

WHITE PAPER

Internet of Things: application areas, guidelines and potential for the development of projects for South Tyrolean companies.

Date 23.7.2019



The ERDF project 2023 Beacon Südtirol (CUP: B31H17000060001) was funded by the European Regional Development Fund of the Autonomous Province of Bolzano, Investment for Growth and Employment FESR 2014-2020.

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1 Introduction

Through the fourth industrial revolution, the world is entering an era where millions of items are able to collect, communicate and share information through the network. The *Internet of Things* (IoT) is placed in this context, representing one of the technologies that will have major implications in the near future. With the IoT, physical and virtual objects can be linked to other objects and the Internet, creating relationships between things and humans. The IoT can combine the physical and virtual world creating smart environments, able to perceive, analyse and adapt to multiple applications and users. Since 1999, the year in which the term was used for the first time by Kevin Ashton, co-founder and director of a research consortium based at the Massachusetts Institute of Technology, the IoT trend has grown a lot. An indicator of this is the number of mobile objects connected, which, thanks to the Internet have seen an exponential increase. In 2018 there were 7 billion objects connected to the Internet [1]. For the year 2020 the number of mobile objects connected through the IoT is expected amount to 50 billion [2]. Other estimates are 14 billion objects connected by the end of 2019 and over 25 billion by the end of 2021 [3]. According to a study by the European Commission, the market value of the IoT in Europe is expected to exceed a trillion euros for 2020 [4]. The IoT Growth was also favoured by the reduction in the cost of sensors over the last 5 years, which is around 30 -70%, as well as by the wide availability of low-cost sensors that lend themselves to multiple uses. Relying on existing communications technologies like the Internet, the IoT allows people and objects to interconnect in different private, public and industrial contexts by facilitating the exchange of information and facilitating decision making in real time. In this way, the objects are capable of interacting with the surrounding environment, gathering data and informing the user about the state, and to the changes that the object detects in the real world. These opportunities represent a real step towards the digitization of many aspects of society, economy, the environment, public administration and industry.

The progress of the *Internet of Things* in Europe

Internet of Things (IoT) is the next internet-driven economic and social innovation. Through the IoT, any physical object (such as a thermostat or a bicycle helmet) and virtual (i.e. a representation of a real object in a computer system) can be connected to other objects and the Internet, creating relationships between things and humans. The IoT can combine the physical and virtual world in an intelligent environment that perceives, analyses and adapts, making the lives of millions of people easier, safer, and more efficient. The strategy for the European Digital Single Market stresses the need to avoid fragmentation by promoting interoperability so that the Internet of things can express its potential at the highest level [5].

In Europe, many countries have implemented programs and initiatives that aim to promote the dissemination of a series of enabling technologies for the industry 4.0, which constitute the foundation of the fourth industrial revolution. Enabling technologies for the industry 4.0 include several technologies, including the IoT. In Italy, in September 2016, the Ministry for Economic Development drew up the National Industry 4.0 Plan, which includes a series of specific actions in favour of business digital processing, including reference to the Industrial Internet of Things (IIoT), or the set of specific IoT applications in the context of production process management. The potential of the IoT is of increasing importance in various sectors, both in the production of goods and in the production of services, as this technology is included within the set of enabling technologies that formally establish the transition to the industry 4.0 technological model. In manufacturing the paradigm to which reference is made is that of **Smart Manufacturing**, in which the IoT can be seen as an innovative tool for increasing the efficiency of production processes and traceability in real time of production assets. However, the IoT will not only help to improve the manufacturing industry, by

monitoring the most precise and reliable manufacturing processes, but will also allow the emergence of new business models, which will be based on the use of large amounts of data, collected from sensors.

The ability to connect the real world to the internet will have implications that will involve, in addition to manufacturing, more strategic sectors of South Tyrol such as agriculture, trade, construction, mobility, public administration, health and tourism. In the previous *Smart Specialization Strategy for the Autonomous Province of Bolzano Bolzano-Alto* [6] the concept of IoT was already being cited as promising in relation to innovation in the area of specialization of creative industries. In these terms, the benefits of creating a link between the electronic and the real world had already been recognised. "In conferring electronic identity to things and places through the physical environment, e.g. through the use of distributed devices such as sensors and/or radio frequency tags (RFID), you can collect data and communicate information over the network, making them accessible and usable by any user "[4]. In this way it was hoped for the development of applications, infrastructure, services and content, mainly ICT-based technologies, acquisition, monitoring, conservation, development and use e.g. the historical, artistic and cultural heritage of 'South Tyrol through the IoT concepts.

In recent years, technological progress has greatly expanded the areas of the IoT application, providing numerous opportunities for developing new products, services and innovative business models that could also benefit the South Tyrolean economy. Relevant applications that are deemed to have positive effects on the territory of South Tyrol also concern the field of **Smart Cities**, in which case the IoT allows people to relate with the infrastructure and services to citizens, in a simple and immediate way. The objects in the case of smart cities could be traffic lights, vehicles, buildings, and monuments that are able to communicate information to users, thanks to sensors that continuously collect data, then transmit to a central network, which processes and connects them. Smart Cities are one of the most relevant areas for the IoT. According to some observers, more than a fifth of all IoT projects announced publicly relate to the theme of Smart Cities [1]. The IoT applied, specifically, to the field of **Public administration** also opens a number of scenarios for improving the relationship between institutions and citizens. Even the theme of mobility is strongly influenced by this technological trend. In this scenario observers talk about **Smart Mobility**, i.e. the set of dynamics caused, for example, by the connection of tracking systems for public transport and infrastructure, allowing various stakeholders to know various information, such as the location of the means, the state of the roads or the vehicle operating state, in real time. The Internet of Things also finds room in the field of **tourism**, a particularly important economic sector for South Tyrol. Monuments or places of interest can be equipped with radio transmitters, which allow the user to receive information about the object on his *smartphone*. One of the most promising sectors for development for the *IoT* regards **Health and Welfare**. Through sensors that monitor parameters such as blood pressure or the level of sugar in the blood, the health of a patient can be monitored remotely in real time. A central computer could not only collect data, but could also analyse and predict the onset of certain diseases promptly notifying the user and the medical staff. Also, the way in which it interacts with buildings and with people's homes has the potential to be revolutionized by the IoT. In this context, the IoT is an enabling technology leading to **home automation**, allowing people to save time and improve the quality of their lives by digitally managing many features and home devices. The relating concept of the **Smart Home** will continue to be one of the main areas of the IoT application, as evidenced by the high volume of sales of dedicated devices globally. The potential of the IoT can be extended to encourage innovation in the **agricultural and environmental sector** with applications which support the concept of **Smart Agriculture**. In this sector there is a great potential deriving from the systematic analysis of data that are generated by agricultural activities in support of decision making. The information derived from the data may help improve the sustainability of business through the optimization of production processes and the use of a targeted use of raw materials in the supply chain.

The transformation of Big Data in Smart Data

Through the Internet of Things (IoT) objects are connected and continuously collect data that are brought to a central system that will analyse, process and share them, so the real and virtual worlds converge in what is called an intelligent world. These items not only collect data, but they can communicate with each other in order to make decisions based on the data collected through algorithms. The huge amount of collected data (Big Data) does not hold any meaning until it is read and transformed into information by a central computer, which assigns, via specific analysis, meaning to the data read by the sensors, giving life to what are defined as **Smart Data**.

Accessibility in terms of cost and availability of the IoT technologies also allows Small and Medium Enterprises (SMEs) to ride the wave of this technological trend. SMEs account for 99% of all businesses in European countries, and a key element in the economic and productive fabric of South Tyrol. Despite the huge potential the IoT presents, numerous studies report that SMEs are still very cautious about the introduction of new technologies in their production structure. This is due to the relatively lower investment level in new technologies compared to large companies, as well as lack of knowledge about the opportunities and risks of Industry 4.0 Key Enabling Technology for their business. Moreover, the fact that there are still no standards and specific rules for the use does not favour a rapid deployment of the IoT in all the above areas. Against this background, both SMEs and start-ups have a real possibility to seize the opportunities presented by the IoT, because their flexibility allows them to radically change their marketing strategy and their organizational structure. Scientific literature devotes much space to the implementation of Industry 4.0 technologies in SMEs. The research focuses on the development of methodologies and tools that enable knowledge transfer to SMEs to develop new solutions for specific contexts (use-case), services and business models that allow the connection of elements of the virtual and digital world.

For versatility of the use of the IoT, the European Commission considers this technology to be the next significant economic and social innovation permitted by the internet, stressing the need to avoid fragmentation by promoting interoperability so that the Internet of things can express potential at the highest level. The development of this trend also contributed to the emergence of several topics of discussion that relate to security, privacy and ownership of data collected. The progress of the debate related to these issues requires careful consideration, including thorough targeted research activities, that encourage responsible, safe and effective use of this technology to support the competitiveness of the territory. The emergence of this technology will also depend on local and international policies which support the IoT spread in SMEs, which represent the majority of companies in South Tyrol. SMEs, like other players in the area interested in exploiting the potential of the IoT, should be able to rely on instruments aimed at creating strategic partnerships between companies and research centres, that promote the transfer of highly technical knowledge and know-how for introduction in the market of new products, services and business models. The European Union recognises the importance of targeted IoT research and testing to support the development and adoption of such a strategically important technology. For the 2014-2021 period, under the European research and innovation program Horizon 2020 [7], the EU will invest nearly 500 million euros in research, innovation and diffusion of the IoT, trying to overcome the possible technological barriers and regulatory and market conditions that could hinder the spread.

2 The potential of IoT businesses in South Tyrol

2.1 Aims of the survey

This chapter summarizes the main results of the analyses aimed at quantifying the number of local stakeholders that can directly or indirectly benefit from the development of projects in the IoT context and analyse their distribution by sector and area of knowledge. The systematic collection of companies and other types of stakeholders (see 2.3 Methodological note) will allow us to define the characteristics of the IoT network as well as the main sectors and areas of strategic knowledge for the development of innovative local projects.

2.2 The IoT community in South Tyrol

The study shows the presence of a network composed of many stakeholders classified as companies, start-ups and research centres, active in different sectors and areas of strategic application for the territory. Figure 1 illustrates the distribution of stakeholders by sector and scope of application at a local level.

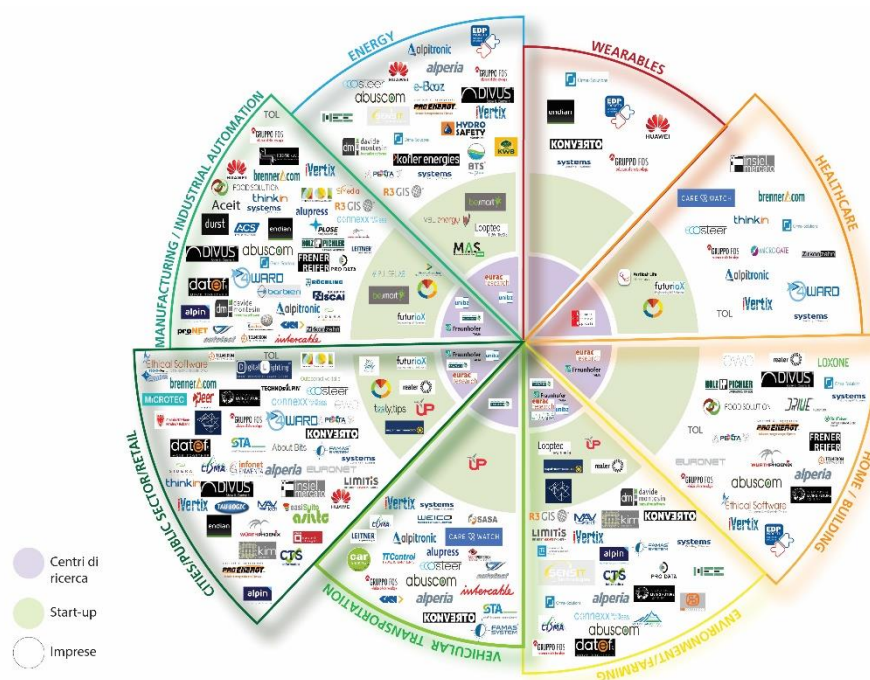


Figure 1: Stakeholder IoT network in South Tyrol

The analysis indicates that the majority of stakeholders in the area in relation to the IoT field is primarily active in the manufacturing sector and in the application areas related to the Smart Cities theme. Further sectors characterized by the presence of numerous stakeholders concern agriculture and the environment, Smart Home and construction, and energy and mobility. The sectors in which a relatively low level of participation is found include healthcare and wearables (Figure 2).

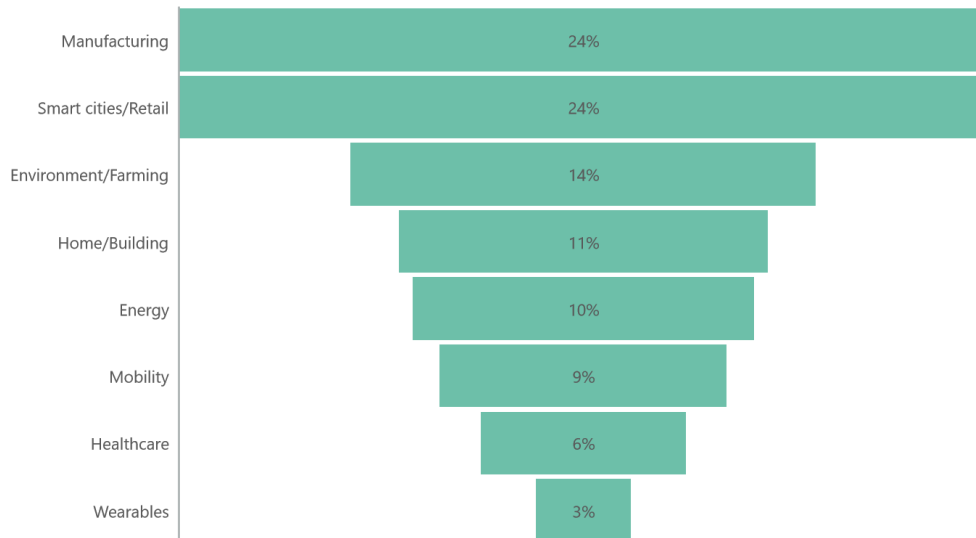


Figure 2: Relative Distribution of stakeholders by sector

The majority of stakeholders (Figure 3) operate in the Business to Business (B2B) market, while a limited number of companies (13) say they work well in the Business to Consumer market (B2C), for this reason only the percentage and not the absolute value of the stakeholders divided by market type was reported.

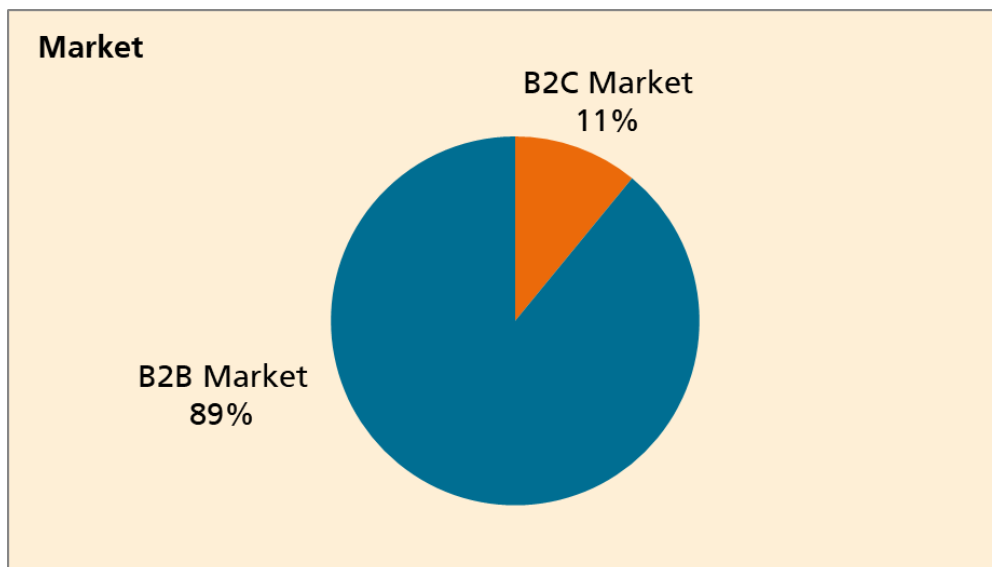


Figure 3: B2B Stakeholders vs. B2C

Further analysis showed that the players involved in IoT, work mainly in products and services in the field of software engineering. Within these categories, the stakeholders are mainly operative in the creation of infrastructure, sensors, interoperability and communication (Figure 4).

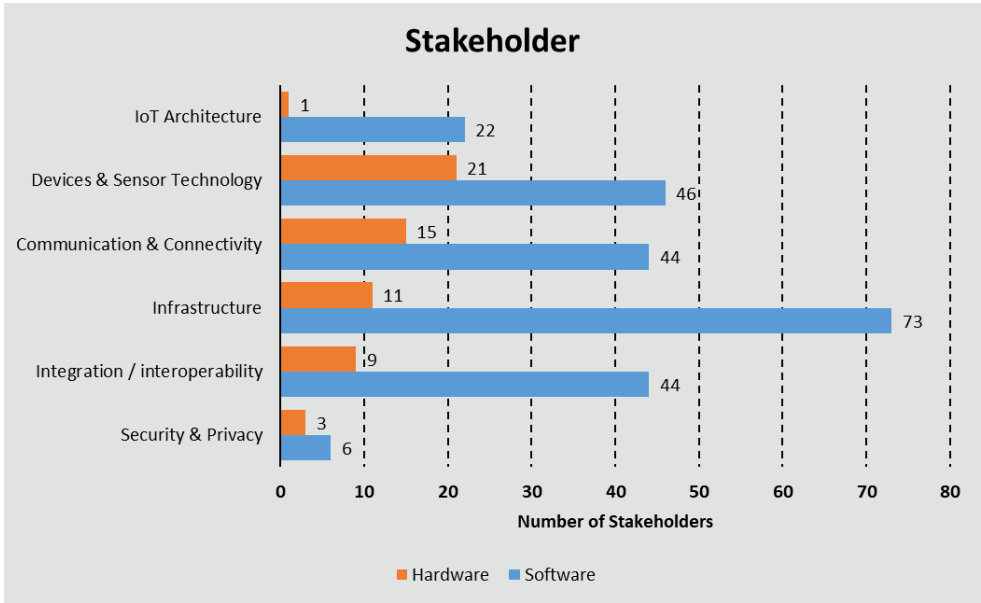


Figure 4: Hardware and software environment applications

More in-depth analysis indicated the areas in which certain types of *stakeholders* (e.g. companies, start-ups and research centres) are active. The analysis shows that there is a clear difference between the different categories of *stakeholders*. While *start-ups* tend to attest under Smart-Cities and trade (Figure 5), businesses are better represented in the manufacturing sector (

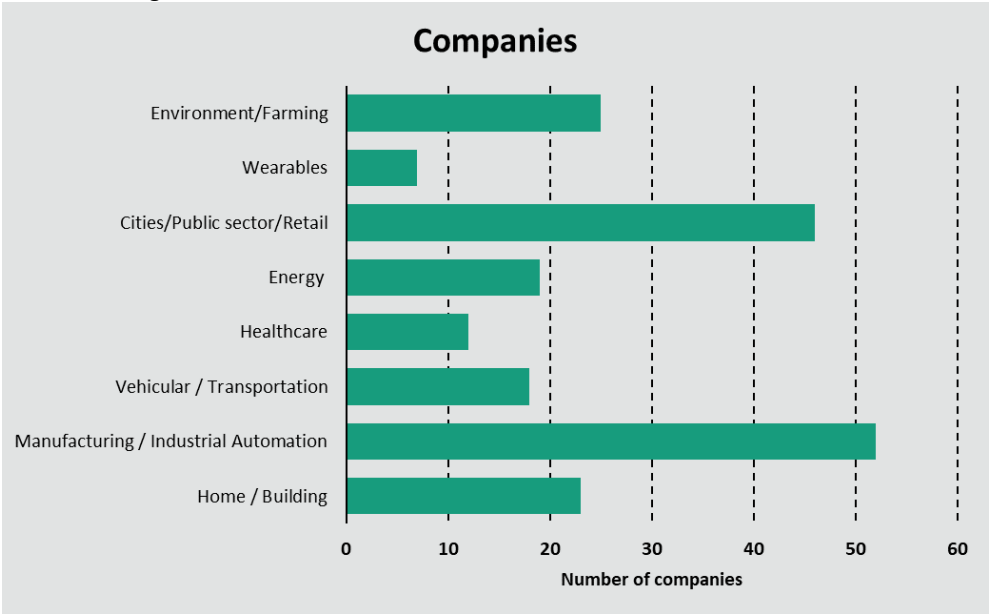


Figure 6). The sectoral division of research centres is more distributed with a greater number of subjects in the environmental/agricultural, manufacturing and *Smart Cities* areas (Figure 7).

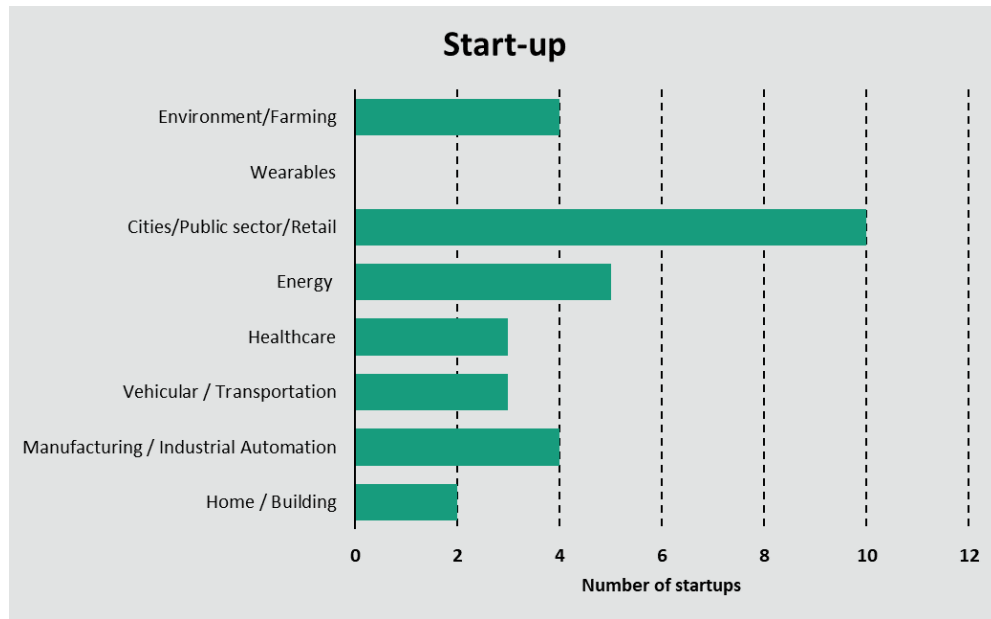


Figure 5: Startup sectors

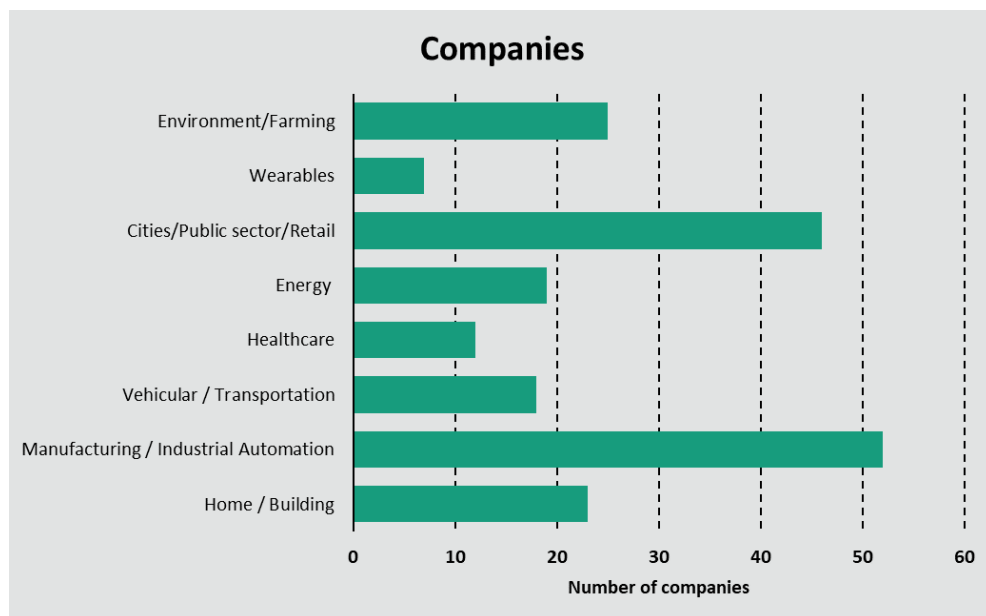


Figure 6: Company sectors

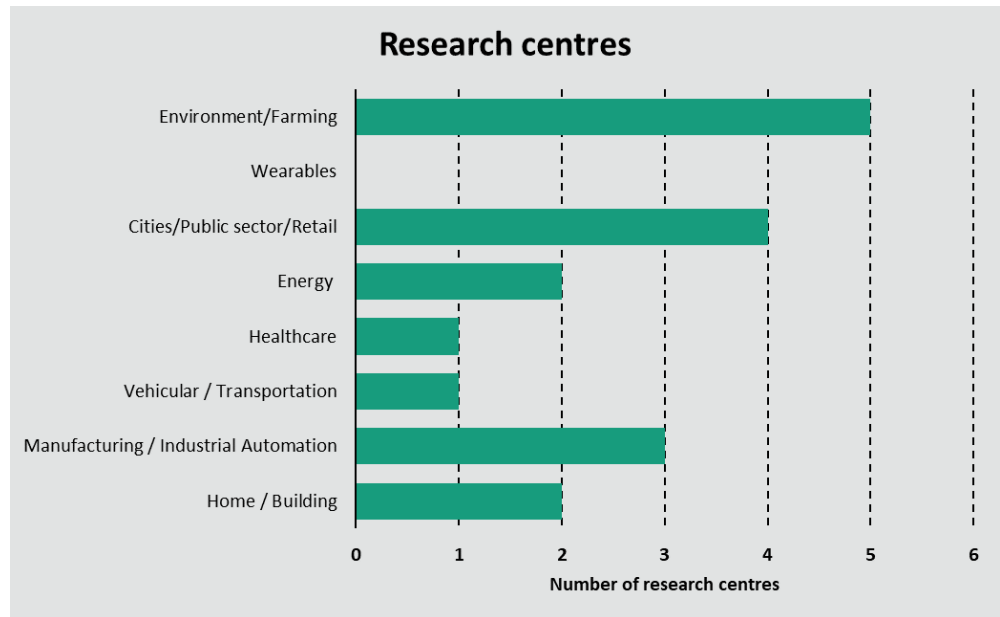


Figure 7: Areas of research centres

The same type of analysis was performed on areas of IoT application. The results show that start-up (Figure 8) and enterprises (Figure 9) are involved relatively more on the aspects related to infrastructure than research centres (Figure 10).

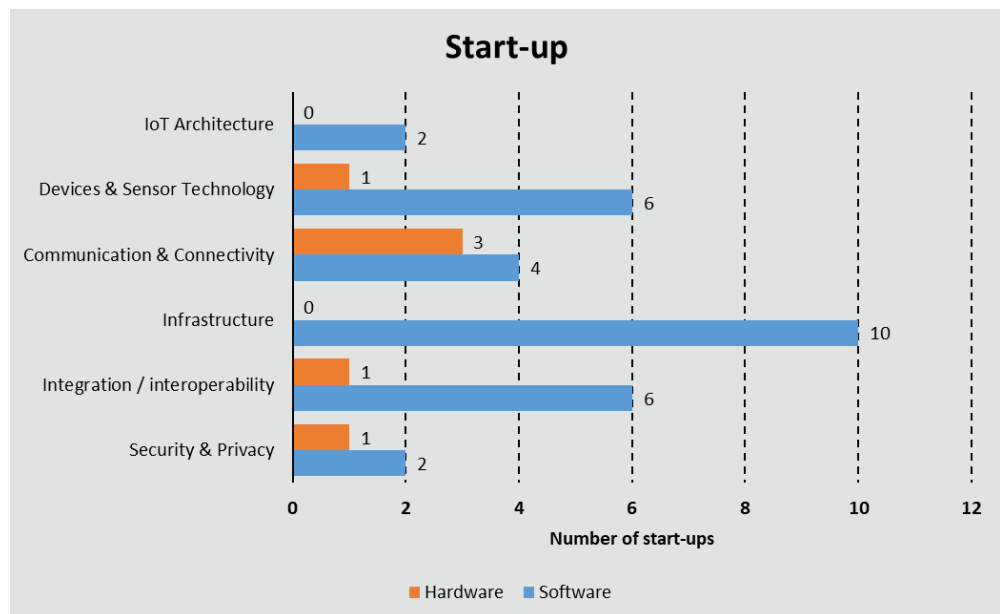


Figure 8: Areas of application start-up

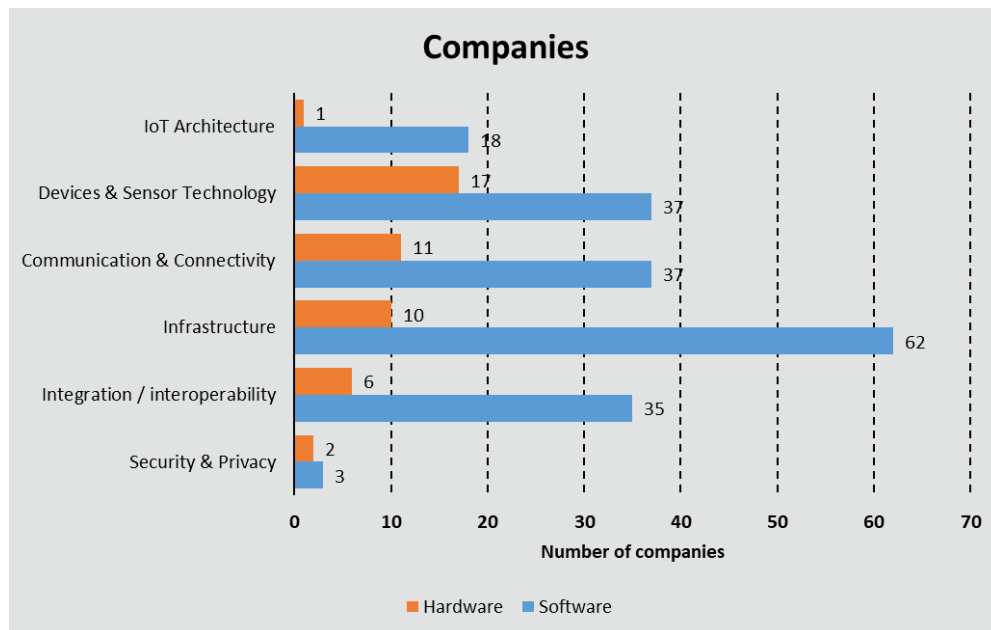


Figure 9: Areas of application companies

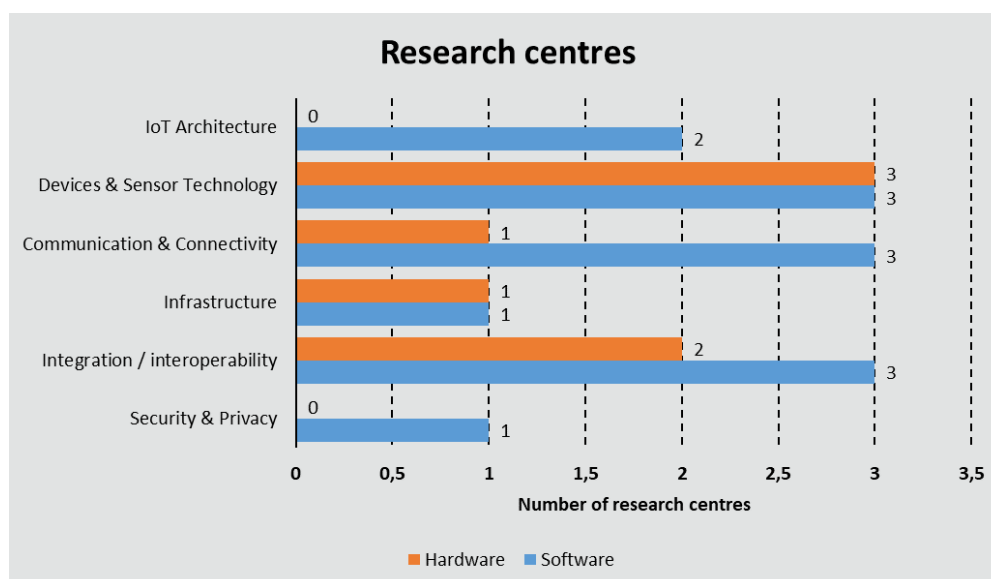


Figure 10: Areas of application of research centres

Further analyses enabled to establish a first classification of companies according to the sector and the area of specialization in terms of market positioning (B2B and B2C), application development (Service & App), and infrastructure supply (Connectivity).

Figure 11 shows the distribution of companies identified as potentially benefiting from IoT technologies, related to the type of applications they offer and market positioning.

Specifically, the lower horizontal axis of the matrix represents the type of market, the vertical axis the orientation to hardware or software solutions, while the upper horizontal axis includes the set of technologies, solutions and applications that the company offers. For a correct reading of the graph it should be noted that the right part of the graph indicates the presence of the company in the B2B market and the left-hand part B2C. Following the same logic, the quadrants at the bottom identify the offer of software solutions, while above are the offers of products/services in the hardware field. The combination of these dimensions

with the columns relating to technologies/solutions/applications allows the identification of the specific positioning of each company.

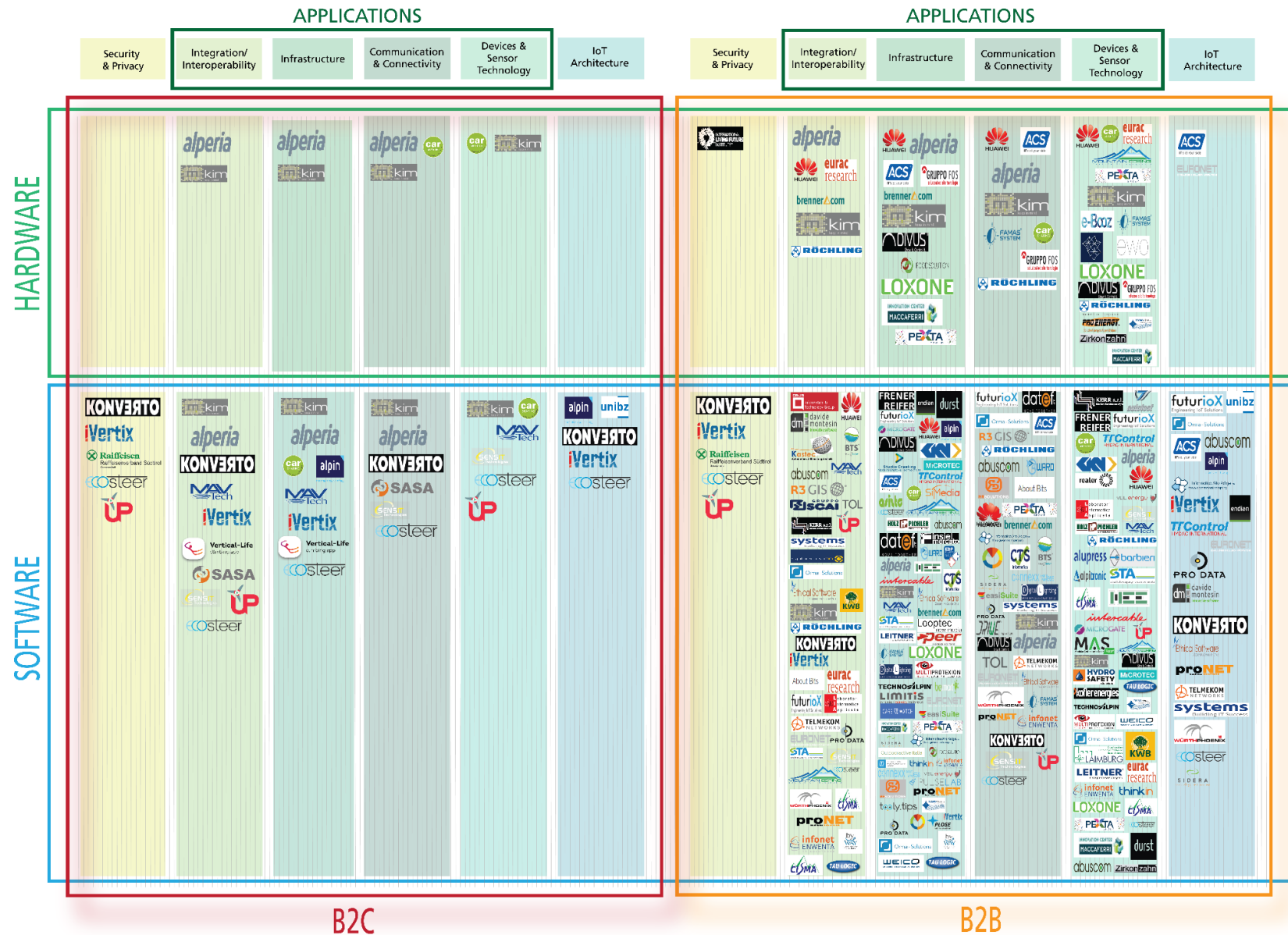


Figure 11 Applications and market positioning

2.3 Methodological note

With regard to the collection of companies that can benefit at a local level from the introduction of innovative IoT services - either directly or indirectly - the methodology used has taken into account several aspects. As a first filter, the ATECO sectors relating to the so-called Knowledge Intensive Business Services (KIBS) were considered, within which the existence of the largest number of operating and/or potential companies benefiting from IoT technologies, products and services is presumed. Table 1 below summarizes the main ATECO sectors identified by the European Monitoring Centre on Change (EMCC) in terms of KIBS.

ICT
62 PRODUCTION OF SOFTWARE, CONSULTING AND RELATED ACTIVITIES
63 INFORMATION ACTIVITIES AND OTHER INFORMATION SERVICES
Research and development
72 SCIENTIFIC RESEARCH AND DEVELOPMENT
Planning and design
71 ACTIVITIES OF ARCHITECTURAL AND ENGINEERING STUDIES, TESTS AND TECHNICAL ANALYSIS
74 OTHER PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES
Communication, research and marketing
73 ADVERTISING AND MARKET RESEARCH
business Consultancy
69 LEGAL AND ACCOUNTING ACTIVITIES
70 BUSINESS MANAGEMENT AND MANAGEMENT CONSULTING ACTIVITIES
78 RESEARCH, SELECTION, PROVISION OF PERSONNEL ACTIVITIES

Table 1 KIBS Classification according to ATECO classification

The attempt to propose a classification of the KIBS and to identify the relevant sectors on the basis of the ATECO codes may involve a complex process, as knowledge is a difficult concept to frame within commodity matrix cataloguing [5]. For the purposes of this study, the search for companies was aimed at the ATECO sectors pertaining to KIBS in the ICT field, included in ATECO sectors 62 and 63, of which the composition is reported in terms of number of companies in Alto Adige (Table 2).

KIBS ICT Sector ATECO	# companies
62 Production of software, consultancy and related activities	768
63 \operations by intelligence services and other computer services	485
Total	1,253

Table 2 Local companies in the ATECO 62-63 sectors

Subsequently, all the companies that carried out research and development projects, funded by Provincial Law 14 (LP 14/2006), were also included. In order to have a complete list of all the players who work or who might have an interest in working in the IoT environment, companies that are part of the *Automotive Excellence Südtirol* network, as well as companies and start-ups pertaining to the topic established at NOI Techpark. Figure 12 represents the criteria used for the selection of companies that can benefit directly or indirectly from IoT projects at a local level.



Figure 12: Selection criteria for companies

The companies in the analysed ATECO sectors are mainly active in the production of software, IT consultancy and related activities, as well as information services and other IT services. Online research has enabled the gathering of companies that have carried out research and development projects within the Provincial Law 14/2006 (LP 14/2006) as well as the players of NOI Techpark and the *Automotive Excellence Südtirol* network. Finally, the research involved the gathering of additional stakeholders that could benefit - both directly and indirectly - from the creation of an IoT themed community to facilitate its adoption, as well as the transfer and strengthening of technical skills at a local level.

Subsequently a search was carried out starting from the websites of each company, to allow the correct definition of the sectors and fields of work. This research was carried out using the categorization defined by AIOTI (Alliance for Internet of Things Innovation) as a basis within the report "IoT LSP Standard Framework Concepts" [6] which identifies the following areas of application for this technology:

- Home/Building
- Manufacturing/Industrial Automation
- Vehicle/Transportation
- Healthcare
- Energy
- Wearables
- Environment / Farming

Finally, a questionnaire was developed and sent to the companies identified within the network to verify the correctness of the information entered. The questionnaire was made accessible from 03/06/2019 to 17/06/2019. The questionnaire is structured as shown in Figure 13.






Azienda	Logo	Home / Building	Manufacturing / Industrial Automation	Vehicular / Transportation	Healthcare	Energy	Cities/Public sector/Retail	Wearables	Environment/Farming	Indicare progetti nei settori selezionati
1006L ORG	N/A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4WARD S.R.L.		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
About Bits	About Bits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ABUSCOM - SRL		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Aceit	N/A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ACS DATA SYSTEMS S.P.A.		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Alperia-Smart Region		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
ALPIN		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 13: Sector Questionnaire and application areas

Attached to the questionnaire, instructions had been prepared to facilitate compilation. The following tables show the descriptions of the categories used for the questionnaire. The different groups are explained in detail, to allow the user in charge of completing the questionnaire to have a clear idea of the sectors in which to position their company. Table 3 provides a definition of the reference market in which companies operate. Next, Table 4 and Table 5 provide a definition of the various areas of work in the hardware and software categories

Category	Definition
B2C Market	Sale of products or services directly to the consumer
B2B Market	Product sales and services between companies

Table 3: Instructions for filling in the relevant market

Table 4: Software development and optimization within IoT

SOFTWARE		Software development and optimization within IoT	
Application		Description	
Security & Privacy		Includes data security and privacy	
Application		<i>Integration/interoperability:</i> includes supply/development of IoT features that allow the IoT system related to the design, implementation and management of customized computational platforms to support IoT based applications	
HARDWARE		Hardware Development and optimization within IoT	
Application		Description	
Category		Definition	
Hardware Connectivity)		Development and optimization of hardware within IoT	
Security & Privacy		includes data security and privacy <i>Integration/Interoperability:</i> includes supply/development of specific interfaces for the integration and management of IoT communication protocols	
Application		<i>Device and sensors technology:</i> includes operating systems, IoT platforms configuration management and virtualization of the sensory part of the system <i>Infrastructure:</i> network technologies for the transmission of data (e.g. optic fibre)	
IoT architecture		<i>Communication and data system:</i> includes the definition of the technical specifications of the IoT system, including the architecture descriptions of the architecture (software) design and development of technologies and devices e.g. sensors	
IoT architecture		It includes the definition of the technical specifications of the IoT system, including the architecture descriptions. (hardware)	

Table 5: Hardware Development and optimization within IoT

The survey considered, in terms of stakeholders, not only businesses, but also public authorities, research organizations and any other type of body within the province which proves active or potentially akin to the IoT industry.

3 IoT projects in EU funding programs

The analysis of initiatives and projects active in South Tyrol in the IoT sector involved the systematic collection of projects co-funded by the European Commission in a number of significant funding programs for the area at different levels, by expanding the search from the local level (eg ERDF) to the international level (eg H2020). The presentation of these projects provides an overview of the thematic areas and the contents subject of research and development, to be considered to establish synergies for any possible future research developments in the area. Before analysing the results of specific projects, a preliminary research was carried out, aimed at identifying EU funding programs potentially relevant to the issues of the IoT area. This operation made it possible to address the search for projects in this area in a more targeted manner. Table 5 summarizes the number of IoT related projects within local and European funding programs. The Interreg ADRION and Interreg Central Europe programs are not shown in the table, since no specific project was found within these funding programs that related to applications in the IoT field relevant to the purpose of the present research.

Programs	Level	Project selection
ERDF Autonomous Province of Bolzano	Regional	12
Interreg Italy-Austria	Transnational	1
Interreg Alpine Space	Transnational	1
Horizon 2020	International	49
Europe Interreg	International	1
LIFE	International	3
Chist-era	International	6
Other programs	International	10
Total		83

Table 6: Overview EU programs in the IoT area

Preliminary research has allowed us to identify general thematic areas in which projects and initiatives in the IoT area have been developed. This reference made it possible to classify the various projects by macro-theme, providing useful information to determine which thematic areas are mostly dealt with in the respective EU Financing Programs. Subsequent analyses at program and comparison level will use this information, also combining more specific elements related to the type of activity performed, showing the main evidences that derive from it.







Topics	Description
 Innovation	Projects whose aim is to encourage networking and knowledge transfer to the players of a territory (e.g. PA, companies) on the potential and use of IoT technologies and systems, as well as coaching services on the subject of digital transformation to different stakeholders in the territory.
 Health and wellness	Using IoT technologies in health. Harnessing technology to improve the control of our health
 ICT-Automation	Projects concerning the development and construction of hardware or high-tech software within IoT.
 Energy and environment	Projects that aim to use and develop a technology to reduce environmental impact
 Buildings	Projects that aim to use and develop a technology to improve construction processes from the design to the construction and maintenance of the building.
 Agriculture	Projects that want to introduce and innovate the agriculture sector, introducing new technologies and changing the way in which certain things are done

Table 7: Topic description






3.1 European Regional Development Fund






The first sample of projects related to the IoT analysed regarding the European Fund for Regional Development of the Autonomous Province of Bolzano, following an analysis logic that starts at a local level, to widen the analysis according to the extension of the areas of cooperation. This research includes projects completed or underway during the 2007-2013 and 2014-2020 funding period.

Project Sheet	
OPENIoT4SmartCities	
Project Name	OPENIoT4SmartCities
Topics	
Description	The project stems from the desire to exploit the possibilities offered by emerging infrastructure in the IoT sector, to respond to the modern needs of urban areas, applying new technologies to serve the city.
Impact	The design and development of a digital platform based on the IoT for Smart Cities, designed to encourage the integration of new services for and with citizens, businesses, tourists and public administrations.
Web	http://www.openiot4smartcities.com/
Funding Program	
Budget	EUR 403,178.97
Duration (months)	20
Lead Partner	Systems GmbH (Private Company)
Partner	Fraunhofer Italy (Research Center)

Project Sheet	BEACON
Project Name	Beacon South Tyrol
Topics	
Description	Through the installation of 3,500 beacons across the South Tyrolean territory and an IoT network, the project aims at creating a favourable environment for the development of innovative ideas, new projects and ideas.
Impact	Creating an IoT community in South Tyrol
Web	https://beacon.bz.it/
Funding Program	    
Budget	EUR 545,300.00
Duration (months)	14
Lead Partner	Department 9 Computing (Public Administration)
Partner	NOI SPA

Project Sheet	MESTECH
Project Name	Merano Smart Tech Community
Topics	
Description	The aims to develop an ecosystem conducive to entrepreneurial development and innovation, sustainable over time and fertile for the creation of new innovative high-tech entrepreneurship in the areas of excellence identified in the framework of the thematic strategy S3 "Energy and Environment".
Impact	Creating a Smart Tech Community, a community of companies constantly focused on innovation technological and social.
Web	http://www.mestech.it/
Funding Program	
Budget	EUR 602,000
Duration (months)	24
Lead Partner	City of Merano (Public Administration)
Partner	Coworking Space Startbase Merano (Private Company)


Project Sheet	Da Vinci
Project Name	Digital Services for Creative and Innovative Companies
Topics	
Description	The DAVINCI project aims to increase the competitive potential of businesses by improving the supply of tools and services for digital innovation. The specific focus of the project covers Big Data, Open Technologies, Creative Industry, and Industry 4.0 Digital Manufacturing.
Impact	Growth of the competitive potential of local businesses and improving equipment and services through the development of digitization.
Web	https://davinci.bz.it/
Funding Program	    
Budget	EUR € 588,900.00
Duration (months)	36
Lead Partner	NOI Spa (Private Company)
Partner	---

Project Sheet	Smart Land
Project Name	Smart Land Südtirol
Topics	
Description	Technological innovation breaks even in the world of agriculture. With sensors and digital infrastructure, it is possible for farmers to talk to their plants and with their customers, in addition to having all the activities of their farm on a tablet.
Impact	The Smart Land project allows you to combine innovation and tradition while respecting the rules of good farming. Sustainability in agriculture is no longer a difficult goal to achieve, but a daily conquest.
Web	www.alperia.eu
Funding Program	   
Budget	EUR 670,280.96
Duration (months)	20
Lead Partner	Alperia Fiber GmbH (Private Company)
Partner	

Project Sheet	PV4.0
Project Name	Using logical Industry 4.0 and the Internet of Things in the photovoltaic sector
Topics	
Description	Each photovoltaic system is composed of numerous components - photovoltaic modules, the various cables, the inverter or the heart of the plant itself - keeping them monitored and making this data easily accessible would allow the management and maintenance of the plants to be optimized, whether it is residential or large plant installations.
Impact	Maintenance of a PV system via tablet. All collected data will be entered into a computer-based platform on the IoT.
Web	www.eurac.edu
Funding Program	
Budget	EUR 550,050.45
Duration (months)	Not available
Lead Partner	EURAC Research (Research Center)
Partner	Saidea (Private Company) OET (Private Company) Elpo (Private Company) PVEnergy (Private Company) BayWa re Italy (Private Company) Huawei (Private Company) Viridis Energy (Private Company)

Project Sheet		KlimaKit
Project Name	Encourage the energy recovery sector in South Tyrol to change.	
Topics		
Description	The project aims to support the construction and energy sector in South Tyrol, offering integrated solutions for the energy recovery of residential buildings, encouraging local political players to change the current legal framework and guide users to achieving a good level of indoor air quality.	
Impact	New business models for the building and energy sectors in South Tyrol.	
Web	https://www.klimakit.it	
Funding Program		
Budget	EUR 545,300.00	
Duration (months)	36	
Lead Partner	Fraunhofer Italy (Research Center)	
Partner	Eurac Research (Research Center)	
Observer	Istituto Provinciale Edilizia Sociale della Provincia Autonoma di Bolzano (IPES)	

Project Sheet	MAKERSPACE
Project Name	Makerspace
Topics	
Description	The aim of the project is to expand the NOI Techpark laboratory with new technologies for prototyping, new software and professional machines for processing different materials in order to make it more attractive and create a "Makerspace for the NOI Techpark".
Impact	The creation of an infrastructure for private, start-ups and small and medium-sized enterprises.
Web	http://www.openiot4smartcities.com/
Funding Program	
Budget	EUR 691,983.81
Duration (months)	25
Lead Partner	BLS - Business Location Südtirol Alto Adige (Private Company).
Partner	

Project Sheet	Senslab
Project Name	Senslab
Topics	
Description	The purpose of the project is the realization of a laboratory focused on the fabrication and characterization of physical sensors, chemical and biological environment monitoring for the environment.
Impact	Use of sensors in precision farming, health monitoring and production processes.
Web	https://oldweb.noi.bz.it/it/een-eu-projects/senslab
Funding Program	
Budget	EUR 493,974.78
Duration (months)	24
Lead Partner	Free University of Bolzano (University)
Partner	NOI SPA (Private Company)



Project Sheet	Green Mobility of the Future
Project Name	The Green Mobility of the Future
Topics	
Description	The project's main objective is to propose and embed a new culture of sustainable mobility, based on the concepts of multi- and co-modality, of connected, informed and aware mobility.
Impact	Use of ICT technologies for bike and car sharing and real-time ride sharing.
Web	https://www.idm-suedtirol.com/it/progetti-eu/energy-environment/58-green-mobility-of-the-future.html
Funding Program	
Budget	EUR 210,980.00
Duration (months)	27
Lead Partner	IDM Südtirol (Private Company)
Partner	

Project Sheet	
RWIS South Tyrolean Initiative	
Project Name	RWIS South Tyrolean Initiative
Topics	
Description	The project aims to explore the new potential offered by the RWIS systems, and to propose them to the advantage and in function of the alpine context in which the provincial territory is located.
Impact	Creation of scalable, non-invasive and integrated solutions with respect to different systems and technologies for detecting traffic and meteorological data.
Web	https://www.idm-suedtirol.com/it/progetti-eu/energy-environment/21-rwis-south-tyrolean-initiative.html
Funding Program	   
Budget	EUR 691,983.81
Duration (months)	18
Lead Partner	Famas System Spa (Private Company)
Partner	IDM Südtirol (Private Company)

Project Sheet	Bolzano Traffic
Project Name	Bolzano Traffic
Topics	
Description	The project aims to improve traffic flow and mobility management in the city of Bolzano compared to external connections with the rest of the Province and with extra-provincial areas.
Impact	Creating an accessible web platform to provide travellers with highway information highway in real time.
Web	https://www.idm-suedtirol.com/it/progetti-eu/energy-environment/11-bolzano-traffic.html
Funding Program	
Budget	Not available
Duration (months)	24
Lead Partner	City of Bolzano (Public Administration)
Partner	IDM Südtirol (Private Company)

Within the ERDF funding program of the Autonomous Province of Bolzano, most of the projects are related to the innovation category. In Alto Adige, the IoT projects focus mostly on the creation of a community that allows them to take advantage of the collaboration of different stakeholders. To do this, some of these projects aim at building real infrastructures in the form of laboratories that are accessible to the whole community. A particularly important theme in South Tyrol is that of energy efficiency, this is also reflected in the projects financed by the ERDF. Some projects propose the use of IoT technologies to improve monitoring and consequently the energy efficiency of buildings.

3.2 Horizon 2020



Project Sheet	VICINITY
Project Name	Open virtual neighbourhood networks to connect intelligent buildings and smart objects
Topics	
Description	The objective of the project is to develop an ecosystem composed of compatible IoT infrastructures, called "Virtual Neighborhood". An ecosystem in which users can share access to their smart objects without losing control.
Impact	Creating a platform compatible with different standards.
Web	https://vicinity2020.eu/vicinity/
Funding Program	
Budget	EUR 7,499,007.50
Duration (months)	48
Lead Partner	Technische Universität Kaiserslautern (University)
Partner	Atos Spain (Private Company) Ethniko Kentro Erevnas Kai Technologikis Anaptixis (Research Institute) Aalborg University (University) Gorenje Gospodinjski Aparati Doo (Private Company) Hellenic Telecommunications Organization SA - OTE AE (Private Company) Bavenir SRO (Private Company) Climate Associates Limited (Private Company) Intersoft A.S. (Private Company) Universidad Politecnica de Madrid (University) GNOMON Informatics SA (Private Company) Tiny Mesh AS (Private Company) Hafenstorm AS (Private Company) Enercoutim – Associacao Empresarialde Energia Solar de Alcoutim (Organisation) Dimos Pylaias Chrtiati (Private Company)

Project Sheet	AGILE
Project name	Adaptive Gateways for diverse multiple Environments
Topics	
Description	The objective of the project is to develop modular software and hardware for the IoT with support for the interoperability of protocols, data and device management, IoT applications, communication Cloud. The project also aims to test different pilot activities and the creation of an IoT community.
Impact	Development of different IoT applications
Web	agile-iot.eu
Funding Program	
Budget	EUR 6.857.550,00
Duration (months)	36
Lead Partner	Create-Net (Research centre) Fondazione Bruno Kessler (Research centre)
Partner	Atos Spain (Private company) Mobistar/Orange (Private company) Eclipse Foundation Europe (Organisation) Resin.io (Private company) Jolocom (Private company) Sky-Watch (Private company) BioAssist (Private company) Startupbootcamp Spain Eurotech (Private company) Libelium (Private company) IoTango (Private company) INRIA (Research institute) iMinds (Private company) University of Passau (University) Graz University of Technology (University)

Project Sheet		symbloTe
Project name	Symbiosis of smart objects across IoT environments	
Topics		
Description	The purpose of symbloTe is to create different solutions for the integration of different IoT domains. 5 use cases will be created in order to verify the validity of the idea in smart space models.	
Impact	Allowing the creation of new business models based on the IoT.	
Web	https://www.symbiote-h2020.eu/	
Funding Program		
Budget	EUR 7.104.827,50	
Duration (months)	36	
Lead Partner	Intracom SA Telecom Solutions (Private company)	
Partner	<p>Sveuciliste u Zagrebu Fakultet Elektrotehnike i Racunarstva (Organization)</p> <p>AIT Austrian Institute of Technology GmbH</p> <p>Nextworks (Private Company)</p> <p>National Interuniversity Consortium for Telecommunications (Organization)</p> <p>Atos Spain SA (Private Company)</p> <p>Wien University (University)</p> <p>Unidata Spa (Private Company)</p> <p>Sensing & Control Systems SL (Private Company)</p> <p>Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.v. (Research Institute)</p> <p>Ubiwhere Lda (Private Company)</p> <p>A1 Hrvatska Društvo s Organiceom</p> <p>Odgovornosci za Usluge Javnih Telekomunacija</p> <p>Instytut chemii bioorganicznej polskiej acadii nauk</p> <p>Na.Vi.Go. Consortium Limited Liability Company (Organization)</p> <p>Universität Zurich (University)</p>	



Project Sheet	TAGITSMART
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Project name	A Smart Tags driven service platform for enabling ecosystems of connected objects.
Topics	
Description	The aim of the project is to connect objects that are technologically limited and have a low economic value such as milk carton, a pack, a book or a CD. To do this, codes will be used that change according to the context in which a particular product is found.
Impact	Cconnect everyday objects through the IoT
Web	https://www.tagitsmart.eu/
Funding program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 6.870.811,25
Duration (months)	36
Lead Partner	DRUSTVO ZA KONSALTING, RAZVOJ I IMPLEMENTACIJU INFORMACIONIH I KOMUNIKACIONIH TEHNOLOGIJA DUNAVNET DOO NOVI SAD (Private company)
Partner	Fujitsu Laboratories of Europe Limited (Private company) University of Surrey (University) Teknologian tutkimuskeskus VTT Oy Evrythng Limited (Private company) University of Padua (University) UPC Konsultointi OY (Private company) Siemens srl (Private company) Thin Film Electronics AB (Private company) Unilever U.K. Central Resources Limited (Private Company) DURST Phototechnik Digital Technology GmbH (Private company) Industries du Commerce (Private company) Lmental Sostenibilitat i Futur S COOP (Private company) Univerexport Export-Import DOO NOVISAD (Private company) Resonance Design BV (Private company)



Project Sheet	SAT406M
Project name	Improved Search and Rescue with wrist-worn Personal Locator Beacons
Topics	
Description	Il progetto SAT406M, ha riprogettato i PLB (Personal Locator Beacons) in modo da essere più user friendly e compatti in modo da poter essere trasportati continuamente. L'orologio da polso integra anche servizi di collegamento (RLS, Return Link Service) SAR/Galileo
Impact	Miglioramento degli attuali sistemi di segnalazione SAR
Web	https://www.sat406.com/
Funding program	
Budget	EUR 1.426.250,00
Duration (months)	36
Lead Partner	Mobit Telecom Ltd. (Private company)
Partner	Thales Alenia Space (Private company) GeoNumerics S.L. (Private company)



Project Sheet	iKaaS
Project Name	Intelligent Knowledge-as-a-Service
Topic	
Description	The project will develop a smart and secure Smart Cities platform. It will be based on big data, specifically on a tool that will analyze all the data collected by the sensors
Impact	Making life smart in the city through the use of IoT technologies
Web	http://www.ikaas.com/
Funding program	
Budget	EUR 1.554.750,00
Duration (months)	36
Lead Partner	University of Surrey (University)
Partner	Wings ICT Solutions Information & Communication Technologies IKE (Private company) Atos Spain SA (Private company) Create-Net (Research Center) Bruno Kessler Foundation (Research Center) INNOTEC21 GmbH (Private company) Oulun Yliopisto (Private company) Empresa Municipal de Transportes de Madrid SA (Private company) Ayuntamiento de Madrid (Public Administration) Comunidad de Madrid (Public administration)



Project Sheet		BIG IoT
Project Name	Bridging the Interoperability Gap of the Internet of Things	
Topics		
Description	The aim of the project is to act as a bridge between vertically integrated IoT platforms and the creation of an IoT applications and services marketplace	
Impact	Creation of an ecosystem of applications and services based on the Internet of Things	
Web	http://big-iot.eu/	
Funding program		
Budget	EUR 7.999.882,50	
Duration (months)	36	
Lead Partner	Siemens Aktiengesellschaft (Private company)	
Partner	Technische Universität Clausthal (University) Bosch Software Innovations GmbH (Private Company) CSI Piedmont (Organization) National University of Ireland Galway (University) Universitat Politècnica de Catalunya (University) Aalborg Universitet (University) Econais Anonymi Etaireia Anaptyxis Efarmogon Asyrmaton Diktyon (Private company) Seat SA Technical Center (Private Company) Atos IT Solutions and Services GmbH (Private company) VMZ Berlin Betreibergesellschaft MbH Vodafone Italia SpA (Private company) Vodafone Omnitel B.v. (Private company) Wolfsburg AG (Private company) CSP Innovation in ICT SCARL (Research Institute)	



Project Sheet	NGIoT
Project Name	NG Internet of Things
Topics	
Description	The purpose of the project is to create an agile and robust research together with an implementation agenda that will lead to unlocking the growth potential of the Internet of Things, respecting European values
Impact	Conceptualization of a Roadmap for the Internet of Things in Europe
Web	https://cordis.europa.eu/project/rcn/218729/factsheet/en
Funding program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1.500.000,00
Duration (months)	36
Lead Partner	Aarthugs Universitet (University)
Partner	Mandate International Alias Foundation for International Cooperation (Organization) Italian Institute for Privacy (Research Institute) Martel GmbH (Private Company) Dnet Labs Doo Novi SAD (Private Company) Archimede Solutions S.a.r.l. (Private company)



Project Sheet		Teraki
Project Name	Teraki	
Topics		
Description	The purpose of Teraki is to reduce the weight of data obtained by sensors in Internet of Things applications. To do this, techniques will be used that do not require the use of external computational resources	
Impact	Innovation of data compression techniques integrated in the sensors	
Web	https://cordis.europa.eu/project/rcn/204591/factsheet/en	
Funding program		
Budget	EUR 71.429,00	
Duration (months)	6	
Lead Partner	Teraki GmbH (Private company)	
Partner		



Project Sheet	UBIGNSS
Project Name	GNSS for mass-market Internet of Things tracking applications
Topics	
Description	The project aims to encourage the use of localization systems based on the Internet of Things. To do this the company will develop a new low-cost and low-consumption GNSS-based technology
Impact	Use of a cloud platform in the field of localization systems
Web	http://ubiscale.com/
Funding program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 71.429,00
Duration (months)	6
Lead Partner	Ubiscale (Private company)
Partner	



Project Sheet		PGplant
Project Name	The Facade of Industrial Internet	
Topics		
Description	<p>Process Genius wants to offer a new approach to data visualization within the company and improve its decision-making process. The aim of the project is to develop a multi-level 3D interface that will replace the current interface of current management systems.</p>	
Impact	A 3D interface for Industrial Internet applications	
Web	https://www.processgenius.fi/	
Funding program		
Budget	EUR 71.429,00	
Duration (months)	5	
Lead Partner	Process Genius OY (Private company)	
Partner		



Project Sheet	AUTOPILOT
Project Name	AUTOMated driving Progressed by Internet of Things
Topics	
Description	AUTOPILOT has the objective of developing new services based on the Internet of Things for various automotive applications such as: self-driving vehicles, autonomous car sharing, automatic parking and dynamic maps to allow a complete autonomous driving experience
Impact	Entry of the Internet of Things in the automotive sector
Web	https://autopilot-project.eu/
Funding program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 26.550.232,50
Duration (months)	36
Lead Partner	European Road Transport Telematics Implementation Coordination Organisation - Intelligent Transport Systems & Services Europe (Organization)
Partner (selezione)	Akka Informatique et Systemes (Private company) AVR S.p.a. (Private company) Cetecom GmbH (Private company) Huawei (Private company) Vicomtech (Private company) IBM Research Zürich (Research Centre) Fiat Research Centre (Research Centre) SENSINOV (Private company) TomTom (Private company) TIM (Private company) The project consortium consists of a total of 46 partners. The complete list of partners is available within the project website.



Project Sheet		DeviceHub
Project Name	The next generation of internet of things (IoT) connectivity	
Topics		
Description	DeviceHub.net is the first free ecosystem management platform for the IoT. The project closes the gap between physical and virtual devices, making a series of very simple systems available for creating IoT solutions	
Impact	Development of an IoT platform that allows its diffusion	
Web	https://www.devicehub.net/	
Funding program		
Budget	EUR 71.429,00	
Duration (months)	4	
Lead Partner	IOT Solutions Spolka Ograniczona Odpowiedzialnoscia (Private company)	
Partner		



Project Sheet	BASTION
Project Name	The next generation of internet of thing (IoT) connectivity
Theme	
Description	The project proposes a research program that will try to use a binary analysis system to increase the security of the IoT. The project will focus on the software part, as this will allow both to analyse the potential vulnerabilities and to add features that protect the device from possible attacks
Impact	Improved security for IoT-based applications
Web	https://cordis.europa.eu/project/rcn/193687/factsheet/en
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1.472.268,75
Duration (months)	60
Lead Partner	Ruhr Universität Bochum (University)
Partner	



Project Sheet	
FITT-iN	
Project Name	Fast IoT market take up through The Things Networks
Topics	
Description	The project launched the first free IoT information network in the world, giving full coverage to the entire metropolitan area of Amsterdam
Impact	Use of an IoT network by companies and citizens
Web	https://www.thethingsnetwork.org/
Funding program	
Budget	EUR 71.429,00
Duration (months)	6
Lead Partner	The Things Industries BV (Private company)
Partner	



Project Sheet	QoSIoTSmartCities
Project Name	Quality of Service for the Internet of Things in Smart Cities via Predictive Networks
Topics	
Description	The objective of the project is to develop a predictive algorithm for the traffic generated by the IoT on the Internet, to develop a predictive algorithm for the optimization of service quality and the development of an IoT simulation network within an intelligent city
Impact	Ensuring the quality of service to the IoT in smart cities
Web	https://www.thethingsnetwork.org/
Funding Program	
Budget	EUR 145,355.52
Duration (months)	24
Lead Partner	Yasar Universitesi (University)
Partner	

Project Sheet	MONICA
Project Name	Management of Networked IoT Wearables - Very Large-Scale Demonstration of Cultural Societal Applications
Topics	
Description	The MONICA project aims to develop a large-scale demonstration of different IoT technologies for smart living. The solution will be tested in 6 European cities.
Impact	Simulation of an IoT ecosystem for smart living
Web	https://www.monica-project.eu/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 17,603,811.00
Duration (months)	24
Lead Partner	Fraunhofer Gesellschaft zur Förderung der Forschung EV angewandten (Research Institute)
Partner	Acoucite (Organization) Atos IT Solutions and Services SRO (Private Company) City of Bonn (Public Administration)



Project Sheet	UNIFY-IoT
Project Name	Supporting Internet of Things Innovation Activities on Ecosystems
Topics	
Description	The aim of the project is to stimulate collaboration between IoT projects, between potential IoT platforms and support the IoT ecosystem by focusing on complementary actions, such as stimulating the acceptance of IoT technologies as well as understanding and overcoming obstacles to the creation of value
Impact	Coordination and support for collaboration between IoT projects
Web	http://www.unify-iot.eu/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1,013,185.00
Duration (months)	24
Lead Partner	Stiftelsen Sintef (Research Institute)
Partner	Digital Catapult (Research Centre) Institut Européen des Normes de Telecommunication (Organization) Hymn STD (Private Company) Istituto Superiore Mario Boella on Information and Communication Technologies (Research Centre) Silicon Saxony Management GmbH (Private Company) Trentino Hub Innovation (Organization) The Commissariat Energie Atomique et aux Energies Alternatives (Government Agency)



Project Sheet	
PROMETHEUS-IOT	
Project Name	Versatile Platform for delivering incremental, scalable and cost-effective ad-hoc services from heterogeneous and collaborating objects in the Internet of Things
Topics	
Description	<p>Moltosenso is the first company in the IoT scene to have solved the problem of developing a highly customized monitoring system for different markets.</p> <p>The objective of the project is to develop an economic and versatile IoT platform</p>
Impact	Creation of an economic and versatile IoT platform standard
Web	https://prometheus.moltosenso.com/
Funding Program	 <div> Horizon 2020 European Union Funding for Research & Innovation </div>
Budget	EUR 71,429.00
Duration (months)	6
Lead Partner	Moltosenso Srl (Private Company)
Partner	



Project Sheet	IoTcrawler
Project Name	IoTcrawler
Topics	
Description	IoTcrawler will focus on the integration and interoperability between different IoT platforms. It will develop dynamic and reconfigurable solutions for the integration of data and services, and secure algorithms for the future development of available systems
Impact	Development of open IoT platforms and ecosystems
Web	https://cordis.europa.eu/project/rcn/212484/factsheet/en
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 4,997,137.50
Duration (months)	36
Lead Partner	Universidad de Murcia (University)
Partner	University of Surrey (University) Stiftung Fachhochschule Osnabrueck (University) Aarhus Universitet (University) Siemens Aktiengesellschaft (Private Company) AGT Group GmbH (Private Company) Digital Worx GmbH (Private Company) Odin Solutions SI (Private Company) Aarhus Kommune (Public Administration) NEC Laboratories Europe GmbH (Private Company)



Project Sheet		IoTEE
Project Name	Internet of Things Everywhere on Earth: a satellite-based M2M solution	
Topics		
Description	IoTEE proposes an approach aimed at bringing IoT services to the space sector. The developed devices have a new communication protocol that allows them to cover greater distances	
Impact	Using IoT technologies in the aerospace industry	
Web	http://www.iot-everywhere.eu/	
Funding Program		
Budget	EUR 2,607,413.75	
Duration (months)	24	
Lead Partner	SAT4M2M GmbH (Private Company)	
Partner	Eureka Navigation Solutions AG (Private Company)	

Project Sheet	INTER-IoT
Project Name	Interoperability of Heterogeneous Platforms IoT
Topics	
Description	The project aims to develop, implement and test an open structure and a methodology to allow interoperability between different IoT platforms
Impact	Development of an architecture for the integration of different IoT systems
Web	https://inter-iot.eu/
Funding Program	
Budget	EUR 7,329,850.00
Duration (months)	36
Lead Partner	Universitat Politècnica de Valencia (University)
Partner	Telecom Italy Spa (Private Company) University of Calabria (University) Prodevelop SL (Private Company) Eindhoven Technische Universiteit (University) Fundacion de Investigacion para la Comunidad Valenciana, Promocion y de Estudios Comerciales Valenciaport (Organization) Rinicom Limited (Private Company) Association pour le Developpement de la Formation professionnelle Dans Les Transports (Organization) Noatum Ports of Valencia SAU (Private Company) Xlab Razvoy Programske OPREME In Svetovanje Doo (Private Company) Systems Research Institute of the Polish Academy of Sciences IBS PAN (Research Institute) ASL to5 (Public Administration) Alessandro Bassi Consulting SARL (Private Company) Neways Technologies BV (Private Company)



Project Sheet	IDEAL - CITIES
Project Name	Intelligence-Driven Urban Internet-of-Things Ecosystems for Trustworthy and Circular Smart Cities
Topics	
Description	IDEAL CITIES aims to develop, demonstrate and evaluate an open and modular platform to create Smart Cities applications based on IoT, supported by tools for data analysis and cloud services
Impact	Development of a platform for Smart Cities
Web	https://cordis.europa.eu/project/rcn/213015/factsheet/en
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1,611,000.00
Duration (months)	48
Lead Partner	Foundation for Research and Technology Hellas (Foundation)
Partner	Ecole Nationale des Ponts et Chaussées (University) Bournemouth University (University) Bluesoft Spolka z Ograniczona Odpowiedzialnoscia (Private Company) Cablenet Communication Systems LTD (Private Company) Nodalpoint Systems (Private Company)



Project Sheet		Barbara-IoT
Project Name	Barbara is an Operating System Platform Software which Enables IoT device manufacturers to boost their level of security, reduce time-to-market, and reduce costs	
Topics		
Description	The project aims to develop a free operating system for the IoT and a management platform in order to increase the security level for the connected devices	
Impact	Increased security for the connected devices	
Web	https://barbaraiot.com/	
Funding Program		
Budget	EUR 71,429.00	
Duration (months)	6	
Lead Partner	Barbata IoT SL (Private Company)	
Partner		



Project Sheet	IoT4ALL
Project Name	Ultimate connectivity platform for global IoT devices: boosting the competitiveness of IoT device makers
Topics	
Description	Within the project an IoT platform prototype was developed that allows IoT device manufacturers to have global coverage for their systems
Impact	Development of a universal IoT platform that provides connectivity globally
Web	https://cordis.europa.eu/project/rcn/217595/factsheet/en
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1,983,750.00
Duration (months)	24
Lead Partner	1ot OU (Private Company)
Partner	Mobi Solutions OU (Private Company)



Project Sheet	ThingSight
Project Name	Industrial IoT Communication and Analytics Platform for Smart Maintenance
Topics	
Description	ThingSight is a data analysis system that generates and collects data from machinery and provides an analysis tool to help manufacturing companies in support and maintenance activities
Impact	Use the IoT for maintenance in manufacturing
Web	https://www.altairsmartworks.com/
Funding Program	
Budget	EUR 71,429.00
Duration (months)	16
Lead Partner	Carriots SL (Private Company)
Partner	

Project Sheet	
BRAIN-IoT	
Project Name	model-based framework for dependable Sensing and Actuation in Intelligent decentralized IoT systems
Topics	
Description	The aim of the project is to establish a methodology and a structure aimed at supporting cooperation between different IoT platforms
Impact	Development of a scenario in which actuators and controls are supported by IoT platforms
Web	https://cordis.europa.eu/project/rcn/216621/factsheet/en
Funding Program	
Budget	EUR 4,992,581.00
Duration (months)	36
Lead Partner	Istituto Superiore Mario Boella on Information Technologies and Telecommunications (Research Centre)
Partner	The Commissariat Energie Atomique et aux Energies Alternatives (Universite Grenoble Alpes (University) Paremus Limited (Private Company) Siotic Spain SL (Private Company) STMicroelectronics Grenoble SAS 2 (Private Company) Siemens Aktiengesellschaft (Private Company) Eclipse Foundation Europe GmbH (Private Company) Institut de l'Audiovisuel et des Telecommunications en Europe (Private Company) Cybersecurity Airbus SAS (Private Company) Robotnik Automation SLL (Private Company) Empresa Municipal de Aguas de la Coruna SA (Private Company)



Project Sheet	IoBee
Project Name	Beehive health IoT application to fight Honey Bee Colony Mortality
Topics	
Description	The aim of the project is to reduce mortality within the bee colonies by at least 50%. To do this, the company proposes the use of IoT-based sensors that can allow monitoring of threats to the status of a colony. The system will transmit the results wirelessly to a server, which will re-process this data and transform it into useful information
Impact	Use of IoT-based systems to reduce the mortality rate of bee colonies
Web	http://io-bee.eu/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1,436,178.00
Duration (months)	30
Lead Partner	Irideon SL (Private Company)
Partner	Avia-GIS NV (Private Company) Technological Educational Institute of Crete (University) Bee Life European Beekeeping Coordination (Organization) Arnia Limited (Private Company)



Project Sheet		SMART Plantone
Project Name	A low-cost IoT - solution for predictive maintenance of small electric motors towards the Factory of the Future	
Topics		
Description	Electric motors are one of the main components of the industry, for this reason, knowing their status, in order to apply predictive maintenance systems, is necessary within the factory vision of the future	
Impact	An economical solution for small to medium-sized enterprises, for predictive maintenance of electric motors	
Web	http://ngs-sensors.it/portfolio/plantone-en/	
Funding Program		
Budget	EUR 71,429.00	
Duration (months)	6	
Lead Partner	New Generation Sensors Srl (Private Company)	
Partner		

Project Sheet	Semiotics
Project Name	Smart End-to-End Massive IoT Interoperability, Connectivity and Security
Topics	
Description	The purpose of the project is to develop a structure, based on existing IoT platforms, to allow compatibility between them
Impact	Guarantee a reliable drive, and a safe and semi-automatic behavior of IoT applications
Web	https://www.semiotics-project.eu/
Funding Program	
Budget	EUR 4,995,915.00
Duration (months)	36
Lead Partner	Siemens Aktiengesellschaft (Private Company)
Partner	Foundation for Research and Technology Hellas (Research Centre) Center Tecnologic Telecomunicacions de Catalunya (Research Centre) Sphynx Technology Solutions AG (Private Company) Engineering - Ingegneria Informatica SpA (Private Company) STMicroelectronics srl (Private Company) Universität Passau (University) Bluesoft Spolka z Ograniczona Odpowiedzialnoscia (Private Company) Inquadrat Informatica SL (Private Company) Bjerke Wind-Consult ApS (Private Company)

Project Sheet	IOTI4.0
Project Name	Integral Open Technology for Industry 4.0
Topics	
Description	The project consists of a feasibility study for the introduction on the market of the first technology for industrial control and automation, entirely based on a free system, which can be used for any industrial machinery and in any type of industry
Impact	Sviluppo del primo sistema libero per il controllo e automazione industriale
Web	https://www.industrialshields.com/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 71,429.00
Duration (months)	5
Lead Partner	Boot & Work Corp SL (Private Company)
Partner	

Project Sheet	IoT4industries
Project Name	Internet of Things for Industry
Topics	
Description	The project supports the growth and competitiveness of the EU through the development of a new chain of intersectoral industrial value based on the integration and use of the Internet of Things (digital security, cloud computing, big data, artificial intelligence) in tools of production, machines and robots, industrial processes, thanks to the cross-border collaboration between SMEs and other actors in the research and innovation of ICT and advanced manufacturing.
Impact	Creating a cross-sector value chain based on the integration and use of the Internet of Things
Web	https://www.iot4industry.eu/
Funding Program	
Budget	EUR 244,269.00
Duration (months)	23
Lead Partner	Pole SCS (Organization)
Partner	microTEC Südwest (Organization) DSP Valley (Organization) MESAP (Organization) Mont-Blanc Industries (Organization) Pole MECATECH (Organization) Manufacturing Technology Centre (Research Centre) Inno TSD (Private Company)



Project Sheet	ACCEPT
Project Name	Assistant Check for Quality during Construction Execution Processes for Energy - efficient buildings
Topics	
Description	The ACCEPT system allows you to import 3D models, components/materials and the related information of each project from the BIM software, as well as providing workers on site with visual information concerning the correct execution of the work through augmented reality. The system consists of 3 applications
Impact	Development of a system that uses different digital technologies for quality control during the construction phase and for the coordination of work in the pipeline
Web	http://www.accept-project.com/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	Not available
Duration (months)	36
Lead Partner	Fraunhofer Italy (Research Institute)
Partner	Ascora GmbH (Private Company) AnswareTech sl (Private Company) CYPE Soft sl (Private Company) Epitessera Architects (Private Company) Lucis (Research Laboratory) Ingleton Wood LLP (Consulting Company) Ferrovia Agroman (Investor) TIE Nederland BV (Private Company) Enterprises Jacques Delens knows (Private Company) Fraunhofer-Gesellschaft (Research Center)



Project Sheet		PATH
Project Name	Passivetracking of people and things for physical behavior analysis	
Topics		
Description	The PATH project is based on the monitoring, control and analysis of people's behaviour, without the use of active devices. This is done by integrating these functions into an Internet of Things (IoT) infrastructure	
Impact	Definition of a new paradigm for monitoring physical behaviours. Where the dynamics of physical entities are monitored with minimal implementation costs, maximum level of privacy, and anti-trigger protection	
Web	www.unife.it	
Funding Program		
Budget	EUR 244,269.00	
Duration (months)	23	
Lead Partner	University of Ferrara (University)	
Partner	MIT - Massachusetts Institute of Technology (University)	

Project Sheet		HitSeedSME
Project Name	HitSeed	
Topics		
Description	HitSeed is conducting a feasibility study on its Internet of Things (IoT) platform, which combines hardware, software, industrial design and software development tools. The use of microcontrollers together with touch screen display and a graphic interface, allow the reduction energy consumption and consequently reduce costs	
Impact	Development of a new Internet of Things (IoT) platform, which includes both software and hardware	
Web	http://www.hitseed.com/	
Funding Program		
Budget	EUR 71,429.00	
Duration (months)	17	
Lead Partner	Hitseed Oy (Private Company)	
Partner		

Project Sheet		biotope
Project Name	Building an IoT OPen innovation Ecosystem for connected smart objects	
Topics		
Description	bloTope has the objective of developing standard procedures to enable horizontal integration between information silos	
Impact	The creation of open innovation ecosystems, where companies can create innovation by creating software for the IoT ecosystem	
Web	http://biotope.cs.hut.fi/	
Funding Program		
Budget	EUR 9,429,160.00	
Duration (months)	36	
Lead Partner	Aalto-Korkeakoulusäätiö sr (Private Company)	
Partner	Administration de l'Équipement et des Déplacements (Public Administration) ControlThings Oy Ab (Private Company) Communauté Urbaine de Lyon (Public Administration) Forum Virium Helsinki Oy (Organization) Holonix SRL (Private Company) BIBA (Research Centre) IS-practice (Private Company) OPENDATASOFT (Private Company) Fraunhofer (Research Institute) ITMO University (University) Eccenca GmbH (Private Company) Ecole Polytechnique Fédérale de Lausanne (Research Institute) Métropole de Lyon iTrust consulting (Private Company) zen city date Université du Luxembourg (University) X / Open Ltd. (Private company) Commonwealth Scientific and Industrial Research Organization (Organization) Enervent Ensto Oy (Private Company) Center d'Informatique Pour la Région Bruxelloise (Research Institute) IRIS Net (Private Company) BMW (Private Company)	

Project Sheet	
Be-IoT	
Project Name	The business engine for IoT pilots: Turning the Internet of Things in Europe into an economically successful and socially accepted vibrant ecosystem
Topics	
Description	The project has several objectives: to support collaboration between IoT projects, to reduce the distance between a project and its stakeholders, to prepare the ground for subsequent IoT-based businesses, the creation of new IoT business models, drafting of a White Paper that collects and describes all the progress made by various projects in the IoT area
Impact	Creation of a project ecosystem in order to foster collaboration. This will have a strong economic impact as it will lead to the creation of new business models and the increase in trust in the IoT, through the transparency of information regarding social challenges and problems regarding privacy and data security
Web	https://iot-epi.eu
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1,041,073.00
Duration (months)	60
Lead Partner	Etventure GmbH (Private Company)
Partner	Faubourg Numerique Services et Objets connectés (Business Incubator) RISE Acreo (Private Company) Fraunhofer (Research Institute) Yossi Dan (Private)

Project Sheet	SOPHIA
Project Name	Securing Software Physical Attacks against
Topics	
Description	The aim of the project is to find effective methods, in software and hardware, to allow the creation of systems whose critical parts are protected from physical attacks
Impact	Ensure that systems are protected from physical attacks by modifying the properties of the programming language
Web	https://cordis.europa.eu/project/rcn/200247/factsheet/en
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 1,964,750.00
Duration (months)	47
Lead Partner	Technische Universität Graz (University)
Partner	

Project Sheet	
GoEasy	
Project Name	Galileo based trusted applications for health and sustainability
Topics	
Description	GOEASY will use some features of Galileo systems, such as interoperability with existing Internet of Things (IoT) infrastructures, to develop secure and protected applications for the mass market of localization systems
Impact	Make tracking systems available to the mass market
Web	https://goeasyproject.eu
Funding Program	
Budget	EUR 2,967,599.00
Duration (months)	36
Lead Partner	Mario Boella Higher Institute (Research Centre)
Partner	Greenapes SRL (Private Company) FRAUNHOFER (Research Institute) City of Turin (Public Administration) Mundo Reader SL (Private Company) CNet Svenska AB (Private Company)

Project Sheet		Orchextra
Project Name	A disruptive innovation in mobile marketing and business intelligence for drastically Increasing SMEs	
Topics		
Description	ORCHEXTRA aims to transform the way SMEs define their marketing strategies, and facilitate the use of business intelligence tools	
Impact	The development of an economic and scalable product, which also allows SMEs to use BI (Business Intelligence) techniques, methods for data analysis, and mobile marketing tools that are currently used only by large companies	
Web	https://gigigo.com	
Funding Program		
Budget	EUR 1,297,844.00	
Duration (months)	36	
Lead Partner	Gigigo Mobile Services SL (Private Company)	
Partner		



Project Sheet		AB ENGINE
Project Name	Advanced Back end service as Engine	
Topics		
Description	AB ENGINE aims to introduce an innovative solution capable of providing developers with applications, components and cloud infrastructures that facilitate the creation and maintenance of mobile applications. Reducing costs, time to market and complexity.	
Impact	Reducing the complexity of the development of systems based on Beacon	
Web	http://www.apps-builder.com/	
Funding Program		
Budget	EUR 71,429.00	
Duration (months)	5	
Lead Partner	AppsBuilder SPA (Private Company)	
Partner		


Project Sheet	
GRICAS	
Project Name	Galileo MEOSAR RLS Improvement for Better Civil Aviation Security
Topics	
Description	GRICAS proposes the development of a new security concept based on the use of Galileo SAR technology. This includes the development of different systems such as Beacon NG, MEOUTL, RLS to allow the identification of flight anomalies
Impact	Using IoT technologies to increase safety in aviation
Web	http://www.gricas-gsa-project.eu/
Funding Program	
Budget	EUR 2,783,638.00
Duration (months)	28
Lead Partner	Thales Alenia Space France (Research Centre)
Partner	ELTA (Private Company) Agence Pour la Securite de la Navigation Aerienne en Afrique et Madagascar (Agency) Pildo Consulting SL (Private Company) CNES - CNES (Government Agency) Aero Club Barcelona Sabadell (Organization) STMicroelectronics SRL (Private Company)

Project Sheet	
Cargo Beacon	
Project Name	Cargo Beacons - no unexpected delays or losses in shipments of valuable cargo
Topics	
Description	The project intends to develop a service based on the IoT concept. This service involves the use of Beacons that communicate their measurement through a dedicated channel. This communication channel is based on cloud technologies. They will be used to identify the causes of damage in the context of shipments, optimization of the flow of materials and reduction of bottlenecks
Impact	Using IoT technologies to improve the monitoring of different processes within the supply chain
Web	https://cargo-beacon.com/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 71,429.00
Duration (months)	6
Lead Partner	Cargobeacon AB (Private Company)
Partner	

Project Sheet	
QR-PATROL PRO	
Project Name	A cost-effective cloud-based platform for delivering the highest level of security, supervision and management companies for security Utilizing Push-to-Talk and Internet of Things technologies
Topics	
Description	In 2014 Terracom presented QR-Patrol, an innovative system for real-time management of civil guard patrols. The aim of the project is to integrate one of the existing IoT technologies platforms, to allow the automation of different procedures. This will be done through the integration of Beacons, wearable systems and communication systems
Impact	Use of IoT technologies in the field of civilian guard monitoring, in order to increase the level of monitoring, communication and supervision
Web	https://www.terracom.gr
Funding Program	
Budget	EUR 1,927,423.00
Duration (months)	24
Lead Partner	Terracom Informatics LTD (Private Company)
Partner	

Project Sheet	
Cloud Your Car UBI	
Project Name	Establishing new eco-driving methods to score drivers and to Enhance good driving habits based on advanced analytical B2B platform software for Connected Cars
Topics	
Description	The project is based on the vision that a server in which machine learning algorithms study the behaviour of an individual at the wheel, identifying any dangerous actions and advising activities aimed at increasing driving safety by reducing fuel consumption
Impact	The use of IoT technologies to monitor road behaviour and increase safety
Web	https://cloudyourcar.com/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 71,429.00
Duration (months)	4
Lead Partner	IoT Spolka z Ograniczona Odpowiedzialnoscia (Private Company)
Partner	

Project Sheet		BEACON
Project Name	Hybrid Digital-Analog Networking under Extreme Energy and Latency Constraints	
Topics		
Description	The goal of the BEACON project is to introduce analogue communication protocols within modern wireless systems, in order to reduce the energy consumption of systems based on the Internet of Everything (IoE)	
Impact	The combination of analogue and digital communications protocols for the development of IoE (Internet of Everything) applications	
Web	http://www.imperial.ac.uk/	
Funding Program		
Budget	EUR 1,496,350.00	
Duration (months)	60	
Lead Partner	Imperial College of Science Technology and Medicine (University)	
Partner		

Project Sheet		SINSIN
Project Name	Enhanced PLB, EGNSS receiver, and MEOLUT, but According beyond the standard Significantly improving the localization in difficult conditions, paving the way to a mass market SAR/Galileo service	
Topics		
Description	SINSIN aims to improve some of the existing localization systems such as Beacon, implementing new technologies compatible with the new Cospas-Sarsat standards	
Impact	Improved localization of moving beacons and beacon in poor visibility conditions	
Web	http://www.mobitcom.com	
Funding Program		
Budget	EUR 1,875,500.00	
Duration (months)	36	
Lead Partner	MOBIT Telecom LTD (Private Company)	
Partner	Saphyrion Sagl (Private Company) Thales Alenia Space France (Private Company) STMicronics SRL (Private Company)	

Project Sheet		MossTree
Project Name	A new climate smart city infrastructure with a capacity for reducing air pollution equivalent to 275 normal trees	
Topics		
Description	The project consists of a structure composed of a specific type of moss that feeds on CO2. The System contains several sensors for monitoring climate data, and to make conditions favourable for the life of the plant. Furthermore, the structure can be equipped with data transmission tools such as Wi-Fi, Beacon and NFC	
Impact	Use of the Internet of Things for advertising and information purposes through the use of Beacons, WiFi and NFC	
Web	https://greencitysolutions.de/en/	
Funding Program		
Budget	EUR 71,429.00	
Duration (months)	3	
Lead Partner	Green City Solutions GmbH (Private Company)	
Partner		

Project Sheet	HELIOS
Project Name	Second Generation Beacon for Galileo / EGNOS-EGNSS Search and Rescue applications
Topics	
Description	The HELIOS project aims to develop a second generation of Beacons and antennas that have the capacity to operate with the new Meosar/Cospas/Sarsat program integrated into satellite navigation systems such as Galileo
Impact	Development of a more reliable Beacon system
Web	http://helios-gsa-project.eu/
Funding Program	 Horizon 2020 European Union Funding for Research & Innovation
Budget	EUR 4,869,656.00
Duration (months)	41
Lead Partner	Orolia SAS(Private company)
Partner	Sioen NV (Private Company) Chelton Antennas (Private Company) Airbus Operations GMBH (Private Company) Center National d'Etudes Epatiales - CNES (Government Agency) Air France SA (Private Company)

Project Sheet	ChArGED
Project Name	CleAnweb gamified Energy Disaggregation
Topics	
Description	ChArGED proposes a system that aims to increase energy efficiency and reduce energy losses in public buildings
Impact	Reduction of losses and improvement of energy efficiency through the use of IoT technologies such as Beacon and NFC
Web	https://www.eurodyn.com/
Funding Program	
Budget	EUR 2,220,312.00
Duration (months)	41
Lead Partner	European Dynamics Belgium (Private company)
Partner	Ministère de la Culture (Public Administration) The Peak Lab GmbH & Co. KG (Private Company) Wattics Limited (Private Company) Institut Catala d'Energia (Research Institute) Dimos Athinaion Epicheirisi Mikhanografisis ProSyst Software GmbH (Private Company) Bosch Software Innovations GmbH (Private Company) Athens University of Economics and Business - Research Centre (Research Centre) Plegma Labs Technologikes Lyseis (Private Company) AnonymOS Etairia (Organization)



Contrary to what is highlighted in the ERDF funding program, most of the projects deal with ICT and Automation within the European Horizon 2020 program. Reading the project sheets shows how the projects within this financing program are mainly focused on the creation of IoT communication platforms or protocols. Although the projects financed by Horizon 2020 are in greater numbers than those financed at a local level, it can be seen that, proportionally, the percentage of private companies participating in this type of project at a European level, is much greater than the number of companies involved at a local level.

3.3 INTERREG ITAT

Project Sheet	ITAT3011
Project Name	A21DIGITAL TYROL VENETO
Topics	
Description	<p>A21DIGITAL TYROL VENETO is a transnational study of the universities of Bolzano and Verona (which operates through the Vicenza Scientific Academic Centre for Studies on Enterprise), in collaboration with the A21DIGITAL digitalization network.</p> <p>Based on interviews with leading experts in the field of digitalisation, operating both at a regional and an international level, we intend to develop strategies for the future and concrete action proposals for political and institutional decision-making bodies in the region</p>
Impact	Development of revealing strategies for the future and concrete action proposals about the opportunities and challenges related to digitization
Web	http://www.a21digital.com/a21digital-tyrol-veneto/
Funding Program	
Budget	EUR 45,000.00
Duration (months)	17
Lead Partner	A21DIGITAL (Private Company)
Partner	Free University of Bolzano University of Verona

In this funding program there are no specific projects on the IoT theme. In the A21 project, the main technological and market trends were analysed in an industry 4.0 perspective, including the potential of the IoT for the competitiveness of different stakeholders such as companies and public administrations in the Tyrol-Alto Adige and Veneto macro-region.

3.4 INTERREG IT-CH



Project Sheet	FreeGIS.net
Project Name	GIS Free Open Source Software
Topics	
Description	FreeGIS.net aims to address the issue of GIS Free Open Source Software as a free tool for recording, analysing, displaying and returning geographical information
Impact	Definition of the specifications of a reference implementation process composed solely of free software components
Web	freegis.net
Funding Program	
Budget	EUR 509,300.00
Duration (months)	36
Lead Partner	R3GIS (Private Company)
Partner	Canton Grisons (Public Administration)



3.5 Alpine Space

Project Sheet		SMART-SPACE
Project Name	Smart manufacturing for Alpine Space SMEs	
Topics		
Description	<p>SMART-SPACE will identify a strategy for "Alpine Smart Manufacturing", capable of combining economic and social challenges, geographical and industrial particularities, sustainability and entrepreneurship in the Alpine arc. A strategic partnership will be developed within the Alpine territory to implement a common action plan supported by a Digital Innovation Hub, a competence centre that aims to assist innovation actors in order to increase alpine well-being and growth .</p>	
Impact	<p>The strengthening of cooperation within the innovation system, in order to promote digital solutions for traditional industrial sectors</p>	
Web	https://www.alpine-space.eu/	
Funding Program		
Budget	EUR 2,381,926.90	
Duration (months)	36	
Lead Partner	<p>Chamber of Commerce and Industry of Venice Rovigo-Lagunare (Public Administration)</p>	
Partner		

Only one IoT project was identified within the Interreg Alpine Space funding program. This has been categorized within the innovation group, as it aims to define a roadmap and create strategic partnerships within the Alpine territory.

3.6 LIFE

Project Sheet	BrennerLEC
Project Name	Smart manufacturing for Alpine Space SMEs
Topics	
Description	The aim of the project is the creation of a low emission channel (LEC) concept for the A22 motorway. This will be done through the use of some measures such as speed reduction and the addition of a third lane in case of traffic
Impact	The development of a forecasting system for environmental conditions, weather and traffic
Web	http://brennerlec.life
Funding Program	
Budget	EUR 4,018,005.00
Duration (months)	55
Lead Partner	Brenner Motorway SpA (Private Company)
Partner	Autonomous Province of Bolzano - Provincial Environment Agency (Rip.29) (Public Administration) Autonomous Province of Trento - United States Environmental Protection Agency (Public Administration) Cisma SRL (Private Company) University of Trento (University)



Project Sheet	Clean - Roads
Project Name	Clean Roads
Topics	
Description	Clean - Roads is a project through which we experience, thanks to technology, a new way to manage road safety during the winter period
Impact	The development of a technological system to support decisions for maintenance operations
Web	http://clean-roads.eu/
Funding Program	
Budget	EUR 1,479,550.00
Duration (months)	40
Lead Partner	Autonomous Province of Trento (Public administration)
Partner	Famas System SpA (Private Company)



Project Sheet	INTEGREEN
Project Name	Integration of Traffic and Environmental GREEN data for improving policies in the city of Bolzano
Topics	
Description	The main objective of the project is to set up a demonstration system for the traffic management centre of the city of Bolzano, able to provide the city decision-makers with distributed and related information regarding the current state of the city traffic and its environmental impact
Impact	Creation of a platform that collects different information from probe vehicles and statistical information from the control units installed in fixed points of the city
Web	http://www.integreen-life.bz.it/
Funding Program	
Budget	EUR 1,811,810.00
Duration (months)	42
Lead Partner	WE SPA (Private Company)
Partner	City of Bolzano (Public Administration) Austrian Institute of Technology (Research Centre)



Only 3 projects that relate to IoT technologies have been identified within the LIFE funding program. Two of these deal with ICT and automation, while the third is applied in the field of energy and the environment. All projects are carried out by local stakeholders in collaboration with partners from neighbouring regions.



3.7 Other funding programs



CHIST-ERA is a program for coordinated research at a European level, focused on information, communication technologies (ICT) and scientific ICT challenges.



Project Sheet		Cocoon
Project Name	Emotion psychology meets cyber security in smart homes IoT	
Topics		
Description	The aim of the project is to understand the psychology of the IoT user, determine the risk of current and future IoT systems, and develop a security system for home use	
Impact	Development of a secure home system based on IoT	
Web	https://cocoon-project.eu/	
Funding Program		
Budget	EUR 986,611.00	
Duration (months)	24	
Lead Partner	University of Reading (University)	
Partner	University of Greenwich (University) ETH Zurich (university) Ghent University (University) Eindhoven University of Technology (University)	



Project Sheet	ID_IOT
Project Name	Identification for the Internet of Things
Topics	
Description	The aim of the project is to use different systems to facilitate the authentication and identification of an object within an IoT system
Impact	Increasing the level of privacy and security of an IoT environment
Web	http://www.chistera.eu/projects/idiot
Funding Program	
Budget	EUR 573,616.00
Duration (months)	36
Lead Partner	Eindhoven University of Technology (University)
Partner	INRIA Rennes (University) University of Geneva (University)


Project Sheet	SPIRIT
Project Name	Security and Privacy for the Internet of Things
Topics	
Description	The project aims to develop a new security and system approach that preserves user privacy in the case of using IoT-based services
Impact	To increase the user's confidence in the IoT technologies
Web	http://www.chistera.eu/projects/spirit
Funding Program	
Budget	EUR 921,375.00
Duration (months)	36
Lead Partner	University of Kent (University)
Partner	University of La Rochelle (University) University of Essex (University) University of Geneva (University)


Project Sheet	SUCCESS
Project Name	Secure Accessibility for the Internet of Things
Topics	
Description	The idea behind the project is to use systems and methods with a proven track record in order to increase the transparency of security risks in IoT usage scenarios
Impact	Communicating with clarity the risks associated with the use IoT
Web	http://www.chistera.eu/projects/success
Funding Program	
Budget	EUR 699,701.00
Duration (months)	36
Lead Partner	Middlesex University London (University)
Partner	INRIA (Research Institute) Univeristy of Grenoble Alpes (University) University of Twente (University)


Project Sheet		Uprise-IoT
Project Name	User centric Privacy & Security in the IoT	
Topics		
Description	The purpose of the project is to allow the user to acquire control over the data generated and collected by IoT devices that surround it. This is done to increase user privacy and security	
Impact	Increasing the level of privacy and security of an IoT environment	
Web	http://www.chistera.eu/projects/uprise-iot	
Funding Program		
Budget	EUR 1,171,192.00	
Duration (months)	36	
Lead Partner	University of Applied Sciences and Arts of Southern Switzerland (University)	
Partner	INRIA (Research Institute) EURECOM (University) University College London (University)	

Project Sheet	Uselt
Project Name	User empowerment for Security and privacy on the Internet of Things
Topics	
Description	The purpose of the project is to allow users and devices to easily control who has access to a particular data type and in what context, to avoid losing information such as location and behavioural data
Impact	Increasing the level of privacy and security of an IoT system
Web	http://useit.eu.org
Funding Program	
Budget	EUR 861,963.00
Duration (months)	36
Lead Partner	IBM Research - Zurich (University)
Partner	University of Murcia (Research Institute) CEA (University) Eindhoven University of Technology (University)

Project Sheet	SINFONIA
Project Name	Smart Cities Initiative of Fully Committed to Invest Advances in Large-Scaled Energy Solutions
Topics	
Description	The SINFONIA project is a five-year initiative aimed at implementing extended, integrated and scalable energy solutions in medium-sized European cities
Impact	Definition of a limited series of district types and their reorganization models aimed at energy saving
Web	http://www.integreen-life.bz.it/
Funding Program	
Budget	EUR 43,000,000.00
Duration (months)	60
Lead Partner	Rise Research Institutes of Sweden (Research Institute)
Partner	Landeshauptstadt Innsbruck (Public Administration) Neue Heimat Tirol GEMEINNÜTZIGE Wohnungs GmbH (Private Company) Universität Innsbruck (University) Tiroler Zukunftsstiftung GmbH (Private Company) City of Bolzano (Public Administration) EURAC Research (Research Centre) IPES Bolzano (Public Administration) ALPERIA SpA (Private Company) Casaclima Bolzano (Public Administration) Boras Kommun (Public Administration) Commune de la Rochel (Public Administration) CORPORACION DE EMPRESAS DE SEVILLA MUNICIPALES IEA - CEMS Municipality of Pafos (Public Administration) Greenovate Europe (Organization)

Project Sheet	APFEL
Project Name	Precision Agriculture with Extended Phytopathological monitoring system and for the preventive Localization of parasitic attacks
Topics	
Description	The project involves the development of hardware and software technologies aimed at prompt, ubiquitous and pervasive monitoring of agricultural crops. The project is located in the Thematic Areas envisaged by the RIS3 of the province of Bolzano, becoming part of ICT & Automation and mainly in Agri-food Technologies. The main objective is to combine an automated and precision monitoring of the agricultural area with a check on the phytosanitary health status and attacks of crop pests, differentiating themselves from the systems on the market for the ability to automatically identify and evaluate with precision, in reaching predefined threshold values during the most critical periods.
Impact	Digital platform based on IoT philosophy for precision agriculture, aimed at favouring the integration of new services for and with farmers, agronomists and research centres
Web	http://www.integreen-life.bz.it/
Funding Program	Province of Bolzano, Provincial Law 14/2006
Budget	EUR 806,400.00
Duration (months)	36
Lead Partner	FOS Srl (Private Company)
Partner	SmarTeam Srl (Private Company)

Project Sheet	BOE
Project Name	SMART PLATFORM INTEGRATED SURVEY ON MULTISENSORY BOE FOR VERSATILE APPLICATIONS IN THE MARITIME
Topics	
Description	<p>The project produced a highly technological and versatile integrated hw/sw platform for the detection of physical quantities in a maritime environment.</p> <p>Its target characteristics are: low cost, operational versatility, high functional performance, usability at the information level, multiple connectivity also with MQTT and COAP protocols</p>
Impact	The impact is the continuous detection of fundamental parameters of marine environments, lake and river environments
Web	Under construction
Funding Program	POR Liguria 2014-2020, Action 1.2.4
Budget	EUR -
Duration (months)	24
Lead Partner	FOS Group Srl (Private Company)
Partner	Department of Naval Engineering, Electrical, Electronics and Telecommunications (DITEN) of the University of Genoa (University)

Project Sheet	BSPM
Project Name	Brain Stroke Monitoring device based on EIT Technology
Topics	
Description	The project involved the creation of a helmet to monitor post-stroke conditions of newly hospitalized patients. Data is made available to the medical environment through different protocols
Impact	Development of new diagnostic techniques
Web	Under construction
Funding Program	2014-2020 EU program Nr. 01.2.1-LVPA-K-823 "SmartInvest LT +"
Budget	EUR -
Duration (months)	30
Lead Partner	FOS Group Srl (Private Company)
Partner	Kaunas University of Technology - Lithuania Lithuanian University of Health Sciences (University)

The sheets in this section concern projects financed by various initiatives. Since these projects are carried out in different geographical locations and are financed by different programs, it is not possible to find a common denominator, and consequently draw conclusions on areas and themes developed by type of funding program. Within the Chiest-era financing program, all the projects were grouped together within the ICT and automation category. Specifically, analysing what the projects have dealt with, it can be noted that they focused mainly on increasing security and privacy in scenarios of IoT use: from the improvement of communication protocols, to transparency in the communication of risks related to use of connected objects in order to increase trust and spread the use of the IoT application.

3.8 Conclusions

Most IoT projects have been identified within the Horizon 2020 funding program. Considering only locally funded projects, it can be seen that in South Tyrol, most projects fall under the concept of network creation and transfer of knowledge of local players on the potential of adopting IoT technologies and systems, as well as coaching services on the theme of digital transformation to support businesses. ERDF projects have mainly been concerned with the creation of an ecosystem favourable to the use of IoT technologies. The table shows that most of the analysed projects mainly dealt with the development of software or hardware platforms linked to the IoT area. This phenomenon is also reflected in the industry 4.0 themed literature and more specifically with regard to the IoT.

Although it has not been mentioned directly in the descriptions, some projects involve the use of Beacons, mainly for proximity marketing and point location purposes. Also in this case, some projects are dedicated to improving the capabilities of the Beacon technology, such as improving the accuracy of position identification. The number of projects that are applied within the health and construction sector has been smaller.

4 Guidelines for the development of innovative ideas in IoT

One objective of this document concerns the definition of guidelines supporting the stakeholder of the community in the future development of innovative projects and ideas in the IoT area. In this sense, we intend to provide NOI Spa with concrete tools to support innovation processes within collaborations between companies, research centres and start-ups.

This section presents the inclusive guidelines of the different phases of interaction between NOI Spa and the interested parties to evaluate the potential of innovative ideas and to develop projects (Figure 14).



Figure 14: Phases of interaction in the development of innovative projects and ideas

For each of the phases, specific objectives, methods, tools, expected results and required participants are indicated to support the creation of a favourable context for collaboration between companies, research centres and start-ups.

4.1 Coordination Board

Companies that intend to implement innovative ideas in the IoT field and need support, for example, research of technological partners, improvements of idea and evaluation of possible financing opportunities have the possibility to involve NOI Spa - *TechTransfer Digital Technologies*. The objective of this meeting (Coordination Board) allows the company to receive feedback on the contents of the idea and to network with other partners of the IoT community for the further development and realization of the idea (Figure 15)

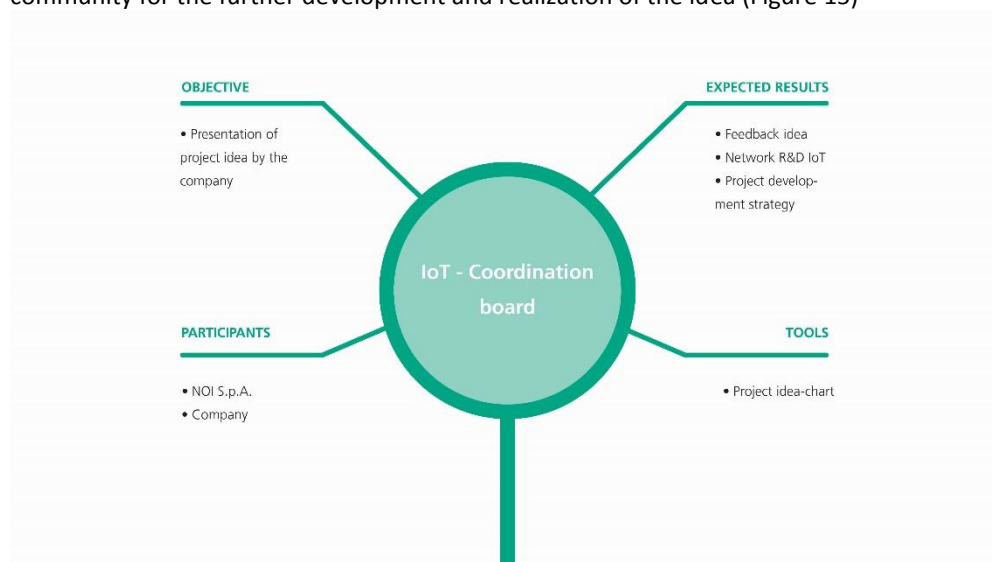


Figure 15: Overview of the coordination Board

Prior to the meeting, the company will be able to summarize its project idea using a project form, including the main aspects to be addressed during the Coordination Board (Figure 16)

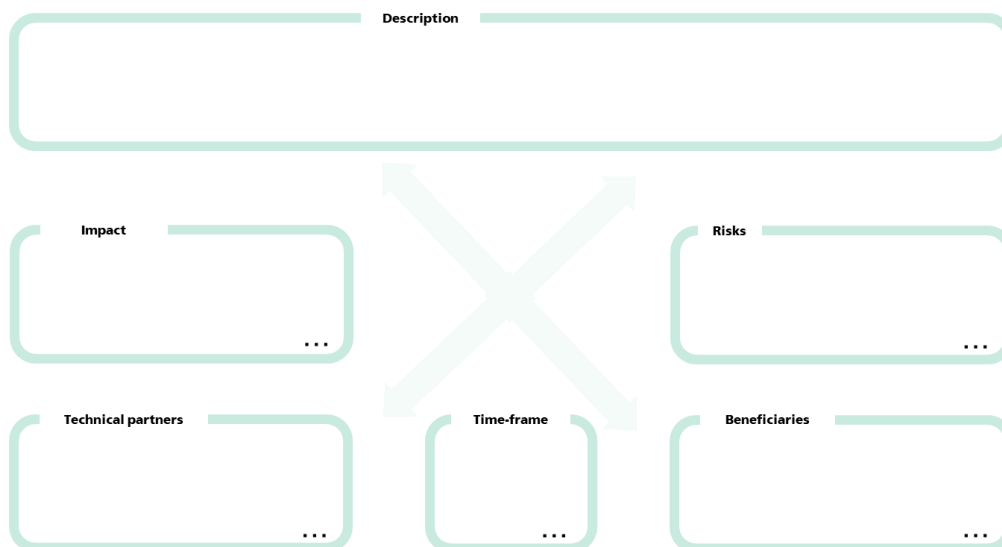


Figure 16: Project idea chart

Compiling the project sheet will facilitate the discussion on the following aspects of the project:

Description	Context and objectives of the project as well as expected results on realization of the project.
Impact	Estimated impact of the project results in the specific area in which they apply and the general local economic development.
Risks	Risks perceived during implementation e.g. maturity of existing technologies to support the project, critical aspects of the business model, market acceptance, degree of applicability.
Partner	Partner required for the realization of the different specific activities within the project.
timing	Anticipated duration of the project.
Beneficiaries	List of the main persons who benefit directly or indirectly from the implementation of the project idea.

The discussion within the coordination board mainly aims to deepen these aspects and to evaluate how the profile of the different subjects of the NOI Spa managed IoT community, can facilitate the development of the project idea. This evaluation is facilitated by the classification of the IoT community subjects in terms of sectors in which they operate and the type of products and services they offer (see 2.3 Methodological note). Therefore, at the end of the meeting, a development strategy will be defined based on the specific needs of the company in the continuation of the project idea.

4.2 Support development of the idea

If the company should be interested in drawing on the expertise, products and services of the IoT community subjects, a second meeting (Figure 17) will be aimed at:

- Networking the company with the most suitable IoT community partners for the development and implementation of the project idea
- Further developing the content of the idea according to the objectives laid down by the proposer
- Consolidating the timing and organizational aspects of the project

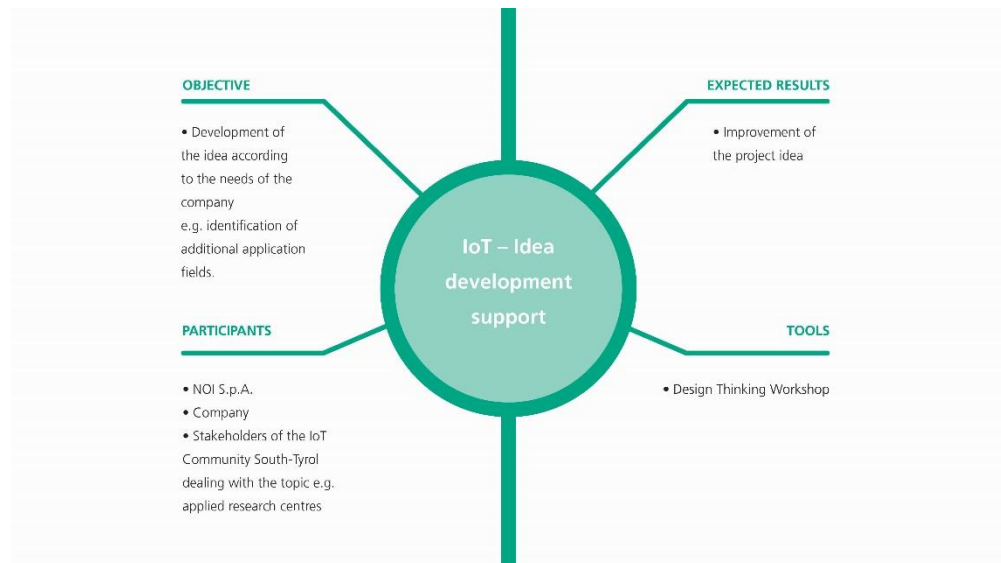


Figure 17: Idea development support Overview

In support of this phase, the *Design Thinking* approach, and in particular the technique of Brainstorming 6|3|5, are particularly promising to promote the development of innovative ideas. This technique characterizes many creative idea generation processes and consists in creating a creative environment, in which each participant, within a work table, contributes to broaden the ideas proposed by those who precede it. The dynamic foresees the passage of ideas, which each participant notes in three worksheets, similar to the one proposed in Figure 18. The starting ideas can be enriched by further aspects during this iteration among the participants. This process continues until the time when each participant has received their own sheets in which the original project idea was proposed. The acronym Brainstorming 6|3|5 refers to the objectives that this technique places, namely six participants, three ideas, five iterations for integration.

BRAINSTORMING 6|3|5 - Generating creative ideas

Keyword

1. Starting Idea

2. Proposal for improvement

3. Proposal for improvement

4. Proposal for improvement

5. Proposal for improvement

6. Advancement of the idea of starting (on the basis of suggestions for improvement).

Figure 18: Brainstorming Material 6|3|5

Design Thinking is a methodological source from which to draw on the use of additional techniques to support companies in the development and implementation of innovative projects. This method, focusing on the end user (*user-centred perspective*), allows market expectations to be translated into a specific product/service, increasing the diffusion of innovation, for example for the local context of South Tyrol. In the perspective of digital transformation, *Design Thinking* can be considered one of the themes of greatest interest for the organizational and managerial culture of companies as a tool for strategic transformation [7].

Design Thinking

The new *problem-solving* creative way of thinking takes its origins from the Stanford University School of Design in the early nineties. Advocates of this technique include Tim Brown, CEO of IDEO, one of the leading international design and consulting companies. The main concepts on which design thinking is based concern the centrality, in the decision-making process, of the person as an active participant and as an end customer. The participants, in a creative process based on Design Thinking, play an essential role as creative individuals driving the entire process in the various phases:

Identification of the problem to be addressed through the involvement of experts and analytical analysis (gathering of information) in order to gain an overview of all the dynamics of the boundary problem.

Definition in-depth analysis of the problem by analysing the data and information gathered in the previous phase. Through group work it will be possible to start collecting valid potential for the project

Ideation of more structured and alternative ideas that will be further improved and filtered in order to pass to the next phase of prototyping.

Prototyping ideas and concepts developed in the previous phase. The prototypes make it possible to identify solutions to problems not addressed in the previous phases.

Test of the realized prototypes and further improvement of certain characteristics. The testing process and the consequent continuous improvement of the prototypes, as well as the possible iteration of some of the previous phases, continues to define a product that meets all the requirements.

4.3 Project Development

A further phase, at the end of the previous ones, foresees the very start of the project or the request for facilitation through participation in regional tenders for Research and Development (R&D) or projects co-financed by the European Commission (Figure 19).

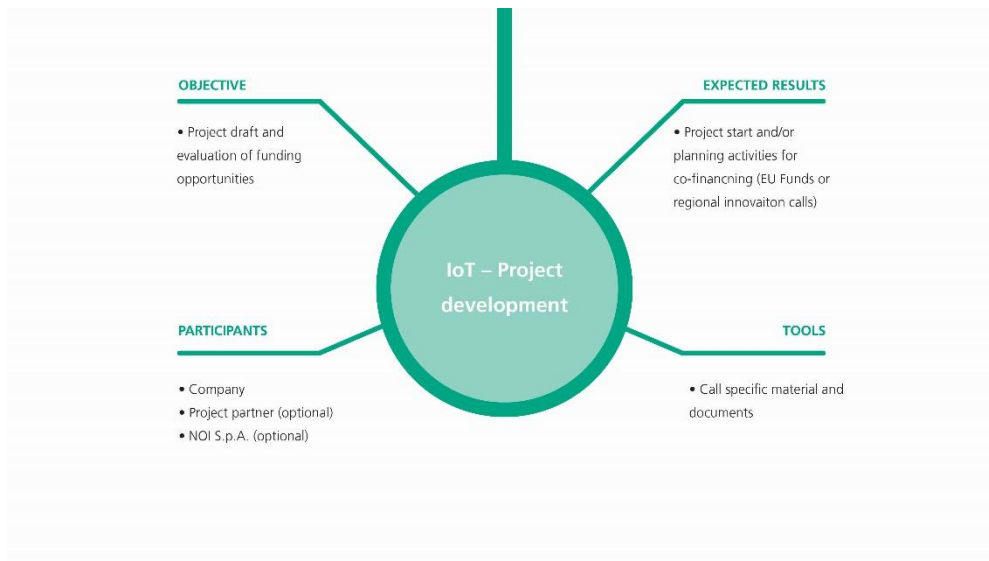


Figure 19: Project development Overview

At this stage no specific tools are provided to support the collaboration but reference will be made to the material prepared by the specific funding program or to the project material made available between the partners.

4.4 Application guidelines

During the FESR 2023 Beacon Südtirol project, in addition to the development of the guidelines described in the previous sections, a test was conducted on 26.06.19 to evaluate its effectiveness among the companies participating in the regular work groups, updating on the progress of the project activities. Workshop participants were asked to propose ideas starting from one of the proposed reference sectors (Figure 20), consistently with the sectors defined by the Alliance for the Internet of Things Innovation [6] (AIOTI 2017).

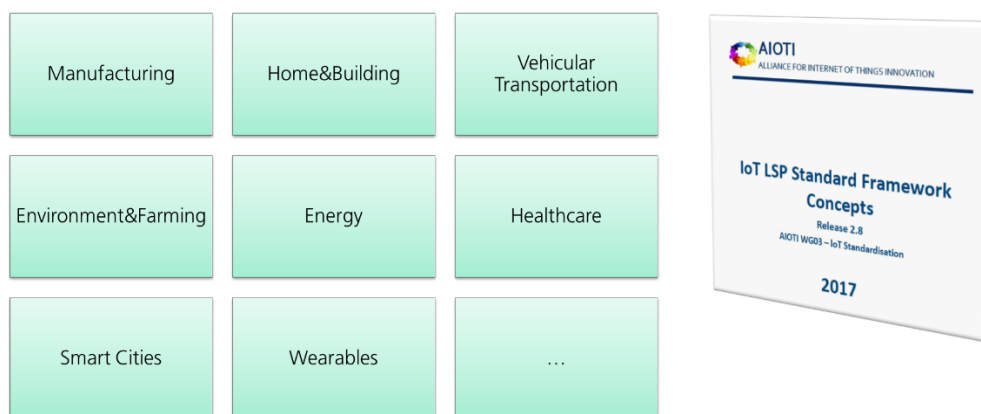


Figure 20: Reference sectors for generating innovative ideas

As an additional criterion, the adherence of the ideas to possible strategic applications for the territory was required. The session was moderated by Fraunhofer Italy and saw the participation of companies and start-ups that offer services and products in the context of the IoT. The work done during this workshop led to the generation of innovative ideas in the following areas: environment, health, smart-cities, and mobility (Table 8).

Table 8: Summary sheet business application guidelines

Target

Developing possible innovative ideas in the IoT area

Technique

Brainstorming 6|3|5

**Participants****Moderator****No. ideas generated by sector**

<i>Environment / Agriculture</i>	<i>3</i>
<i>Smart city</i>	<i>2</i>
<i>Health</i>	<i>1</i>
<i>Mobility</i>	<i>1</i>

Table A1 in the Appendix summarizes the main ideas generated during the brainstorming 3|6|5 session.

4.5 Final Remarks

Being a general test, participants were allowed to freely select or indicate the sector in which to propose innovative ideas in the IoT area. Within the work table (see § 4.2 Development of the idea support), the application of this technique is foreseen in a specific way to the sector and to the content of the project idea provided by the company using, for example, the description indicated in the "Project idea sheet" (see § 4.1 Coordination board). This will make it possible to obtain more concrete results that are more consistent with the specific idea that we intend to develop. For the test a simplified model has been proposed which requires the compilation of a worksheet for each participant, compared to the three envisaged by the original methodology. This aspect allowed the participants to focus exclusively on the concept of the technique and provide feedback on its effectiveness independently of the complexity of the dynamics provided by the original method. The positive opinions that emerged on the side-lines of the test suggest that the application of this technique can be gradually proposed in its original version. Consistent with the specific objectives of the moderation activities, additional techniques related to *Design Thinking* may be used in moments of interaction between companies and other subjects belonging to the IoT community.

5 Technological state of the art analysis of the IoT industry

This chapter contains an introduction and a summary of the work carried out by the FOS Group and reported in the document entitled "Realization of an analysis of the state of technological art in order to identify current and future technologies and platforms regarding the IoT sector". The document contains all the results obtained in the development of the analysis of the state of technological art in order to identify the technologies and platforms, in particular, current and possibly future for the IoT sector. The first difficulty to consider in dealing with an analysis of this type is given by the reality that the IoT is a concept, a paradigm and not a technology; the IoT is embodied in the technology of things, in fact it arises from important insights that saw a maturation which started with the telegraph, perceived with research on Wireless Power Transfer (WPT) by Tesla, unconsciously applied to solve some student problems at Carnegie University and finally defined and summarized with the idiomatic phrase "Internet of Things" by Ashton. Today, 20 years after the awareness of the existence of the Internet of Things - as well as the coining of its name - we can affirm that the expansion of this paradigm has allowed the technologies related to it to have become so important that they are changing our lives socially and industrially, both in habits and in the management of business processes. Developing IoT applications does not just mean creating systems to connect devices in a network, but more complex activities are expected. We are at the peak of development activities and relative expectations for the IoT. It is therefore necessary to first understand the technological structure involved in an IoT application. In fact, to be applied, the IoT paradigm must be considered as a set of different systems including objects, communication systems and combinations of various software solutions, as well as the data itself, the related analysis activities and the actions arising from them. In the present study, the technological world of the IoT was analysed considering its fundamental aspects: device, communication and application framework.

5.1 Study Features

The analysis saw a first bibliographic study of existing technologies, considering both market (commercial) and research (scientific) contexts, with evaluation of the most promising emerging trends. The evaluation was carried out considering both hardware-independent platforms - therefore unrelated to the type of infrastructure and hardware technology - and platforms operating exclusively with a specific type of hardware and considering commercial off-the-shelf components or those consisting only of chipsets. The technologies and platforms have been evaluated based on the following characteristics:

- level of development
- quality, availability at market level and relative support
- development philosophy: open/closed, proprietary/free, both hardware and software, and related distribution licenses and use
- quantity and quality of the projects in which they are used
- future trends in following years

Subsequently the technological world of the IoT was analysed considering its fundamental aspects: device, communication and data management. The study is certainly not exhaustive, given the technological vastness that the IoT invests, but it represents a tool that can give the idea of the technological path that will be configured, with a look at the situation in South

Tyrol, seen in chapter [8]. The work continued with the identification of exemplary IoT platforms that were subsequently tested in the field, exploiting a specially designed test protocol together with the Beacon Südtirol - Alto Adige community.

5.2 Technology trends in South Tyrol

In this chapter we took a look at the technological trends of the IoT world on the Italian territory and in particular in South Tyrol. In Italy the evolution towards the IoT for the corporate fabric was impressed by the Government through the incentives contained in the National Industry 4.0 Plan (today Company 4.0), which provide for forms of tax relief for the purchase of industrial machines equipped with remote maintenance and/or tele diagnosis and/or remote control systems, continuous monitoring of working conditions and process parameters as well as other systems for monitoring the production process. Therefore, it can be established that the IoT at a national level is moving towards defining technological developments in order to push the industrial digitalization process towards IIoT and consequently the birth of IoT services for people. Obviously individual companies can move freely in the intricate world of hardware, software and protocols available, but at a national level it is necessary to have a reference infrastructure, in particular with regard to networking and access technologies (see Network Access Layer pag. 22 [8]). The technologies which are taken into consideration are, of course, the technologies that allow the coverage of large areas, therefore from *cellular-like* to *cellular* ones, if we consider *wireless*. In fact, as can be seen from the document issued by the Chamber of Deputies' research department (XVIII legislature) of 5 April 2019 [9], there is a reorganization of the electric radio spectrum following the new National Frequency Distribution Plan (PNRF 2018 - MISE decree dated 10/10/2018). The Plan divides the spectrum by providing for the reassignment of frequencies according to international and European agreements in recent years, to allow the development of new technologies - which include, among other things - the reduction of the band for television broadcasts in favour of new developments in 5G communication networks [9]. For the concrete allocation of frequencies, the new National Frequency Allocation Plan (FIP no. 2018) was approved by the Communications Regulatory Authority, with resolution no. 290/18 / CONS of June 27, 2018, then updated February 7, 2019 with Resolution No. 39/19/EC, as required by the 2019 budget law. Furthermore, with Decree Law no. 135 of 2018 the definitions of *blockchain* and *smart contract* were introduced in our system. The 2019 budget law has established a Fund for the development of technologies and applications of Artificial Intelligence, *blockchain* and IoT [9]. This document also shows that the requirements for its implementation were scheduled within the four-year period 2018-2022 to arrive at the definitive passage of the frequencies of the 700MHz band, from digital terrestrial television broadcasting to that of G wireless broadband. Currently in Italy 5G is being tested in 120 small municipalities, as well as some *smart cities*: Bari, L'Aquila, Matera, Milan, Prato, Rome and Turin. No municipalities in South Tyrol are among the municipalities involved in the experimentation.

In addition to mobile operators with cellular technologies, such as 5G, other realities are moving around the country, mostly related to *cellular-like* technologies such as *Sigfox*, *Ingenu/RPMA* and *Long Range Wide Area Network (LoRaWAN)*. *Nettrotter*, a subsidiary of *El Towers*, is the only licensee for the distribution of the *Sigfox* network for IoT in Italy. The site reads textually that the "*Sigfox* project has already started: *Nettrotter*, exploiting the existing TLC and television towers, plans to achieve national coverage, with almost 1,000 *Sigfox* Base Stations installed. Over 40 of the main Italian cities are already covered, including Rome,

Milan, Turin, Bologna, Florence, Naples, Bari, Reggio Calabria, Palermo [10] also declaring that 80% of the population is already served by the *Sigfox* network. *Materlink Spa* is the licensee for Italy of *Ingenu/RPMA* technology, but is only available for its own *metering* products. The site itself [11] does not include coverage outside the United States of America.

For LoRaWAN, the discussion changes, as a Dutch company *THE THINGS NETWORK* has identified a different business model and proposes the installation of a global *LoRaWAN* network with free access. As also stated in the Community Manifesto, *The Things Network* "aims to build a completely open, decentralized, user-owned and managed IoT network [12]. Currently in Italy there are 31 registered communities and about 211 gateways installed [ibid.]. In general, Trentino-Alto Adige at the level of the AGCOM decree is affected by the 5G experimentation in some municipalities in the Trentino region. Autobrennero Spa, together with the Bruno Kessler Foundation and other international partners, will test a 5G system along its motorway network [13] with the project called 5G-Carmen.

Nettrotter which holds the licenses for the development of the *Sigfox* network in Italy, from its site, [10] points out through the coverage map that Trentino Alto Adige has a coverage that fluctuates between 20% and 49%. The *LoRaWAN* issue in Trentino-Alto Adige is different, as today there are 3 gateways registered in the *THE THINGS NETWORK* in the Province of Trento and around 15 communities present [14]. Since 2018 in South Tyrol, there has been particular excitement concerning the infrastructure for IoT technologies and applications. In fact, in addition to the *5G-Carmen* project, *Fastweb* has also announced an investment of 3 billion euros over five years for the expansion of broadband infrastructure [15], so it is very likely that a 26GHz *backbone* will be created for 5G (of which the company is a licensee). These initiatives, aimed at creating a complete infrastructure, also include *Wireless* and *Wired* initiatives, such as the project carried out by Alperia Fiber in collaboration with *Saidea* and *Huawei* [16], whose goal is to make more evolved digital services more accessible to the citizens and businesses of Alto Adige [ibid.]. In the ERDF 1069 *Open IoT for Smart Cities* project, which involves *systems Srl* and *Fraunhofer Italia*, the experimentation takes place through a comparison with a medium-sized municipality in the Alto Adige area identified in the Municipality of Merano [17], where one of the technologies taken in consideration is *LoRaWan*. Still on the subject of *LoRa*, there is an important initiative by the business incubator *Noi spa* within the *FESR 2023 Beacon Südtirol* project, which provided the technology park with a free access *LoRa* network for study and test purposes. In addition, there are many initiatives that involve the use of technologies that require gateways to access the Internet and that implement concepts of *Edge* and *Fog internet*. Ultimately, on the territory of South Tyrol an evolution of the *5G/5G Fixed Wireless Access/Fiber* as a *backbone* and the growth of *LoRaWAN gateways* and technologies that require particular gateways both for routing on *LoRaWan* and directly on the 5G network can be envisaged. It is understood that the current *LTE* networks will also still be widely used in the IoT area.

5.3 Final Remarks

In the present technological study, there is no clear distinction between the concept of IoT and IIoT. Therefore, the vision of the IoT can be oriented both to the consumer and to the industry. In the consumer-oriented concept, the focal points are people, domestic applications, *consumer* electronic devices, cars, computers and many other commonly used objects. Industry 4.0 (IIoT) instead creates opportunities for companies, production plants or

entire sensor networks. The examination of the various protocols and technologies present at the *Network Access Layer* level in the IoT panorama has shown a first settlement at least for the *LWPAN/Cellular like*. In fact, the *3GPP* has already released all the *LTE* and *NB-IOT* specifications, only the *EC-GSM-IoT* remains which is at version 13. On the other hand, companies and research centres do not expect *GSM* operators and thanks to the various associations and consortia they are increasingly giving life to various valid alternatives, first of all noting *Sigfox* and *LoRaWAN*. In the world of *WLAN*, *PAN*, *ULPW LAN*, highly targeted and application-related technologies are emerging, such as the *ANT/ANT +* devices on the market for personal *fitness* and *health-care gadgets*, and technologies with *BLE* and *ZigBee* that are linked to more broad-spectrum activities. *ZigBee* is more oriented towards the industrial and domestic side, where even in these cases there are convergences, as is happening between the *ZigBee Alliance* and the *Thread group*. The latter products are now becoming part of our homes, in fact there are many *Google NEST Thread* products. In the *Session Communication Layer*, the situation is in the process of stabilization, the most used protocol is the *MQTT* which is seeing an evolution from a protocol designed for telemetry to the IoT-oriented protocol. Not forgetting the classic protocols of the *WEB*, among which the adaptation of the *XMPP*, born for the exchange of messages, stands out but which is also proving to be an excellent protocol for the IoT. Finally, the way data is managed and analysed can boast the presence of a myriad of different systems and platforms. In this analysis, only a few that are not always the most used in the IoT world have been considered, but they are very interesting from a technological point of view.

The situation in South Tyrol shows a diversity of applications linked both to technologies that require a gateway to access the Internet, and to technologies directly connected to the Internet. Considering only the latter we notice a major launch of technologies related to 5G, but at the moment we are reporting the presence of specific projects or the creation of *backbone* connection. Furthermore, as it is also being structured at a national level, 5G will cover the areas of greatest voracity of data, such as large cities and vast industrial areas. The peripheral areas - and in particular - the rural areas, which represent a strong point for South Tyrol, will not be the focus of attention. From this point of view the business ecosystem linked to the South Tyrolean IoT is being organized both with *PAN*-related technologies and with *LPWAN*. These allow, through gateways, access to Internet networks maintaining transparency with very high connectivity (as opposed to the use of wireless and wired, and cellular or cellular-like technologies) and to take advantage of the technological developments of connectivity that will gradually arrive over the territory.

6 Conclusions

The IoT represents one of the main technologies enabling the fourth industrial revolution. The possibility of connecting every single object to a network, univocally reachable, as well as being integrated in a context of centralized or distributed information systems, will allow the development of technologies, products, services and business models. The creation of an IoT community at a local level that intends to collaborate in the definition of innovative ideas, can favour the further development and use of this type of technology, increasing the capacity of local stakeholders to generate positive effects on the region. In addition to stakeholders that include representatives from the world of industry, research and public administration, as well as civil society involvement is desirable in order to guide the development of innovative products and services based on market expectations and needs. In South Tyrol there are numerous opportunities for the application of IoT technologies in sectors and areas that are more strategic for the territory such as agriculture, tourism, mobility, services to citizens and public administration, smart-cities, healthcare, manufacturing and construction. Such applications can represent new growth opportunities for local companies, as well as the offer of innovative services with high technical content and know-how in the area.

The systematic collection of projects highlights the wide range of sectors and application areas for the development in the IoT area, potentially transferable according to needs within the context of South Tyrol. The knowledge of previous experiences carried out at a local and international level in the IoT field represents useful information that can facilitate the stakeholders interested in defining innovative projects in strategic sectors.

The results of the survey aimed at defining active South Tyrolean stakeholders or those that can benefit, even indirectly, from the introduction of innovative IoT services shows the existence of a very heterogeneous and synergetic network composed of companies, research centres, start-ups up and public administrations. The profile of the community that the research allowed to delineate, can be considered the initial context of competences, to which NOI Techpark will be able to refer in order to foster collaborations for the development of innovative ideas. Encouraging the creation of such collaborations in the territory can contribute to the development and market introduction of innovative products and services. In support of the innovation processes and the definition of new ideas, guidelines have been prepared that indicate the type of interaction between the parties that are part of the IoT community and NOI Techpark. In this sense, we also intend to inform interested parties about the development of collaborations in the IoT field regarding the type of support offered by NOI Techpark in the development of the idea, in the search for potential cooperation partners, in the definition of concrete projects, and in the evaluation of financing opportunities.

In technological terms, in South Tyrol there is a potential of several applications that refer to both technologies that require a gateway to access the Internet and directly connect to the Internet. Initiatives reported locally that Wireless, Wired and LoRaWan use can be evaluated for further local applications. In this context, the interested parties will be able to benefit from the Long Range Wide Area Network made available to local companies by a network of sensors capable of transmitting information in real time, to conduct research aimed at introducing products, services and models to the innovative business market based on the potential of the IoT for the benefit of competitiveness and as a factor in the attraction of skills (e.g. innovative start-ups) for the territory.

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The English version of this report is a translation of the original in Italian *"Internet of Things: potenziale, ambiti di applicazione e linee guida per lo sviluppo di progetti per le imprese dell'Alto-Adige"*. The present document has been translated by Rawlinson Emma Victoria.

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Fraunhofer Italia Research is a partner of the Fraunhofer-Gesellschaft, the largest applied research organization in Europe. Thanks to its multidisciplinary team it guides businesses towards digital transformation, assisting them from the first ideas of development to prototyping. In IoT it is involved in the conceptual development of areas of application, distributed systems for data acquisition and sensors, as well as consulting on enabling technologies such as 4G / 5G, LoRaWAN, NFC, Bluetooth, embedded platforms and advanced sensors.



The FOS is a high-tech company involved in IT, the Internet of Things and electronic design, leader of the FOS Group, a group of companies focused on ICT and Technology Transfer. In particular, the FOS Group is very active in the development of high value-added technologies and provides a wide range of services in Information Technology and Telecommunications, Engineering and fast prototyping.



The Digital Technology Sector at US Techpark AIMS to turn into a smart green South Tyrol region. Together with strategic partners, as well as with start-ups and companies, it is setting up a Free Software Lab and an Open Data Hub. Moreover, promotion and networking of software developers and R & D projects are a key factor in the development of South Tyrol as a pilot region in digitalization and future issues: such as the Internet of Things and Big Data.

Appendix

Table A1 Innovative development ideas through technical 6|3|5 summary

Sector	Starting Idea	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Advancement of the starting idea
Environment / Agriculture	Optimize water and pesticide use in agriculture while maintaining quality of the final product	Measure the degree of ripeness of the grapes	Give access to real-time data for research on opendatahub.bz.it	Communicating concise information to the winemaker for example, for sale	Share the map with the public/customers	Optimize water and pesticide use by using data available on existing platforms and sensors installed in the fields to monitor useful parameters (e.g. maturation, soil moisture, plant health). Some parameters should be shared with different players and each should be given the most useful information in the best way.
Environment	Widespread monitoring of outdoor air quality in urban areas	Through crowd-sensing and use of low-cost sensors	Carrying out the analysis of environmental parameters not normally considered, eg random	Points where the user cannot give personal feedback	Using data also coming from mobile "sensors" installed on fleets of vehicles/means of transport	Low-cost sensors on transport fleets with fixed sensors also managed by citizens (crowd-measurement).
Environment	Geographical walking routing avoiding city heat-maps	Use of interaction between mobile devices	Creation of points of interest can be interfaced with a smartphone	Promotion of a community of runners who can share their journeys to make them more enjoyable	From the vineyard to the bottle	Proposals are not very relevant as smartphones cannot collect the geographically localized data at sufficient granularity. We need a network of IoT sensors

Sector	Starting Idea	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Advancement of the starting idea
Health care	Simulation of a biological system	Knowledge of the initial context and parameters	Data Sharing	Machine Learning		Development of a simulator of biological systems using distributed configurations defined through the initial context and boundary conditions, through data sharing and applying AI and Machine Learning concepts
Intelligent City	Register data via opendatahub.bz.it for app developers	Create categories of data broken down by type of user and data source type	Using simple interface for statistics on Open Data Hub (GEO type BI)	By enabling a display system with control over knowledge of the problem	Provide API for sending real-time data	Create a web interface for users, as a data browsing and discovery tool for available data. Also provide a public API to upload data accessible to third parties
Smart Cities	Share for proximity marketing information	Publishing information such as Open Data and Machine Readable on opendatahub.bz.it	Profiling the users of commercial activities	Add gamification to attract users	Connect the data to other open data sources	Create an integrated tourist culinary information system for example food and wine tours
Mobility	Intelligent bus stop	Monitoring the number of people at the bus stop and buses to manage places	Vehicular tourism advertising	Publishing real-time data, Open Data and Machine Readable on opendatahub.bz.it	App development for the user who can see the occupation of the bus in advance	Smart bus stop for monitoring people at the bus stop and the location of the bus. Data published in real time (anonymous) and availability to be able to add tourist information viewable in the app where the eventual subscription is associated