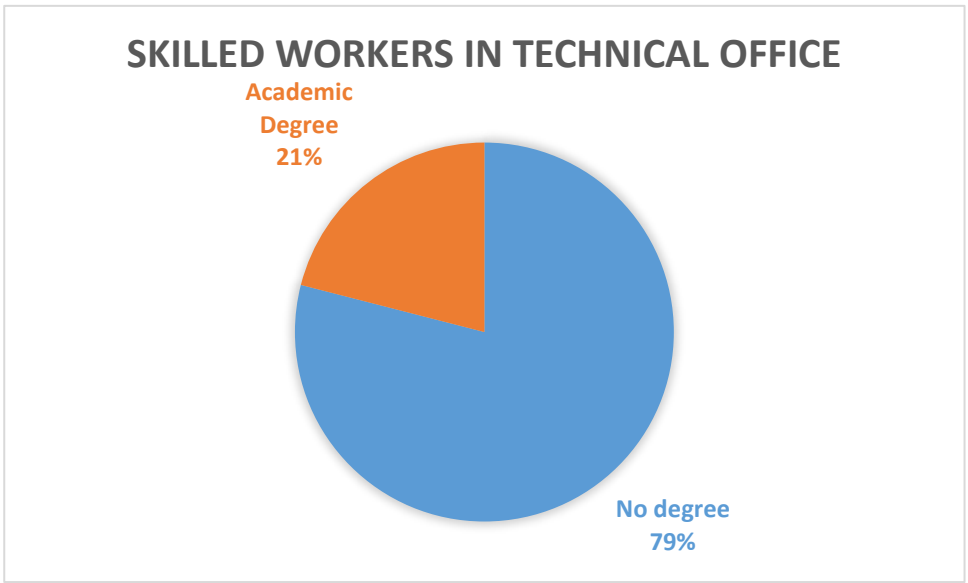


Figure 5 Average skilled workers in Technical office

With reference to the participation in funded project, the 54% of the companies has already an experience in this realm. Within these projects, the vast majority was referred to the National (26%) and Regional (21%) level, while only residual numbers refer to European (4%) and International (3%) fundings.

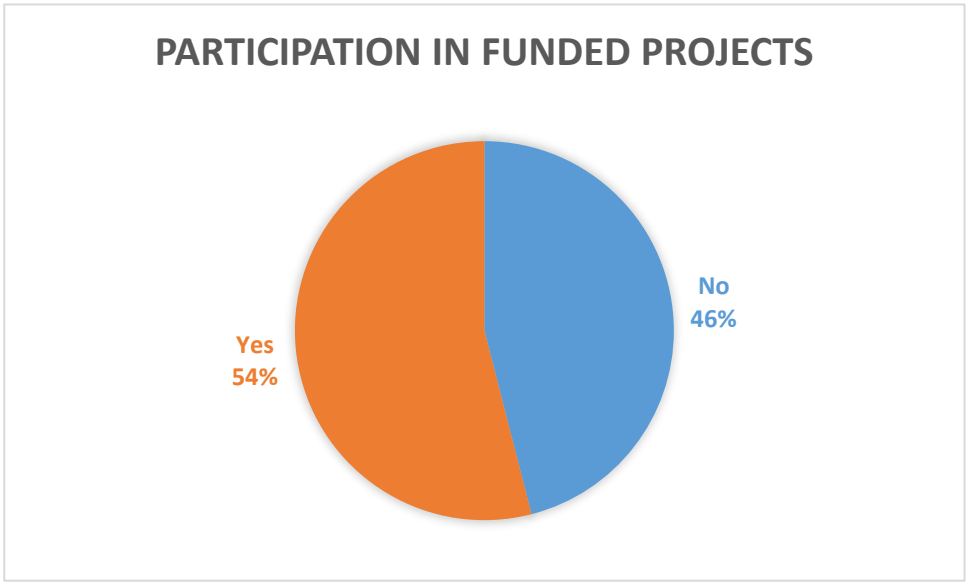


Figure 6 Participation in funded projects

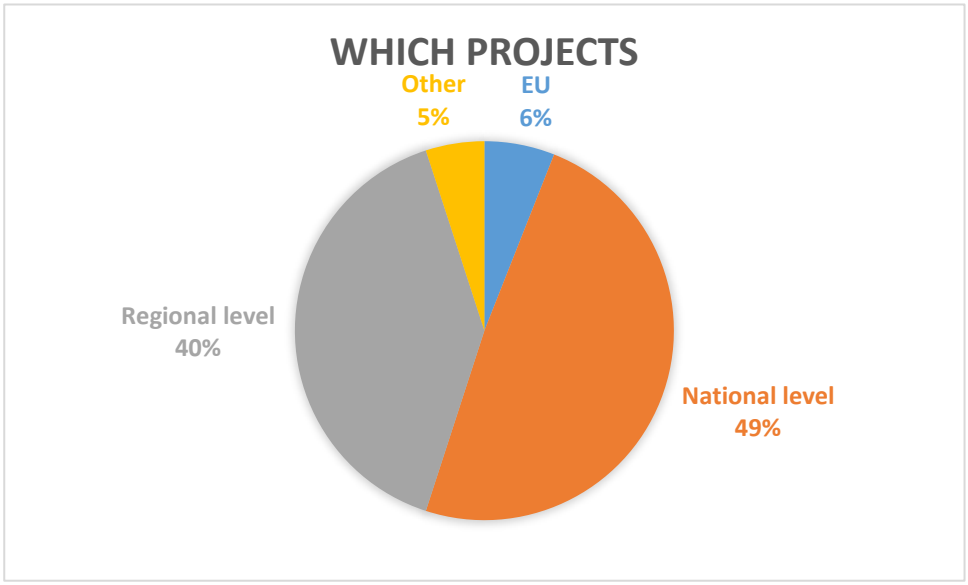


Figure 7 Share of funded projects

As it concerns the number of projects, the totality of the companies with projects declared to have between 1 and 5.

The cooperation with research labs, universities, cluster initiatives and associations is not well developed, with only the 12% declaring to have ongoing collaborations.