IoT4Industry

Project Deliverable

Identification and analysis of focus sectors for collaboration support

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Abstract

This report aims to:

- Assimilate the findings of the research work undertaken in Project work packages 1.1, 1.2 and 1.3
- Identify the areas of focus where IoT can benefit the manufacturing industry in the short and medium term
- Provide information for use in WP2 (Pre-identification of SMEs, training and matchmaking) on the requirements of SMEs and Technology providers

Keywords

Industry 4.0; smart manufacturing; IoT; regional innovation strategies;; Smart Manufacturing;

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Acronyms and definitions

Acronym	Meaning
ESIF	European Structural and Investment Funds
I4.0	Industry 4.0, the digitalisation of manufacturing
IoT	Internet of Things
ICT	Information and Communication Technologies
SME	Small or Medium sized enterprise
i4.0	Industry 4.0 – sometimes known as the 4th industrial revolution, or the digitalisation of manufacturing industry

The IoT4Industry project

The proportion of GDP from the manufacturing sector is currently decreasing in developed European countries'. Industry 4.0 – also called smart manufacturing, digital industry or industry of the future – provides several technological responses to the challenging competitive market. Indeed, the integration of the Internet of Things (IoT) and related components – Cyber-Physical Systems (CPS), Digital Security, Cloud Computing and Big Data – in manufacturing SMEs will increase productivity, improve efficiency and flexibility, and reduce wastes in production and consumption.

Industry 4.0 focuses on the development of processes based on technologies and devices autonomously, gathering data and, communicating with each other along a value chain. IoT4Industry is an EC-funded project aimed at fostering this integration by connecting ICT clusters (having capacities in IoT) with Advanced Manufacturing clusters (having access to process manufacturers) and manufacturing SMEs. Based on a cross-border and cross-sector approach, one hundred SMEs will be selected to receive funding and support to develop their access to 'smarter' means of production and to modernize their processes and security. In short, the project and this integration, aims to create new or improved value chains and new business opportunities.

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1. Executive Summary

This report is a synthesis of the research activities undertaken in the first work package of the project. The research focussed on 3 areas:

1. **The requirements for manufacturing SMEs in relation to IoT technologies.** The project partners interviewed cluster organisations representing around 4000 manufacturing SMEs to identify the technologies of interest, the barriers, challenges and potential interest in the project.
2. **The offering from IoT technology vendors in terms of products and services.** 15 technology clusters were interviewed representing over 1600 organisations. The aim was to identify the competencies, sector spread, challenges and barriers, application experience and potential case studies.
3. **European regional strategies and European Structural and Investment Funds with relevance to smart industry.** Through a combination of desk research and interviews with representatives from organisations in the partner countries that are involved in strategy and funding activities. The aim was to identify the programmes that have synergy with the IoT4industry project and that may be used to leverage the project activities.

The findings have identified a good match between the requirements of manufacturing SMEs and the technology offerings of IoT providers. With the exception of Robotics and Automation, which is under supported, the IoT providers are well placed to support SME projects.

Most SMEs see their lack of knowledge, skills and awareness as a barrier to adoption of IoT technologies, being able to accurately assess the benefits and financial returns is also an issue. IoT providers cite the main issue as a lack of industry standards. They believe SMEs primary fear is that of data security and a general lack of awareness about the technologies involved.

There are a wide range of national and regional programmes that have synergies with the IoT4industry project. Many of these provide similar funding models and these may be used in conjunction with funding from the IoT4industry project. It is anticipated that there will be benefits to seeking collaboration with these programmes and the project.

The report makes recommendations for actions to support subsequent work packages necessary to achieve the greatest value for the project's stakeholders. These include:

- Content and format of the **training and awareness** events
- Implications for **Calls for Expression of Interest** and Participation
- **Criteria for voucher** evaluation

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2. Introduction

2.1. Background

The IoT4Industry project is aimed at promoting the use of Internet of Things (IoT) technologies to transform European manufacturing processes. To ensure the project activities are channelled effectively, it's important to understand the environment in terms of the manufacturers, vendors and regional initiatives.

The first project activities relate to collecting information from the organisations that will benefit from the project as well as those that co-ordinate funding for sectors/regions in similar technology areas.

The 3 research areas (WP1 tasks 1.1, 1.2 and 1.3) collected information from the following organisations:

1. Clusters of manufacturing SMEs that will be using IoT technologies to support innovation projects (demand side). Understand the current state of awareness and requirements for technology.

2. Clusters of IoT technology vendors that can deliver products and services that can support innovation projects (supply side). Understand the relevant technologies and solutions available to determine a match with requirements from 1.

3. Regional enterprise groups that administer or sign-post for funding and initiatives. Understand synergies with other initiatives that could be used in conjunction with the IoT4Industry funding to support development in this technology area.

2.2. Objectives

This report aims to identify the learning points from the research undertaken in the preceding project work packages for use in later stages of the project; specifically: Training and awareness (WP2) and Collaboration (WP3).

The primary objectives are:

1. Define the focus areas for subsequent work packages (Awareness training, Expression of Interest and service offer definition)
2. Identify technology and application focus areas where IoT technology providers and SME Manufacturers are likely to obtain the most benefit from collaboration
3. Identify potential synergies for the project funding with regional funding initiatives
4. Identify short, medium and long term opportunities resulting from the project activities

The Key Performance Indicators (KPIs) for the project are:

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Key Performance Indicator	Estimated value
Outreach to SMEs	1000+
Expression of interest	300
Collaborative project applications received	200
Eligible applications received	160
Available vouchers	100
Collaborative projects selected	80
Call success rate	40%
Satisfaction of beneficiaries	>90%
SMEs having carried out feasibility studies	50
…to be followed by an effective integration	40 (80%)
SMEs having reached a prototype version	35
SMEs having demonstrated in real environment the effectiveness/readiness to the market of a new manufacturing solution	15
Turnover growth rate in the SMEs having participated in collaborative projects one year after the end of the project[4]	+30%
Jobs preserved / created during the project and by 2025	1000 +

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3. IoT requirements for SME manufacturers

This section summarises the findings of the IoT4 Industry project Work Package 1.1 that identifies the requirements of SME manufacturers as interpreted by representatives of manufacturing clusters.

The clusters represent a broad segment of manufacturing, with 15 sectors represented and around 50% in Metalworking, Electronics, Automotive, Mechanical and Aerospace. These clusters were spread across 12 countries with over 4000 members represented.

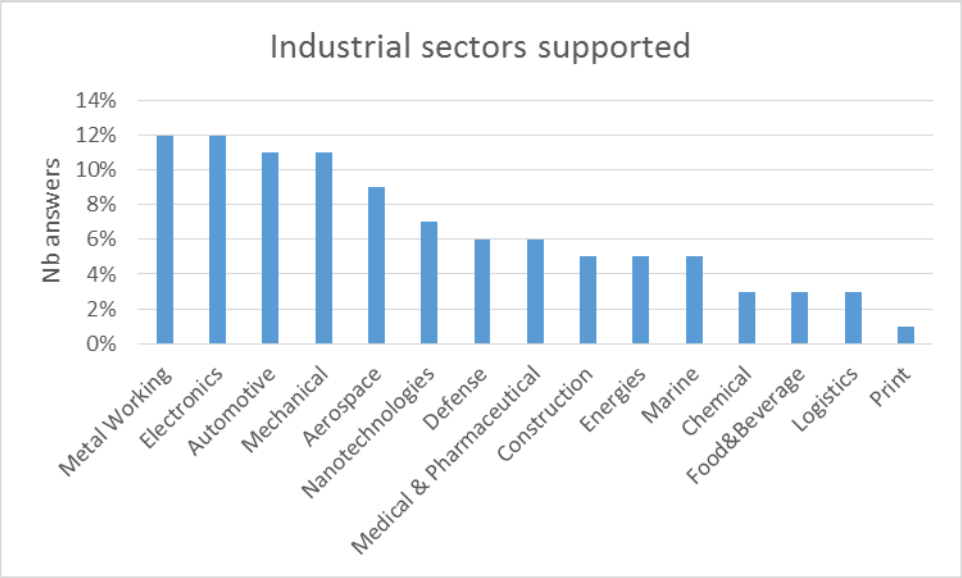

Figure 1: Industrial sectors supported by the 21 clusters interviewed

Source: D1.1 European mapping of concerned SMEs and selected/suggested focus topics and sectors

The research was based on interviews with 21 clusters and covered 3 key areas:

1. Cluster demographic, sector coverage and cluster Industry 4.0 activity status.
2. Members' technology interests, industry trends and barriers to implementation
3. Expectations for a voucher funded projects on IoT technologies in terms of areas of interest and types of projects anticipated.

3.1. Interests and Opportunity Areas

The report identifies strong interest in the industry 4.0 technologies represented identified within the previous WP1 tasks. The highest interest areas are Robotics and Automation, Simulation & Modelling and Sensors. However, there is no particular stand-out technology and as with all i4.0 solutions, a combination of technologies to provide a solution will be an inevitable outcome.

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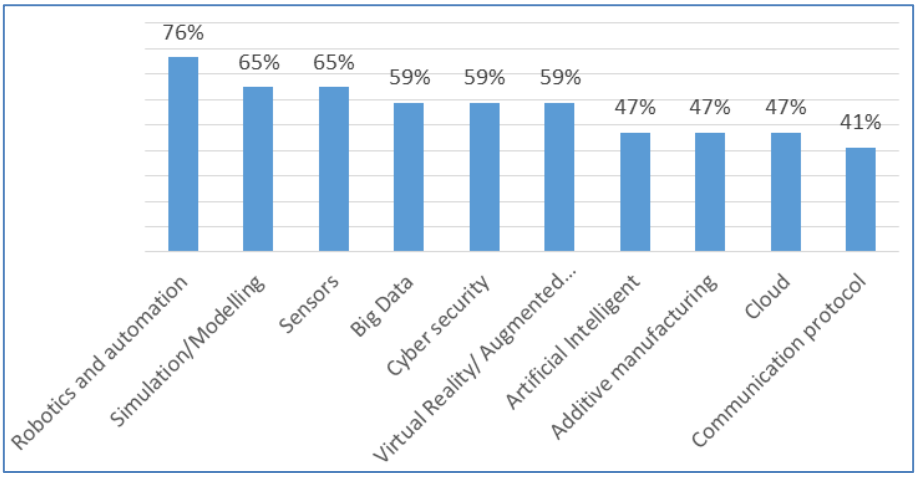

Figure 2: Clusters' members' interest areas

Source: D1.1 European mapping of concerned SMEs and selected/suggested focus topics and sectors

Figure 2 shows broad interest from SMEs across all of the technology areas. With none of the areas showing a low representation, it suggests that all technologies should be considered as potential subject areas for collaboration projects.

When reviewing proposals and finding use case examples for developing training and awareness material, the project should consider focusing on the top 4 areas:

- Sensors and data acquisition (including big data and analytics)
- Robotics and Automation (including communication and sensor technology)
- Cyber security
- Simulation and Modelling (including Virtual reality and Augmented reality)

It must also be noted that IoT4Industry projects may span multiple of the related technologies included in Figure 2. For example, a predictive maintenance project may include the elements:

- Sensors - to gather data from machinery.
- Big data – to perform data mining and data preprocessing on the gathered data.
- Artificial Intelligence – to build a predictive machine learning model.
- Cloud based platform – to visualized and interpret data using live dashboards.
- Cyber security – to ensure that valuable production data is kept safe.

The implications from this are that more than one IoT provider may be required in a project collaboration, or potentially choosing an IoT provider with a broader set of competencies to be able to support a complete solution.

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3.2. SME barriers to i4.0 adoption

Barriers to Adopting IoT Solutions

There are several technologies and solutions on the market but SME manufacturers are hesitant when adopting IoT solutions. Task 1.1 as well as identifying focus areas, also set out to identify the barriers of adopting existing IoT technologies. Considering the common barriers that SME manufacturers face, will ensure that they're addressed within the SME training sessions. This should allay any fears and encourage SME's to make the move towards "smart manufacturing" using IoT technologies.

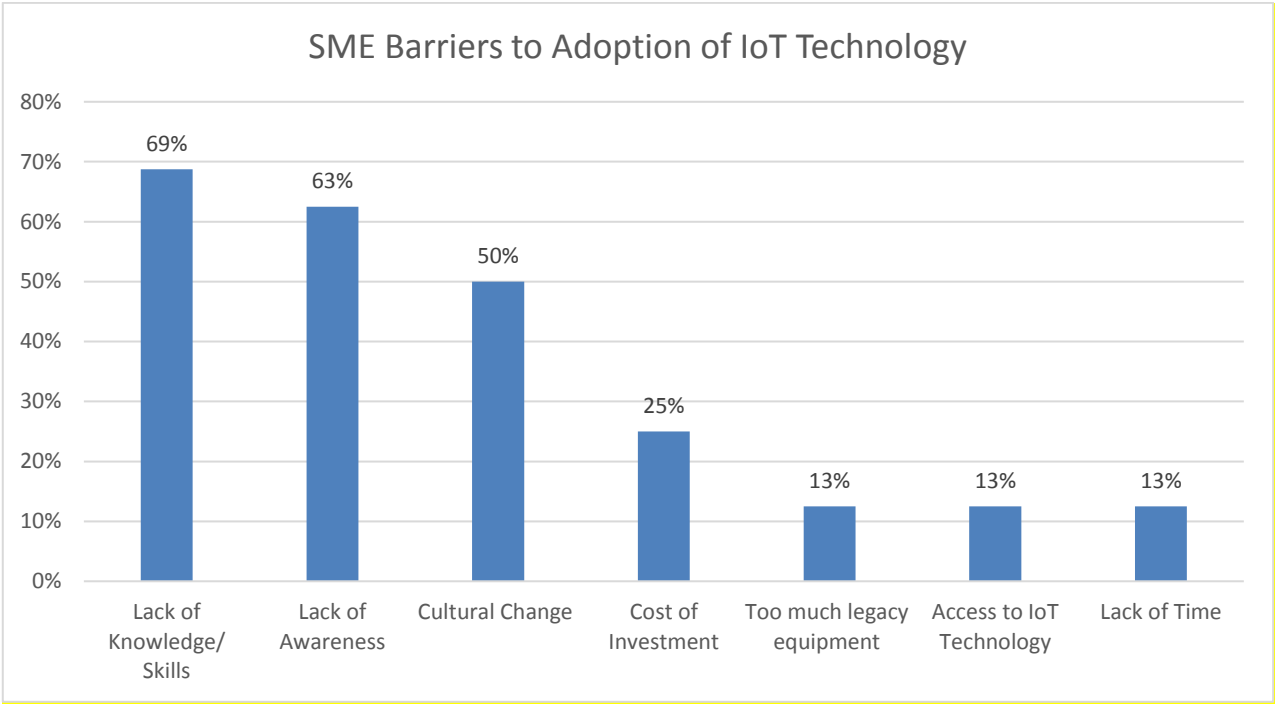

Figure 3: Manufacturing SME Barriers to Adoption of IoT Technology

From Figure 3, it can be seen that the most significant barriers are:

1. Lack of knowledge/skills
2. Lack of awareness
3. Cultural change
4. Cost of investment

Awareness and knowledge

The interviews conducted in 1.1 suggest that the main needs of manufacturing SMEs is to increase the knowledge and awareness about how IoT technologies can be applied in typical manufacturing problems. In doing so, it should provide a clear understanding of the benefits and potential return on investment, especially as cost of investment was highlighted by 25% of those interviewed. Lack of knowledge and awareness also suggests that IoT is still a technology push with manufacturers reluctant to invest due to not understanding the true benefits of IoT. The IoT4Industry project aims to address this barrier in work package 2 (training for SMEs) by providing high level awareness training in the countries of partner clusters. Details on the training can be found in D2.1.

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Cultural change

The culture amongst manufacturers is cited as a barrier to adopting IoT technologies. To an extent, the culture is related to the lack of awareness and knowledge. It was also commented that "some of our members see new technology as a threat". If the general feeling amongst the workforce is negative, it does suggest there needs to be an element of awareness training to show the benefits (for businesses and employees), to create a positive attitude to the opportunity and a potential culture-shift.

3.3. Challenges by Sector and Region

Figure 1 shows the spread of sectors covered by the research. This suggests that the challenges are broadly similar across all sectors, and that there are not particular issues that manifest themselves in a sector or region. To some extent, this is a benefit to the project because it suggests that the industry is broadly at the same level and the project calls can be consistent throughout Europe.

Table 1: Countries interviewed and key challengesincludes a list of the countries interviewed as part of D1.1 and the key challenges identified in the research. Interviewees were asked about the factors that were limiting adoption of IoT technologies. These were broadly grouped into categories such as: Uses, Technology, Economic or Regulatory.

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Table 1: Countries interviewed and key challenges

Countries	Key challenges
Austria	• Uses: lack of competences • Regulation: we have to learn how to use the data, regulation is a limit because it slows processes. Ex: health care management systems for cows (tracking movement, position) all the data can predict if the cow is getting sick. This example is a good use case for Predictive maintenance, but if regulation doesn't allow the access of the data for "privacy" reason we become efficient-less. • Internal regulation can be a limit because they are afraid of cybersecurity and prefer locked everything.
Hungary	• Lack of capacities; challenge to manage manpower needs. • There is special focus on education due to a lack of skills.
Germany	• Access to IoT • Lack of awareness • High initial investment • Lack of skills
Belgium	• Technological & Uses : time to acquire knowledge; • Economic: time for investment; Most SMEs have no time or are focused on classic products (without IoT technologies) • Some companies are well developed in the area and others don't know about it. • State of doubt for economy • Low rate of use of technologies (ERP/dematerialization) • Lack of competences
Italy	• Technological: network telecommunication • Economic: without public grants it wouldn't be so fast. • Regulation: big lack of regulations and standards. They need to be defined at the European level • Technological (e.g. traceability solutions such as RFID) Uses (e.g. poor interoperability) • Economic (expensive and not integrated offers) • Regulation (e.g. standard protocols)

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United Kingdom	• Technological: infrastructure Uses: lack of competences • Economic: cost - value of using IoT • Regulation: data protection, data format, lack of standards • Technical, Uses, Economic and regulations. • Technological – Corporate IT Departments. Fear & uncertainty from security risks. • Economic –Reputational damage to the brand through mistakes, quality problems etc. • Concern around technology being vendor lead and seeking trusted advice • Concerns around how to de-risk the decision making on investments in technology • Lack of cohesion on Government policy • Policies tend to focus on short term job creation, despite an acute labour shortage

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3.4. Learning points for subsequent work packages

Training & Awareness:

With Lack of knowledge, awareness and skills identified as the top 2 barriers to adoption, the importance of the training and awareness events planned as part of WP 2.1 will be critical. In order to help SMEs see the benefits and impact of digitalisation, the events should cover:

- Practical examples of problems solved and how the technologies supported this.
- Focus on benefits and impact of the solutions (Inc. financial)
- Understanding of the impact on people

Practical examples will resonate with business owners, the project partners will aim to incorporate use cases and real life examples as part of the awareness training. Furthermore, there will be a key focus on how IoT technologies benefit manufacturers, with a focus on the demand side as opposed to the IoT providers' offer. E.g. the training will promote the challenges and within those challenges will be the technologies to solve them.

Call for Expression of Interest:

- A broad range of technologies can be supported. However there are 4 main areas that should be focussed on when identifying potential IoT technology providers be part of the project collaborations to ensure we are able to meet the needs of SMEs during the matchmaking phase.

    - Sensors and data acquisition (including big data and analytics)
    - Robotics and Automation (including communication technology)
    - Cyber security
    - Simulation and Modelling (including Virtual reality and Augmented reality)

- Communication about practical success stories will help engage participants. As it has been identified practical examples are what manufacturers can relate to, it is important to use the challenges as a mechanism to discuss the technologies, rather than pushing the technologies.

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4. IoT Technology Provider offering

This section summarises the findings of the IoT4 Industry project task 1.2 that identifies the technologies and competencies of IoT technology providers as interpreted by representatives of technology clusters.

4.1. Objective

There were two objectives for this task:

1. Provide an overview of the technological offering and competencies in the field of IoT of a number of representative clusters
2. Undertake a preliminary mapping of the IoT providers competencies on the needs of SMEs as identified in WP1.1

4.2. Methodology

Interviews were performed with representatives of 15 technology clusters in regions, by several of the project partner organisations (Germany, Belgium, France and Italy) as well as organisations in Spain, Portugal, Netherlands, Hungary and Romania. Each cluster was provided with an interview guide in advance to understand the context of the interview and this was followed up with a telephone interview to work through the cluster responses. The interview covered 3 main areas:

1. Areas of Technology competence
2. Industry 4.0 trends, challenges and barriers
3. Potential for participation in the project

Following the interview, the cluster responses were documented and sent to the representative for confirmation and agreement to use the information in the project.

The findings of the interviews have been collated and interpreted to provide conclusions. These results are contained in a report deliverable - D1.2.

See Appendix for details of Technology clusters interviewed

4.3. IoT Technology Competencies

Across the clusters interviewed there were a broad range of competencies identified, which aligns well with the project being able to support a high proportion of the technology applications through existing cluster relationships. This should enable a more efficient matchmaking process. See figure below:

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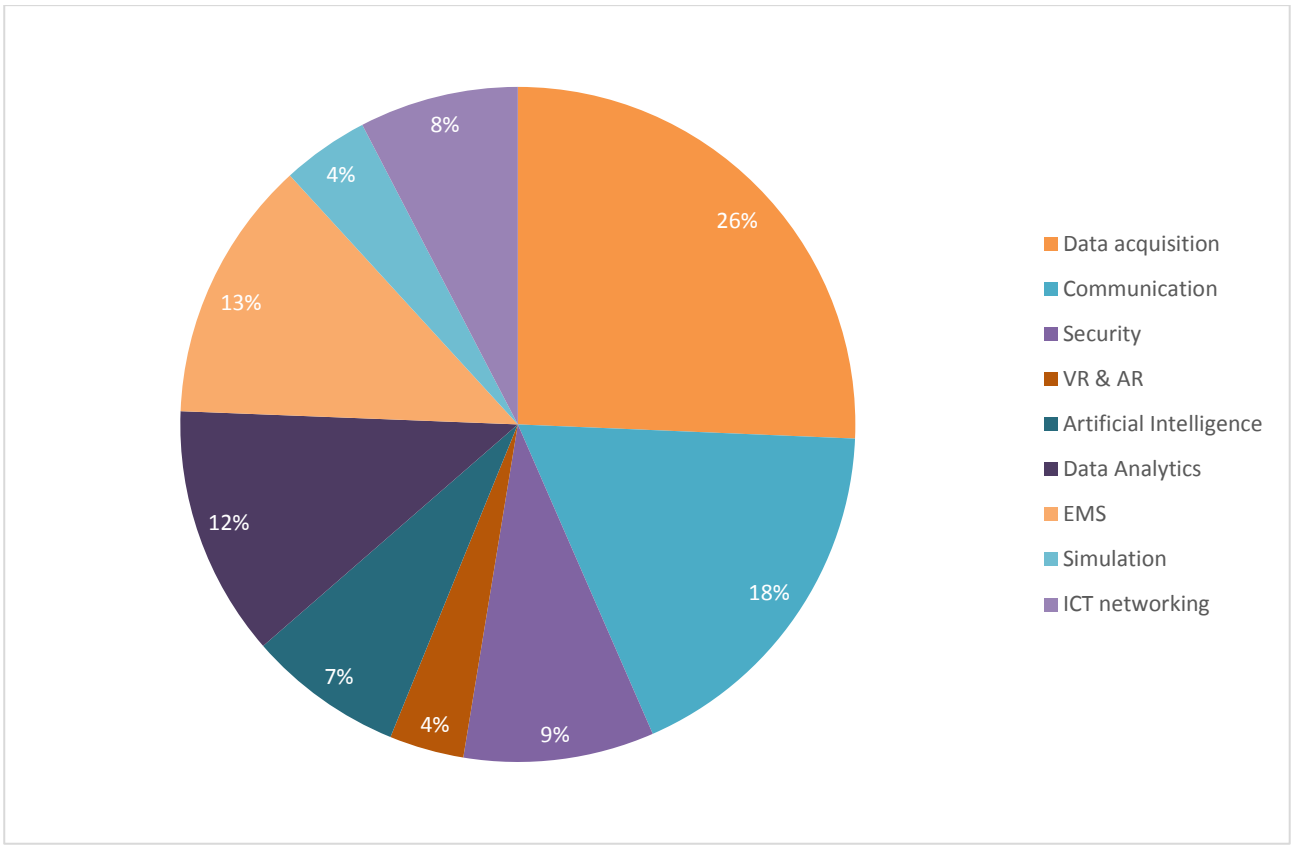

Figure 4: IoT Competency areas of IoT providers

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

There is particulalry strong technology coverage in Data acquisition and Data Communication which will benefit a broad range of projects because these underpin many potential solutions.

The IoT clusters also have a broad sector support base, with a balanced coverage across most sectors (see Figure 5):

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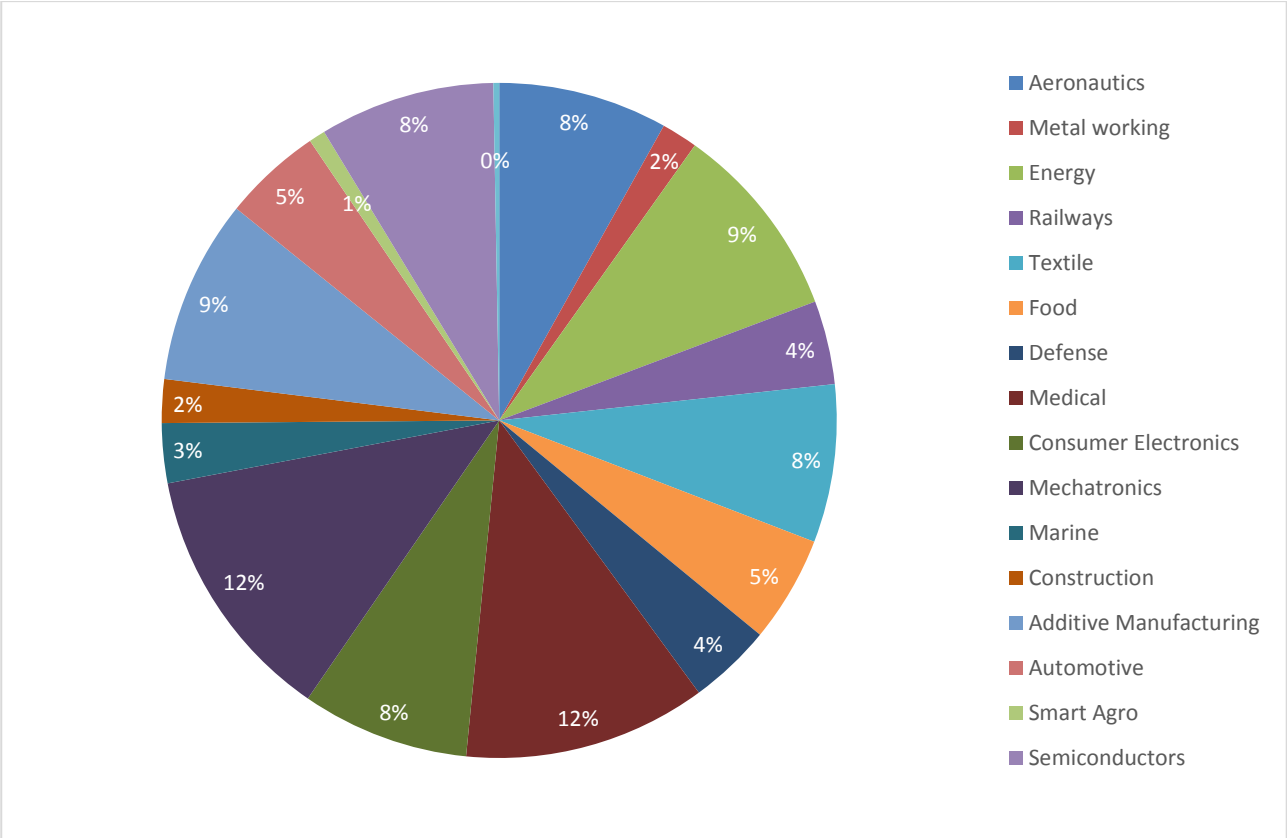

Figure 5: Sector domains for IoT clusters

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

4.4. IoT Technology providers' challenges and barriers

Challenges

The IoT clusters were asked to identify the factors that they felt were of concern in the industry and also what barriers they perceived for SME companies to engage with the technologies. From an industry perspective there are common issues relating to Security and Standards. Security of data and access to systems widespread and much of this is driven by fear and a lack of understanding of the risks and how to mitigate them. IoT vendors must support SMEs by highlighting the risks and identifying how they are managed using the chosen solution.

A lack of standards is also seen as an issue by IoT providers, however this often isn't usually shared with, or understood by SMEs. Currently there is no uniform standard for communication protocols. This is an industry wide issue and until such time as open standards are adopted, will mean that the choice of protocol will rely heavily on the IoT providers' expertise and view on future connectivity requirements.

There were also concerns regarding the need to involve several vendors in any integrated solution. It can be difficult for an SME to find the right partners to deliver the solution and it will be important in the "matchmaking" process to take account of the fact that more than one IoT provider may be

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required. Working with IoT partners that have good connections to linked technology vendors should, therefore, be encouraged.

Barriers

The IoT cluster interviews identified the top 5 potential barriers for IoT adoption. Significantly Lack of knowledge concerning the benefits of using IoT technologies was seen as the most common problem area. Beyond detailed technical knowledge, which to some extent is to be expected, there is a need for SMEs to understand the benefits that will be derived from using the technologies as part of the solution and this is demonstrated by another identified barrier – the lack of a supporting business case. If businesses can understand and quantify the benefits of the technology they are more likely to consider investment in a project.

Table 2: Possible hurdles for the deployment of IoT in industry

1	Lack of knowledge
2	Resources (skills, money, people)
3	Mindset - Business case
4	Reluctance to engage
5	Social aspects - big brother

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

4.5. IoT Technology applications

The IoT Technology clusters were asked to identify trends across the IoT technology areas and where they expected organisations to be looking for applications. In the majority, the respondents felt that manufacturers were predominantly looking to improve efficiency and that using sensors for data capture, combined with advanced analytics will be the most popular area for applications. From the research the Top 5 application areas are shown below:

Table 3: Top 5 of expected applications

1	Predictive Maintenance
2	Logistics & supply chain
3	Track and trace
4	Monitoring applications
5	Process analysis

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

The IoT clusters were also asked to identify the areas where they were expecting to receive requests for collaboration from the SMEs applying for funding. These topics showed that Sensing and Smart data activities are strongly favoured and supported by the IoT clusters interviewed.

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Table 4: Relevant topics for IoT projects

1. Smart Data projects
2. Smart Sensing platforms
3. Connected systems
4. Energy management systems
5. Robotics/Cobots

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

This suggests that whilst there is broad technology competence coverage, the particular strengths are covered by the interest areas identified above.

4.6. Project Types

There are 3 types of project applications that can be supported by the IoT4Industry project:

1. Feasibility Studies
2. Prototyping projects
3. Demonstrator projects

The interview respondents were asked to give their opinion on the type of projects that SMEs may apply for through the calls. Figure 5. Shows the spread of opinion. It suggests that there will be greater interest for Prototype development projects and Demonstration projects, rather than undertaking Feasibility studies.

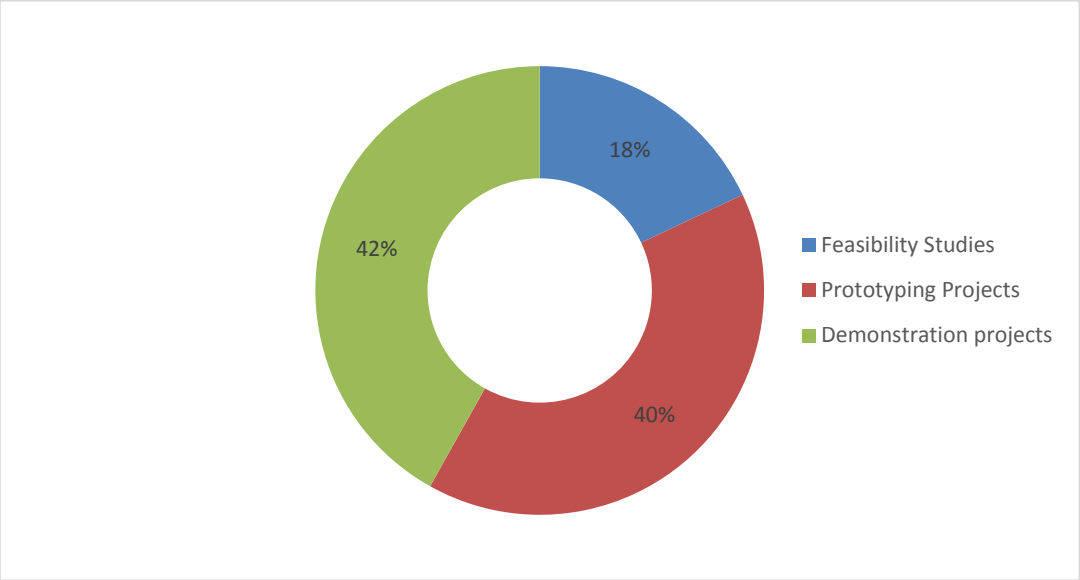

Figure 6: Potential different project types

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

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4.7. IoT Technology Provider Case Studies

Case studies can be a powerful way to demonstrate how a technology has been used to solve a particular problem. The relevance of a problem to other SMEs is often quickly understood and this enables them to consider similar scenarios in their own business. The interviews did not solicit any specific case studies that might be used for the awareness training in WP2. However ensuring IoT cluster members are involved in the training and matchmaking events should enable us to find relevant case studies to help SMEs identify potential project opportunities.

4.8. Matching the IoT providers offering (Supply) with SME requirements (demand)

An important aspect of the project is to determine whether the requirements of SMEs can be met by the products and services of the IoT providers. The results of the two pieces of research suggest that there is broad overlap between the two. However, a potential gap in the technology providers' competences is also highlighted.

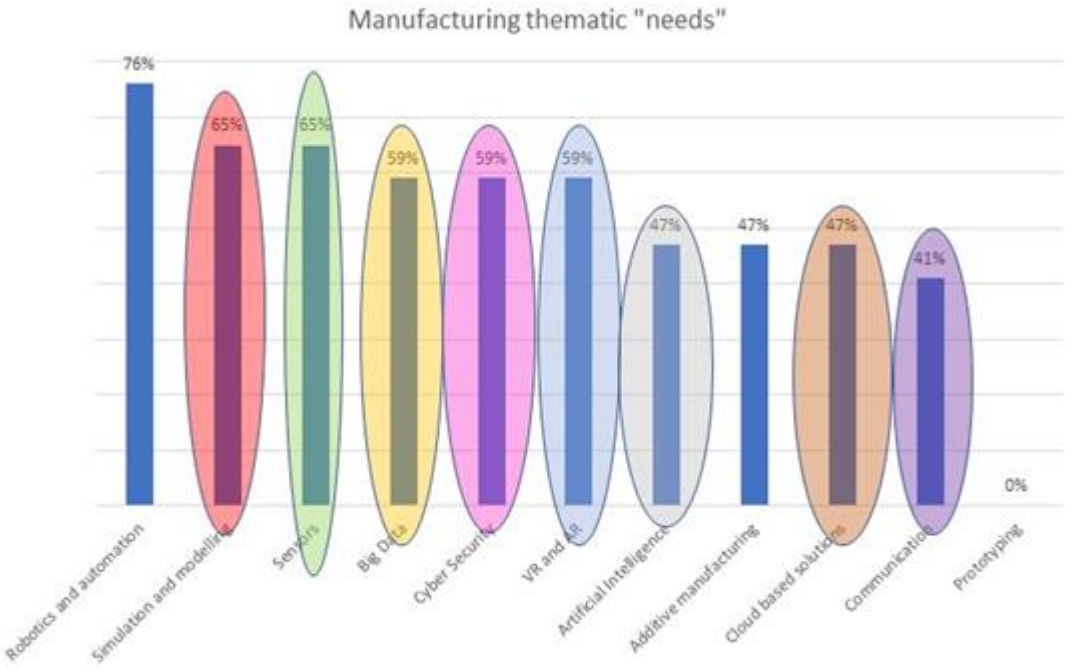

Figure 7: Interest areas of Manufacturing SME's

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

Figures 7 and 8, show the technology coverage of the two research groups.

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Figure 8: Technology offerings of IoT technology providers

Source: D1.2 ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

Robotics and Automation

The apparent anomaly between the requirements of SMEs (Demand side) and IoT providers (Offer side) in the areas of Robotics & Automation and Additive Manufacturing may be as a result of several factors. In the first instance the understanding of what constitutes IoT technologies usually focuses on data and connectivity elements and typically would exclude the wider industry4.0 technologies that encompass robotics and additive manufacturing. Additionally, there were subtle differences in the data gathering for each group, where Robotics and Additive Manufacturing weren't included as a discrete technology group for the IoT providers to respond to.

Quote from D1.2 report: "The probable explanation would be that robotics is not seen as a clear IoT topic. It certainly consists of a number of subtopics like data gathering and processing, analytical data handling and others. A second area is additive manufacturing. Again this is not generally seen as an IoT topic."

All clusters invited to participate in the data gathering were primarily focussed on the IoT technology space, as implied by the title of the project. Subsequent desk research has shown that there is some coverage of Robotics within the cluster groups interviewed, with around 3/15 showing competencies in this area. Table 6 indicates the areas where IoT providers are expecting interest in projects from SMEs, Robots and Cobots are included in this list, suggesting that the IoT providers fully expect to support projects of this nature.

Other technology cluster groups that were identified during the process of finding clusters for future participation in the project have shown competencies in Robotics and Automation and it is highly likely that we can find suitable partners to support the technology requirements should this be required in match making activity.

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There is good overlap in the areas of Sensors, Big Data and Cyber Security which suggests that the demands for projects in these areas will be readily supported and should form the focus of the awareness and case studies used in Work Package 2.

4.9. Learning points for subsequent work packages

The highest potential for collaboration is for projects using Sensor technology. The IoT technologies providers are strong in this area and there is also high demand from SMEs.

Sector spread: the research has identified that there is technology support across a broad range of sectors and demand for these technologies is also evenly spread. The focus technologies for awareness and collaboration should be:

- Sensors
- Big Data
- Cyber security

The potential applications identified are broadly suited to all sectors and therefore the awareness training can be generic and application focussed.

Identification of training and awareness needs - Practical applications of the technology with defined benefits – best established with case studies of successful projects.

Applications where these projects are likely to arise include: Predictive Maintenance, Logistics and supply chain optimisation, Track and Trace solutions, Process and condition monitoring and Analysis.

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5. National and Regions strategies and funding synergies

The work of work package 1.3 involved research on the National and Regional strategies in support of Smart Manufacturing and to identify funding available to SMEs for Smart manufacturing projects.

The aim was to identify relevant regional strategies and funds that have potential synergy with the IoT4 Industry project and how these initiatives might be leveraged to support the project and its aims.

5.1. National and Regional strategies

Within the European Union each country has a core national initiative to support the awareness and adoption of industry 4.0.

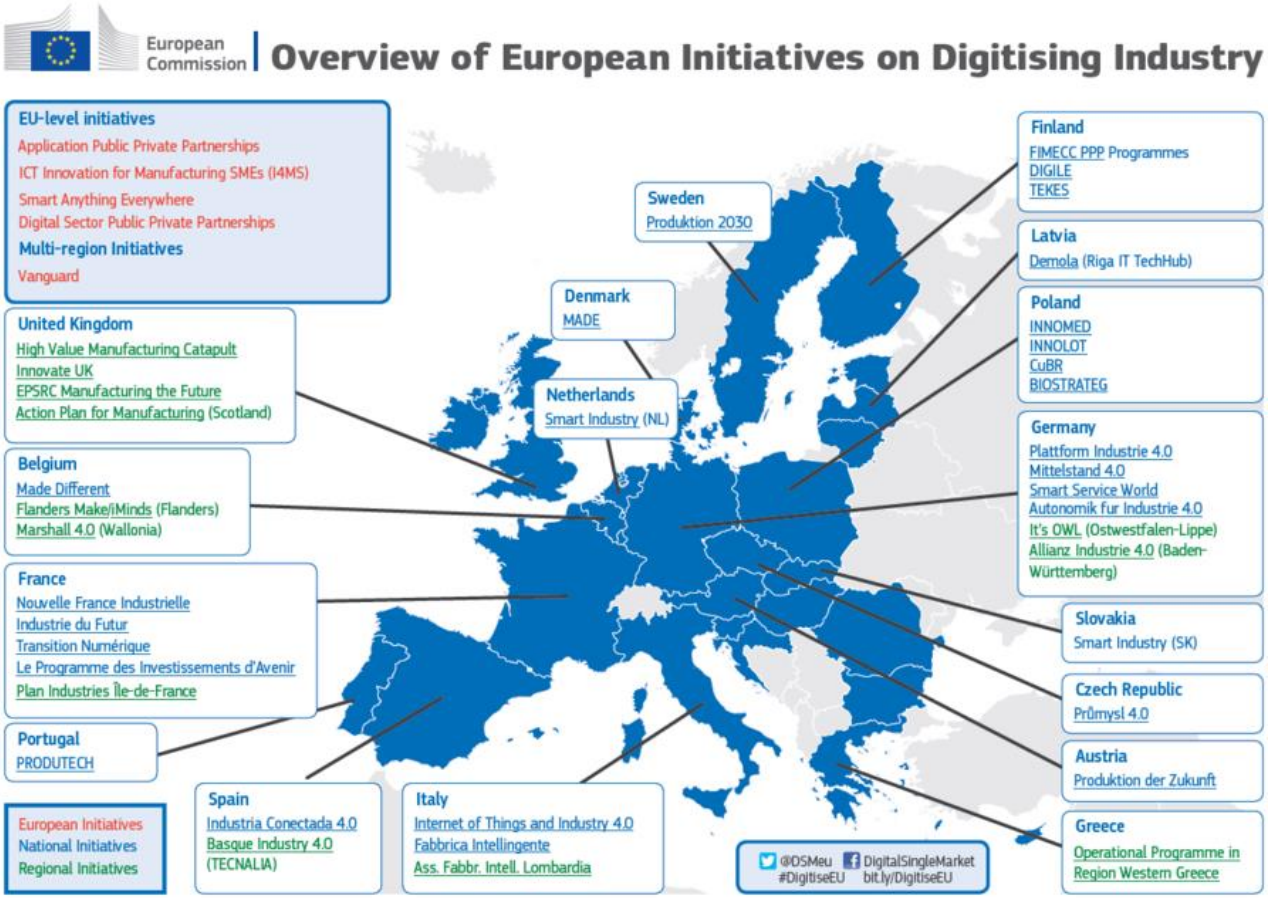

Figure 9: EU Initiatives (source: EU – information society)

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	Launch date	Target audience	Budget	Funding approach
	2015	Industry & production base, SMEs & mid-caps	Approx. €10 billion	Mixed
	2011	Manufacturers / producers, SMEs & policy-makers	€200 million	Mixed
	2012	Large companies, SMEs, universities, research centres	€45 million	Public
	2014	General business community	€25 million	Mixed
	2016	Industry, above all SMEs & micro-enterprises	€97.5 million	Public
	2013	Research, academia & industrial & service SMEs	€50 million	Mixed
	2012	Business, industry & research organisations	€164 million	Mixed
	2016	Industry & service sector companies, trade unions	Not yet defined	Public

Figure 10: Key facts of some national I4.0 policies (source: Digital Transformation Monitor)

Beyond these nation-wide initiatives, there are also local and regional programmes that provide support and funding for local innovation development.

Table 5 provides an overview of regional schemes that are relevant to the IoT4industry project.

Table 5: Overview of Regional schemes supporting Industry 4.0

Country/Region	Programme	Support	Aims/Results
Belgium (Federal)	Made Different	Diagnostic and on-site advisory visit. Resulting Transformation plans can receive 10-15 Days of consultancy ~ €10k	Companies involved have invested nearly €500m, report 11% increase in jobs and 80% reduction in lead-times
Belgium (Flanders)	Industrie 4.0	Spearhead clusters – max €500k/yr over 10 years. Innovative Company networks – max €150k/yr over 3 years)	€4m spent to set-up and support innovation and pilot lines in 2017.

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Country/Region	Programme	Support	Aims/Results
Belgium (Wallonia)	Digital Wallonia	Vouchers for Operational Excellence and Industry 4.0 – Expert support (€30k/€60k) + capacity building (up to €20k) Digital transformation – expert support (€20k/€60k) Cyber Security - €20k Limited to €100k/yr per company and €200k over 3 years.	Long running programme. Mobilising €2.9 billion over 5 years. Digital innovation has a budget of €250m.
France	Industrie du Futur	€350m in subsidies and loans. €425m from Industry partners. Personalised support – audits to SMEs. Financial support - €2.5bn in tax incentives, €2.1bn in loans over 2 years Employee training	Provide support 2000 companies over 2 years. Upskilling the industrial workforce and training the next generations.
France	*Pôles de Compétitivité (includes SCS and MBI project partners)*	Subsidies and fiscal advantages for collaborative R&D projects.	Multiple regional projects and programmes.
France (Auvergne Rhône Alpes)	Industry of the Future	Support SMEs in production systems, business information and work optimisation. €3.2m over 3 years.	Support SME technology investment Reshape support for skills development Create an efficient Eco-system

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Country/Region	Programme	Support	Aims/Results
			Reinforce collaboration with partners
France (Provence Alpes Côte d'Azur - PACA)	Various under the Industry of the Future	Numerous programmes for SMEs	2-3000 industrial diagnoses for SMEs to raise awareness in Smart processes. Other Acceleration programmes
Germany	Industrie 4.0	Establishment of SME Competence Centres (11 since 2016) National (IUNO) lighthouse project for IT Security	
Germany (Baden-Wuerttemberg)	Industrie 4.0 für Baden-Württemberg	Vouchers for Digitalising SMEs in field of R&D for use of digital solutions. €20k & €40k to cover 50% of consultancy support costs.	
Italy	Piano Nazionale Industria 4.0	Tax incentives for start-ups and SMEs. 30% break on personal income tax for investments of up to €1m. Corporate tax breaks. Guarantee fund to support upto 80% of a loan (upto €2.5m).	
Italy (Piedmont)	Intelligent Platform Factory	12 Innovation Poles to promote generation and sharing of knowledge	
UK	Made Smarter	Government founded commission to support the UK to become a global leader in Industrial Digitalisation by 2030.	Made Smarter Commission established Feb 2018. Future funding and initiatives are expected to follow. £20m North West pilot

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Country/Region	Programme	Support	Aims/Results
			launched in 2018 to support NW Manufacturing SMEs and technology providers.
UK	Innovate Loan scheme	SME loans from £100k-£1m to cover eligible project costs up to 10 years.	Develop commercially usable prototypes & pilots. Experimental production and testing. Planning and design phases.
UK (Liverpool)	LCR4.0 – Liverpool city region	Subsidised support for i4.0 innovation. Access to R&D, knowledge transfer and project acceleration	Collaboration between businesses and providers.
UK	Innovate UK - REACH programme	Government funded programme to support manufacturing SMEs. Match funding for SMEss on support costs from authorised centres.	Long running programme support by UK High Value Manufacturing Centres. Accessible to all UK SMEs.

Source: D1.3 Report on European regional strategies and European Structural and Investment Funds with relevance to smart industry

5.1.1. Countries / Regions of interest (not 'covered' by a partner)

Research was also conducted on regions outside of the areas covered by IoT4Industry partners to identify comparisons in other countries as well as identifying potential "Ambassadors" for extending the reach to the project beyond the project partner coverage. Table 8 provides an overview of these schemes.

Table 6: Overview of Regional schemes supporting Industry 4.0 (non-partner country)

Country/Region	Organisation	Focus	Relevance to IoT4 industry
Austria	Business Upper Austria	Advanced manufacturing systems / Manufacturing &	Highly relevant but not among the priority

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Country/Region	Organisation	Focus	Relevance to IoT4 industry
		industry. Industrial production processes.	geographical areas defined by the project
Germany (Bavaria)	Centre Digitisation Bavaria	Advanced manufacturing systems / Manufacturing & industry Industrial production processes; Efficient production technologies, mechatronics, automatisation and robotics; ICT (including Industry 4.0)	Region/ country with an important ecosystem of Industry 4.0 stakeholders, notably on manufacturing side. In a country 'covered' by the partnership.
Italy / Abruzzo	Regione Abruzzo - Department of Economic Development	Advanced manufacturing systems / Manufacturing & industry Industrial production processes; Automotive 4.0; Advanced technologies for health and living care services (life science)	Region with priorities relevant to IoT4Industry project with a relatively advanced ecosystem, country 'covered' by a partner and within a geographic area in line with the project target
Spain / Basque Country	SPRI – Basque Agency for Business development	Advanced manufacturing systems / Others (including Industry 4.0)	Region with priorities relevant to IoT4Industry project, with an lighthouse initiative, country not 'covered' by a partner and within a geographic area in line with the project target

Source: D1.3 Report on European regional strategies and European Structural and Investment Funds with relevance to smart industry

Potential for ambassador representation

From interviews undertaken with stakeholders of these regional initiatives it is apparent there are common factors that impact the adoption of i4.0 technologies. These include:

- lack of cross-disciplinary collaboration as a major barrier to the uptake of Industry 4.0. solutions

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- difficulty accessing EU / national funding for SMEs beyond the first steps

The stakeholders in these organisations were generally supportive of a cluster approach and the need to undertake "train-the-trainer" sessions to cascade awareness and knowledge into their organisations and subsequently to SME manufacturing businesses.

Activities to identify potential ambassador clusters will be developed in subsequent project work packages, however we should be reassured that the issues in outlying regions are common and the proposed approach to promoting adoption is being positively received.

5.2. Funding Synergies

Over half of EU funding is channeled through the 5 European structural and investment funds (ESIF). They are jointly managed by the European Commission and the EU countries.

The ESIF mainly focus on 5 areas:

- research and innovation
- digital technologies
- supporting the low-carbon economy
- sustainable management of natural resources
- small businesses

The European Commission has encouraged Member States to use the European Fund for Strategic Investments (EFSI) and the European Structural and Investment Funds (ESIF) to meet the demands of their national initiatives for digitisation. Overall, the planned ICT investments under ESIF with relevance to smart manufacturing research and dissemination greatly exceeds 10 billion euro.

Table 7: H2020 and ESIF funding for research and innovation - totals per regions

Region	Total H2020 (M€)	Total ESIF (M€)
Flanders	618,3	171,4
Wallonia	143,8	226,7
Auvergne Rhone-Alpes*	461,4	244,5
Provence Alpes Côte d'Azur	178,4	119,1
Baden-Württemberg	734	209,5
Piedmont	243,1	208,1

Source: Regional R&I viewer - S3 platform

Using the information in table 7, there are some extrapolations possible:

- ESIF funding is more focused on regions with lower GDP/inhabitants. Wallonia and Piedmont are thus implementing programmes with higher proportion of ESIF funding than the other regions from the consortium;

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- H2020 funding is fostering research and innovation initiatives, providing regions with innovation ecosystems to benefit from the leveraging effects of grants and projects involving stakeholders in their territories.

ESIF funding is important for most of the partners' regions involved in the consortium. The 'exact' distribution at regional level is difficult to assess due to the dilution of ESIF funding within the regional tools made available to R&D stakeholders and beyond.

5.2.1. Availability of funding to SMEs on Industry 4.0 projects

Table 6 shows the broad range of funding available to support SMEs in Industry 4.0 and Smart manufacturing projects.However, it is often difficult for an SME to find the relevant information. The regional partners and potential ambassadors will be essential in providing SMEs with accurate information concerning potential funding available to their local SMEs and technology partners. The findings of the report and partners' local experience and knowledge of these programmes should be exploited during matchmaking to activities to support successful proposals.

5.3. Maximising IoT4Industry vouchers impact within European, National and Regional strategies

The report identifies some key areas that should be considered to ensure the IoT4 Industry project is able to achieve the most impact when aligned with regional and national initiatives:

- The need to inform & convince business stakeholders on I4.0 benefits
    - Funding is available to support technology projects – it is critical to get a positive message to businesses about the practical benefits of i4.0 technologies to encourage take-up. Included in this process should be the impact of I4.0 on employment, and employees, which is often seen as a negative factor for digitalisation.
- Designing programs that correspond to business stakeholders' actual needs
    - A gap exists between the positioning of the local and national strategies and the current state of digitalisation in SME businesses. However, it entails a level of coordination that may prove difficult to reach. The IoT4 Industry project will allow funding to be channelled directly to SMEs with real problems to solve and providers of technology whose products and services can provide pragmatic solutions.
- Regional partnerships and agencies will play an essential role in disseminating project information and encouraging collaboration with SMEs. Providing support and tools will help these organisations to foster potential projects.
- National/Region funding schemes
    - Lack of funding is not a concern. The main issue is how these funds are being targeted. Focal points for success should include vocational training in IoT, Consultancy for support practical solution implementation, training and networking within industry groups to demonstrate solutions and use of a flexible approach to project administration that takes account of SME resources.
- EU funding schemes: multiple frameworks and formats with a common objective
    - The IoT4industry project partners in each region should act as a communication channel between businesses and funding programmes.

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  - Establish connections from the project to S3 IM Partnership and Vanguard initiatives.
  - Explore with industrial partners the opportunity to collaborate on EU-PPPS, such as I4MS and EIT Digital.
- EU funding schemes: the IoT4Industry project should be adapted to the needs of regional end-users.
  - Experience of working with the local business community will be essential when co-ordinating these technology projects and steering them to success.
- Complementary funding schemes
  - There should be no incompatibility between the project funding and most existing regional funding schemes. The ESIF/ERDF management schemes should prevent any potential issues.
  - Combination of other funding types such as MIDIH may be subject to different criteria and should be explored by the project partner concerned as part of the approval process.

5.4. Assessing IoT4industry synergy and leveraging effects

Several opportunities were identified for combining with national and regional funding to boost the impact of the project including:

- Invest in Vanguard initiatives and Industrial Modernisation Thematic platform(s)
  - The IoT4Industry vouchers would be seen as an enabler for extending development within these programmes
- Conferring another lever for mobilizing stakeholders into regional open calls
  - Many funding programmes often fail to fulfil expectations due to a lack of technology readiness in target businesses. The IoT4industry vouchers may be used to seed projects that allow small-scale practical implementations or feasibility studies to elevate readiness for later projects.
- A stepping stone for accessing PPPs environments
  - IoT4industry collaboration and matchmaking events may allow improved awareness of these activities and how they can used to scale up technology initiatives.
- Reinforcing Industry 4.0 project proposals' business cases for transnational cooperation funding opportunities
  - Several Transnational and transregional initiatives exist that require cross regional collaboration in the EU. The framework for IoT4industry projects uses a similar model and may encourage participants to engage with these larger programmes as a result.
- Building upon regional vouchers' outcomes
  - Where regional schemes have provided consultancy support, the IoT4industry vouchers may be seen as the means to implement the outcome of the initial proposal. Working at a regional level, the providers of such consultancy programmes should be encouraged to work with project partners to develop co-operation.
- An 'even faster track' to innovation at EU level
  - 2 programmes within H2020 (Fast Track to Innovation and SME Instrument) would benefit from IoT4Industry voucher support in undertaking feasibility studies or initial implementations of higher TRL technology solutions.

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5.5. Learning points for subsequent work packages

There is significant funding available across the region from both National and Regional programmes. The key to accessing the funding is providing awareness and support.

Providing awareness of complementary funding schemes should enhance the take-up of Iot4industry vouchers and vice versa.

Developing collaboration directly with the organisations responsible for managing regional programmes should benefit the IoT4industry project through better awareness of the synergies.

Dissemination of information concerning complementary funding schemes is best managed by the regional project partners as part of the awareness training and/or matchmaking activities.

The combination of Iot4industry vouchers with other forms of national and regional funding should be entirely compatible. There are defined frameworks in place to prevent conflicts.

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6. Short, medium and long term perspectives for the project calls

The project research undertaken in Work Package 1 asked cluster representatives about their views on the priority trends in Europe in relation to IoT. The responses varied in context and it is difficult to draw firm conclusions about the adoption of IoT technologies and their impact in the future.

From an industry perspective, there is a lot of momentum in supporting adoption of digital technologies in manufacturing. Whether through government and regional strategies, large scale technology vendors or research and development centres, there has never been a better time for manufacturing SMEs to embark on a digitalisation journey. The project is well timed to take advantage of the energy being generated in the industry 4.0 space across Europe.

The research shows that SME businesses may be reluctant to embark on IoT projects because they lack the skills to implement and uncertain of the benefits. The advantage of using small scale projects to "dip their toe in the water" and gain confidence from working with competent vendors is likely to develop their confidence to expand these into wider scale digitalisation activities across the business.

A potential outcome will be for them to explore the wider impact of digitalisation on their business. At this stage they will benefit from using one of the widely available digital maturity assessments to take a holistic view of the business and the opportunities presented by industry4.0.

As IoT and more broadly industry4.0 technologies develop, the scope for SMEs to embrace digitalisation will expand; the project is expected to impact in the following ways:

Short term: Provide valuable case-studies to share with the manufacturing space and encourage others to engage in similar projects. Develop skills and knowledge on small-scale tactical projects. De-risk early experimentation, prototyping and feasibility activity.

Medium term: Gain confidence to explore wider impact of digitalisation and develop a business strategy that is underpinned by digitalisation. Engage with Customers and Suppliers in their supply chain to identify benefits from collaboration and digitalisation.

Long term: Wider adoption of digitalisation should realise benefits in terms of productivity, cost and quality leading to more agile businesses. This will encourage a mind-set of digitalisation as a fundamental enabler and used as a competitive advantage. Consideration of alternative methodologies and business models is a likely outcome of the widespread use of the technologies.

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7. Conclusions and recommendations

The 3 research reports in WP1 have provided a good level of insight into the requirements of SMEs and Technology providers that will enable the project to focus on specific activities that meet their needs. Additionally, the reports have developed a better understanding of the national and regional strategies that are in place across the EU and the synergies that may be exploited.

The conclusions have been summarised according to how they may impact the subsequent work packages.

7.1. Recommendations for training and awareness activities

Overcoming the lack of awareness and knowledge about IoT technologies and how then can benefit business is a key barrier to adoption of technology. Providing support in addressing this barrier is a key deliverable of the IoT4industry project.

The research has identified the technology themes and associated areas where SMEs want more information. These can be summarised as:

- Understand how IoT technologies can be applied to manufacturing scenarios
- Understand the benefits and potential return on investment
- Understand how to address the impact on People when implementing technology projects

There are 4 technology themes that have been identified as being of most interest to SMEs:

- Sensors and data acquisition (including big data and analytics)
- Robotics and Automation (including communication technology)
- Cyber security
- Simulation and Modelling (including Virtual reality and Augmented reality)

Whilst it is important to recognise these as significant, no single technology area had less than 41% interest amongst SMEs. It is important that the training content acknowledges the broad range of IoT technologies, especially as solutions will often require more than one technology.

It is recommended that the training covers sections where technologies and applications are covered at a high level, supported by more detailed use cases/case studies where the themes of most interest are used as examples. Specific focus should be made to the benefits and impact.

- Work Package 2 includes the definition and preparation of training material. Based on the work undertaken in Work Package 1, the training programme will include:Train-the-trainer event to share material and process to project partners
- SME IoT4 Industry event hosted by each project partner (Example event agenda below)
- Collateral to support training e.g. work book

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Table 8: Example training event agenda

Welcome and introduction to the project
Introduction to Industry 4.0/Smart Manufacturing.
Introduction to IoT (including barriers to adoption)
IoT technologies overview and their application
Presentation of Case Studies - examples of successful IoT projects (supported by IoT providers)
Break-out groups (activity around specific challenges and potential solutions
Re-group and discussion
Question and Answer section
Support for project proposals and additional services

To facilitate the project matchmaking activity, it is recommended that where possible IoT technology providers should be involved in the training events where possible. Of particular interest to SMEs will be the practical use cases where IoT technology providers have supported other SME solutions and these can bring to life how technology is solving real manufacturing problems.

Funding awareness

As the research has shown, there are regional and national programmes that provide funding and support in synergistic areas covered by the IoT4industry project. Where project partners have knowledge of these programmes (especially at a regional level), the subject should be broadly covered in the events so that SMEs can see the wider picture and consider combination of funding options. It is unrealistic to cover the subject in detail at an event, however partners should raise awareness for subsequent conversations to take place with SMEs. This may have significant value for an SME and will strengthen links to the relevant project clusters.

Partner service portfolio

The role of project clusters in promoting take-up of the calls is critical. The knowledge and experience of project clusters in responding to calls and preparing proposals will be of significant value to SMEs, especially those with little previous experience.

Each project cluster is providing a range of services to support businesses in responding to the calls. This will usually be free of charge to members of the project partner cluster and for non-members it will be a chargeable service. Details of the support available should be included as part of the awareness event as well as in any subsequent dissemination material.

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7.2. Recommendations for Calls (Expression of Interest and Participation)

7.2.1. Communications

Content

In preparing for communication of the calls consideration needs to be given to the level of knowledge and awareness currently within SMEs. To encourage uptake we should ensure the communications provide subject matter context to allow SMEs to understand how IoT may impact their business. Many SMEs may not be able to attend the awareness and training events in person and the project needs to consider how the messages from the training might be disseminated to this wider group.

Consideration should also be given to the following activities:

- Provision of output material from the training event e.g. workbook, or summary "newsletter"
- Run a webinar to cover highlights of the training, example use case and details of the IoT4industry projects.

Targeting

In addition to the clusters involved in the research, it will be important to extend awareness of the project beyond this group. The research identified interest from a range of sectors and whilst any manufacturing SME is a candidate, it is recommended that project partners focus on the larger sectors in the first instance to make best use of resources. The largest sectors are represented by:

- Metal working
- Electronics
- Automotive
- Mechanical
- Aerospace

Identifying local companies and clusters that represent these sectors should be a priority when considering the broader communication strategy.

7.2.2. Funding outreach activity

Taking account of the wider regional and national strategies, it is important for the project to link with the organisations that are promoting and co-ordinating funding on these programmes. Creating awareness within the funding bodies about the synergies of the IoT4 project and the potential to combine funding mechanisms will provide benefits for both initiatives. The opportunity to obtain referrals both to and from other schemes will further enhance project take-up.

A core part of each project cluster activity in Work Package 4 should include specific actions to develop and maintain relationships with national and regional organisations responsible for complementary programmes.

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7.3. Criteria for Vouchers

The research has identified that with the exception of Robotics and Automation there is a good match between SME requirements and IoT provider capabilities. It also concluded that there is demand for projects of this nature and that a voucher based scheme will be welcomed by SMEs and IoT providers alike. The broad range of technologies of interest and potential use cases suggests that there are likely to be a wide range of applications proposed for funding. The challenge for the project partners will be in identifying what is, and what is not, in scope for the proposal evaluation. To assist the expert evaluators, we should provide a reference list of technologies that we consider are "IoT" to help avoid ambiguity in the evaluation process.

The following technology list has been included as a potential reference for consideration by the project partners:

Table 9: List of potential project technologies for consideration

Technology area	*Including*
Sensors / Data Acquisition	*Sensor technology, systems for data acquisition, Digital Signal processing*
Communication technology	*Communication protocols, baseband technology, RF Technology*
Security	*Encryption, data security, network security*
VR and AR	*Advanced Visualisation techniques for visualization, simulation and support*
Artificial Intelligence	*Deep learning, Machine learning, Neural networks*
Data Analytics	*Big data, data mining, data processing*
Tooling and simulation	*Design and simulation tools, visualization*
ICT Networking	*General ICT networking services like routers, modems, servers*
Robotics and Automation	*Use of IoT technologies in automation solutions*

The other factor that was highlighted by IoT providers was that most solutions will require a combination of technologies to achieve an outcome. Proposals are likely to be received from an SME with more than one technology provider as collaborators. This was recognised when the current voucher criteria were devised and these should be retained.

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8. Advisory Board Feedback (Publishable Quotes)

Advisory board member	Feedback	Comments from the project team	Action to address the feedback
Name witheld	We have to put inside the project some key considerations: Project milestones, clear KPI and specifics requirements and barriers for each vertical, clear tools to measure progress in the project, strong analysis on vertical requirements, etc.	At this current stage we can include KPIs which have been defined at the beginning of the project, as for specific requirements and barriers, this would require a lot more work which wasn't initially in the plan.	Project KPIs have been included. (Pg. 9)
Prof. Dr. Olivier Schecker (HsKa)	One of the big difficulties is the number of closed proprietary solutions for specific problems. The broader use of open solutions allowing the implementation of technology of various IOT suppliers could – beside standardization – give a boost for SMEs to develop solutions for their specific needs.	Solutions can and will be defined in project proposals which will be unique and tailored to the specific requirements of the manufacturers. Deliverable 1.4 is not defining solutions, but stimulating ideas based on previous experiences.	None
Malcolm Harold	Most businesses want to improve and streamline processes. IOT, being a part of industry 4.0, represents a great opportunity to take either small low budget steps that can make a big difference or bolder innovative steps to link up assets and systems within the business. Either way, starting the 4IR journey with projects like IOT4industry, and de-risking the costs, will make companies more profitable and resilient.	Agree with the comments.	None

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9. References

IoT4 Industry Project – Deliverable 1.1: European mapping of concerned SMEs and selected/suggested focus topics and sectors

IoT4 Industry Project – Deliverable 1.2: ICT competencies for existing (ready to use) or potential developments of IoT Smart Manufacturing solutions

IoT4 Industry Project – Deliverable 1.3: Report on European regional strategies and European Structural and Investment Funds with relevance to smart industry

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Appendices

The appendix section contains information that is supplementary to the main body of the report. It can include a summary of the raw data or extra details and images from the work conducted.

Appendix A. WP1.1 – SME Clusters interviewed to evaluate "Demand" for IoT support

Table 8: List of European Manufacturing Clusters Interviewed

	Name	Country
1	AFM cluster	Spain
2	BalticNet-PlasmaTec	Germany
3	Brainport industries	Netherlands
4	Cluster Precision	Switzerland
5	DIMECC	Finland
6	EEF	United Kingdom
7	Engineering and Machinery Alliance (EAMA)	United Kingdom
8	Flanders Bike Valley	Belgium
9	IT'S OWL	Germany
10	Linz Center of Mechatronics (LCM)	Austria
11	Materalia	France
12	MBI	France
13	MESAP	Italy
14	Midlands Aerospace Alliance	United Kingdom
15	MTC	United Kingdom
16	PANEL	Hungary
17	Plastipolis	France
18	PMT	Belgium
19	Pointex	Italy
20	POOLING Engineering and Tooling	Portugal
21	Processing & Packaging Machinery Association	United Kingdom

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Appendix B. WP1.2 – IoT Technology providers clusters interviewed to evaluate the "Offer" for IoT services

The appendix section contains information that is supplementary to the main body of the report. It can include a summary of the raw data or extra details and images from the work conducted.

Table 10: WP1.2 - Interviewed IoT Technology cluster representatives

Cluster	**Country**
Cluj-IT	Romania
DSP Valley	Belgium
Fondazione Distretto Green & High Tech Monza Brianza	Italy
Fondazione Torino Wireless	Italy
GAIA	Spain
HighTech NL	Netherlands
IK4-Tekniker	Spain
Innoskart ICT Cluster	Hungary
IVAM Microtechnology Network	Germany
Manufuture Baden-Würtenberg	Germany
microTEC SüdWest	Germany
Minalogic	France
Secured Communicating Solutions Cluster	France
Silicon Saxony	Germany
TICE.PT	Portugal

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Appendix C. WP1.3 – Regional representatives interviewed to support desk research on regional strategies and funding

Table 10: Interviewed regional organisations

Organisation	Country / region
ARII PACA (Regional agency for innovation and internationalisation)	France / Provence Alpes Côte d'Azur
Provence Alpes Côte d'Azur regional authority	France / Provence Alpes Côte d'Azur
Auvergne Rhône-Alpes regional authority	France / Auvergne Rhône-Alpes
Manufacturing Technology Center*	UK
Agence du Numérique (Regional agency for Digital strategy - Wallonia)	Belgium / Wallonia
Wallonia regional authority	Belgium / Wallonia
VLAIO - Agentschap Innoveren en Ondernemen (Innovation and entrepreneurship agency – Flanders)	Belgium / Flanders
SRPI - Agencia de Desarrollo Empresarial (Business development agency – Basque Country)	Spain / Basque country
Ministry of Economy	Germany / Baden-Wuerttemberg
Allianz Industry 4.0	Germany / Baden-Wuerttemberg
Zentrum Digitalisierung Bayern (Center for Digitisation Bavaria)	Germany / Bavaria
Business Upper Austria	Austria / Upper Austria
Piedmont Regional Authority	Italy / Piedmont
Abruzzo Regional Authority	Italy / Abruzzo

* MTC, while being a partner of the project, is also the best contact for UK Industry 4.0 funding schemes

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