AIOTI STRATEGY
2017 - 2021

AIOTI
ALLIANCE FOR INTERNET OF THINGS INNOVATION

PREFACE AIOTI STRATEGY 2017-2021

Dear AIOTI members, stakeholders, and IoT Innovators,

It is my pleasure to present to you the first AIOTI Strategy defined by the members of the Alliance. The Alliance for Internet of Things Innovation (AIOTI) was established formally in September of 2016, after a period of one and a half years of exploration, pioneering and informal discussions with the support of the European Commission (EC).

Now, with an organisation of over 190 members and growing rapidly, we can focus on the true purpose of AIOTI, which is stimulating IoT innovation in Europe for the interests of our members in Industry (large and small), Academia, Society and Government. The involvement of all these stakeholders across application domains is crucial to our success.

AIOTI is leveraging a strong relationship with the EC while being independent, and intends to increase the leverage with other organisations, focusing itself on what is missing in the chain to make things work.

Over 100 AIOTI members have contributed directly to this strategy during the Strategy Workshop, held in May 2017 in Toulon, and later in reviews. It will form the guideline for AIOTI's actions in the coming years. It includes keeping an eye on new trends as there is no fully predictable future in IoT, and AIOTI must be able to re-focus and re-invent itself.

AIOTI's strategy features a general, Association-level approach for which the Management Board assumes responsibility, Horizontal elements across domains managed by Working Groups 1 to 4, and application domain strategies in the other Working Groups.

Some sections are still under development and the newly elected leadership of the Working Groups will assume ownership for it as we are a member-driven organisation.
I am looking forward to the implementation of AIOTI's strategy, driving IoT innovation for economic and social relevance of our members.

On behalf of the AIOTI Management Board,

Kees van der Klauw
Chairman

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INTRODUCTION

While the Internet has been established in recent decades as a network mainly serving the exchange of information between people and their computers, the Internet of Things (IoT) holds many more promises and challenges.

The IoT is about real time, massive data sharing between very large numbers of users, being not only humans but increasingly machines that will exhibit forms of autonomy and intelligence. Those machines (often referred to as 'smart things') will be autonomously processing the data to control cyber physical systems such as buildings, homes, factories, transportation systems, and more.

In such configuration, the IoT pushes the digital revolution further and promises societal transformation beyond what we can imagine today. However, it poses many challenges.

Apart from the technological challenges to manage e.g. the vast amounts of nodes, data and data transfers with high reliability, power consumption, and interoperability, there are many other issues to be resolved before such Internet of Things is successfully implemented with social and economic relevance. Traditional approaches of stimulating technological research and development are no longer a guarantee for success; neither is the linear innovation model applicable to IoT.

Issues such as acceptance and trust by end-users, identification of relevant use cases, experimenting and learning in real scale pilots, creating eco-systems across vertical industries, involvement of a wide range of stakeholders, openness of platforms and securing privacy and security have already been identified as critical.

The European Commission recognised that an innovation approach was required to stimulate the socially and economic relevant take up of IoT in Europe, and so in 2015, invited a group of industry and academic stakeholders to discuss this. This was the start of the Alliance for Internet of Things Innovation, AIOTI. After having operated as a 'start up' Alliance without formal status and organisation, AIOTI became an independent, member-driven Association by the end of 2016, with participation of industrial companies large and small, academia, and representatives of end-users and society and with the goal to stimulate IoT Innovation in Europe.

The core of AIOTI is formed by working groups, united in the Steering Board (SB) that initiate and drive activities across application domains in so-called horizontal working groups (on R&D roadmaps, Eco-Systems, Standards and Policies) and vertical working groups that focus on application domains such as transportation, cities, buildings etc. The role of AIOTI's Management Board is to enable and support the working groups with a common backbone, to organise operational management (such as communications and administration), to represent and secure the relevance of AIOTI overall in the international context and to define and execute the overall strategy.

This document provides the strategy of the Alliance for Internet of Things Innovation, AIOTI, on an association level and with full detailing on Working Group levels. It is created and endorsed by AIOTI members. For the latest version of the document and more information on the Alliance please visit on www.aioti.eu

Vision of the Alliance for Internet of Things Innovation (AIOTI)

AIOTI is the multi-stakeholder platform for stimulating IoT Innovation in Europe, bringing together small and large companies, start-ups and scale-ups, academia, policy makers and end-users and representatives of society in an end-to-end approach. AIOTI works with partners in a global context.

AIOTI strives to leverage, share and promote best practices in the IoT eco-system, and to be a one-stop point of information on all relevant aspects of IoT Innovation to its members while proactively addressing key issues and roadblocks for economic growth, acceptance and adoption of IoT Innovation in society.

AIOTI goes beyond technology and addresses horizontal elements across application domains, such as: matchmaking and stimulating cooperation in IoT eco systems, creating joint research roadmaps, driving convergence of standards and interoperability and defining policies, while also putting them into practice in vertical application domains with societal and economic relevance.

AIOTI is the partner for the European Commission on IoT policies and stimulus programs, focusing specifically on identifying and removing obstacles, fast learning, deployment and replication of IoT Innovation in Real Scale Experimentation in Europe, whilst taking a global perspective.

AIOTI is a member-driven organisation with equal rights for all members, striving for a well-balanced representation from all stakeholders in IoT and recognizing the different needs and capabilities of each.

AIOTI wants to be recognised by its members as the most relevant actor for connecting to the European IoT Innovation eco systems in general, and as the most practical intermediary to find partners for Real Scale Experimentation.

Strategic Issues of AIOTI

Identified in 2015 by the European Commission and detailed by the initial working groups of AIOTI, traditional approaches to innovation are not effective for IoT Innovation. More speed and agility is required, a stronger involvement of end-users with specific criteria for market adoption while creating new value requires cross-cutting approaches and shared platforms.

AIOTI working groups made clear recommendations on how these challenges could be addressed and they are now instrumental in the implemention of these recommendations via its members. A very important element is continuous learning from Real Scale Experimentation in the market, which will lead to further recommendations to policy makers and refinements of our approach.

The key strategic challenges identified at the general AIOTI level are:

- Addressing rapid technological developments.
- User acceptance of IoT innovation, building trust.
- Drive towards deployment.
- Managing the risk of fragmentation, converge in a field of international competition.
- Involvement of SME's.
- Education and information to stakeholders in their context.

And from an operational point of view
- Professionalizing the AIOTI organisation and making it sustainable.

Addressing rapid technological developments
While IoT innovation is enabled by advancements in semiconductor, communication and information technology, the breakthrough power of IoT innovation comes from the end-to-end application of all these technologies in many domains. And there is a prominent role for the use of data generated in the digital society by people and machines. The reach of IoT innovation is global and for virtually any application domain that one could think of, which implies that many are still to be discovered and explored.

Technological advancements will continue, leading to new application domains with a distinct relation to IoT. Clear examples already identified today are 5G networks, Artificial Intelligence (approaching the powers of the human brain), robotisation, quantum computing, block chain and nanotechnologies. Some will have an impact within the scope of an AIOTI working group; some may even require the formation of new working groups and building new networks in an AIOTI context.

AIOTI should sense these trends on permanent basis and assess how they should be treated in an end-to-end perspective across the value chain. At the same time, technologies may become so common that dedicated attention may no longer be required, which should lead to off-loading of Working Groups. Working Groups in AIOTI should always be relevant, which implies a dynamic management of focus areas and even of entire Working Groups.

User acceptance of IOT Innovation, building trust

One of the main inhibitors identified for the uptake of IoT Innovation is the lack of trust in IoT technologies and applications in society (ref. OECD 2016). Yet, many technologists are insufficiently engaged with these social challenges. The simple question 'who owns the (personal) data and who decides what can be done with it' is a major topic in AIOTI.

Security and privacy breaches will happen, which will create distrust, and at this moment many of the stakeholders are insufficiently aware of the exposure and risks of IoT. Public opinion and policies are very different in various countries and they may shift over time. In this dynamic international context, avoiding dispersion and driving convergence for economy of scale are main interests of our members.

This issue cannot be resolved by regulations and requires a consistent, learning approach across many modalities: education, technology, policy, continuous involvement and dialogue, and experimentation. It is a perception issue which will require establishing justified trust where AIOTI can play a role as an end-to-end stakeholder organisation.

Drive towards deployment

IoT innovation can only take place in society, even though technological solutions usually originate in a laboratory. It is about identifying the right use cases (value proposition), the boundary conditions and stakeholder roles in a real-life (but still contained) environment in which all stakeholders are participate and mutually and jointly learn. Society is the new laboratory and there are many good examples these days (Farming, Cities, Mobility, Living/Aging, Wearables). In these constellations one also steers new business models.

Such Real Scale Experimentation, RSE, (called Large Scale Pilot with the EC) requires upfront commitments, the use of platforms, appropriate performance measures and evaluations and fast learning loops but when proven successful, the transition from such RSE to a real commercial proposition is much more straightforward than in the traditional approach.

AIOTI wants to be the champion organisation of such RSEs, by proposing them, by engaging with and matchmaking between our members for participation, by inviting missing stakeholders (including non-technical), by defining and promoting criteria for execution and success and by sharing best practices. This includes contributing to defining business values and models, making available technology platforms to members participating in RSEs and ensuring synchronisation between research activities, standardisation and go-to-market activities. In other words, AIOTI needs to be in a strong relation with the European Commission (ETP) as well as independently with members.

Managing the risk of fragmentation, converge in a field of international competition

While the scope of IoT Innovation is already very large, the risk of fragmentation across too many independent initiatives that are duplicating efforts, competing for resources, developing non-interoperable solutions and driving different standards is very real.

AIOTI is the organisation that drives for convergence with dedicated working groups on standards and policies, and in the working group

on Innovation Eco-Systems. In the latter it also addresses convergence of stakeholders in common approaches (based on best practices), criteria, use of language, promoting common regulation and policies, organizing joint symposia and many other relevant topics. This should enable easier participation of our members, and particularly SMEs, in the eco-system and help to avoid non-value-added diversity and cost.

While this is already a challenge in the European landscape, AIOTI recognises that the Internet operates very much across national boundaries and therefore should cooperate in an international context with strong partners. Such partners may be other consortia but also special interest groups. High level relationships are built and maintained at AIOTI board level (MB, SB) but operate on various levels with strong involvement of the working groups.

With the strong backing of the EC, AIOTI is in a key position to drive this convergence and conversely, the fact that many members of AIOTI are rooted in the individual member states of the European Union is a driver for deployment of convergence in the roots.

Involvement of SME's
While large industrial companies usually have sufficient knowledge and resources to proactively participate in the IoT eco-system, startups and small and medium enterprises often lack those means. Yet, the SME's play a significant role in economic value creation in the IoT. This is already demonstated in applications SME's develop for established eco systems in personal computing and mobile phones, but they are expected to play an important role in every vertical application domain, contributing to the value of platforms. AIOTI will pay dedicated attention to lowering the barriers for SME's to participate in the IoT Innovation eco-systems, both for horizontal topics such as standards and policies, but also in vertical domains. Easy access to relevant information and finding one's way in the eco-system for partnership are just a few elements.

Rather than separating the SME's in dedicated working groups, AIOTI will involve them proactively in all its activities, which is reflected in each of the workpackages below.

Education and information to stakeholders in their context
Many aspects of the future Internet of Things (which includes people, processes next to machines) cannot possibly be understood today by a single person, or even a single company. This leads to a 'separation of concerns' by layering the eco system in component and technology providers, communications operators, applicants in many business models on the one hand, and experts in e.g. legal and political aspects on the other hand. However, a successful application does require that the right knowledge is created and bundled in a timely fashion, and in a vertical application domain. This is particularly valid for the creation of new value, i.e. in creating new value propositions across traditional boundaries.

Until recently, several stakeholders have not been engaged in the development of IoT Innovation. This is particularly true for representatives of society and end-users. Those and other stakeholders lack a clear understanding of what IoT is, what it not is, what it can bring, what the risks are and what knowledge should be acquired. AIOTI, in its role to stimulate the uptake and acceptance of IoT Innovation in Europe, has a key role in identifying these knowledge and information gaps and organizing and orchestrating for filling those gaps in the interests of our members.

Apart from this, there will always be a need to have rapid access to relevant information for specific programs and projects in IoT Innovation, be it access to funding, access to partners, and legislation made simple, and AIOTI will arrange for a 'one stop shop' on how to get this information to its members.

Professionalising the AIOTI organisation and making it sustainable
AIOTI can only be relevant for its members and stakeholders if it is a healthy, sustainable and highly professional organisation itself. Since its start, AIOTI has transformed from an informal organisation with loose membership responsibilities into a formal organisation with currently 170 members and much clearer governance.

However, we must improve further to create a successful future for AIOTI. We need to grow (at least double the number of members in 2 years), we need to professionalize our communications and administration, and we need to develop new initiatives for expanding our activities (e.g. sponsored events). Communication and administration should not be considered as costs, but as investments to drive higher efficiency, income and relevance for members.

Primarily we need to provide a very efficient and effective (modern technology-based) infrastructure for communications in all aspects to our working groups supporting an agile way of working the IoT innovation needs.

We need to proactively develop financial plans, linked to activity plans in more detail and have financial statements audited and reported to the General Assembly. At all times, members should have transparency over our activities while securing an agile and effective Association.

Strategy of AIOTI Board 2017 – mid 2021

Objectives & Work Packages AIOTI Board up to mid-2018

WP 1: Continuous renewal of AIOTI focus areas, addressing rapid technological developments.

The purpose of this work package is to ensure that AIOTI's Working Groups (WGs) are covering the full range of relevant topics and that the working groups remain relevant. While it is primarily a responsibility of the WG leadership and the Steering Board, the Management Board (MB) should regularly benchmark AIOTI's relevance and scope to identify missing elements, and to stimulate WGs to act based on member's feedback. The MB can propose to the GA to start, stop or merge Working Groups in a member's interest. This WP 1 will install a regular assessment process. In addition, this WP will cover the creation of an external network (on Association level) with peer organisations and important stakeholders to assess AIOTI's relevance in the global context and position the AIOTI as a thought leader, based on Working Group activities.

Owner: Chairperson. Support by other MB members, particularly the Secretary. Close cooperation with SB.

Timing: First documented assessment with findings/recommendations by end of 2017. Network building on continuous basis with regular consultation of SB.

WP 2: Linking AIOTI with society and end user stakeholders.

The purpose of this work package is to stimulate the involvement of missing key stakeholders in the IoT Innovation landscape in Europe at the highest level. This activity is complementary to the role of WG 2 (Innovation Eco-Systems) and aims to make AIOTI and its goals known to society, and open doors for cooperation at a working level with our Working Groups and members.
By presenting AIOTI at high-level occasions, we can contribute to user acceptance of IoT innovation and contribute to common understanding and convergence, supporting the main goal of AIOTI to stimulate the uptake of IoT Innovation.
AIOTI MB will develop standard communications packages (also for WGs and members), create a calendar with targeted events, reach out and promote AIOTI, and link contacts with Working Groups and the Steering Board. The MB will drive the development of information packages (leveraging the WGs / SB that can contribute to the education of stakeholders.

Owner: Secretary, supported by Chairperson and Communications. Deployment by all MB members

Timing: Targeted calendar by October 2017, execution cf. plan. Standard communication/ presentation packages available by October 2017 to all WGs and SB. First information / education package available in Q1 2018 (in cooperation with WG 2, WG 4)

WP 3: Drive Real Scale Experimentation programs

The purpose of this work package is to drive in AIOTI a program for Real Scale Experimentation across application domains and involving all

relevant stakeholders. While the European Commission has successfully defined the Large-Scale Pilots, those initiatives are limited, and for a true uptake of IoT Innovation, a much wider approach is required that does not depend on the stimulus of the EC.

AIOTI currently has a unique group of stakeholders in its organisation and should be able to make a strong contribution to the orchestration of such Real Scale Experiments, based on needs rather than subsidies.

While Working Group 2 is very much engaged with building such eco-systems, AIOTI Board can contribute by opening contacts at high level, and arrange stimulus measures and advice on the scope of EC calls for cooperation in the interest of our members, thereby driving a need-based program.

At the same time, AIOTI wants to play a stronger role towards the EC in defining priorities and program content by establishing a formal ETP (European Technology Platform) relationship with the EC.

Owner: Integral Management Board of AIOTI

Timing: ETP relationship established before end of 2017. Defined engagement with the EC by Q3 2018, specifically the involvement in LSPs. First Real Scale Experiment proposal driven by AIOTI by mid-2018 in close cooperation with WG 1, WG 2.

WP 4: International cooperation.

The IoT landscape is very scattered and many new local and regional interest groups and initiatives exist. Rather than having to link with the many initiatives, it is in AIOTI member's interest to have AIOTI representing a large and converging network with a one-stop service. This implies that AIOTI management should continuously look for international cooperation, recognition, sharing and adoption of best practices and provide a clear overview of this landscape to its members. Smaller companies especially are facing challenges to keep up with the network.

The purpose of this work package is to assess the international landscape, provide a clear overview of its characteristics to AIOTI members (with special

attention for SME's), identify relevant opportunities for cooperation with clear scoping, discuss them with the SB, decide upon them and see to it that they are maintained, either by WG, SB or MB.

Owner: Entire Management Board, in close cooperation with the Steering Board.

Timing: Ongoing activity with first assessment presented to SB before end of 2017, including targeted cooperation. Evaluation of current MoU's with Brazil and Japan, assessment of invitations by China and India. Issue a policy paper on scoping of cooperation with the SB by Q3 2017. Establish formal cooperation with clear scope in 2018.

WP 5: Organise information sessions and information networks for stakeholders

The purpose of this work package is to provide information to key stakeholders in IoT Innovation, engage them in AIOTI (membership) and/or in cooperation models in the interest of our members.

End-users and governments especially are lagging in IoT and digital knowledge, which makes them underrepresented in IoT Innovation discussions and programs. Yet they are crucial stakeholders and AIOTI can provide high quality, multi-faceted information (presentations, papers, workshops) to get them engaged.

At the same time, many of our members need information on how they can best leverage the IoT Innovation network. Topics such as IP rights, acquiring subsidy, participation in Real Scale Experimentation, privacy and security legislation etc. are very relevant, particularly for SME's. AIOTI should provide easily accessible and practical information to its members

Owner: Secretary, supported by Integral Management Board and Steering Board

Timing: Inventory of most relevant information needs to be internally completed by end 2017. Inventory of externally relevant information dissemination should be completed by Q1 2018; providing internally information sessions and

packages from Q1 2018 onwards (supported by website for members); offering of external information sessions to commence in 2018, building on (horizontal) WG knowledge.

WP 6: Professionalizing the AIOTI organisation and making it sustainable.

This work package focuses on installing a professional backbone for AIOTI, providing a seamless experience to members. involving and attracting members and external stakeholders. It is only since May 2017 that AIOTI has had professional communications support on an interim basis; meanwhile there is no professional administration support in place yet. This has lead to several missed opportunities and corrective actions.

AIOTI needs to grasp the full communication and membership service opportunity by having a structural support team, not necessarily employed by AIOTI bearing liabilities, but very much a structural partnership with communications and administration professionals. The cost for such support has been incorporated in the financial plan since the establishment and executing it will only justify the investment, as members and stakeholders will experience the benefits and we will be able to grow the membership base. It is essential marketing the AIOTI proposition.

AIOTI also needs to extend the communication and administrative services, e.g. by providing communication platforms for working groups, by managing secure and dedicated mailings, but administering various working groups and task forces, by supporting WGs in organising events, by facilitating on-line polls, along with many other services.

Owner: Integral Management Board, Treasurer for contracting following MB decision, Secretary to chair an editorial board for communications. The Board may be extended using members with specific background in Communications.

Timing: Implementation on very short notice, before Q4 2017. Extension of web facilities for Working Groups by end of 2017. Communication planning by end of 2017 (assuming continuation of current service contract).
Introduction of an AIOTI Quality System (with documented processes) by 2019.

Introduction Working Group 1

The IoT technology is evolving, and demonstrating the features in various applications domains require the integration of the highest, most generalized layers of intelligence and user interfaces, which tie connected devices together and web services using interoperable platforms that ultimately deliver the functionality required by the end-users. The technology behind the IoT must be combined with a number of larger and broader social, economic and political factors if Europe is to make the most of the available productive and innovative potential in the digital transformation process across application domains. Cross-domain challenges in public safety, mobility, health and energy efficiency can be addressed by user-centric ecosystems of interoperable vertical sub-systems. The integration and compatibility of sensors and actuators, artificial intelligence, machine learning and context re-configurability of connected sub-systems that are often complementary in the public space, in turn stimulates the development of novel data-driven, value-added application domain services. Due to their high density and ubiquitous nature, connected systems offer the prospect of evolving into platforms acquiring domain-level contextual information and delivering application management functions to diverse domains' stakeholders. In this context, the WG 1 identifies the technological and societal activities topics which have an important impact on the development, deployment and adoption on IoT applications and technologies, while focusing on tasks defining a common vision of IoT technology and addressing European research challenges for the future.

Vision Working Group 1

We inspire, enable and catalyse the promotion of the advanced research progress and results through creating IoT sustainable solutions, which are essential to a better, safer, and more secure life for people everywhere. We monitor, identify and analyse the research trends, technologies and applications to define the paths towards IoT technologies, the applications for societal, economic progress, and the creation of value for our AIOTI stakeholders and society at large.

Mission Working Group 1

To build a vibrant, thriving and supportive IoT community and the venue to address the industrial and societal IoT research technologies and methodologies across industrial sectors, and to roadmap the research activities, opportunities to connect and explore ideas through collaborative research and community action.

Our mission is guided by key values:

- We value high-quality research, and practice in the field of IoT technologies, applications and deployments.
- We cultivate and advocate excellence in all aspects of our research work.
- We provide a dynamic and supportive community for all AIOTI members, embracing the full diversity of our backgrounds and experiences.
- We listen to AIOTI members' voices and seek to amplify their ideas and reflect them in the current and future research activities.
- We build cooperative relationships with the other AIOTI working groups, the EC and promote close cooperation with the EC funded projects and initiatives.

Strategic Issues Working Group 1

Identify and discuss the IoT technological and societal trends

The IoT applications and deployments demand an extensive range of new technologies and skills and a challenge for the coming years in the IoT space to address the immaturity of technologies/services and the lack of skills. The technological enhancers in the IoT space are the convergence of hardware, software and platforms that use artificial intelligence, cognitive machine-to-machine learning, neuromorphic architectures, robotics, autonomous systems, energy-efficiency solutions, IoT platform architectures, and hyper-connectivity. This requires a multidimensional optimisation of the IoT solutions and a focus on open platforms, common architectures, interfaces, virtualisation and a continuum of implementation from edge to cloud.

IoT Cross-sectorial and multi-dimensional industrial research

IoT technologies and applications involve multiple disciplines: technical, economics and social sciences with the emphasis on research, services, education and policy. This brings for the first time the need to converge multidisciplinary, interdisciplinary and transdisciplinary elements, to address the IoT challenges in the digital transformation across industrial sectors. The IoT cross-sectorial and multi-dimensional industrial research is bringing together multi-disciplinarity by bringing the knowledge from different disciplines, inter-disciplinarity by analysing, synthesising and harmonising links between disciplines into a coordinated and coherent whole, and trans-disciplinarity by integrating the natural, social and health sciences in a human-centric IoT cross-sectorial application context. This approach is required to address real IoT complex applications, and multi-IoT platforms integration/interaction, to provide different perspectives on these, to create comprehensive research questions, to develop consensus definitions and guidelines, and to provide novel IoT products, services and experiences.

Research policies EC, Member States, Regions

Support alignment of IoT research policies among EC, Member States, and Regions as part of the digital transformation involves strengthening the IoT research systems, contributing to IoT system development, and improving and accelerating the digitising process across Europe. It also include the dissemination and translation of valuable knowledge or research, the creation of ethical, human-centric and evidence- based research policies, including norms and standards, and the promotion, monitoring and implementation of high quality IoT and digitising research evidence in Europe. Supporting the creation of a new framework for IoT research in the era of digital transformation and providing input to the future European Research Framework is also required. In this context, an important element is to present the effect of IoT technologies and application in the digital transformation on society, and on the workforce structure, jobs and growth.

Research on business models for IoT

The dynamic development of IoT global landscape requires addressing the IoT ecosystems and platforms' new business models in the context of digital transformation where various stakeholders in the value networks are drivers, value nodes and those involved in the value exchange and extraction. There is a need for new research methodologies to identify new IoT business model frameworks, to highlight the motivations of diverse stakeholders who fulfil a need to generate/exchange value, realize innovation, and make money in an IoT ecosystem. These methodologies are built on identifying barriers to IoT business model innovation, and develop new conceptual frameworks. The new research on business models for IoT must address the conversion of multi-disciplinary work on IoT technologies, platforms, value proposition, revenue mechanisms, and transformation of value chains into value networks, competitive strategy, and market and virtual experiences.

Verification, validation and testing research methodology

Verification, validation, and testing are essential in the life cycle of IoT systems that contain a heterogeneity of devices, technologies, platforms and sub-systems. The development and deployment of IoT systems and applications require rigorous testing and verification that

the implementation is consistent with, while considering security, safety, privacy end-to-end and context based variables. Verification, validation and test research methodologies are important here, since planning for verification, validation and testing is necessary from the beginning of the development life cycle of any IoT system. Defining methodologies for IoT across industrial sectors for verification, validation and testing is critical as their results form an important component in the safety case, which support certification of future IoT-based autonomous systems.

IoT research and technology best practices
Identifying, defining and promoting best practices based on expertise and especially IoT domain areas is an important ingredient for supporting IoT technologies' social acceptance and clear explanations for technology limitation/ opportunities/ consequences. This implies involving and attracting stakeholders to move forward with IoT science and technology and social aspects, and to identify global views about IoT technology by establishing robust mechanisms for international collaboration (research, teaching, practice, personal career development, etc.). In this context, the promotion of best practices from running IoT projects, deployments and initiatives are very important. In addition, lead education/ training activities for cross-domain/sectors in multiple aspects of the IoT technology need to be prioritised to facilitate knowledge transfer regarding IoT research results and ideas through collaborative thematic activities.

Strategy Working Group 1

Develop the implementation plan for the WG 1 and identify cross-sectorial research challenges for IoT derived from IoT applications and deployment in different vertical sectors that are integration solutions across industrial domains; plan for collaborating and cooperating with selected AIOTI vertical groups on technological development across the sectors; develop the structure of the strategic research and innovation agenda and the plan for periodical update.

2017	2018-2019	2020-2021
• WG 1 annual work plan . • Identify the liaisons on AIOTI WGs that will work on the contributions to the research aspects. • Identify the IoT cross-sectorial industrial research topics and promote multi-dimensional optimization. • Adopt the WG 1 vision towards activities in sectorial and horizontal WGs. • Define the mechanisms for interaction with EC, Member States, and Regions for defining future research policies. • Education/training activities for cross-domain/sectors in multiple aspects of the IoT technology to facilitate knowledge transfer regarding IoT research results and ideas.	• WG 1 bi-annual work plan • Present the best practices, best results as outcomes from the European IoT community for dissemination and awareness of the latest research. • Present the effect of IoT technologies and application, autonomous interconnected systems, augmented and virtual reality, artificial intelligence, security, privacy in the digital transformation on society, on the workforce structure, jobs and growth. • Research and Innovation Agenda (SRIA) structure, contribution and release. • Research on business models for IoT and provide the position of WG 1. • Verification, Validation and Testing research methodology overview and WG 1 recommendations.	• Evaluate and understanding of the IoT large experimentation projects and technology gap analysis for future deployments. • Mapping the value of IoT and the integration and convergence of autonomous, robotic, financial, hyper-connected systems of systems. • Technology, market and societal effect as result of digital transformation across industrial sectors and virtualization of product, services and experiences. • Adapt the SRIA based on the market, societal and cultural challenges. • Technological and societal trends 2025 – knowledge everywhere, about anything at anytime and anywhere.

INNOVATION ECOSYSTEMS

Introduction Working Group 2

This Working Group on Innovation Ecosystems aims to design actions to develop innovation ecosystems across Europe by stimulating start-ups, encouraging the use of open IoT platforms, enabling real-world pilots, and linking large and small companies through open innovation. This document sets out the strategy of this Working Group for the coming 4-5 years. It is a living document that will be updated.

The term 'innovation ecosystem' has been adopted by the business management field to include, but go beyond, the network of business relationships, in which innovations are developed: "an innovation ecosystem models the economic […] dynamics of the complex relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation. In this context, the actors would include the material resources (funds, equipment, facilities, etc.) and the human capital".[1]

Strategy Working Group 2: Innovation Eco-Systems

The focus of this Working Group is to drive IoT innovation ecosystems across Europe by, in the first instance, enabling the creation of pilots and test beds for use by a range of stakeholders.

We enable an integrated decentralized innovation ecosystem with a focus on simplification. We achieve simplification by sharing best practices, building common experiments and by helping to reduce the existing number of standards by influencing policy and regulation. As a part of this, we help to drive improvements on interoperability. We enable the decentralization by linking local organizations (Digital Innovation Hubs), and through education and training.

We create an innovation framework for trustworthy collaborations that cement the EU IoT ecosystem. Key actors in these collaborations are civil society, economic actors, governments and academia. We aim to stimulate learning and the sharing of best practices both within and across domains. We drive this by understanding, sharing and demonstrating best practices from individual domains using our network. This includes pilots, new business models, data sharing solutions and novel technologies. We enable and stimulate cross-domain collaboration to find opportunities in joint innovation.

In education and training, we intend the AIOTI ecosystem to be the reference point that guides knowledge development on emerging technologies for IoT, taking a global perspective. We stimulate knowledge implementation into an economic reality through the development of high-quality talent and start-up initiatives. The AIOTI ecosystem enables business and education actors to interact and to take practical, market oriented, action. The Working Group on Innovation Ecosystems makes knowledge about the competences and needs of each member visible, as a way of enhancing easier partnership collaboration. This includes the engagement of new stakeholders to be part of the AIOTI community.

In policy and regulation this Working Group plays a role in supporting and influencing policy makers to provide an environment conducive to healthy innovation ecosystems across Europe. Taking the analogy of biological ecosystems from environmental science, it is the environmental conditions, like soil minerals and humidity, which determine the organisms that can flourish together in that situation. This means that policy makers are responsible for enabling IoT innovation, by providing clear, coherent and consistent policies within and across regions, for example, in the areas of the circular economy and data privacy. When the policy and regulatory environment is clear, coherent and consistent, then many IoT innovations will be possible within a short time frame. We help to make this to happen by providing evidence of successful policy and

[1]Jackson, D. J. (2012). What is an Innovation Ecosystem? National Science Foundation Report, 2012-11-28. Page 2.

regulatory experiences and by advising policy makers at regional, national and European levels.

At this stage, we have identified the following five key objectives, whereby the first three will initially be the focus for action:

To develop a framework for trustworthy collaboration

Here we aim to provide a technical, legal and organizational framework to stimulate and enable inter-company collaboration and easier partnerships. Currently, a key problem is that it takes too long to establish acceptable conditions for collaboration and partnership, which slows the pace of innovation. The envisioned framework will solve this problem by providing a simple, effective and flexible set of tools and agreements that a wide range of organizations can apply to create new, trustworthy collaborations and partnerships. This will help to drive cooperation between large companies and SMEs, as innovative SMEs will be assured that their IPR is protected whilst they can mutually benefit for the resources made available by the larger firms. Current H2020 projects drive innovation, but they may not be able to adapt to the fast changes occurring in the IoT world. Once this framework is made available, it will increase the speed of innovation within Europe.

IoT experimentation and knowledge building through real-world test beds and pilots

Here our objective is to stimulate experimentation with end-users to address real needs and to enable innovations to be developed that are informed by real-world, day-to-day practices, habits and routines. This will also promote end-user acceptance, not only because they will see how the innovations address real user needs, but also because of end-user learning about the technology and the opportunities it brings. Through the process of stimulating test beds and pilots, we expect a process of trust building to develop in the technology across a range of domains. One key element of these test beds and pilots is that they are open to SMEs, given the limited resources typically available to these small-sized organizations. Another key focus is to ensure that the experiments carried out can test and validate interoperability.

Share cross-domain learning and insights for ecosystems, including data integration, business models, mapping technologies and expertise across Europe

This focus begins with the mapping of IoT-relevant technologies as well as IoT-related expertise across Europe. The insight and learning that these bring can then be implemented in stimulating experimentation with radical business models, including those arising from a cross-domain approach. Here, we will help to guide developments in other Working Groups by sharing our insights and knowledge on the importance of innovation ecosystem thinking, providing support for spin-offs arising from research projects, and exploring models for cross-domain data integration in IoT ecosystems.

Influencing education to boost Europe's IoT innovation ecosystem

Here the focus is on building the innovation mind-set in the future workforce including those developing high-tech start-ups. We will influence pan-European education and training in IoT-related disciplines, to improve the quality of the graduates and the young entrepreneurs. As a part of this, the continuous training of teachers, professors and advisors will be addressed.

Influencing policy to boost Europe's IoT innovation ecosystem

Here we aim to stimulate policy at the regional, national and European levels, to provide a clear direction in key application areas. This is because IoT is not a goal, but can enable a societally-relevant impact. An example is policy and regulations related to the Circular Economy: once this policy is clear, coherent and consistent, then many IoT-based innovations will emerge to take advantage of the market opportunities, including automated recycling, products-as-a-service, material passports in buildings and in many other application areas. Part of our role will be to provide evidence-based insights for policy makers.

Introduction Working Group 3

This Working Group identifies and, where appropriate, makes recommendations to address existing IoT standards, analyses gaps in standardization, and develops strategies and use cases aimed at

1. Maintaining an IoT standards framework Landscape .
2. Consolidation of architectural frameworks, reference architectures, and architectural styles in the IoT space.
3. (semantic) Interoperability
4. IoT Identifiers.
5. Personal data protection to the various categories of stakeholders in the IoT space
6. Security.

Vision of Working Group 3: IoT Standardization for mid-2021

The vision for WG 3 is to be recognized as a major contributor to the worldwide interoperability, security, privacy and safety of IoT systems and applications, and particularly for the development of the market in Europe. It has a focus on enabling trust to be established and maintained between stakeholders, and supports diversity of market opportunities for individuals, large and small enterprises, public sector organizations, and administrations.

It has an important role in increasing confidence in IoT markets, providing guidelines for users and showcasing successful applications. It is a standardization partner to the European Commission, including both policy and research aspects. It provides support for major innovation initiatives such as European Large-Scale Pilots, providing a well-used "toolbox" aimed at encouraging interoperability and defining approaches to facilitate industry to penetrate the IoT market.

WG 3 promotes the development of coherent, cross-sector standards for IoT, enabling transversal solutions across sectors based on transparent interoperability. Thus, this working group is the leading forum for exchanging information about standards, implementations and innovation in IoT. This is achieved via a vibrant online presence. Moreover, WG 3 is a leading source of requirements for standards development organizations, and is a recognized coordinator of standards development. As a leader, WG03 promotes best practices in the use, development and validation of standards, referenced architectures in the research and open source software communities.

Strategic Issues of Working Group 3: IoT Standardization

The following aspects and trending topics in particular are being considered by WG03 in preparing the following:

- Cross-IoT application domain activities, including standardization, policies, use cases and business models, can be considered as a key trend to stimulate cooperation between vertical and horizontal industries.
- IoT is an important enabler for the success of 5G and vice versa.
- Focus on Business drivers and business models in each vertical AIOTI WG, it is important to enable AIOTI members to understand and apply IoT-related business values and for the deployment of IoT in Europe. Moreover, it will attract other companies to join AIOTI.
- Large Scale Pilots are important to verify the IoT gaps that are identified by AIOTI in IoT standardization, policy and IoT deployments, and to show how these gaps can be alleviated. Formal cooperation between AIOTI and LSPs is needed.

- Cooperation with other IoT related initiatives and SDOs are needed to reduce fragmentation and remove all barriers on the deployment of IoT in EU and worldwide. Some important Initiatives and SDOs that could benefit from the cooperation of AIOTI include: OneM2M, ETSI, 3GPP, IEC, ISO/IEC JTC1, CEN/CENELEC, ITU-T, IIC, Platform 4.0, and OPC Foundation

The development and adoption of effective standards can play an essential role in realizing the anticipated benefits of IoT. An important motivation of the WG 3 is to foster the development of open markets for IoT products and services, using global standards to achieve local prosperity.

A second major theme is the need to extend the scope of IoT to include applications dealing with personal and sensitive data, and those whose operation can impact on safety. These are likely to deliver some of the more valuable outcomes of IoT but present significant challenges.

As the adoption of IoT increases and machine-to-machine interactions become more important, it is essential to maintain a human-centric perspective, both in terms of the role of people in the operation of IoT systems and in the impact of these systems on people's quality of life.

Finally, there remains a clear need to make sense of the complexity of the global landscape of IoT standards, both for developers of standards and for those who could choose to adopt them in products and services.

Foster the development of open markets for IoT products and services

The potential benefits of IoT in stimulating innovation across a range of different industry sectors are widely recognized. The opportunities to improve existing processes and to develop new solutions are compelling, but there are many challenges and potential barriers in the adoption of these new technologies. Open markets offer opportunities for new businesses to bring new products and services to market, thus contributing to complex, integrated IoT systems.

A fundamental issue is the need to establish trust in IoT across different technologies and markets. Trust can be promoted by demonstrating appropriate behaviours, but ultimately what is required is that people have a clear understanding of, and confidence in, the new approaches being proposed. Without this, the risks of adoption will be perceived as too great. Stakeholders including end users, developers, device manufacturers, system integrators and service providers need to be confident that all technical components behave in predictable and desirable ways, both individually and as part of complex systems. (IoT introduces new challenges here as systems are inherently interconnected so external interactions will be more important than, for example, in conventional industrial automation systems). Organizations need to behave in ways which enhance their trustworthiness. Privacy, security and dependability are key concerns.

While improvements to processes within established industry sectors are the immediate goal of IoT, there are also considerable cross-sector opportunities. The ability to share information between related sectors (e.g. transport and cities, agriculture and water etc.) offers good scope for innovation. This requires an understanding of the semantics of information used and the relationship of concepts across sectors. There is also the opportunity to reuse technology and information across sectors to advance towards a more collaborative intelligence and interconnected world. Chips, sensors, gateways, communication modules and data processing services are common components. The ability to reuse components widely across sectors is desirable. More generally, industry sectors are expected to share common use cases and requirements. These would form a useful basis for standardization with wide applicability – helping to reduce unnecessary fragmentation.

The role of standards in promoting best practices and encouraging trustworthy behaviours within and across industry sectors is a key concern of WG 3. There is a need to understand how AIOTI can most effectively promote and enable trust in IoT systems.

Safety and security in IoT systems

Many current IoT systems focus on data acquisition – collecting information from sensors and other systems, delivering it to applications for alerting and analysis and allowing human operators to make improved decisions. These applications leave people with control and responsibility of the processes they manage, supporting them with richer, more relevant information. As a result, well-established regulation and best practice generally continue to be applicable.

There is increasing interest in automating management, maintenance and optimization actions, and removing people from the decision-making process to some extent. This has benefits in terms of rapid response to low-level changes, and potentially more reproducible, less error-prone behaviour. Where the systems concerned deal with personal or sensitive data, or where their operation can impact on safety or the integrity of critical infrastructure, there are several challenges that must be addressed.

Some industry sectors already have well-established practices to assure safety and security of automated systems. There are anticipated opportunities to share these practices with different sectors. The stakeholders in AIOTI provide the opportunity to coordinate and promote knowledge sharing. A related issue is the emergence and applicability of legislation dealing with privacy, safety and security. Some of these are general (e.g. GDPR Regulation (EU) 2016/679, dealing with data protection, and eIDAS Regulation (EU) 2014/910, dealing with electronic identification and trust services for electronic transactions), while others are established in certain sectors (e.g. Machinery Directive 2006/42/EC) and may apply directly to some automated systems. Even if not directly applicable, the principles and approaches adopted may be relevant in other sectors.

Human-centric challenges

While much work on IoT focuses on the increasing interconnection between devices – a generalization and expansion of machine-to-machine systems – it is important that the role of people is fully considered.

People may be directly involved in the operation of IoT systems. Most obviously, they may receive information which they use to make management and control decisions. As IoT systems develop, more of the routine responses to changing conditions may be made without human intervention, leaving people to deal with more difficult situations requiring deeper insight and experience. A challenging example is that of autonomous vehicles. When a vehicle is capable of fully autonomous operation in normal circumstances, the human "driver" is only required in emergency situations. However, the time available to take effective control may be too short.

People may also be involved in IoT systems because of data collected as they go about their daily lives. Some of this will be obviously classified as personal data (and subject to the provisions of GDPR, for example). However, some cases may be less clear. Tags in clothing may provide information to retailers or manufacturers, sensors in vehicles may send telemetry or other data to manufacturers. The data collected may be sufficient to identify individuals. Clarity on what constitutes machine data and what is personal data is required, particularly as this may impose regulatory constraints. On a more general point, the extent to which implementation of standards can assure compliance with GDPR needs to be investigated.

In addition, the broader implications of adoption of IoT technologies on people's quality of life (e.g. automation of jobs currently done by people, potentially leading to increased unemployment) need to be considered.

Making sense of the IoT standards

The global landscape of IoT standards remains complex and dynamic. WG 3 has a clear interest in the promotion and adoption of open, standards-based approaches but is neutral as to which standards are used. Confusion and complexity are inhibitors to adoption. Improving the understanding of available standards and relevant activities is therefore a strategic issue for WG 3. This requires making sense of the roles of different development organizations standards and the potential relationships between their outputs.

An important challenge for WG 3 is the identification of gaps in current activities and specific unmet requirements from use cases derived from a range of industry sectors. Coordination with WG 4 (IoT Policy) on the relationship between policy and standardization, in the context of developments such as GDPR, is also required.

The role of global standards in developing an open market for IoT products and services is a major focus of WG 3. Several strategic issues provide a focus for its activities.

Establishing trust in the technology and in the organizations involved in delivering IoT products and services is essential, and can be supported by appropriate and effective standards.

Safety, privacy and security are key aspects that must be addressed by IoT systems, particularly as they are used for automation of processes that impact on people's health and wellbeing, the environment, and the different critical infrastructures (transport, energy, banking, water, etc.).

It is essential to maintain a human-centric perspective, both in terms of the role of people in the operation of IoT systems and in the impact of these systems on people's quality of life.

Finally, there is a clear role for WG3 in helping all interested stakeholders make sense of the global landscape of IoT standards, aiming to ensure that appropriate standards are available and accessible to those developing IoT products and services.

Strategy of Working Group 3: IoT Standardization 2017 – mid 2021

Objectives & Work Packages Working Group 3: IoT Standardization up tol mid-2018

Identify horizontal concerns/general principles for IoT derived from AIOTI vertical working groups and other relevant prior work. Common concerns are expected to include security, privacy, semantics, metadata, data models, Service Level Agreements (SLAs) including non-functional concerns/

constraints. Deliverable will include a description of horizontal concerns and a plan for developing standards adoption guidelines. (Guidelines deliverable anticipated mid-2019).

Bootstrapping trust – developing an understanding of the potential role of standards in promoting trust in IoT systems, including both technical and social (e.g. confidence building, reputation establishment) aspects. Interim deliverable in 2018 will report on status and making recommendations for future work.

Investigation of relevant regulations and their potential impact. Generally applicable regulations include GDPR and eIDAS. Sector-specific regulations (e.g. Machinery Directive) will also be investigated with a view to establishing their broader applicability or scope for generalization to IoT systems. These activities will require cooperative working with WG4.

Community building. Select key SDOs to begin direct interaction and establish working arrangements. Collect information on standards used in vertical WGs, LSPs and other relevant projects. Initiate dialogue with the EC on standards and how AIOTI can contribute to the EC standards agenda from both a policy and innovation perspective. Plan for engagement with selected academics and open source software communities. Deliverable will include an initial online presence/ information sharing platform for IoT standards. (This should be based on aioti.eu and will require administrative support).

Initial study on the role of people in IoT. Deliverable will include a video/white paper suitable for widespread dissemination aimed at raising awareness of the issues involved.

The objectives that will be worked out by AIOTI WG03 (as defined before Toulon and approved by the WG in 2016 and reconfirmed during the preparation) are the following:

AIOTI WG 3 Specific Objectives	Timeframe	
	Before 2020	2020 and beyond
Cooperation with SDOs/Alliances to foster co-creation and interworking	X	X
Maintain IoT landscape	X	X
Identification of missing (semantic) interoperability standards and techno-logies within IoT domains and cross - IoT domains and recommendations on solving them	X	
Recommendations and guidelines on solving protocol and interface gaps nee-ded to support new IoT features within IoT domains and cross - IoT domains. Promote particularly the uptake of IoT standards in public procurement to avoid lock-in	X	
Identify possible sustainable strategies for effective industry-wide deployment of the IoT standards	X	X
Provide guidelines on how IoT can become an enabler for 5G and vice versa	X	X
Provide guidelines on IoT-EPI IoT Platforms analysis improvement	X	
Promoting the use and development of Open Reference Vocabularies and Open Application Programming Interfaces to allow for flexible ad-hoc commu-nication and interaction between different actors within IoT domains and cross - IoT domains	X	
Provide guidelines on how to translate the Digital Rights Management recom-mendations within IoT domains and cross - IoT domains	X	X
Recommendation of an interoperable IoT Identifier space that transcends geographical limits, which can be applied within IoT domains and cross - IoT domains	X	
Recommendation of an open system for object authentication, which can be applied within IoT domains and cross - IoT domains	X	
Recommendations of Key Principles on Security & Privacy in the IoT, which can be applied within IoT domains and cross - IoT domains	X	
Explore options and recommend guiding principles, including guidelines for the support of developing standards, for trust, privacy and end-to-end securi-ty, e.g. through a 'trusted IoT label' that can be applied within IoT domains and cross - IoT domains	X	X

Before defining this strategy, AIOTI WG 3 has been already structured into 5 working groups, which can be considered as work packages; these are:

WP 1: IoT Landscape
(Leader: Georgios Karagiannis (Huawei))

This WP focuses on (1) IoT Landscape maintenance to keep the liaisons alive and maintain dialogue on how to foster collaboration to improve interoperability & security, (2) IoT platform analysis improvement, (3) gap analysis and recommendations, (4) cooperation with SDOs/Alliances to foster co-creation and interworking.

The objectives, the roadmap of accomplishing the objectives relevant for this WP, the name of the deliverables and the owner of the objective are listed below:

WP1 Specific Objectives	Timeframe		Name of deliverable	Owner
	Before 2020	2020 and beyond		
Cooperation with SDOs/Alliances to foster co-creation and interworking.	X	X	Multiple, including cost benefit analysis, liaisons, MOUs	Patrick Guillemin
Maintain IoT landscape.	X	X	IoT LSP Standard Framework Concepts	Georgios Karagiannis
Recommendations and guidelines on solving protocol and interface gaps needed to support new IoT features within IoT domains and cross - IoT domains. Promote particularlythe uptake of IoT standards in public procurement to avoid lock-in.	X	X	High Priority IoT Standardization Gaps and Relevant SDOs (to be started	Emmanuel Darmois and/or Michelle Wetterwald (to be confirmed)
Identify possible sustainable strategies for effective industry-wide deployment of the IoT standards.	X	X	Not yet defined	Not yet defined
Provide guidelines on how IoT can become an enabler for 5G and vice versa.	X		IoT relation and impact on 5G (to be started)	Thomas Klein (IBM)
Provide guidelines on IoT-EPI IoT Platforms for analysis improvement	X		UNIFY IoT-EPI IoT Platforms analysis improvement	Philippe Moretto

WP 2: HLA / High Level Architecture
(Leader: Omar Elloumi (NOKIA))

This WP provides guidelines for (1) an IoT Reference (High Level) Architecture and its mapping with existing IoT Reference Architectures and for (2) IoT Identification.

The objectives, the roadmap of accomplishing the objectives relevant for this WP, the name of the deliverables and the owner of the objective are listed below:

WP 2 Specific Objectives	Timeframe		Name of deliverable	Owner
	Before 2020	2020 and beyond		
Recommendations of reference architectures, both for experimentation and deployments within IoT domains and cross - IoT domains	X	X	High Level Architecture (HLA)	Omar Elloumi
Recommendation of an interoperable IoT Identifier space that transcends geographical limits, which can be applied within IoT domains and cross - IoT domains	X	X	IoT Identifier	Juergen Heiles / Henri Barthel

WP 3: IoT Semantic Interoperability
(Leader: Paul Murdock (Landys&Gyr))

This WP focuses on semantic interoperability concepts.

The objectives, the roadmap of accomplishing the objectives relevant for this WP, the name of the deliverables and the owner of the objective are listed below:

WP3 Specific Objectives	Timeframe		Name of deliverable	Owner
	Before 2020	2020 and beyond		
Identification of missing (semantic) interoperability standards and technologies within IoT domains and cross - IoT domains and recommendations for solving them.	X		(1) Semantic interoperability for AIOTI LSPs (2) Semantic Interoperability for the Web of Things	Paul Murdock
Promoting the use and development of Open Reference Vocabularies and Open Application Programming Interfaces to allow for flexible ad-hoc communication and interaction between different actors within IoT domains and cross - IoT domains.	X	-X		

WP 4: IoT Privacy (In cooperation with WG 4)
(Leader: Arthur van der Wees (Arthurs Legal))

This WP focuses on guidelines on concrete standard framework & references to enable "IoT Trust" and IoT "Privacy by design" for Platform, experimentation, and LSPs.

The objectives, the roadmap for accomplishing the objectives relevant for this WP, the name of the deliverables and the owner of the objective are listed below:

WP 4 Specific Objectives	Timeframe		Name of deliverable	Owner
	Before 2020	2020 and beyond		
Provide guidelines on how to translate the Digital Rights Management recommendations within IoT domains and cross - IoT domains	X		Not yet defined	Not yet defined
Recommendations of Key Principles on Security & Privacy in the IoT (focusing mainly on Privacy), which can be applied within IoT domains and cross - IoT domains	X		Not yet defined	Not yet defined
Explore options and recommend guiding principles, including guidelines for the support of developing standards, for trust, privacy and end-to-end security, e.g. through a 'trusted IoT label' that can be applied within IoT domains and cross - IoT domains	X	X	Not yet defined	Not yet defined

WP 5: IoT Security (in cooperation with WG 4)
 (Leaders: Arthur van der Wees (Arthurs Legal) Jacques-Kruse Brandao (NXP), Harm Jan Arendshorst)

This WP focuses on providing guidelines on (1) an IoT Security Architecture for Trusted IoT Devices, (2) Baseline Requirements for Security & Privacy up to segment requirements and (3) concrete standard framework & references to enable "IoT Trust" based on IoT "Security by design".

The objectives, the roadmap for accomplishing the objectives relevant for this WP, the name of the deliverables and the owner of the objective are listed below:

WP 5 Specific Objectives	Timeframe		Name of deliverable	Owner
	Before 2020	2020 and beyond		
Recommendation of an open system for object authentication, which can be applied within IoT domains and cross - IoT domains	X		Not yet defined	Not yet defined
Recommendations of Key Principles on Security & Privacy in the IoT (focusing on IoT Security), which can be applied within IoT domains and cross - IoT domains	X		Not yet defined	Not yet defined

Introduction Working Group 4

IoT is a major trend in the digital transformation of the European economy and society. Accordingly, policy makers are highly interested in it, and law makers are keen to take regulatory action both to help Europe harness the novel technologies in the best possible way, and to mitigate the risk of harmful disruption that may be the result of the technological and economic paradigm shifts. As policy and regulation are essential factors in determining market access and setting the conditions for doing business in the European Single Market, it is essential for AIOTI and its membership to engage the policy community with a constructive agenda, both on the issues that are of concern to them, and on the ones that are priorities for the industry. The vision of Working Group Policy (WG 4) is to contribute substantially to devising and shaping Europe's future IoT Policy Framework. Its mission, therefore, is to be the custodian of the pro-active and constructive dialogue of AIOTI with the policy community. To be effective, the efforts of WG 4 will focus on four priority areas: building trust, enabling the data economy, addressing the societal dimension of IoT, and promoting its uptake in the interest of Europe's global competitiveness. The short-, medium- and long-term actions undertaken between now and 2021 will all seek to create a unique knowledge base of IoT specific expertise and industry best practices, to elevate AIOTI into an unrivalled, highly visible and trusted advisor to national and European policy makers and regulators up to the highest levels, and to position AIOTI as an indispensable partner of, and source of, information and advice to the broader community, including professional organisations and trade unions, small- and medium-sized companies, academia, research and civil society, in all of their IoT-related activities.

Management Summary Working Group 4

IoT is a major trend in the digital transformation of the European economy and society. Accordingly, policy makers are highly interested in it, and law makers are keen to take regulatory action both to help Europe harness the novel technologies in the best way possible, and to mitigate the risk of harmful disruption that may be the result of the technological and economic paradigm shifts. As policy and regulation are essential factors in determining market access and setting the conditions for doing business in the European Single Market, it is essential for AIOTI and its membership to engage the policy community with a constructive agenda, both on the issues that are of concern to them, and on the ones that are priorities for the industry.

The objective of AIOTI WG 4 is to contribute to a stable, predictable, reliable and enabling IoT Policy Framework across Europe which stimulates innovation, accelerates IoT uptake and thus strengthens European competitiveness.

The focus of AIOTI WG 4 will be:
- Building trust in IoT (addressing privacy, security, liability, ethics, transparency and data emerging issues)
- Securing the development of adequate user awareness, education and skills
- Ensuring continuous partnership and collaboration between the IoT community and society at large.

Currently, the uptake of IoT across Europe is below previous expectations. This is largely due to a lack of understanding of the benefits of IoT devices to consumers, the lack of trust in IoT solutions themselves, the lack of clarity, certainty and predictability in the regulatory conditions that should govern IoT and data-based business models moving forward, and to mounting concerns regarding the disruptive potential of IoT and

related technological developments for Europe's economy and society.

In many cases, the gut reaction of European policy makers is to precipitate premature, precautionary, regulatory intervention to anticipate feared developments that haven't even materialised yet. The result in most cases is legislative proposals defined in negative terms, i.e. designed to prevent something from happening. As often in such cases, industry reactions are focused on pushing back against these initiatives, in the name of the freedom to do business, of innovation and of free trade. This dynamic however is not constructive for either side, as it forces policy makers and industry into opposing each other instead of working together.

Therefore, AIOTI should distinguish itself by deliberately adopting a different approach, building on the idea that policy and regulatory tools, if wielded cleverly, can be very effective to support innovation and advance the adoption of IoT, as long as they are defined in terms that seek to achieve positive outcomes that IoT can help reach, as opposed to defining restrictions and limitations on what IoT may or may not do. AIOTI should contribute to a positive IoT policy agenda by devising and suggesting regulatory and policy options that open new business opportunities and are conducive to higher IoT adoption.

Vision of Working Group 4 for mid-2021

By 2021 AIOTI WG 4 will have contributed to a stable, predictable, reliable and enabling IoT Policy Framework across Europe which will stimulate innovation, accelerate IoT uptake and thus strengthen European competitiveness. AIOTI is a reputable partner and trusted advisor to policy makers, public authorities, the business community and civil society on all matters related to IoT. The Framework builds trust in IoT, secures the development of adequate user awareness, education and skills, and ensures continuous partnership and collaboration between the IoT community and society at large.

Trust: In the IoT Policy Framework, IoT systems are developed and operated according to privacy- and security-by-design principles, including continuous lifecycle security approaches. Advanced IoT systems, particularly those involving artificial intelligence and robotics, are developed and operated with ethical considerations included already at the design stage. Users are provided with adequate transparency including on the ownership of, access to and usage of data generated by IoT devices. Equally, all players involved share a clear understanding of the liability chain that is the most appropriate to manage risk in each use case.

Education, skills, and awareness: In the IoT Policy Framework, individuals are aware of the benefits and challenges of using IoT devices, and they make conscious and informed choices in that regard. Workforce as well as consumers are consistently educated and trained to the proper and responsible use of IoT products. This helps to minimise safety risk, optimise economic performance and maximise social benefits, including through successful adaption to the disruptions that IoT innovation may bring. AIOTI contributes substantially to the necessary education, training and awareness raising activities. This is done in cooperation with schools, universities and other relevant public, academic, business and non-governmental / civil society organisations. Tools include the development of IoT-related massive open online courses (MOOCs) as well as appropriate and dedicated educational and academic curricula.

Partnership and collaboration with society: In the IoT Policy Framework, AIOTI - and particularly its WG 4 - nurtures early, ongoing and constructive dialogue between the IoT industry and society, including governments and public authorities, trade unions, trade associations and professional organisations, as well as academia and the non-governmental sector. The purpose of this dialogue is to create acceptance of and adjustment to IoT-induced disruption. To that effect, AIOTI conducts research and analysis to explore, anticipate and propose solutions to address the wider societal challenges that IoT brings. At the same time, AIOTI also identifies and helps to leverage the opportunities that IoT creates, to build both a more competitive economy and a more cohesive society. This dialogue contributes

substantially to creating favourable conditions for the pursuit of Europe's broader policy goals such as strengthening Europe's industrial base, repatriating manufacturing to Europe, improving the performance of European health and social welfare systems, and delivering on Europe's environmental and climate commitments. The dialogue is instrumental in identifying novel jobs created because of IoT uptake. It promotes the reskilling of the workforce to fill those jobs, and contributes to designing other accompanying social and welfare measures, such as funding systems to support transitions in the labour market. The partnership and collaboration extend well outside the technology sector to involve notably social scientists who can help ensure that the design, development and deployment of IoT solutions is consistent with Europe's social fabric.

Strategic Issues of Working Group 4

To be an authoritative advisor on IoT policy matters, AIOTI must be prepared to contribute positive and constructive answers to the concerns that policy makers have in relation to IoT. This covers already current policy topics such as the issues of trust and of data ownership and use in the IoT space. It also extends to more forward looking, emerging challenges such as the impact of IoT-powered automation on the labour market and on society at large. In the overall picture, it also involves building the case for positive policy action to boost IoT uptake in Europe, ultimately to improve European competitiveness in the global markets.

Trust: Privacy, Security, Liability, Ethics and Transparency
User confidence is an indispensable foundation for the adoption of IoT in Europe. Without trust, IoT may not be able to succeed. Building trust however requires convincing a broad variety of stakeholders, including policy makers, regulators and supervisors, as well as individual and corporate users, their professional organisations, trade unions and several opinion makers such as politicians, academia, civil society and the media of the trustworthiness of IoT. This involves not only making credible commitments to building privacy, security, adequate risk management

and associated liability governance, as well as transparency and ethics into IoT, but also actually and demonstrably delivering on those commitments in practice. A key challenge for AIOTI in this regard is to position the industry as a credible, willing and even volunteering contributor to trust though self-regulatory approaches while also being a constructive partner of public decision makers in the development of the hard regulatory and soft policy measures they envisage to respond to the public demand for trust, security, privacy, ethics and transparency in IoT. Striking the right balance in that regard is crucial, as too little effort on the part of industry would fail to convince, whereas overly interventionist approaches from policy makers could quickly stifle innovation. AIOTI is in a unique position to collect, advocate and disseminate best practices and to demonstrate industry good will, and this should be leveraged as much as possible to dispel broadly shared suspicions of the industry's actions to build trust being only self-serving. This is why all efforts undertaken by AIOTI need to aim for the right blend of economic growth and social cohesion, making the building of trust in IoT as much of a commercial stake as one of corporate social responsibility. On the understanding that in Europe's cultural and legal tradition, market regulation is viewed as the default path to effectuate economic and societal change, it is important for AIOTI in all circumstances to work – and to be perceived as working – WITH policy makers, and not against them.

Data Ownership, Access and Use
A good illustration of this challenge is how the topics of IoT data ownership, access and use, and the question of liability for fully automated devices have come to dominate many IoT related policy discussions at the European level. This is understandable given the realisation that digital data has great and increasing economic value. The questions that arise relate to who should own IoT generated data, who should be able to access it and on what grounds, who should be allowed to use it, in what circumstances, for what purposes and under what conditions, and who should be liable for malfunctions/accidents in fully automated devices. In many cases, sweeping assumptions are made that these questions lend

themselves to one-size-fits-all answers such as conferring exclusive rights upon a particular stakeholder (e.g. the user or the manufacturer of an IoT device), establishing a limited list of permissible purposes for processing such data, predefining contractual terms for data access and use, or allocating strict liabilities to particular players in the value chain. Often these discussions, and most of the solutions proposed thus far, are inspired by misperceptions or very partial or extrapolated representations of niche issues encountered in particular market segments of the nascent IoT landscape. Typically, observations made in consumer markets (B2C) are assumed to apply also in B2B markets, which however is rarely the case. Without credible hard evidence against misrepresentations though, some of these issues quickly tend to be perceived as structural market failures that justify blanket regulatory intervention. Therefore, it is of the utmost importance that AIOTI does two things. On the one hand, the industry must acknowledge the real concerns that exist, clearly identify their root causes, and suggest suitable and practicable policy solutions to remedy them in their particular context. On the other hand, the industry must also demonstrate that those issues are not ubiquitous, that they do not constitute structural market failure, and that the solutions that may be devised to remedy them where they exist are not necessarily suitable or workable if taken out of their intended context. Responding to these two needs requires AIOTI to develop a granular, broad and deep understanding of the various vertical applications, business models, technological architectures, market dynamics and operational realities of IoT across the European economy, and to deliver that body of knowledge to policy makers in a constructive and pedagogic approach which will help them address real issues that can only be addressed through policy measures, without however causing unintended collateral damage.

Societal Impact of Automation

The advent of IoT brings with it a certain number of disruptive trends, including increased reliance on automation, artificial intelligence, and robotics. This leads to several positive economic outcomes, mainly in terms of innovation, new value creation and productivity improvements. At the same time, some of the social and societal impacts of these transformations create important challenges such as, most notably, the loss of traditional jobs which can be replaced by automation, not only in sectors like manufacturing, but also in logistics and transportation, utilities and even retail. Moreover, the use of algorithms and artificial intelligence for quicker and often better-informed decision making is also raising ethical questions related to the acceptability of such machine decisions when they have significant impact on humans. Discussions around these topics tend to very quickly focus on the potential problems that can arise, and fail to take into consideration the positive contribution that the same trends can bring to human health and quality of life, social cohesion and welfare, economic performance and the creation of novel jobs, access to education and culture, and many others. For AIOTI to be credible as a cross-cutting industry organisation, it is important to acknowledge these concerns early on and to work with all relevant stakeholders, including policy makers, academia, social scientists and civil society, to articulate and maximise the benefits of IoT, and at the same time to address the disruption it is causing, potentially to relatively large swathes of Europe's society. Some of the questions that arise, such as those related to the limits of the permissible use of automation and artificial intelligence in relation to human beings, are likely to warrant a regulatory response, as is already the case with the provisions of European privacy law around profiling and automated decision-making concerning individuals. Many of the concerns however can also be addressed through voluntary industry action, e.g. through codes of conducts and other self-regulatory approaches. By showing a pro-active and constructive attitude on both fronts, and by collecting and sharing best industry practices as well as devising suggestions for workable policy options where needed, AIOTI can claim a unique role in creating a well-balanced IoT Policy Framework which creates a win-win situation between economic performance and social responsibility.

Positive Policy Action to Stimulate IoT Take-Up to serve European Competitiveness

Effectively delivering on the previous three strategic issues is crucial to ensure that AIOTI can articulate a sufficiently positive IoT narrative to policy makers and other relevant stakeholders for them to embrace IoT more easily. Currently, the uptake of IoT across Europe is below previous expectations. This is to a large extent due to a lack of understanding of the benefits of IoT devices to consumers, the lack of trust in IoT solutions themselves, the lack of clarity, certainty and predictability in the regulatory conditions that should govern IoT and data-based business models moving forward, and to mounting concerns regarding the disruptive potential of IoT and related technological developments for Europe's economy and society. In many cases, the gut reaction of European policy makers is to precipitate premature, precautionary regulatory intervention to anticipate feared developments that haven't even materialised yet. The result in most cases is legislative proposals defined in negative terms, i.e. designed to prevent something from happening. As often in such cases, industry reactions are focused on pushing back against these initiatives, in the name of the freedom to do business, of innovation and of free trade. This dynamic however is not constructive for either side, as it forces policy makers and industry to oppose each other instead of working together, with the knock-on effect of creating a climate of distrust which fuels ideological and politicised debates on often purely hypothetical issues, and hinders the effective adoption of IoT for no actual economic or societal benefit at the end of the day. Therefore, AIOTI should distinguish itself by deliberately adopting a different approach, building on the idea that policy and regulatory tools, if wielded cleverly, can be very effective to support innovation and advance the adoption of the IoT, as long as they are defined in terms that seek to achieve positive outcomes that IoT can help reach, as opposed to defining restrictions and limitations on what IoT may or may not do. Good examples in EU law would be the eCommerce directive, the Services directive and the eIDAS regulation, none of which favour any particular business model or technological approach, but which create a stable and predictable legal framework in which any innovation is welcome to deliver the desired results, as long as the general principles of EU law are respected. AIOTI should contribute to a positive IoT policy agenda by devising and suggesting regulatory and policy options that open new business opportunities and which are conducive to higher IoT adoption.

European Competitiveness

Ultimately, such a positive policy agenda which responds to the need for trust in IoT, creates clarity and predictability for the IoT-based data economy across Europe, tackles the societal challenges caused by disruptive innovation, and creates sufficient synergies across these efforts meaningfully to boost the uptake of IoT in Europe can greatly contribute to the completion of the European Digital Single Market, and more broadly to the improvement of European competitiveness and economic performance not only in the EU DSM itself, but in the global competition. By delivering on the strategic policy issues identified, AIOTI can very clearly play a role not only in IoT-related policy making, but also in the major league where Europe's mid- to long-term economic, industry and trade strategies are shaped. The key objective here is to position IoT as a powerful enabler of improvement and progress across all sectors and areas of Europe's economy and society, and the industry community represented by AIOTI as an indispensable, inspired, creative, committed and reliable contributor to such improvement and progress.

Strategy of Working Group 4 2017 – mid-2021

Working on the strategic issues explained in this paper towards the vision described in the introduction, WG 4 will actively help AIOTI to position itself as a highly visible and credible thought leader in all relevant IoT-related policy discussions and fora. To contribute meaningfully to such discussions, WG 4 will collaborate effectively and continuously with the vertical WGs to identify policy priorities and track their evolution over time. To advance those priorities proactively, WG 4 will also engage with the horizontal WGs in a top-down approach to policy setting and a bottom-up approach to implementation, among others through consistently aligned technical standardisation activities.

Objectives & Work Packages Working Group 4 up to mid-2018

2017
- Develop an IoT Privacy and Security By Design Charter in response to the ambition voiced in the European Commission's DSM Mid-Term Review to propose regulatory measures on IoT certification and labelling.
- Back up the Charter with a compendium of best industry practices to achieve transparency about the privacy and security performance of IoT devices and systems.
- Inventory current or expected policy and regulatory obstacles to the deployment and take-up of IoT in the European Digital Single Market, and make recommendations to address them, including in relation to the free flow of data.
- Collect best practices on how ownership of, access to and use of IoT-generated data can be orchestrated and governed to the satisfaction of all parties involved in specific use cases.

First half of 2018
- Build trust by demonstrating the value of IoT for regulatory compliance (e.g. case studies on privacy by design, privacy by default and privacy enhancing technologies in IoT for GDPR compliance).
- Make recommendations on how and where public procurement in areas like e-government can kick-start or speed up IoT adoption in the public sector.
- Research and synthesise existing R&D and Innovation funding opportunities for IoT and formulate recommendations for improvements as well as for future priorities .
- Develop a code of conduct on the ethics of using artificial intelligence and robotics in IoT to avoid negative impact on humans .
- Convene expert dialogue and conduct studies into the societal impact of automation to identify positive outcomes as well as to devise measures to mitigate negative side effects.

Second half of 2018 and beyond
- Develop a concept on regulatory sandboxing as a measure to promote IoT experimentation.
- Explore and initiate partnerships with relevant academic institutions to develop AIOTI-supported / AIOTI-endorsed curricula.

Introduction Working Group 5

Smart living environment for ageing well: The topic for this Working Group refers to smart homes and smart living environments that can support vulnerable people, such as, but not limited to elderly or disabled people, in staying active, independent and out of institutional care settings, also leading to reduced costs for care systems and better quality of life for vulnerable categories of citizens. The workgroup deliverables include white papers, recommendation reports, innovative use cases susceptible to improve the quality of life of Elderly people using the latest IoT technologies.

Vision of Working Group 5

WG 5's ambition is to be the reference for IoT in Smart Living Environments for Ageing Well. It aims to build a dynamic pole for knowledge sharing in the domain while acting as a bridge between initiatives that bring added value to healthy living.

This vision is supported by the following two strategic objectives:

1. Drive of the IoT uptake in smart living.
2. Unleash the supporting technologies.

Mission of Working Group 5

Smart living for ageing well faces five challenges:

- Acceptance
- Use-cases
- Impact
- Evangelization
- Sustainability & Expansion

These challenges will be addressed through the two strategic objectives defined in the vision.

To help drive the IoT uptake, we intend to:

- Consolidate success stories and best practices focusing on innovation and socio-economic impact, acceptance, business model and ecosystem sustainability. We'll have to provide recommendations, and act as an enabler, a facilitator and a connector between the different stakeholders (public authorities, health & social services network, private and public insurance…).
- Support know-how sharing and promote best practices, through papers, reports, common Wikis and visual materials, also co-organizing conferences, with the purpose of connecting demand and supply as well as connecting SMEs & start-ups with larger corporations.
- Increase the acceptance of IoT-based solutions for smart living environments for ageing well, and contribute to their sustainability and their expansion.
-
While spreading and coordinating with the different EU living labs, we'll increase the acceptance of IoT-based solutions for smart living environments for ageing well and contribute to their sustainability and their expansion, based on impact consolidation and WG 5 evangelization of the ecosystem.

To unleash the supporting technologies, we intend to:
- Identify and select/suggest the key IoT technologies – the most impactful - to target the key priorities to be addressed for the best and quickest possible acceptance. These priorities are compliance (ethics, GDPR, user friendliness…), Security and Privacy, Interoperability & standardization. Successfully addressed, those technologies will enable and empower the use of IoT-based solutions, then improve stakeholder acceptance and help demand creation through a larger deployment of financing policies.

- Demonstrate the efficiency of the technological enablers (standardization, interoperability, security & privacy, personalization, modularity & continuous process...). Use case prototyping, interfacing the crossed domains (Cognitive homes, assistive systems, e & m Health…) through collaboration and recommendations with other entities and bodies, is a solid lever to demonstrate user benefits through evidence-based designs.
- Involve demand-side requirements to increase technological acceptance through knowledge sharing and co-creation processes. Involving demand is a key requirement to support knowledge sharing, thus evangelization (replication, co-optation, demonstrations…) through the demand side itself, at a first stage. At a second stage, achieving mass customization ensures the maximization of the sustainability for this digital transformation in "ageing well", therefore ensuring the expansion of the "smart living environment for ageing well" ecosystem.

Until end 2018 *Plan, consolidate and prioritize*	Until end 2019 *Build and Demonstrate*	Until 2021 *Expand, Grow & Sustain*
Benchmark initiatives to consolidate success stories and best practices *Step1* Preparing the infrastructure to consolidate (2017) white paper summarizing the strategic actions of the WG 5 with started actions and expected deliverables Motivate newcomers to join and members to participate (2017) *Step 2* Relevant basis of consolidated projects benchmarked (H1 18) Innovation impact strategy (2017) Socio-economic impact strategy (2018) Self-sustaining consolidation system (end 2018) **Define key priorities to be addressed and the way to address them for the best and quickest possible acceptance (2017)** Compliance (ethics, GDPR, user friendliness…) Security & Privacy Interoperability **Involvement of demand-side for use case prototyping, to ensure evidence based designs (2018)** **Know-how sharing (best practices promotion)** act as an enabler, facilitator, connector between the different stakeholders conference co-organisation Collaboration with other entities & bodies (standard bodies, consortia, industry influencers, group of interest…)**	**Use case prototyping aiming at mass customization** **Demonstrate the technological enablers** (standardization, interoperability, security & privacy, personalization, modularity & continuous process...) first innovation impact assessment recommendations with other involved entities and bodies **Drive acceptance through know how sharing, best practices promotion and market place structuration** act as an enabler, facilitator, connector between the different stakeholders conference co-organization	**Expand demonstration of the technological enablers** (standardization, interoperability, security & privacy, personalization, modularity & continuous process...) Innovation impact assessment (cont.) **Demonstrate the sustainability of IoT based solutions** Socio-economic impact assessment **Drive acceptance through know-how sharing, best practices promotion and market place structuration** act as an enabler, facilitator, connector between the different stakeholders conference co-organization Recommendation leveraging on demand co-creation process conference co-organization Papers, reports common Wikis and visual materials

Introduction Working Group 6

Farming is a major economic activity in Europe[2], encompassing about 12 million farms in the EU-28 in 2010, 40% of the land area and 25 million people dedicated to farming activities. In a European context with its population increasing, achieving higher efficiency, safety and sustainability in food production is a top priority.

AIOTI WG 6 is the key meeting point of EU-based stakeholders interested in developing and exploiting the benefits of IoT (technologies, ecosystem and infrastructure) in the domains of farming for food production and food safety, from farm to fork (see figure below). The scope of the working group encompasses precision farming (IoT devices, data management tools and issues) applied to multiple farming modalities, food traceability and safety, considering the business, policy and societal dimensions.
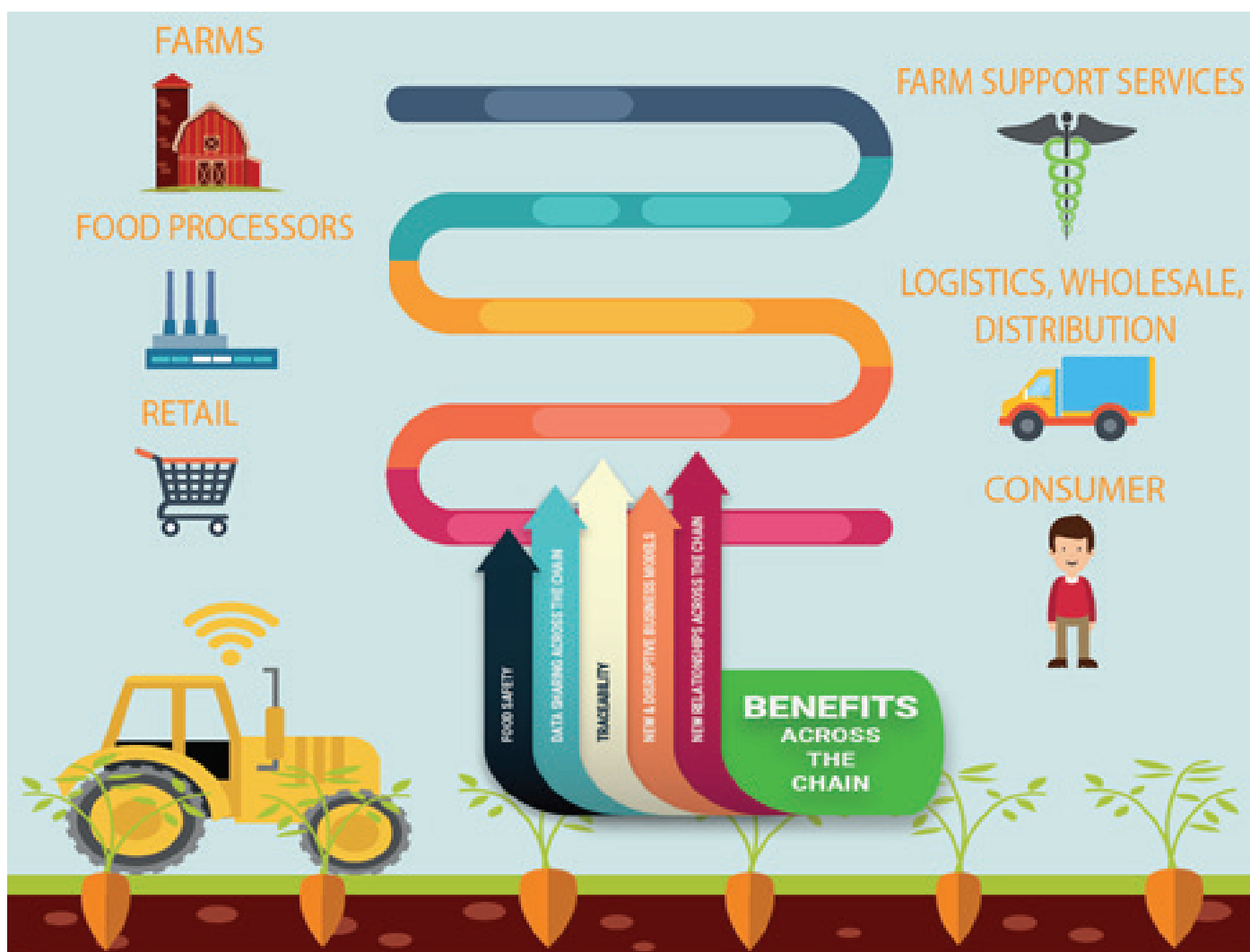

Figure 1: Impact and benefits of IoT in the food value chain (source: Gradiant)

Management Summary Working Group 6

Farming is a major economic activity in Europe, with about 12 million farms in the EU-28 in 2010, 40% of the land area and 25 million people dedicated to farming activities. WG 6 is the key meeting point of EU-based stakeholders interested in developing and exploiting the benefits of IoT in the domains of farming for food production and food safety.

Our vision for the future is that smart farming based on easy-to-use IoT solutions will be widely used by farmers and their partners in the agri-food value chain. A trusted ecosystem will be in place, where all relevant stakeholders collaborate and exchange information, and create shared value. Smart farming represents an unprecedented opportunity to produce value and create business opportunities, by applying data-driven solutions to:

- improve resource efficiency, productivity, environmental processes and provide tools to mitigate climate change
- adapt business plans, respond to dynamic markets and consumer expectations
- provide better and more prosperous living conditions for rural communities and farming families by decreasing administrative and bureaucracy costs
- deliver better public services
- maintain high quality of EU products
- increase connection, communication, cooperation and transparency within the value chain, cross-linking with other IoT ecosystems

Smart farming will also increase the attractiveness of the farming/food sector for young people and the overall trust and transparency. WG 6 will be considered as the undisputed knowledge leader when it comes to queries around adoption of IoT in the smart agri-food value chain.

WG 6 has identified four strategic issues that need to be addressed to drive us towards our vision. First, we are convinced that without IoT we will not be able to address the needs of the world's growing population and increasing food demand in a sustainable manner. Therefore, it is a must to

push for the adoption of technologies, which will also help to improve the image of farming and food production in general. Secondly the value proposition for the customer is not clear enough to foster adoption. In addition, there are a lot of other technological and legal barriers that need to be fully understood before they can be resolved. Finally, a lot of isolated technological solutions are already available, but real progress can only be achieved if we put more focus on interoperability and truly integrated solutions.

The strategy on a high level is to foster and increase the adoption of smart faming technologies until 2021, which will automatically also support food safety aspects. This will be a step-by-step approach and will focus on communication to raise awareness of IoT in smart farming, and enhance the overall image of food production. First, we need clear value propositions and easy-to-understand case studies to convince the farmer that the investment makes sense. It is fundamental that farmers are involved from the start on decision of innovation priorities. The goal is to develop more farmer-focused business model innovations. It is essential to have an integrated approach of the different systems and technologies involved in a way that the ecosystem delivers real value for farmers.

We also need to focus on training, and to push the suppliers to make the systems as easy-to-use as possible. The development of standards for interoperability and data exchange also needs to be very high on the priorities. To foster the development of integrated solutions, it is mandatory to involve all partners of the value chain. The work packages for 2018 are clearly working towards that objective.

Work package 1 focuses on the mapping of the complete smart farming landscape in Europe. This is an extremely dynamic area and we need to have a good understanding of the main activities, initiatives, actors and existing solutions before we take the next steps.

Besides the supplier situation, we need to understand the demand side, creating the appropriate conditions for a fruitful dialog between the demand side, the supply side and the

policy makers. Therefore, work package 2 focuses on the instruments and measures to ensure that we engage all the necessary stakeholders in this extremely diverse environment, and that WG 6 delivers real added value to them.

Work package 3 will take advantage of the active dialog among the stakeholders to clearly identify the main barriers and levers where we must focus our efforts to accelerate the take-up of IoT technologies by the farming sector. WP 3 will also focus on showing the real value proposition of IoT to the demand side by promoting case studies and pilots of smart farming solutions.

Finally, work package 4 will start addressing the growing need for considering smart farming as a new, mixed discipline within future academic curricula, at the crossroads of information technology and life sciences. We see this kind of mixed training as one of the keys to accelerate innovation in cross-cutting disciplines like smart farming.

Vision of Working Group 6 for mid-2021

Smart Farming based on easy-to-use IoT solutions is widely used by farmers and their partners in the food value chain. A trusted ecosystem is in place, where all relevant stakeholders collaborate and exchange information. It is flexible and inclusive, and covers the requirements of existing and new innovative farming operations as well as the needs of the value chain and the consumer. This includes political, legal and technological frameworks with the necessary data exchange and data privacy/security standards. Decision support systems are widely used to support the farmers and support environmentally and economically sustainable production. Communication, educational and training programs are in place to foster the technology adoption. This has several positive impacts:

- Greater efficiency and profitability of farming.
- Greater guarantees of food quality and food security/safety.
- Significant reduction of the environmental footprint and mitigation of climate change.
- Greater trust and transparency for the consumer.

- Greater adaptability of business plans, responding to dynamic markets and consumer expectations.
- Providing better and more prosperous living conditions for rural communities.
- Increasing the attractiveness of farming/food sector for young people as a career choice.

WG 6 is considered as undisputed knowledge leader when it comes to queries around adoption of IoT in the smart agri-food value chain. It acts as the trusted advisor for future policies, definition and prioritization of research programs. WG 6 fosters and facilitates the collaboration of start-ups, SMEs, research organizations, universities and large companies to identify business opportunities to bring innovation faster to the market.

Strategic Issues of Working Group 6

The vision of our working group is motivating and inspiring, even if we are still far away from the ideal status. Some stakeholders might even say this is too ambitious and unrealistic. Even if it takes a few more years to reach that vision, it is necessary to start with the right actions to get there as soon as possible.

Therefore, WG 6 identified the most important issues that need to be addressed immediately to drive us towards our vision. Without IoT we will not be able to address the needs of our growing population in a sustainable manner. Adoption of the technology so far has been relatively low, because the value proposition for the customer is not clear, for example. There are also other barriers that need to be fully understood, before they can be resolved. A lot of isolated technological solutions are already available, but real progress can only be achieved if we put more focus on interoperability and truly integrated solutions. Four strategic issues are described on the next page in more detail.

Strategic issue #1: Relevance of IoT to the long-term sustainability and image of the agri-food sector

Sustainability of agriculture and food production is a global challenge with deep implications in our society and way of living. Taking into consideration the limited resources available (e.g. decrease of agricultural/arable land due to urbanisation) for food production and the impact of climate change (e.g. desertification of ex-arable land) in the existing food production systems, it becomes obvious that farmers need to make the most out of the existing resources to ensure food security for a constantly growing population. IoT and data-powered approaches can help here, by allowing farmers to make informed decisions to increase the quantity while maintaining the quality of food, ensuring the precise application of inputs (e.g. agrochemicals and irrigation water), thus maximizing food production in a sustainable way.

Thus, it is necessary to create awareness and show how IoT can contribute with a positive impact to feeding the world and producing more food with less resources in a sustainable manner, considering multiple facets: food security, food safety, animal well-being, simplification of daily farmers' activities, and reduction of environmental footprint and food waste/loss from the point of view of circular economy, exploring the relationship with other verticals (e.g. water, energy) in AIOTI. By improving communication between stakeholders, variations in the demand can be better controlled resulting in less waste (which currently amounts to one third of the food production). Agriculture will need to evolve from a "push" production strategy into a "demand side pull" chain, where the production quantities and qualities are defined by the market.

Contributing to a more sustainable food production activity will contribute to a better society and improve the quality of life of rural families. Finally, it will help to improve the overall image of agriculture and food production as a highly skilled, well-paid and exciting way of life.

Strategic issue #2: Value proposition of IoT to agri-food sector

While the possibilities of IoT in smart farming are enormous, it is necessary to focus first on applications where IoT can bring real added value not only to large actors, but to all farmers and rural SMEs, which in general have low capacity for investing in new technologies and solutions.

In general, it is still necessary to a) create, validate and demonstrate the value proposition of IoT to the agri-food sector (user-centric IoT), focusing on precision farming and food traceability/safety solutions throughout the whole food chain (from farm to fork). Testing and benchmarking in realistic conditions are key to prove the added value of IoT and thus facilitate its take up. Thus, efforts must be put in facilitating such (large-scale) testing and benchmarking through (but not only) collaborative R&I projects, considering all types of farms and actors in the agri-food chain.

Strategic issue #3: Barriers and levers to democratise IoT in the agri-food sector

IoT technologies can greatly contribute to the long-term sustainability of the agri-food sector, but only if there is widespread adoption. In this regard, it is essential to identify the barriers and the possible enablers to accelerate such adoption.

Hence, AIOTI WG 6 must work to identify barriers, provide guidelines on how to overcome them, and find ways to leverage the democratization of IoT in smart farming and the agri-food value chain. In close collaboration with WG 3 and WG 4, we need to consider the following different dimensions. From the technology perspective, the focus needs to be on interoperability, technology integration, ease-of-use, standardisation and data security. Regulation-related activities need to cover questions around data ownership and data access (especially in a context of data sharing), data management, use of inputs and outputs, and availability of public and governmental data. Other issues include infrastructure, transparency, upskilling and awareness, and access to investment. Finally, the role of the Member States and respective policies supporting IoT integration will need clarification and better alignment at the EU level.

Strategic issue #4: Foster interactive innovation

Farmers and farmers' associations are not only food producers but also data producers and entrepreneurs. In a highly competitive global market, the agri-food stakeholders need to improve

their competitiveness and this can be achieved through innovation. Effective innovation in the farming sector, as with any sector nowadays, becomes more and more a collaborative activity, relying on the match between the technological offer and sectorial need/demand, before it becomes a successful market solution. The interaction of agri-food stakeholders, ranging from farmers to retailers, with cross-sector experts such as innovation brokers and policy makers, will facilitate the development of innovative products with added value –resulting in products with a competitive advantage over similarly placed products. This requires the involvement of expertise from different knowledge areas (technology, regulation, business, etc.) and demanding solutions which can be integrated in ecosystems of solutions and platforms built by multiple players.

Thus, it is necessary that AIOTI WG 6 facilitates and accelerates the transition from isolated innovation practices to multi-actor innovation models capable of delivering integrated services and solutions. It is mandatory to involve and organize all necessary stakeholders around innovation ecosystems (e.g. taking advantage of digital innovation hubs). It is imperative to integrate farmers and agri-cooperatives in the early stages of research and innovation. We also need to consider new business/collaboration models and new smart farming trends (e.g. aquaculture, vertical farming, etc.), in liaison with WG 2 and other AIOTI verticals.

The last chapter described the most important strategic issues for WG 6. It is clear that the adoption of IoT in smart farming is mandatory to address the food needs of our growing population in a more sustainable way, and will also improve the image of farming and food production. Missing value propositions for the farmer and other technological and legal barriers has prevented its wide adoption so far. For a successful outcome, it is mandatory to deliver fully integrated solutions that require strong interdisciplinary cooperation from all stakeholders in the food value chain.

Based on these strategic issues, the following strategy is proposed for the near future to drive the adoption of IoT technologies in smart farming and the food value chain.

Strategy of Working Group 6 2017 – mid-2021

The strategy on a high level is to foster and increase the adoption of smart farming technologies until 2021, which will also automatically support food safety aspects. This will be a step-by-step approach and will focus a lot on communication to raise awareness of IoT in smart farming and finally improve the overall image of food production. First, we will need clear value propositions and easy-to-understand case studies which convince the farmer that the investment makes sense. We also need to put a lot of focus on training, and need to push the suppliers to make the systems as easy-to-use as possible. The development of standards for interoperability and data exchange needs to be a priority. To foster the development of integrated solutions it is mandatory to involve all partners of the value chain. Therefore, we also need to ensure that we attract other stakeholders to become members of AIOTI WG 6.

In order for the WG 6 to achieve the aforementioned high-level strategic goals, effort should be put on a detailed mapping of the existing IoT ecosystem (existing technologies & standards, successful use cases and commercial solutions, prominent prototypes and exploitation of research project outcomes etc.). Existing gaps need to be identified (in terms of representation of stakeholder types and technologies/technology providers) and of the state of the art (referring to technologies, companies etc.). In this context, it is important to ensure the sufficient representation of each stakeholder type identified and envisaged along with the engagement of the "spearheads" of the sector, to ensure that innovators will be a part of the team. On top of that, the strategy should make sure that there will be a flow of requirements through a bottom-up approach (e.g. from technology consumers/farmers to technology providers) so that the outcomes of the WG will solve real issues faced by farmers. At the same time, through a top-down approach, existing technologies can be replaced and, in collaboration with end-users, new innovative applications for them can be identified.

Strategic issues	GA 2018	GA 2019	GA 2021
Relevance of IoT to the long-term sustainability of the agri-food sector	• Turn AIOTI WG 6 into the main source of information in the smart farming area • Define the principles of educational training programs on smart	• Wide dissemination and awareness of the role of IoT in the sustainability of farming • Consolidate AIOTI WG 6 as a trusted partner of policy makers in the agri-food domain	• Significant increase in the number of academic institutions offering smart farming training programmes
Value proposition of IoT to the agri-food sector	• Identify and promote case studies in smart farming • Identify needs on the demand side that can be addressed by IoT and quantify the benefit • Facilitate participation in smart farming pilots	• Promote benchmarks for smart farming technologies • Identify and promote the most promising business models	• Disseminate best practices and success stories
Barriers and levers to democratize IoT in the agri-food sector	• Provide recommendations to facilitate democratization of IoT	• Promote support to address smart farming gaps in future EU R&I programs	
Interactive innovation	• Significantly increase membership in WG 6, specially from demand side • Establish an active dialog between farmers and ICT actors to foster multi-actor innovation	• Consolidate European-wide smart farming community with strong connections at national and regional level	• European IoT marketplace for smart farming • Collaboration with non-European smart farming networks

Objectives & Work Packages Working Group 6 until mid-2018

1. Turn AIOTI WG 6 into the main source of information on the smart farming area.
   - Related WPs: 1, 3
2. Establish an active dialog between farmers and ICT actors to foster multi-actor innovation.
   - Related WPs: 2, 4
3. Identify and promote case studies in smart farming
   - Related WPs: 2, 3
4. Identify needs on the demand side that can be addressed by IoT technologies and quantify the benefit.
   - Related WPs: 2, 3
5. Significantly increase membership of the working group, specially representation from the demand side (farmers and actors of the food value chain).
   - Related WPs: 2
6. Facilitate participation in smart farming pilots.
   - Related WPs: 3
7. Provide recommendations to facilitate democratization of IoT in the agri-food sector.
   - Related WPs: 3
8. Define the principles of educational training programs on smart farming.
   - Related WPs: 4

To reach these objectives, four work packages have been defined:

Work package 1: "Mapping of the smart farming area"

- *Description:* This work package aims at building a complete survey/picture of the smart farming landscape in Europe, considering not only the available smart farming technological solutions, but also the main external actors in the smart farming area (public/private organizations, policy-makers, etc.). AIOTI WG 6 needs to establish liaisons with all these stakeholders. This includes smart farming initiatives driven by Member States and regions, platforms, testbeds and pilots. We need to cover available public funding sources for research and innovation projects, as well as private funding opportunities for smart farming.
  The survey of technological solutions must not focus on individual solutions but on aspects such as their architecture, use of standards, security measures, the types of available sensing technology, etc.
  We must identify external initiatives (i.e. non-AIOTI, such as the SmartAKIS thematic network or the EIP AGRI) which might be covering certain sub-areas of this area survey and collaborate with them, to not reinvent the wheel, but provide added value to what is already on-going.
  The work performed in this work package must consider the different farming domains (agriculture, livestock, and possibly aquaculture), including food safety and traceability applications, and new trends like indoor/vertical farming.
  The mapping of the smart farming area should be done in close collaboration with AIOTI WG 2.

- *Related objectives:*
  - 1

- *Main deliverables (what and when):*
  - D1.1 – First draft of complete mapping (October 2017).
  - D1.2 – Final version (February 2018).
  - Once D1.2 is released, regular updates will be needed.

- *Main steps to reach the deliverables:*
  - Define clearly all smart farming sub-areas of interest for the mapping. It should be done while considering the interests of WG 6 members.
  - Identify external actors covering sub-areas of the mapping and establish collaboration with them.
  - Define proper formats for information dump and arrangement (in wiki, database…) in coordination with AIOTI WG 2.
  - Assign sub-areas of responsibility to WG 6 members and ask for contributions to WG 6 members.

- *Stakeholders for whom the deliverables are important:* This work package is relevant for all stakeholders interested in the smart farming area. The deliverables can be used for several purposes. First, it can help to attract new members to WG 6 interested in getting a complete picture of the smart farming area. Secondly, we will detect gaps, overlaps and complementarities that can be useful to policy makers in the agri-food domain. A third benefit, especially for WG 6 members, is the identification of opportunities for funding R&I projects and testing/benchmarking technology/products.

- *Critical success factors (include stakeholder relations):* effective collaboration with external initiatives covering sub-areas of the mapping. There are multiple "mapping" initiatives currently being undertaken across the broad field of ICT in agri-food so it would be important to collaborate with them.

- *Potential roadblocks*: Missing openness of other stakeholders who see AIOTI more as a competitor and not as a partner who helps to make the overall ecosystem more successful.

- *Owner(s):* Srdjan Krco (Dunavnet), Christopher Brewster (TNO).

Work package 2: "Networking with farmers and agri-food sector"

- *Description:* this work package will address the means for engaging and establishing an active dialog with the demand-side stakeholders of AIOTI WG 6, with special focus on associations of farmers at EU and MS level, advisors, agri-food policy-makers (DG AGRI, DG REGIO, DG RTD, DG CONNECT, DG MOVE, DG GROWTH, JRC, and those from the Member States) and rural development networks. The dialog will be done via a combination of face-to-face events (workshops and seminars), online activities (webinars, newsletters, etc.) and position/white papers. It is intended to contribute to the consolidation of AIOTI WG 6 as a reference for the farming sector (including the policy

makers) and the establishment of a wide smart farming network in the EU. The design of the activities will pay special attention to the involvement of ICT SMEs and start-ups in the agri-food sector, in face-to-face events where active participation of the local/regional SME communities will be sought. This active dialog will also contribute to the recruiting of new members for the working group, especially those representing the demand side, which is a strategic objective for WG 6.

- *Related objectives:*
  - 2, 4, 5

- *Main deliverables (what and when):*
  - D2.1 – Identification of actors and proposal of governance structure (July 2017).
  - D2.2 – Proposal of engagement/dialog activities and proposal of funding instruments for those activities when relevant/necessary (October 2017).
  - D2.3 – Implementation plan and KPIs (December 2017).
  - D2.4 – Start executing first workshops and meetings (March 2018).
  - D2.5 – Review on implementation (June 2018).

- *Main steps to reach the deliverables:*
  - In collaboration with WP 1 "mapping", identify the players from the demand side who must be involved in the active dialog
  - Define the minimum subset of players who must be reached out to in a first phase, and propose a suitable governance structure for coordinating the dialog among them and AIOTI.
  - Define the activities of interest to be performed (with input from both the demand side and the members of WG 6).
  - Define position papers and white papers (e.g. on the role of IoT in circular economy, EU agri-food policies, digital innovation hubs, Digitising European Industry strategy…) that should be

promoted to further support the dialog with the agri-food sector. This could require coordination with AIOTI WG 4.

- Contact relevant DG of the EC to support the definition of future research funding frameworks and strategic R&I agendas, getting a better alignment with the activities detected by AIOTI.
- Look for public/private funding instruments/opportunities for implementing the proposed activities if necessary (e.g. for organization of events).

- *Stakeholders for which the deliverables are important:* especially for farmers and representatives of farmers, and providers of ICT technology/products for agri-food sector (companies and research centres). Through the active dialog between the agri-food demand side and the ICT players, several positive impacts are expected. ICT players will get direct input concerning the needs of the farming sector, and the latter will have access to the latest developments in IoT technologies and recommendations about them. Policy makers will receive valuable feedback for the design of support programs.
- Critical success factors (include stakeholder relations): adequate governance structure, being successful in capturing funding for implementing actions.
- Potential roadblocks: other organisations already establishing this dialog (potential competitors / mixed messages, etc).
- Owner: COPA-COGECA (Matteo Ansanelli)

Work package 3: "Case studies and tests/pilots"

- *Description:* Identification of best practices, recommendations (keys to success, barriers, how to overcome them…) and quantification of economic and ecologic value added by IoT solutions, derived from real case studies in smart farming. Identification of opportunities for WG 6 members to participate in pilots, testbeds and benchmarks of smart farming solutions in collaboration with users (farmers and agri-food industry). Such opportunities

must consider the existing H2020 LSP (increasing interaction with it) and other projects.

- *Related objectives:*
  - 3, 4, 6, 7

- *Main deliverables (what and when):*
  - D3.1 Map of opportunities for pilots (October 2017). This map should be regularly updated and publicized.
  - D3.2 White paper: keys to a successful smart farming project/solution (February 2018).
  - D3.3 Recommendations for participation in H2020 agri-food digital innovation hubs in 2018-2020 Work Programme (September 2017).
  - D3.4 Recommendations for participation in H2020 agri-food pilots in 2018-2020 Work Programme (April 2018).
  - D3.5 White paper: quantifying IoT value propositions from smart farming case studies (July 2018).

- *Main steps to reach the deliverables:*
  - Collaborate with WP 1 to identify opportunities for pilots, including the LSP IoF2020.
  - Selection of representative case studies (in collaboration with WP 1 and through the input provided by activities launched from WP 2) from which to derive best practices and possible issues/barriers that should be addressed from the AIOTI point of view, possibly including topics on data sharing, interoperability, security, etc. which are key to success. Their analysis, which will probably require interaction with WG 3 and WG 4, should lead to deliverable D3.2.
  - A selection of case studies will be analysed to understand and quantify the IoT value proposition, leading to deliverable D3.4.

- It is expected that the upcoming H2020 ICT and SC2 2018-2020 Work Programme will provide support to large=scale pilots and digital platforms in the agri-food sector. Once the details of the Work Programme are available, AIOTI WG 6 will analyse the relevant calls to elaborate a set of recommendations for prospective participants (D3.3, D3.4).

- *Stakeholders for which the deliverables are important:* all members of WG 6 interested in learning from real case studies, and participating/implementing pilots and testbeds for smart farming solutions, especially those interested in H2020 pilots, for validation of value proposition of IoT.

- Critical success factors (include stakeholder relations): Stakeholders need to provide enough resources (funding) to make progress on this time-consuming activity. Existence of sufficient numbers of use cases and best practices, close collaboration between different stakeholders involved in pilots & testbeds, multi-actor approach (ensuring the involvement of all necessary stakeholder types).

- *Potential roadblocks:* Willingness of other stakeholders to share success stories, because they think that the data provide a competitive advantage. Lack of sufficient information on the existing status and ongoing work (use cases, best practices), lack or insufficient number of key components / stakeholders (e.g. testbeds, end users), insufficient funding options to allow the exploitation of existing testbeds.

- *Owner:* Vassilis Protonotarios and Fotis Chatzipapadopoulos (NEUROPUBLIC), and IRTA

Work package 4: "Educational training programs"

- *Description:* Soon, the design, implementation and use of IoT solutions in the agro-food branch will require practitioners with specific competences at the cross-road of Life Sciences (especially farming) and Information Technologies (especially IoT). Currently, those two fields correspond to specific, separated disciplines. To facilitate the design and adoption of IoT in smart farming, we will have to specifically train professionals with new curricula mixing green tech, high tech, information technology and agronomy.

- *Related objectives:*
  - 2, 8

- *Main deliverables (what and when):*
  - D4.1 List of existing European curricula training in Smart Farming (December 2017)
  - D4.2 Design of a specific curricula at Master Level mixing IoT and farming (May 2018)

- *Main steps to reach the deliverables:*
  - In collaboration with WP 1, "mapping" the players (schools, universities) proposing curricula in the field of Smart Farming, with a specific focus onto training mixing IoT and farming
  - Organization and facilitation of a co-design workshop joining together practitioners and scientists of IoT and farming, to imagine and describe a specific curriculum to train IoT farming professionals
  - Assess the feasibility and attractiveness of such training for students

- *Stakeholders for which the deliverables are important:*
    - IoT solutions providers may be interested by these curricula to hire professionals specifically trained to design and implement specific solutions in farming
    - Farmers and their representatives will need these curricula to make their digital transition and make the most of IoT innovations
    - Traditional providers of farmers will need these curricula to imagine and develop new tools, devices and methods for smart farming

- *Potential roadblocks:* Willingness of other stakeholders to share success stories, because they think that the data provide a competitive advantage. Lack of sufficient information on the existing status and ongoing work (use cases, best practices), lack or insufficient number of key components / stakeholders (e.g. testbeds, end users), insufficient funding options to allow the exploitation of existing testbeds.

- *Owner:* Vassilis Protonotarios and Fotis Chatzipapadopoulos (NEUROPUBLIC), and IRTA

Introduction and Vision of Working Group 7

Wearables are enabling a better society (smarter healthcare, cities, mobility, energy, security, farming, and manufacturing).

They are not seen as gadgets but as multifunctional "tools", in an interoperable open environment. They are the cornerstones of cross-domain applications and of an ecosystem open to new players and source of economic growth in Europe. Wearables are accepted by a large majority of users, proven and recognised as bringing added value to the users while being safe and ensuring privacy.

WG7 is recognised by the EC as an important expert partner in IoT Wearables, participating in defining and writing recommendations for calls, evaluating proposals and managing Cross Section Actions.

WG7 impacts all stakeholders: policies for the EU, recommendations to the industry for architectures, recommendations to academia regarding relevant research topics, promoting proven, safe and added-value proposition for users.

WG7 is driving an expert body conducting technical evaluations of solutions and "validating" products to provide users and specific stakeholders with conclusions regarding technological limitations, accuracy of the measurement, IoT "trust index", and known issues, to increase adoption of wearables.

Strategic Issues of Working Group 7

- An Ecosystem (new business model) is necessary to support stakeholder's adoption:
  - An Open platform is required to get developer adoption (Developer startup environment)

- It would help Incorporate research input
- With a Financial model viable for the user
- Proven benefit should promote trust in the wearables and increase user acceptance:
  - For all users (active and non-active)
  - Professional grade solutions and evidence of impact (better coaching/advice) are needed
  - Multi-functional devices
  - Governance acceptance (for validation)
- Data security and privacy is one of the conditions of user acceptance
  - Regulation change (GDPR) is positive
  - But if it is too stringent: (e.g. medical, with solution more difficult to certify and regulation being more a policy to block competition), it may kill the market
- The Fast pace of the technology changes is a challenge: how to keep up?
  - More technology enablers are maturing fast, AI, sensors, natural language processing (also related to user acceptance), Battery life, Washable devices
  - It is also an evidence that wearables are more than gadgets, Mass adoption: 305 million by 2020
- Wearables need to be linked to use cases: a wearable is a device only; without a use case, it has no value
  - Wearables are cross domain: they are used in sport / health/ smart building / or other applications
  - An open platform is the key to different usages or applications for a single wearable device.

Objectives & Work packages Working Group 7 until 2019

WP1: industry strategic agenda and development roadmap

Objective: provide recommendations for the wearables industry, in the form of strategic agenda and development roadmap

Deliverables: document providing recommendations

People / WG members to involve in completing the plan: all WG7 members

First step: Q4 2017, first draft

WP2: Large scale pilot

Objective: Collaboration with large-scale pilots and proposals of private funded large-scale experiments

People / WG members to involve in completing the plan: all WG7 members

First step: Contact EU with the support of the management board to participate in the evaluation process and advisory board of H2020 LSP3

WP3: Guidelines for the Industry

Objective: provide guidelines on topics of interest and relevant for the members.

Deliverables: Guidelines (documents) on the relevant topics (mid 2018)

People / WG members to involve in completing the plan: all WG7 members, + WG3

First step: compile a list of topics of interest from the WG members for Q4-2017

WP4: Academia involvement

Objective: provide guidelines on research topics of interest and relevant for the members.

Deliverables: Guidelines (documents) on the relevant research topics delivered to WG1 (ongoing process)

People / WG members to involve in completing the plan: all WG7 members

*First step:*compile a list of research topics of interest for the WG members for Q4 2017

WP5: Enroll universities in AIOTI

Objective: increase the active participation of universities in AIOTI in general and WG7 in particular.

Deliverables: membership (mid 2018)

People / WG members to involve in completing the plan: WG1

First step: promote AIOTI in academia

WP6: Expert body conducting technical evaluations

*Objective:*WG7 is creating and promoting an expert body conducting demand-driven technical evaluations of solutions and "validating" products to provide users and specific stakeholders with conclusions regarding technological limitations, accuracy of the measurement, IoT "trust index", known issues, to increase adoption of wearables. For instance, evaluating the accuracy on non-medical devices (activity tracker, optical HR sensors …) to be used by GPs only, and tracking issues.

Deliverables functional and recognized expert body structure (mid 2019)

People / WG members to involve in completing the plan: all WG7 members

First step: provide alternative of viable concepts for creating the expert body, for mid 2018

Introduction Working Group 8

The Smart City is an evolving concept encompassing services such as e-government and IoT to allow developing solutions addressing urban needs such as sustainable development and collaboration.

IoT enabled smart city is emerging as a key component to enable the vision of smart cities.

According to a recent market study from Machina Research, "the success of the smart city depends on interoperability, achieved through standards and layered architectures". The role of data sharing (both open and access controlled data) is central in such a horizontal layered approach.

Despite several successful pilots based on a layered horizontal approach for smart cities, such an approach remains limited when it comes to operational and mainstream deployments. However, new approaches such as PaaS[3] could help in migrating from CAPEX intensive models to OPEX models which allow for much more flexible technology consumption (i.e. pay as you grow) through a horizontal approach.

AIOTI will help mainstream future-proof IoT deployments in smart cities through developing guidelines and replicable blue-prints based on real world use cases and requirements. To achieve this goal, AIOTI WG 8 will leverage results from EU pilots and collaborations with other city alliances (such as OASC, Eurocities and EIP-SCC) and standards organizations.

AIOTI WG 8 examines the IoT solutions used by a city to enhance performance, safety and wellbeing, to reduce costs and resource consumption, and to engage more effectively with its citizens.

Management Summary Working Group 8

Key 'smart city' sectors include transport, energy, building management, healthcare, lighting, water, waste and other city-related sectors. Cross vertical domain communication using open common platforms and the exposure of city data are equally important aspects for sustainable deployments of IoT-enabled smart cities.

WG 8 on Smart Cities serves as an AIOTI focal point for collecting stakeholder requirements for IoT enabled Smart Cities, and will actively engage with existing standards groups (in coordination with AIOTI WG 3) to ensure those requirements are considered.

WG 8 will leverage results from pilots to make recommendations for operational and sustainable models for IoT enabled smart cities.

The workgroup deliverables can include white papers, recommendation reports and presentations, susceptible to clarify and accelerate the deployment of ICT based solutions in global Smart cities.

Based on identified challenges for smart cities, AIOTI builds a set of consistent guidelines to help operational and market-driven deployments of IoT enabled smart cities. Those guidelines are initially targeting case studies, enabling city cross domain data economy, enforcing privacy according to regulation, etc.

WG 8 also promotes a framework for replication and experience sharing among cities and interconnection of city platforms.

[3]*Platform as a Service*

Vision of Working Group 8 for mid-2021

The vision of AIOTI WG 8 on Smart Cities is to ensure simplification and enable acceleration of ICT enabled Smart City roll-out in Europe and beyond.

Market Trends for Smart Cities

- Operational city-funded projects remain vertically integrated and justified by –short term- RoI (e.g. street light).
- Open city data already happening but is limited to key verticals.
- Cities are still building their IoT strategies to be attractive for citizens and businesses.
- Horizontal platform and cross-vertical data exchange remain limited to pilots or EU funded projects.
- Cities worry about indicators (KPIs), usually they do not care about technology.
- A Key concern for city: avoid vendor/platform lock-in.

Strategic Issues of Working Group 8

To be an authoritative advisor to cities and policy makers on IoT enabled smart cities in EU and beyond, AIOTI must be prepared to contribute positive and constructive answers to the concerns that cities are facing or will face when deploying IoT. Some of those concerns include:

Need for *guidelines* for
- Tendering: procurement departments need material to help them issue tenders and evaluate bids.
- Business cases/case studies: which can be used to study, validate the needs and fast track trials and deployments .
- Systems and blueprints: allow to simplify / understand key architectural concepts and navigate through relevant standards and open source initiatives.
- Best common practices and replication: will be key for removing uncertainty and fast-tracking deployments.

Avoid lock-in: the rise of open source software and open standards including for APIs will help to avoid proprietary lock-in by platform, solution and cloud providers. However, cities may not be staffed to navigate all the standards and open source around IoT.

Data retention and privacy protection: sharing data is an integral part of smart cities. However, the cities must be aware of data protection and privacy principles including collecting appropriate citizen consent for appropriate usage of the data.

Objectives & Work Packages Working Group 8 (2018 and 2019 are tentative)

2017
- Collect/document use cases for cross-domain communications in IoT enabled smart cities.
- Deliver a first set of guidelines to deploy IoT enabled smart cities.
    - replication and components of replications such as best practices, KPIs
    - reference architecture for cross-domain smart cities use cases
- Establish collaborations with other smart city related organizations to bring the city voice into AIOTI WG 8.
- Reach out to cities to involve them in the work of AIOTI WG 8.
- Establish WG 8 as trusted partner for EC.

2018
- Organise a workshop with EC to promote WG 8 and disseminate the results.
- Establish guidelines for data sharing and privacy in smart cities context.

2019
- Facilitate networking / consortium building across research, innovation and industry.
- Create a catalogue of guidelines and best practices.
- Organise events with cities and metropolitan areas.

SMART MOBILITY

Introduction Working Group 9

With IoT, the Smart Mobility community and in particular the automotive supply chain will bring mobility to a new level. Thanks to IoT, scattered information will be brought together and made available to be utilized for decision making, managing the whole lifecycle of mobility systems. IoT is a necessary enabler for increased efficiency and safety of mobility services, and automated/autonomous vehicles. It relies on smooth, secure and efficient involvement of billions of connected objects. WG 9 has, to this end, established an ecosystem, including business models and privacy policies, a framework including protocols, architecture, interfaces, and standards, tools including ontologies, test beds and test infrastructure for safe, smooth, secure, and efficient flow of data in smart mobility. As a result, we have achieved visibility and trust in smart, seamlessly connected mobility for all citizens. To guide research and technologies development, bi-annual strategic research agendas (SRA) act as a basis for FP9 calls. A necessary condition for maximum impact of the SRA is that WG 9 works in an easily approachable, transparent way, integrating all stakeholders. WG 9 also manages knowledge repositories, helps setting up IPR models, and has established relevant education channels.

Management Summary Working Group 9

IoT is expected to bring automotive and mobility applications to a new dimension, while increasing the amount of useful data to be collected beyond the existing sources of data.

The significant progress of IoT in the domain of Mobility is however linked to removing several adoption and deployment barriers. Addressing specific needs of Safety Critical Applications is essential for involving IoT sensors in the dynamic driving chain. Also, the benefit of sharing data has to be accepted by all the stakeholders involved in the data chain. Finally, Interoperability is critical

if there is to be a massive adoption of IoT by the multiple heterogenic stakeholders involved in the automotive supply chain.

The WG 9 has identified the enablers that can foster rapidly the adoption of IoT, and proposes the creation of five work packages to address these relating issues.

Vision of Working Group 9 for mid-2021

The AIOTI WG 9 overall vision is to bring Mobility and more precisely Intelligent Transport Systems (ITS) to a new dimension, thanks to the IoT.

Efficiently involving billions of smart connected objects, providing a wide range of data types to contribute to the Transport big data is very likely to progress in a very short time frame; key Mobility applications like Connected and Automated Driving or Mobility will serve as Service (MaaS) platforms.

WG 9's vision therefore is to remove existing barriers for a quick adoption of standardised IoT solutions by all the Mobility stakeholders, being the vehicle and systems providers, the service providers, the operators and the Users.

Beyond addressing the interoperability barriers, enabling the use of IoT in the context of Safety Critical Application is one of the key enablers for the wide adoption of IoT in automated driving systems (ADS, see SAE J3016).

WG 9 also believes that IoT is the essential catalyst for creating common business models with Big Data in the context of Intelligent Transport Systems, and in particular for Autonomous driving, by creating a well-structured, secured and standardised framework for big data collection, management and sharing.

Strategic Issues of Working Group 9

To increase focus and impact of WG 9's work, IoT's place in smart mobility needs to be clearly defined in close cooperation with WG 1 and WG 2. Current IoT approaches need to become consistent, and require definition of a cross-sectorial global IoT model and data format, as well as focus on increased security and methods for certification. A high-level architecture for smart mobility is urgent because of the long OEM integration cycles. Specifically, we have to provide an appropriate data privacy policy framework (GDPR) in collaboration with WG 4.

Free flow of data is hampered by the lack of a consolidated business model for data sharing, and the lack of trust for IoT-based applications among all stakeholders and users. To maximise the impact of IoT, related research agendas need to be consolidated, an example being the need to address the challenges of safety-critical applications. In addition, all working groups need to cooperate closely on the development of new regulations.

Define simply what IoT is

IoT is a complex topic and the Mobility domain is very wide in terms of types of application and services, and the compilation of technologies used for assembling vehicles or managing transport systems. To understand the benefit of IoT for Mobility, and to better deal with the forthcoming challenges, the WG 9 would profit by having a simple definition of IoT, how it can be applied in the Mobility areas, and what benefits should be expected.

It is particularly important to clarify what differentiates IoT from just connected objects.

Complete the IOT standardisation

As the Mobility solutions use a lot of heterogenic systems and collect data for operation coming from different groups of stakeholders, like, for instance, public authority, users, professional services providers etc., it is important to deploy IOT solutions, in particular in the Automotive domains, based on public open standards. The availability of a complete set of standards, covering all layers in the IoT domain, would significantly accelerate the wide adoption of IOT.

The standards should provide a global architecture, common data formats, Security specifications and compliancy assessment (certification) frameworks. For the standardisation, a cross-vertical global IoT model needs to be considered.

Provide guidelines to apply IOT in compliance with the forthcoming regulation on Data Privacy (GDPR)

Mobility services, or sharing data from private parties, i.e. Mobility service users, car owners etc., raise an important risk relating to the protection of Data Privacy. With IOT leading to connect far more user and data sources, it raises new challenges with data privacy. However, IOT is also likely to offer new ways to manage private data in a more efficient way. Therefore, the relationship between the protection of private data and the wide use of IOT for Mobility applications should be clarified as soon as possible.

Address Safety Critical Application Challenges

Dynamic Driving Task (DDT see: SAE – J3016) applications are safety critical meaning that failures are likely to cause injuries or fatalities. Automotive stakeholders developed specific standards to address safety relevant issues, like for instance the ISO 26262 series (Road vehicles – functional safety). Involving data from a large set of connected sensors will also require developing dedicated functional safety requirements for IoT.

Consolidate business models for sharing data

IoT works seamlessly with sharing data among the different stakeholders in the Mobility domains. More precisely, IoT would enable a big data-sharing community to be created, including vehicle providers, vehicle and road users, service providers, public authorities etc. However, the different professional stakeholders need to be convinced about the benefit of sharing their data, instead of keeping ownership on the data they have collected. Convincing all stakeholders about the benefit of data sharing, or how to protect the data (where applicable), which cannot be shared or is confidential, would help to accelerate the adoption of IoT solutions.

Support the development of new regulations for Mobility

The aim of Intelligent Transport Systems (ITS) is to provide a safer, more efficient use of transport. Getting ITS solutions adopted by the different communities has often required the use of regulations, such as, for instance, eCall. In addition, the sharing of data or the requirement for defining rules for data privacy, will very likely lead to new regulations. The massive adoption of IoT would also certainly require new kinds of regulations, either to facilitate the collection, sharing and use of data, or to mandate new solutions to foster the use of innovative Mobility solutions.

Strategy of Working Group 9 2017 – mid-2021

As a first step, an ecosystem will be established by defining business models and privacy policies. A second phase will work on a framework including protocols, architecture, interfaces, and standards. Finally, tools including ontologies, test beds and test infrastructure will be addressed. For all three the following applies: in year 1, a white paper will be created as the basis for a first prototype implementation carried out in year 2, and a demonstrator in year 3.

To ensure the smooth, secure and efficient involvement of billions of connected objects, we have to create a "GDPR for IoT". Interoperability across all vertical domains will be ensured by providing test beds and test environments within an "integrated project".

A global IoT model and high-level architecture is defined in year 1. In the following year, a coordinating action (CA) is set up to move towards consensus. This provides the mobility eco-system by integrating useful data for the purpose of Smart Mobility applications, including the full life cycle.

We connect to AUTOSAR and other relevant industrial associations in year 1, and start an appropriate pilot project (RIA) to achieve visibility and trust in smart, seamlessly connected mobility for the citizens. It will be important to communicate success stories from these pilots. Establishing and promoting IoT trademarks will prevent low-quality solutions, thus building trust and adding to the impact.

AIOTI will establish a European Technology Platform, allowing WG 9 to contribute to the bi-annual strategic research agendas to become a basis for FP9 calls.

Given the urgency of solving these problems, white papers on business models for data sharing, followed by a coordinating action on the same subject integrating all stakeholders, will be important components in helping WG 9 to be identified as an easily approachable and transparent facilitator.

WG 9 will create a WIKI addressing smart mobility, define appropriate IPR models, and suggest an ERASMUS program to build up knowledge repositories and define education channels. In the following year, a track/special session on smart mobility will be established at a relevant conference. Sustainable dissemination will be supported by research centres.

Objectives & Work Packages Working Group 9

Work package 1 - Standardisation

This WP aims at delivering a complete set of standards specifying the functional architecture, the protocols (including security) and the test and certification.

Work package 2 – IoT Ontology

This WP will provide clear definitions and description of what IoT is and what it isn't. The WP will also maintain an IoT catalogue presenting the context of applying IoT for different verticals as windows to show IoT benefits. The catalogue will also serve as a reference for collecting and presenting the IoT solutions, including platforms, sensors and connectivity forming the IoT Eco-System.

## Work package 3 – fostering business models

This work package is aimed at solving main deployment barriers that clear business models face when deploying new innovative solutions. The main barrier is how to create confidence and win-win solutions for sharing data. This WP will also be an excellent catalyst for networking with the different automotive and transport industry associations, when dealing, for instance, with standards, technology or regulations.

Work package 4 – dealing with Safety Critical Application

The main goal of this work package is to address the needs relating to the use of data for decision-making processes in the Safety Critical Application domains of Automotive, like, for instance, Connected and Automated Driving.

Work package 5 – Research Agenda

This work package aims at linking with all the relating research initiative and strengthening the IoT topics in all their agendas.
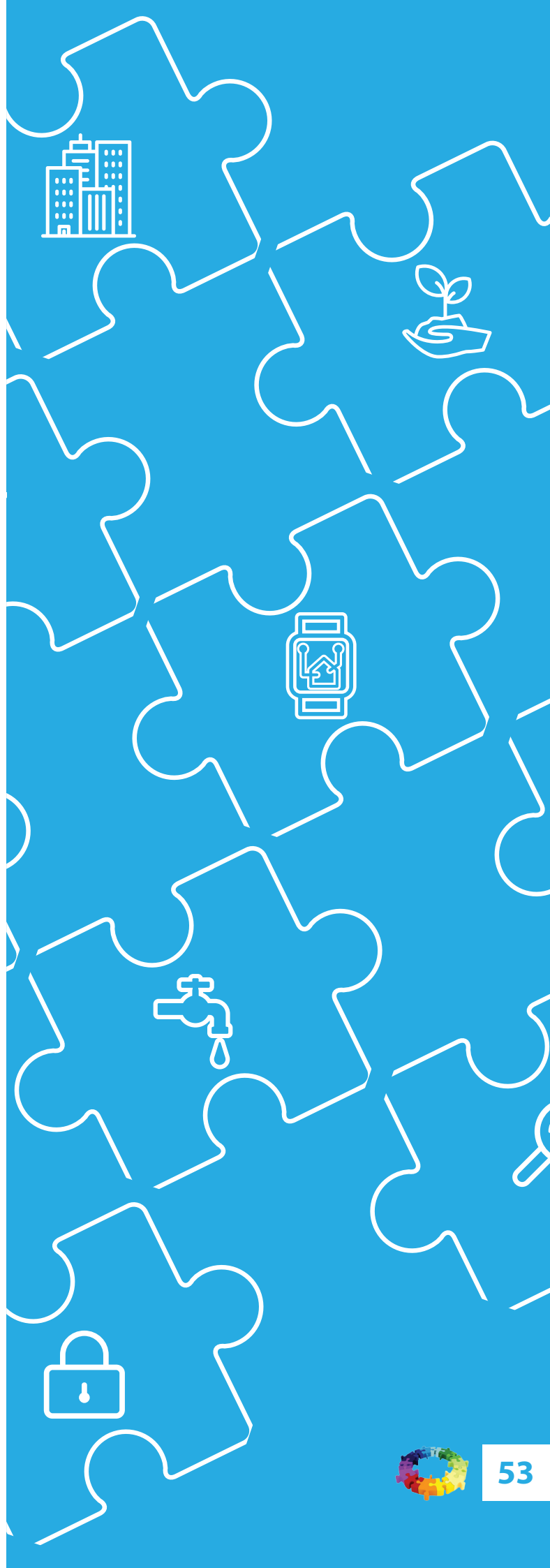
Introduction Working Group 10

Water is Life – maybe there is no other WG in AIOTI whose scope is directly related to addressing the basic needs, the foundation of human development.

Water is a scarce good – less than 1% of the water on the planet can be used by mankind. Scarcity and abundance of water exist in parallel. Regional differences in the availability of water require multi-level approaches.

Water is an Economic Asset – approaches to privatize water supplies and to subject water under market rules may result in a better water infrastructure but may limit adequate access to water.

Water is a Human Right – according to the UN Human Rights Council the human right to water and sanitation forms part of the right to an adequate standard of living.

Water is critical infrastructure – an attack on water infrastructure and/or water supplies has the capacity to severely harm communities, industries and the environment.

Based on the observations above, WG 10 aims to address specific issues on water and ICT from a vertical point of view, but also highlight the need to understand water-related issues and their importance for other sectors. Water should be perceived as a subject matter of horizontal and cross-cutting character.

Management Summary Working Group 10

AIOTI Smart Water Management WG (WG 10) involves the main technological and domain-oriented stakeholders in the water sector. A tight and open collaboration exists between WG 10 and the most important clusters and associations in this domain, such as WssTP, ICT4WATER or EIP Water.

WG 10 acts as a dynamic forum on IoT applied to the water sector. This implies monitoring, promoting and visualizing a collection of success stories where the application of IoT approaches adds value to the sector. Besides, it has summarized the diversity of legislation scenarios existing around Europe, and promotes a legislative harmonization. At the same time, it promotes a continuous debate on water safety issues, their possible technological solutions, and legal implications.

WG 10 has a smooth and transparent interaction with other vertical WGs, especially Smart Energy (WG 12), Smart Farming and Food Security (WG 6), Smart Cities (WG 8), and Smart Manufacturing (WG 11).

Issues around water management need to be addressed from several angles. The following approaches are to be considered:

- The imperative societal need to make best use of a scarce good.
- The geographical characteristics that require tailor-made approaches.
- The technological trends that are enablers to improve water quality, ensure access, realize better water management and ensure adequate pricing.

Vision of Working Group 10 for mid-2021

WG 10 aims to have positioned issues around smart environment and smart water management from two angles. On the one hand WG 10 strives to address issues around water scarcity, quality and economic viability and intends to identify and link solutions based on IoT technology to these issues. On the other hand, WG 10 intends to highlight the cross-cutting character of smart water and its importance for other vertical applications represented in other AGs in AIOTI. All this is to be based on the enhanced understanding of socio-economic developments, needs and respective engagement of external stakeholders. WG 10 will base its activities on the understanding that regional peculiarities require bespoke approaches. WG 10 endeavours to quickly identify technological trends in IoT and highlight them to be an enabler for better environmental and water management for the benefit of societies.

Strategic Issues of Working Group 10

WG 10 has identified several issues of strategic importance. These issues especially relate to the following:

Identify Societal Facts / Trends

Scarcity of high-quality water is the predominant challenge and strategic issue to be addressed. Consequently, WG 10 has put its emphasis on contributions to address on the one hand the pressure to minimize pollution, and on the other hand the pressure to optimize efficiency. Closely related to this is the question to the social and economic value of water. The notion of "full cost pricing" needs to be put in perspective to ensure that access to water remains a human right. One interesting point in this regard which merits careful attention is how far data creation from water infrastructure and use of water could become part of the equation to determine adequate pricing. Water management creates data which has value; the question of who owns and has access to this data needs to be assessed. Moreover, water infrastructure is a critical infrastructure. An attack to harm a municipal water infrastructure is likely to result in unprecedented harm for people and environment. Protecting the system against physical and virtual attacks is crucial.

Fully understand Geographical Facts

WG 10 will address issues around ubiquity and pervasive systems and will aim to embed them into large-area projects. This exercise is to be guided by the understanding that if geographic characteristics are to be adequately considered, this requires a multi-player and integrative approach. In-depth analysis of potential stakeholders is a prerequisite for successfully addressing this item.

Identify and use Technology Trends

WG 10 will focus on the higher demand for smart sensors and the specialized sensing applications for chemical, biological and physical parameters. Technical solutions are addressed in the context of opportunities for 'hard sensing' and 'soft sensing'. This will detect e.g. leakages and pollution and will enable citizens to make full use of their water infrastructure. Technology around smart sensing will enable predictive maintenance of infrastructure, and help to make informed decisions based on water quality and quantity.

Besides that, there are well-established and long-standing water management systems; the trend is to integrate the new technology and to ensure interoperability.

In summary, WG 10 has the approach to work in three steps. Firstly, get a thorough understanding of the socio-economic environment that governs water-related issues today. This includes the building up of a stakeholder network to enhance the WG's understanding and at the same time to assess possibilities to better include the water sector into the data economy. Secondly, WG 10 will assess the geographic peculiarities and will contribute to develop bespoke solutions combining geographic and socio-economic patterns. Both issues will be the basis for identifying best technologies based on IoT applications to exploit the full potential of water – digitizing water will be the leitmotiv for the group in this regard.

Strategy of Working Group 10

2017 – mid-2021

Based on the above deliberations, the WG will follow a structured approach which will still require fine tuning over the next months. One of the first exercises to realize is to build up new ties to potential external stakeholders and to strengthen the contacts to the existing ones. In this regard, the WG has identified the following stakeholder groups:

- Industrial users (to be developed and enhanced via WssTP).
- Cities, Regions, Member States and EU administration (partly existing, to be reviewed).
- Hydographical administrations, also cross-border (existing via members of the WG).

- Environmental Agencies (level to be defined and to be built up via WG members).
- Farmers associations (existing via AIOTI WG 6).
- WssTP and other water platforms (existing, needs to be assessed as for its completeness).

Building up a stakeholder network is always a work in progress. However, it is the basis for a successful implementation of this strategy, which is outlined in the following matrix:

STRATEGIC ISSUES (WPS)	NOW	2018	2019	2021
Involvement of stakeholders	• Invite stakeholders to join AIOTI. • Contact WssTP / ICT4Water	Meeting WG10 + Stakeholders		
External communication & visualization globally		- Catalog of stories - Marketing plan - Stimulate discussion		
Interoperability in the water sector			- First draft of WIM (Water Information Model) - Harmonization among WGs	Promote WIM Alliance
Water legislation issues			Report on legislation around water	
Technology take-up		Catalog of 'Citizens science' projects on water	Report on Smart Metering penetration	

Objectives & Work Packages Working Group 10 up to mid-2018

The actual translation of the strategic issues into concrete work packages is subject to a F2F meeting of the WG prior to the summer break 2017. As immediate steps, the WG will concentrate on reviewing and, if required, to enhance its network of external stakeholders. This is the most important first step to continue the WG's activities as defined above including best available expertise.
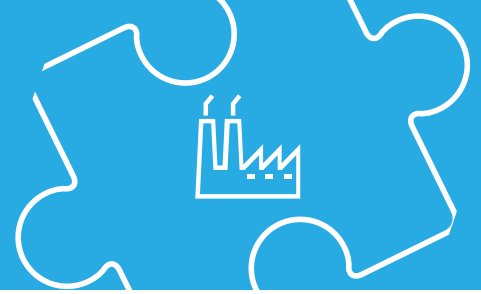
Introduction

Facilitating secure Smart Manufacturing Industry

One of the main advantages of Industrial IoT (IIoT) in the discrete and process manufacturing industry can be derived from the cooperation among companies enabled by increasing automated exchange of data and information. For example, efficacy can be increased when each stakeholder exchanges data and information, and explores optimal distribution of resources under the consensus of each other.

Data and information exchange across company borders requires trust in the partners that are part of the production network. Security measures, both technical and organizational, must be established by all participating companies along the value chain.

Management Summary

Working Group 11 will focus on Smart Manufacturing Industry, addressing discrete and process industrial interests. One of the goals will be to avoid duplicated work in overlapping topics in other workgroups like Smart Cities or Smart Water (utilities). Smart Manufacturing Industry is based on successful collaboration of OT & IT and new active stakeholders. Knowledge of national industrial associations can be shared by WG 11 in terms of common European Industrial knowledge. New key performance indicators like trustworthiness and secure joint OT/IT overall systems examine the foundation of digital twin optimization and secure cross-company communication. We want to investigate whether Cybersecurity in Smart Manufacturing Industry is readily in place and whether the ecosystem needs lowest amounts of regulation.

Discrete Smart Manufacturing Industry requires a good understanding of the future global value chain based on secure interconnected cross-company, country and continent communication.

The following work packages will be realized up to GA 2018. WP1: Create a WG11 Governance and Strategy, WP2: Create WG11 Awareness in EU Countries and Regions and WP3: Increase awareness for Securing IIoT in Industry. The work packages until GA 2019 are defined as WP4: Engage in WG11 Industrial IOT experiments and Innovation Hubs and WP5: Support the WG11 Industrial IOT research and innovation agenda.

Vision of Working Group 11 for mid-2021

As WG11 focuses today on Smart Manufacturing we concluded that this topic is part of the broader topic of the Smart Industry. It is desirable that WG 11 develops over time to cover the broader topic of Smart Manufacturing Industry, addressing both discrete and process industrial interests. In this extended role, WG 11 will continue to work on Smart Manufacturing Industry, and also intensify the collaboration with other vertical working groups with overlapping topics, e.g. WG Smart Cities, WG Smart Water (utilities) and the horizontal work groups Standards and Policy. All working groups will benefit from each other's work and avoid duplicated work.

The IIoT success in general depends amongst others on successful collaboration of OT & IT staff and on reshaped educational models. In terms of increasing efficacy of WG 11 it is evident to foster machine component & sensor suppliers to become active stakeholders in the WG.

From the communication's point of view, we have to understand the big picture of global Smart Industry, and the WG can be the main hub for best practice sharing of industrial IoT

topics by different national associations. This new manufacturing environment will become more transparent and we have to ensure that end users are aware of how their personal data is used by machines, and that they understand the legal requirements arising from GDPR, ePrivacy, etc.

We will create a global understanding of trustworthiness, and we can trust infrastructures which are in place and OT & IT staff can work together due to cross-cutting educations. The usage of Digital twins will be a daily use case to continuously improve the products.

In general, we can state that in the Industrial IoT realm, identical processes & standards are in place across Europe and beyond, and exchange and standardization are best practices on industrial cyber security among Member States.

We improve methods of education to provide better skills, and new Smart Industry qualifications are implemented at the European level for the new IT/OT skill sets. The security for safety problem resulting from IT/OT convergence has been addressed successfully.

Nearly all products have a digital twin before being produced containing their properties/functions, data, experience over the lifecycle and nearly all machines optimize their consumption and manage energy.

Unnecessary regulations should be avoided and shall, if unavoidable, help overcome fragmentation but not stifle innovation.

Machine-tool builders provide machines based on standards, and most machines can collaborate with each other based on interoperable parameters. Predictive collaboration is crucial.

The security by design approach is generally adopted and Machines can be secured based on authentication, authorization, accounting, confidentiality (generally encryption), integrity (the accuracy of a message or server), and availability (of a service).

Digital twin is used to continuously improve products and R&D groups continue to provide disruptive solutions in smart manufacturing.

Strategic Issues of Working Group Smart Manufacturing Industry (WG11)

Along all other issues as mentioned before there is a strong requirement from discrete industry to be pointed out regarding the maturity model which relies on principles of trustworthiness.

The correlating core requirements of process industry must be researched in a next step.

Requirements: Metric of Trustworthiness

- Ensure that security and privacy become quality KPIs of a product!
- Collaborate with other stakeholders to achieve a common understanding and define "Trustworthiness" and findings on how to deal with the aspects of trustworthiness like "Security, Safety, Privacy, Resilience and Reliability".
- Give valuable input to the development and standardization of a metric or measures for a graded level of trustworthiness.
- Setup a generic product model to show the influence of trustworthiness during product development, similar to the treatment of functional safety.
- The metric must include a model that allows the calculation of the trustworthiness level of a value-added network under consideration of the trustworthiness level of each participant in the value-added network.
- At engineering time, the resulting level of trustworthiness must result from the composition of the components.
- This requires a model for a composite product.
- It is necessary to conduct unification across the different domains.

The overall goal is to foster cyber resilience, as well as security and trustworthiness in increasingly digital and interconnected economies. As a result, cyber security cannot be seen only as a technical issue, but rather a multilateral cooperation that is required between all stakeholders (politics, economy, academia, society). A mutual understanding of the process is a basic prerequisite.

Strategy of Working Group Smart Manufacturing Industry (WG11)
2017 – mid 2021

	Now	End 2018		End 2019	End 2021
	Smart Manufacturing	Smart Industry approach		cont	Trusted European Smart Industry Platform
	IIoT fragmentated	Align with national Initiatives in Europe		cont	Aligned European IIoT Stakeholders
	Securing IIoT	Raise the level of Security and Awareness		cont	Secure IIoT Devices
	Show and Implement	Use Cases Demonstrators		cont	PoCs and Large-Projects Best Practices
	Overarching Research Questions	Help SMEs Identify Research Questions		cont	PoCs and Large-Projects Best Practices

Objectives & Work Packages WG 11
until mid-2018

1. Define the scope of the WG such that it encompasses all aspects of digitalization of smart (manufacturing) industries.

2. Include value chains and production aspects for smart, digitalized products and new business models for industry resulting from digitalization (smart services).

3. Have a base of at least 10 active contributing members dedicated to fostering Smart Industry in Europe.

4. Produce an initial mapping and evaluation of the most important organizations in Europe focusing on Smart Industry and IIoT.

5. Synergize with WG3 and WG4 standardization, certification, trustworthiness metrics, mapping of cybersecurity approaches/conversations on the national (BSI, ANSSI, etc.) and EU level (EC/ENISA) towards smart industry/ support Competitiveness and Innovation Framework Program approaches.

6. Start to create a strong value chain between European R&D, H2020 and FP9 project partners and Smart Industry. Help companies large and small, researchers and public authorities to make the most of new technologies by implementing Digitize European Industry strategy. Help that small or large company, high-tech or not, to grasp the digital opportunities with EU Digital Innovation Hubs.

To reach these objectives, five work packages have been defined:

Work Package 1 - "WG11 Governance and Strategy"

Short Description:
Due to the WG11 relaunch at the Strategic Workshop Toulon in a new member constellation we need agreements with all members and we agreed to develop our team to a "Smart Manufacturing Industry" work group, addressing on the one hand discrete industry, and on the other hand process industry.

Deliverables (link to objectives):
Our scope will be approved by the group members after GA2017

When Ready:
Starting by GA 2017 as a permanent process

Owner/principal:
Thomas Walloschke, Fujitsu

People/WG members to involve in completing the plan:
All existing members

First step (who, what, when):
All existing members at the Strategic Workshop Toulon

Main steps to reach the deliverables:
Discussion with all existing members as a permanent process

For which stakeholders are these deliverables important:
For AIOTI as association and the WG members

Critical success factors (include stakeholder relations):
Participation of all existing members

Work Package 2 - "WG11 Governance and Strategy"

Short Description:
This work group will engage and align with national smart industry initiatives and PPPs (with smart industry perspectives) in Europe to provide a holistic approach of the emerging European smart industrial landscape.

Deliverables (link to objectives):
Stakeholder map

When Ready:
First step at GA 2018, this is a permanent process

Owner/principal:
Dr. Philipp Wolfrum, Siemens & Thomas Walloschke, Fujitsu

People/WG members to involve in completing the plan:
All existing members

First step (who, what, when):
Research by Philipp with others involved

Main steps to reach the deliverables:
Identify and collaborate with initiatives and associations

For which stakeholders are these deliverables important:
AIOTI members and new members

Critical success factors (include stakeholder relations):
Work load balance and WG11 member's support

Work Package 1 - WG11 Governance and Strategy

Short Description:
Due to the WG11 relaunch at the Strategic Workshop Toulon in a new member constellation we need agreements with all members and we agreed to develop our team to a "Smart Manufacturing Industry" work group, addressing on the one hand discrete industry, and on the other hand process industry.

Deliverables (link to objectives):
Our scope will be approved by the group members after GA2017

When Ready:
Starting by GA 2017 as a permanent process

Owner/principal:
Thomas Walloschke, Fujitsu

People/WG members to involve in completing the plan:
All existing members

First step (who, what, when):
All existing members at the Strategic Workshop Toulon

Main steps to reach the deliverables:
Discussion with all existing members as a permanent process

For which stakeholders are these deliverables important:
For AIOTI as association and the WG members

Critical success factors (include stakeholder relations):
Participation of all existing members

Work Package 2 - WG11 Awareness creation in EU Countries and Regions

Short Description:
This work group will engage and align with national smart industry initiatives and PPPs (with smart industry perspectives) in Europe to provide a holistic approach of the emerging European smart industrial landscape.

Deliverables (link to objectives):
Stakeholder map

When Ready:
First step at GA 2018, this is a permanent process

Owner/principal:
Dr. Philipp Wolfrum, Siemens & Thomas Walloschke, Fujitsu

People/WG members to involve in completing the plan:
All existing members

First step (who, what, when):
Research by Philipp with others involved

Main steps to reach the deliverables:
Identify and collaborate with initiatives and associations

For which stakeholders are these deliverables important:
AIOTI members and new members

Critical success factors (include stakeholder relations):
Work load balance and WG11 member's support

Work Package 3 - Increase Awareness for Securing IIoT in Industry

Short Description:
Raise smart industry stakeholders' awareness to increase the level of security of IIoT and foster better understanding of the cross-cutting IT/OT related security gaps

Deliverables (link to objectives):
Mapping of cybersecurity approaches and conversations on the national (BSI, ANSSI, etc.) and EU level (EC/ENISA) towards smart industry. As a result, contribution to cybersecurity standards and identification of cybersecurity best practices

When Ready:
First step at GA 2018

Owner/principal:
Evgeny Grigorenko, Kaspersky

People/WG members to involve in completing the plan:
Stephane and all existing members

First step (who, what, when):
Competitiveness and Innovation Framework Program approaches after GA 2017 by Evgeny Grigorenko

Main steps to reach the deliverables:
Identify the right measures and metrics for industry

For which stakeholders are these deliverables important:
For discrete and process industrial IoT manufacturers and their customers

Critical success factors (include stakeholder relations):
Identify the right measures and metrics for industry, strong alignment and collaboration with WG3 and 4

Potential roadblocks:
New methods of alignments between WGs must be established

Work Package 4 - WG11 Industrial IOT experiments and Innovation Hubs

Short Description:
Best practices, use cases and demonstrations shall increase joint leverage of AIOTI and WG11 member experiences.

Deliverables (link to objectives):
Proof of Concept, participation in Large Projects and resulting best practices

When Ready:
GA 2019

Owner/principal:
To be defined after GA2017

People/WG members to involve in completing the plan:
All WG members

First step (who, what, when):
Identification of SMEs and academia partners for joint potential R&D projects with AIOTI/WG members, Test- and Field-Labs of national initiatives and Digital Innovation Hubs

Main steps to reach the deliverables:
To be defined after GA2017

For which stakeholders are these deliverables important:
AIOTI, new members, Commission, discrete and process industry, SMEs, and market in general

Critical success factors (include stakeholder relations):
To be defined after GA2017

Potential roadblocks:
To be defined after GA2017

Work Package 5 - WG11 Industrial IOT research and innovation agenda

Short Description:
Help SMEs on identified research questions

Deliverables (link to objectives):
Proof of Concept, participation in Large-Projects and resulting best practices

When Ready:
GA 19

Owner/principal:
Sergio Gusmeroli, Politecnico Milano

People/WG members to involve in completing the plan:
To be defined after GA2017

First step (who, what, when):
Identification of SMEs and academia partners for joint potential R&D projects with AIOTI/WG members

Main steps to reach the deliverables:
Re/establish H2020 community; help companies large and small, researchers and public authorities to make the most of new technologies by implementing Digitize European Industry strategy; help so that small and large companies, high-tech or not, can grasp the digital opportunities with EU Digital Innovation Hubs

For which stakeholders are these deliverables important:Academia, R&D, SMEs, discrete and process industry
Identify and activate SMEs

Critical success factors (include stakeholder relations):
Participation of all existing members

Potential roadblocks:
Increase R&D and SMEs members in WG1

Introduction Working Group 12

IoT is expected to facilitate the deployment of new, smart-energy apps within energy stakeholders' applications (generation and retail companies, grid and market operator, new load aggregators) bringing new options for real-time control strategies across energy asset portfolios for faster reactions to power fluctuations. These new technologies should combine both centralised and decentralised approaches integrating all energy generation (generation, storage) and load (demand responsive loads in residential, buildings and industries as well as storage and Electrical Vehicles (EVs)) through interconnected real-time energy markets. IoT technologies improve the management of asset performance through more accurate estimations of asset health conditions and deployment of fact-based preventive maintenance. The smart energy apps will largely be based on the networking of IoT intelligent devices embedded within Distributed Energy Resources (DER) spread across the energy system i.e. consumer appliances, heating and air conditioning, lighting, distributed generation and associated inverters, grid-edge and feeder automation, storage and EV charging infrastructures. While energy systems have historically been controlled through single central dispatch strategies with limited information on grid-edge and consumer behaviours, energy systems are now characterized by rapidly growing portfolios of DER structured through several layers of control hierarchies interconnecting the main grid down to microgrids within industries and communities, nanogrids at building level, and picogrids at residential scale. As most of DER have diffused within end-user premises, new transactive energy (TE) control approaches are required to facilitate their coordination at various scales of the grid system through real-time pricing strategies. Aggregators and energy supply companies are developing new flexibility offers to facilitate DER coordination virtually through ad hoc virtual power plants, raising new connectivity, security and data ownership challenges. Climate change has also recently exposed grids to new extreme weather conditions, and this requires the physical and architectural aspects of grids to be reconsiderd to allow self-healing during significant disasters, while taking advantage of distributed generation and storage to island-critical grid areas (hospitals, large public campus) and maintaining safe city areas during emergency weather conditions.

Vision of Working Group 12

We enable the development and deployment of the advanced IoT technologies and applications creating IoT sustainable, safe, secure and standardised solutions to address the changing paradigm of energy asset portfolio management and grid infrastructure, toward a dynamic and volatile distribution network, based on self-consumption and micro-trading, integrating ubiquitous distributed energy resources and transactive energy and based on machine learning and analytics-driven automation to manage the grid.

Mission of working Group 12

To leverage networked IoT technologies through an energy Internet for the development of smart energy apps through new IoT platforms, allowing radical changes to the way energy is controlled and transacted throughout the generation-grid-supply-consumer value chain targeting new business models, where energy flows will be managed the same as internet data packets across grid nodes, which autonomously decide the best pathway, thus minimising energy system dispatch costs while guaranteeing its best resiliency. This is supported by building an IoT cooperative community that embraces the development of Internet of Energy concept across the sectorial domains as a network infrastructure based on standard and interoperable communication nodes, which allow the end-to-end, real-time balance between the local and the central generation, responsive demand and storage. It will allow units of energy to be transferred peer-to-peer when and where it is needed.

Strategic Issues Working Group 12

Definition of a strategic IoT roadmap for the European energy sector

The IoT applications and deployments in the energy sector require defining the European strategic IoT roadmap, which aims to accelerate the development and deployment of IoT technologies and bring down costs by coordinating national research efforts and help finance IoT projects in the energy sector. The IoT strategic roadmap reflects the developments in the energy sector with the grid implemented as a two-way, networked, distributed, clean and intelligent system, integrating ubiquitously DER (i.e. solar PV, energy storage, and EVs) and implementing transactive energy business models whereby DER owners can trade their self-generated power.

Facilitate deployment of new IoT services through significant size community of early adopters

IoT technologies and applications in the energy industry is accelerating the radical transformation of the industry from asset ownership to shared economy. The trend is supported using IoT enabled digital platforms and the change of the energy value chain into a transaction centric enabled by a multi-sided market characterized by localized, connected, transactive markets. This requires facilitating the deployment of new IoT services through a significant sized community of early adopters that will use distributed energy resources, connected devices, processes and data to deliver the right information to the right person at the right time, and transactive decentralized generation and flexible consumption.

Promote best practise on IoT deployment in the energy industry

Energy companies that are already working to define and implement IoT projects and access the IoT's value are piloting an evolving energy environment and market. The challenges to a successful IoT implementation as well as several best practices are as a result of reference implementations in large-scale pilots and large experimentation initiatives. These include the evaluation of strategies and architectures used across the energy industry to integrate the benefits of fast-growing IoT platforms in anticipation of the future regulatory directives established for the European Energy market (published 2016). The best practices cover the areas of hierarchical controls from energy nodes with sensors through ranges of aggregation structures (pico, nano and micro energy systems), new communication infrastructures at the level of each grid node to meet necessary service level agreements for each of the energy services considered (energy efficiency, grid ancillary services, grid resiliency, etc.), development of software/smart data and machine learning approaches that support real-time distributed decision support/transactive controls in highly volatile environments, apps for energy prosumer feedback facilitating smooth, real-time energy transactive controls in daily lives leveraging consumer ICT (mobile, TVs, vehicle, IoT, etc…) and the IoT end-to-end security, privacy, trust and safety framework approaches.

Monitor progress of the adoption of IoT technologies within the energy sector

The use of IoT technologies for energy applications goes beyond one industrial sector. Energy, mobility and home/building sectors need to share data through energy gateways that will control the transfer of energy and information. Enabling this requires the adoption of standardised, scalable IoT-enabled technologies from sensors/actuators, to communication networks, augmented intelligence and platforms to process, store and exchange information and knowledge. In this context, the grid becomes a platform that can detect, accept, and control decentralized consumption and production assets, where power and information flow in multiple directions as required. Monitoring the progress of the adoption of IoT technologies based on sensors/actuators, robotics, and advanced analytics, allowing flexibility, self-healing features and plug-and-play generation is a critical part for accelerating their deployment, and identifying and reporting any obstacle/roadblock.

IoT platforms and energy market platforms convergence and customer portals

New generation IoT platforms, data filtering, analytics and machine learning procedures are necessary to handle the high amount of raw data provided by billions of data sources while guaranteeing resiliency, security and end-user data protection. System and data models need to support the design of real-time decision support systems which guarantee a reliable and secure operation of vital energy infrastructures. The convergence of IoT platforms, interoperability among the platforms across sectors, data structures and models using industry established standards that can be exchanged at the enterprise level using messaging technology and web services, need to be considered for the energy industry. Advanced software applications need to be developed by leveraging the functions provided by different types of platform technologies to provide utilities with valuable information to optimize their operations by combining open and private solutions, with a subset of the data made available to the public through secure web interfaces and web services-based APIs.

IoT sensing/actuating data, energy, financial bidirectional exchange, storage and artificial intelligence processing

The future smart electric grid includes distributed intelligence that increases the operational efficiencies of the electric power system, resulting in benefits through additional cost savings. The grid is evolving from proprietary, isolated, and single-function (i.e. siloed) centralized management systems to a multi-function and integrated distributed grid management system, that simultaneously employs both decentralized and centralized systems in a highly coordinated manner. The current electricity networks are designed to operate according to a unidirectional flow (generation - transport - distribution - consumption), while the requirements for the distributed intelligent grid based on IoT sensing/actuating devices facilitate the integration of distributed bi-directional load flows, storage and artificial intelligence processing, allowing for real time flow of data, energy, financial transactions. This radical change from the transformation of the centralised monitor and control centres (i.e. intelligence provided by human operators to manage network infrastructures and SCADA, EMS, and DMS systems) into a management architecture based on distributed intelligent devices (i.e. IoT sensing/actuating devices) is capable of performing complex event processing, simulations, and executing high-level technical and business rules, while transforming the network operation process from a top-down approach to a distributed control system of systems, providing new services to consumers/prosumers, optimizing the use of energy resources and generating knowledge on the generation and demand trends in these dynamic and volatile environments.

Strategy of Working Group WG 12

Develop the implementation plan for the WG 12 and identify cross-sectorial challenges by defining a strategic IoT roadmap for the energy industry, leveraging existing Smart Grid demonstrators and pre-deployments to cope with near-real-time speed requirements, extensive back-end integration effort and, often, a lack of scalability. Facilitate the deployment of new IoT services across the energy industry through large scale demonstrations that employ multi-functional, standards-based, and modular systems to promote and allow interoperability, lower costs, and improved reliability by integrating and analysing multiple information sources based on their timeliness, location, and availability. Provide recommendation for large-scale pilot implementations of IoT technologies and applications in the energy sector and across various other sectors.

2017	2018-2019	2020-2021
• WG 12 annual work plan • Identify the liaisons with AIOTI cross-sectorial industrial WGs that will work on the contributions to strategic IoT roadmap for the energy industry. • Define the mechanisms for interaction with ETSI-CEN-CENELEC Coordination Group for the Smart Energy Grid. • Align IoT architecture model with SmartGrid architecture model, sets of standards, security recommendations and regulatory guidelines produced as part of the European SmartGrid task force led by DG Energy. • Check progress of the energy industry towards the deployment of the IoT roadmap, identify and report any obstacle/roadblock.	• WG 12 bi-annual work plan • Present the best practices, best results on IoT deployment in the energy industry. • Define a strategic IoT roadmap for the energy industry - leveraging existing SmartGrid demonstrators and pre-deployments. Provide input to Research and Innovation Agenda (SRIA). • Provide recommendation for large scale pilots implementations of IoT technologies and applications in the energy sector and across various other sectors. • Facilitate the deployment of new IoT services across the energy industry through large scale demonstrations, from technology development to the pre-commercialisation stage across significant size early adopter communities (100,000 typically). • Energy storage, IoT technologies and the effect on the distribution service orchestrators to manage the electricity infrastructure.	• Support and monitor the deployment of IoT architecture platforms as part of the integration of energy applications across industrial sectors (energy, mobility, buildings, cities, manufacturing, etc.) • Mapping the value of IoT in the energy sector and the integration of real-time energy transactive applications. • Autonomous and self-healing, smart grid technology convergence evaluation leveraging innovations in, IoT AI, cyber-physical systems, autonomous EVs, etc. • Analysis of transactive energy platforms connecting prosumers, consumers combined with customer portals • Support new IoT large-scale energy applications across sectors.

Introduction Working Group 13

The WG 13 "Smart Buildings and Architectures" is the place where the key stakeholders discuss how the Internet of Things (IoT) brings value to the occupants of buildings or to the people operating/ maintaining buildings, and how IoT helps the buildings to better manage energy, be more sustainable, improve the comfort and make life easier for the occupants.

The challenges for taking benefit of IoT are identified, and recommendations are made for easing the adoption and deployment of IoT solutions to make buildings smarter for the benefit of the people living or working inside.

In addition, the buildings are not isolated but become part of a more global environment within a city which can be smart itself. A building is therefore connected to many other systems such as other buildings, the energy grid, the cars, the district it belongs to or even the city itself. The WG 13 explores this connectivity for identifying the associated needs and potential gaps in standardization.

By liaising with the relevant organizations and SDOs, the WG plays a role for removing the obstacles, improving standardization, and eventually accelerating the adoption of IoT in Buildings.

Finally, the WG 13 identifies areas for innovation, working with SMEs and start-ups, in order to invent the architecture of the future taking full benefit of the digital world and the Internet of Things.

Management Summary Working Group 13

Scope and purpose of the working group

The scope of WG 13 is wide because of the great variety of building types. The WG will cover all types of buildings, residential and non-residential, as well as existing buildings and newly constructed buildings. The purpose is to work on the application of IoT solutions and understand how they can benefit the various stakeholders, the occupants being top priority.

Summary of the vision

By mid-2021 through its work and deliverables, WG 13 will become the undisputable place for addressing Smart Buildings and Architecture issues with the key stakeholders represented. The value brought by IoT will be well understood so that the decision makers can invest in IoT and deploy IoT solutions in the field. Occupants of Smart Buildings equipped with IoT will have a positive user experience, better security, better comfort, better services, and a better quality of life, and they will use less energy. Smart buildings will be easier and cheaper to operate and maintain. A smart building will be green and sustainable; it will also be connected to its environment within the City where it can exchange information with other systems and services. It will produce and store energy as well as exchange energy with other buildings, within, for example, a district area.

Summary of the strategic issues

To realize the 2021 vision, the WG has defined 5 strategic issues that need to be addressed:

1. Understanding the Building ecosystem for IoT adoption: it is important to secure the adoption and real deployment of IoT.
2. IoT value and acceptance by people living in buildings is also fundamental. A pure "technology push" approach could lead in the worst case to the rejection of IoT in buildings.
3. Regulatory environment can be a lever to adopt IoT solutions. WG 13 will study how IoT enables the Buildings to be compliant with up-to-date regulations and prepared for the future.
4. Data and cybersecurity issues are not specific to smart buildings. Nevertheless, understanding these issues in the context of buildings with its specifics is key. This will be done in collaboration with WG 3 and WG 4.

5. A smart building is connected to its environment in the context of smart cities. WG 13 will study the impact on buildings with a focus on interoperability with other ecosystems. This will be done in collaboration with other vertical WGs of AIOTI.

Vision of Working Group 13 for mid-2021

The stakeholders covering the whole value chain of the smart buildings are engaged in AIOTI/WG 13 which is the place to be for discussing Smart Buildings and Architecture issues, and how the buildings are connected to a wider environment within a city.

AIOTI/WG 13 has demonstrated how IoT brings value to the occupants living or working in buildings, making their lives easier, more comfortable and providing them with new services. In addition, it has provided insights for creating new buildings and architectures taking benefit of the new capabilities offered by IoT.

AIOTI/WG 13 has explained how IoT can make buildings greener, more energy efficient, safer, and compliant with up-to-date associated regulations (sustainability, energy-efficiency etc.). Therefore, the energy bill is significantly decreased without impacting the comfort of the occupants or the processes.

WG 13 has developed compelling use-cases and recommendations for addressing the operation of buildings. It shows gains in flexibility for better adaptation to new needs such as layout change, and better efficiency for the maintenance with reduced repairing time. The capability of IoT to facilitate and decrease the cost of operation and maintenance has been demonstrated.

As IoT applies not only to newly constructed buildings but also to existing ones, WG 13 has issued recommendations for integrating IoT with current legacy Building Management Systems, allowing an easier upgrading path so that IoT can be adopted more widely.
We have worked within AIOTI to clarify how to handle data so that nobody is afraid anymore about being non-compliant with the regulations.

Strategic Issues of Working Group 13

To achieve the vision, there are plenty of issues which need to be addressed and solved by the WG. Here, we describe the 5 major strategic issues that the WG focuses on for the first 3 years, so that we can realize the 2021 vision as it has just been described above in the document.

Understanding the Building ecosystem for IoT adoption

The building ecosystem is complex in many ways: there is a full chain of stakeholders, from the intent to construct a building, the necessary investors, down to the occupants living and working in the building, including the design, the construction, the operation, the maintenance etc. Each of these stakeholders has requirements, constraints and pain points, and the understanding of the whole chain is crucial for the success of IoT solutions, so that people will agree to invest in and become part of a viable business model.

There are many applications running in buildings today, including lighting, Heating Ventilation and Air Conditioning (HVAC), shades and shutters, access control, energy distribution and management. In most of the cases they run in different vertical silos without much interaction between them. Understanding the roadblocks for better interaction is fundamental because IoT is in essence crossing various domains.

It is important also to study the geographical specifics as Europe is a wide zone with very different climates and cultures. Therefore, it is likely that the issues can be quite different from the north of Europe to the south for instance, and even from on country to another. The WG must understand the variety of requirements to deliver the relevant recommendations.

In summary, identifying the requirements while considering the whole building ecosystem complexity is key to a successful adoption and deployment of IoT for buildings.

IoT value and acceptance by people living in buildings

IoT solutions are usually based on many sensors and devices deployed on the field. If we add the development of automation, cloud-based services and machine learning, there is a serious risk that the global concept is rejected by the people living in buildings implementing IoT solutions. It could be for different reasons such as privacy issues, feeling spied upon, and losing control when automation takes over decision-making etc. First, of course, IoT solutions must always put the user in the middle of the picture (human centred IoT). However, it is very important also to identify which values IoT is delivering to the occupants and that the occupants will perceive, and communicate about them.

The lifetime of a building is long, generally running into several decades. Therefore, the occupants can change during the lifetime and their needs change over time. IoT can offer a greater degree of flexibility so that the building can better adapt to changing needs over a long period.

Defining which value IoT can bring to the occupants of the buildings during the lifetime of the building is important to ensuring that smart buildings with IoT systems will be accepted by the people.

How IoT enables the Buildings to be compliant with up-to-date regulations and prepared for the future ones

At a time where more and more people live in cities, increasing attention is being given to buildings. With regard to energy, buildings are responsible for about 40% of the global energy consumption. Having greener, more energy-efficient buildings is no longer optional. Standardization efforts are not new in this field, and regulations such as the Energy Performance of Buildings Directive (EPBD) are pushing to address the way buildings use energy. Another trend is the decarbonisation of energy and the increase in decentralized renewable energy production. As well as consuming energy, a building can also produce energy. This energy can be given back to the grid or used locally, or stored for future use.

In addition to energy, there are other areas like safety of people inside buildings where regulation has to be taken into account. Ensuring good indoor air quality is one example so that people are not affected by exposure to air pollutants in ambient air.

Knowing the regulatory environment – whether at European or national level - is very important in understanding how IoT can enable buildings to better address these challenges and be compliant with the applicable regulations.

Address the data and cybersecurity issue for buildings

There are many questions about data in IoT which are not specific to the smart building case. For example, ensuring data privacy for people in buildings, or understanding data ownership and the related constraints are very important issues. In the case of buildings, there is a complex combination of players, as well as a mix of private and professional activities, which makes this subject particularly difficult to address.

Cybersecurity is also a generic issue but the consequences of a security breach in a building can be very serious, depending on the size of the buildings, and the type of activity hosted (e.g. a hospital). It is commonly agreed that the security level in a building is expected to be higher than in a pure residential space.

Even if these data and cybersecurity issues are not specific to buildings and should be addressed in horizontal WGs within AIOTI, WG 13 will be explicitly involved so that the specifics of smart buildings are all taken into account.

Smart building connection to its environment

A building is not just an isolated island, but part of a wider environment: the smart city. A building as a system is potentially connected to many other systems:

- To other buildings, at district level for example.
- To the energy grid and infrastructures like water or gas
- To the Telecommunication networks and IT infrastructure
- To the cars, in particular electric vehicles
- To the public transportation system
- To the smart city

Thanks to the digitization trend touching every domain, the connection of the buildings with their environment will expand and be an opportunity for offering innovative new services for the people if the interoperability between these different systems can be achieved. Most of these systems are within the scope of AIOTI. Through adequate collaboration between the WGs, we have the opportunity to bring innovative ideas and provide recommendations for the future.

Strategy of Working Group 13 2017 – mid 2021

Year 1	Year 2	Year 3
Develop inclusion of stakeholders for better understanding of the ecosystem and business • Engaging new members • Liaising with relevant organizations	Investigate the link between the building and the Grid through collaboration with WG 12 (Smart Energy and organize workshops with the key stakeholders	Investigate the link between the building and Smart City, Cars, Environment through collaboration with WG 8 (Smart Cities), WG 9 (Smart Mobility), WG 10 (Smart Environment)
Be recognized by the EC when Smart buildings are discussed. Link with current LSP (Smart City) and provide recommendations for future LSP for smart buildings	Support a call for LSP related to Smart Building	Support the selected LSP
Describe IoT value on selected use-cases: • Energy management • Comfort • Operation & maintenance	IoT value on other use-cases • Usage (occupation, move…) • New services	
Interact with WG 3 and WG 4 for addressing data issues (privacy, ownership, protection…)		
Describe how IoT can be introduced by enhancing existing BMS		
Describe how to enable interaction across the different functions within the building (lighting, HVAC, shades, access control etc.)		
Clarify the respective scope of WG 13 and WG 5 (Smart living) to avoid duplication of work and identify potential common issues		

Acronyms:
• BMS: Building Management System
• EC: European Commission
• HVAC: Heating, Ventilation and Air Conditioning
• LSP: Large Scale Pilot