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Terms of Reference

IIoTNet

Version 1.0

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Content

Abbreviations

Abbreviations	Explanation
IoT	Internet of things
IIoT	Industrial Internet of things
M2M	Machine to Machine
OT	Operation Technologies
IT	Information Technologies
EU	European Union
IIoTNet	Industrial internet of Things Vocational Education and Training Network
SMEs	Small and Medium-sized Enterprises
VET	Vocational Education and Training
Industry 4.0	Fourth Industrial Revolution
ITPIO	Institute for Training of Personnel in International Organisations
PIB	Vocational Education Association
TUCEP	Tiber Umbria Comet Education Programme
AKMI	Sectoral Network of VET
IPS	Institute for Postgraduate Studies
ReadLab	Research Innovation and Development Lab P.C.
DIMITRA	DIMITRA Education and Consulting
HEA	Hälsingland Education Association
WG	Working Group
ETF	European Training Foundation
3G	Third Generation
4G	The Fourth-Generation of Broadband Cellular Network Technology
LTE	Long-Term Evolution
5G	The Fifth-Generation of Broadband Cellular Network Technology
2G	Second-Generation of Broadband Cellular Network

Introduction

According to John Conway, the Industrial Internet of Things (IIoT) is often presented as a revolution that is changing the face of industry in a profound manner. In reality, he claims, it is an evolution that has its origins in technologies and functionalities developed by visionary automation suppliers more than 15 years ago. As the necessary global standards mature, Conway says, it may well take another 15 years to realise the full potential of IIoT. Over this period of time, the changes of the industry will be far reaching, he claims, and end users and machine builders can now leverage their existing investments in technology and people while taking advantage of available new IIoT technologies.[1]

The IIoT is the extension and use of the Internet of Things (IoT) in industrial sectors and applications. It is strongly focused on machine-to-machine (M2M) communication, big data, and machine learning, and it enables industries and enterprises to have better efficiency and reliability in their operations. The IIoT encompasses industrial applications, including robotics, medical devices, and software-defined production processes. It converges information technologies (IT) and operational technologies (OT) providing industries with greater system integration in terms of automation and optimization, as well as better visibility of the supply chain and logistics.[2]

The monitoring and control of physical infrastructures in industrial operations are made easier through the use of smart sensors and actuators and the capturing and transmitting of data among smart devices and machines provide industries and enterprises with many growth opportunities. This data allows industries and enterprises to address errors or shortcomings in the supply chain, for example, thus, ensuring efficiency in daily operations and finance. Viewed more broadly, the use of IIoT can also optimize the use of assets, predict points of failure, and trigger maintenance processes autonomously.

IIoT technologies and applications are pushing the digital transformation across industries and society, and developments in this field can provide essential contributions that strengthen scientific and technological foundations, increase competitiveness, tackle the most important global challenges and ensure sustainable development of the European Union (EU). Any serious contribution to the advance of the IIoT must necessarily be the result of coordinated and interconnected activities conducted across the whole spectrum of industries — not a simple task by any means. In such a complex scenario, IIoT Vocational Education and Training Network (IIoTNet) is built for those who want to approach this

[1] http://www.mhi.org/media/members/15373/131111777451441650.pdf
[2] https://www.trendmicro.com/vinfo/us/security/definition/industrial-internet-of-things-IIoT

complex discipline and contribute to its development, particularly focused on micro companies and SMEs and related issues.

Mission statement

The IIoTNet encompasses the national VET institutions of the EU Member States, while respecting the independence of training providers, therefore, it is the principal platform and advocates for the development, training and exchange of knowledge and skills of the IIoT of the European Union. IIoTNet will make the most significant contribution to reinforcing a European area of IIoT by developing and sharing a common European IIoT culture.

IIoTNet will contribute to an increased adoption of IIoT by European SMEs via supporting measures that strengthen ecosystems and structurally enhance the supply of necessary skills and facilitate organisational development.

Vision

The promotion, advancement and involvement into the European IIoT training is IIoTNet's *raison d'être* and will remain so for the foreseeable future; that is, IIoTNet intends to provide the initial and continuous training of EU IIoT company leaders, professionals and users. It will also combine forces to achieve better and more effective results in IIoT training in the European area. IIoTNet is fully autonomous in defining the training needs of the European IIoT stakeholders, as well as its own priorities in the light of these needs, while fully respecting training providers' independence and taking into account priorities set by the European institutions.

Aims

- As an organization, the aim of IIoTNet is the pursuit of European interests in the field of IIoT VET. IIoTNet intends to become a well-recognised and prominent player operating at European level.

- IIoTNet respects the different capacities, missions and structures, as well as the different needs of individual Member institutions that may have an impact on their involvement in IIoTNet's activities.

- IIoTNet will offer high quality, innovative training activities that provide added value to training offered at national level, while appreciating that the primary responsibility for the provision of such training activities lies with national training providers.

- IIoTNet's Members have a legitimate interest in using the Network as their forum for networking. It is, therefore, considered vital that IIoTNet will provide a platform and adequate tools that enable an exchange of concepts and best practices, which should have a wider scope beyond Europe.

- IIoTNet intends to bring together national IIoT VET providers from all EU Member States. IIoTNet will enter into enhanced cooperation with a wide array of partners (EU institutions and agencies, associations and other partners), demonstrating its leading role in the area of European IIoT VET.

Objectives

IIoTNet intends to develop far-reaching training projects and programmes in a broad array of respected IIoT training seminars and workshops, for example, offering individuals and businesses a wide range of training courses, seminars and workshops to promote professional competence and career growth, focusing on areas such as IT, network systems and cyber security.

Courses and seminars may include the following topics (a non-exhaustive list):

- IT & Network Security;
- Authentication Systems;
- Management & Analytical Tools;
- E-mail Security;
- Web based "conference systems" like Microsoft TEAMS and Google version
- Check Firewall and Troubleshooting;
- DDoS Security;
- User Identity Protection & Management;
- Cyber Security;
- Cloud System;
- The Internet of Things (IoT);
- Radio Communications Fundamentals;
- Critical Communications & Broadband;
- Microwave Links;
- Communication Equipment, Calibration, Operation and Testing.

By developing and coordinating these training activities, IIoTNet contributes to the achievement of the following objectives:

- Facilitating the participation of IIoT professionals from one State in other States' training programmes;
- Facilitating new IIoT training opportunities, best practices, methods and tools;
- Producing authoritative IIoT training standards and curricula;
- Building trust among IIoT practitioners;
- Developing the competencies of national IIoT trainers and trainees (company leaders, professionals, users);
- Promoting cooperation and the exchange of information between IIoTNet's Members, Observers and Partners;
- Advocating for EU IIoT training issues.

IIoTNet will establish monitoring and tracking system for participants attending IIoTNet's cross-border training activities and individual training days in a wide range of training activities with a differing variety of formats and lengths.

These Terms of Reference are based on the institutional and policy framework set by the EU, reflected in Industrial Strategy for a globally competitive, green and digital Europe 2020 and SMEs Strategy for a sustainable and digital Europe 2020. A new type of governance emerges, aimed at achieving the twin transition towards climate neutrality and digital leadership. Digital Education Action Plan (2020) of the EC is expected to boost digital literacy and competences at all levels of education. A reinforced Skills Agenda will strengthen digital skills throughout society and Youth Guarantee to put a strong focus on digital skills in early career transitions. Furthermore, the Terms of Reference are also aimed to give the Network internal and external visibility and to guarantee its strategic position in an evolving European IIoT VET landscape.

01 The Scope of IIoTNet

The original description of IoT used by the IIoT was derived from the common usage of the term across several industries, such as manufacturing (Industry 4.0), logistics, oil and gas, transportation, energy/utilities, mining and metals, aviation, and other industrial sectors and the situations of use, typical to these industries.

Just like the IoT in general, the Industrial IoT covers many situations of use, many industries, and applications. Initially focusing on the optimization of operational efficiency and rationalization/automation/maintenance, with an important role for the convergence of IT and OT, the IIoT opens plenty of opportunities in automation, optimization, intelligent manufacturing and smart industry, asset performance management, maintenance, industrial control; it will support the move towards an on-demand service model, new ways of servicing customers and the creation of new revenue models, the more mature goal of the industrial digital transformation.

Initially, the term (IIoT) referred mainly to an industrial framework whereby a large number of devices or machines were connected and synchronized through the use of software tools and third platform technologies in a machine-to-machine (M2M) and IoT context; later it was supplemented by an Industry 4.0 or Industrial Internet context.

Today, the term is used mainly within the scope of IoT applications outside of the consumer space and enterprise IoT market, as an umbrella term for applications and use-cases across several industrial sectors. The IIoT is defined as “machines, computers and people enabling intelligent industrial operations using advanced data analytics for transformational business outcomes”.

In the pure M2M and Industry 4.0 context, the advantage of the frameworks and systems that IIoT refers to, is that they can operate semi-independently or with very minimal human intervention.

Such systems will increasingly be able to intelligently respond and even change their course of action based on the information received through the feedback loops established within the framework. As mentioned before, the keyword here is M2M communication, which is an element of the IoT; it also refers to specific activities and to the initial stages of the IIoT.

The idea behind M2M communication is to reduce human interventions as much as possible, so that the highest level of automation is achieved. If we look at the concept of the Internet of Everything, this M2M dimension of the IIoT happens within the sphere of

the things, as you can see in the original depiction of the Internet of Everything by Cisco (Figure 1).

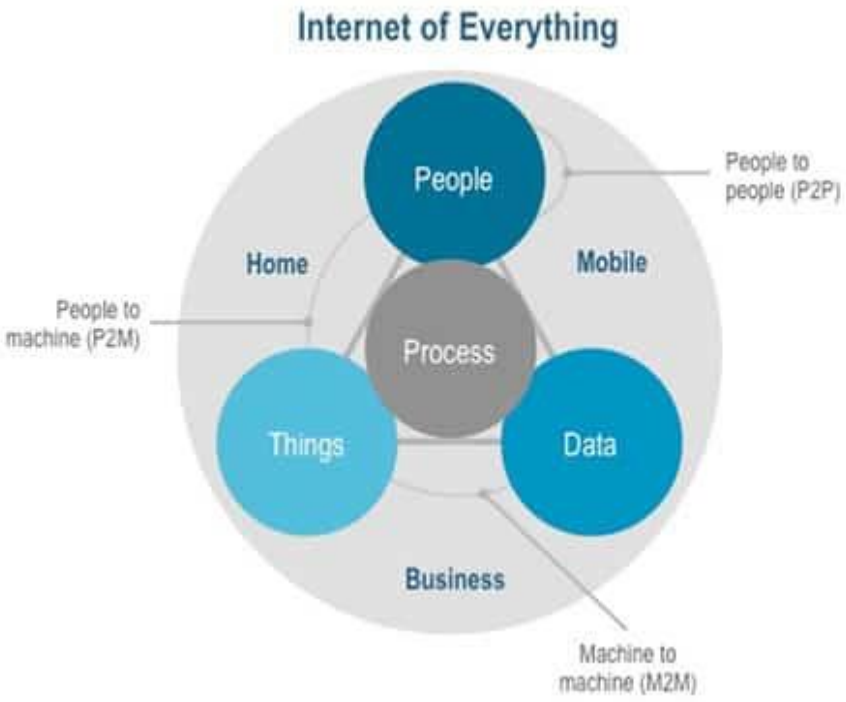


Figure 1 Internet of Everything by Cisco

The place of machine-to-machine or M2M in the Internet of Everything view of Cisco – source Cisco

In this sense, the IIoT can be considered a movement towards 'smart machines', whereby the accuracy levels of the operations involved in the respective systems are heightened to a level that cannot be achieved through human interventions.[3]

IIoT transforms contemporary industry radically, but unlocking its significant value is challenging and cumbersome. The emergence of the new technology is creating new skills gaps, addressing shortages and mismatches, especially for micro companies and SMEs, which are in an inferior position compared to large enterprises in manufacturing sector, in terms of attracting and retaining the scarce digital talents.

[3] https://www.i-scoop.eu/internet-of-things-guide/industrial-internet-things-IIoT-saving-costs-innovation/industrial-internet-things-IIoT/

IIoTNet intends to support (knowledge, guidance and learning) companies tailoring training to their needs. The Network will contribute to increasing the vocational education and training offers of its Members. They will join efforts to build sustainable training offers that match SMEs needs (content, form, set-up), and develop training capacity. The Network will collect intelligence to increase understanding of training needs.

IIoTNet will support companies with the implementation of structured skills development in IIoT technology and business fields. It will contribute to enhancing capabilities for assessment, monitoring and decision-making, increasing transparency and access to funding.

02 Membership and Stakeholders

The partnership aims to develop initiatives focusing on one or more areas of IIoT education, training, and to promote the exchange of innovation, experience, and know-how between different types of organisations involved in education and training or other relevant fields. Membership is open to organizations and institutions willing to contribute to the goals and objectives of the Network. These may include (non-exhaustive list):

- Training providers;
- Government bodies at the national and sub-national level involved in the promotion of IIoT;
- Research and other scientific institutions; and
- Non-Governmental organizations.

Objectives

The objectives of the stakeholders is to promote innovation, entrepreneurship, creativity, employability, knowledge exchange and/or multidisciplinary teaching and learning; Sectoral Associations supporting the development and implementation of joint vocational training plans, programmes and teaching and training methodologies, using evidence of trends in a given sector and the skills needed to operate in one or more; or in a number of professional areas; portals providing virtual cooperation facilities, capacity databases, practice communities and other online services for teachers and practitioners in the field of schools and adult education, as well as youth, volunteers and youth workers throughout and outside Europe.

It is expected that the members (stakeholders) will bring either or all of the following to the network: knowledge in the fields of education, training and youth for evidence-based policy-making and monitoring, in particular: - country specific and thematic analysis, including through cooperation with academic networks; - mutual learning and peer evaluation, using the open method of coordination in the fields of education, training and youth.

Stakeholders are equipped to push for initiatives policy innovation to encourage the development of an innovative policy between stakeholders and enable public authorities to examine the effectiveness of innovative policies in on-the-spot testing, based on a sound

evaluation methodology. The members of the IIoTNet will use and promote European policy instruments, with regard to ensuring transparency and recognition of skills and qualifications, in order to promote the professional orientation of quality assurance.

Participation in the Network will contribute considerably to the promotion of exchanges across Europe, training and job mobility for citizens, and the development of flexible learning pathways between the different areas of education, training and youth; cooperation with international organisations with highly evaluated expertise and analytical capacity to strengthen policy impacts and added value in the fields of education, training and youth.

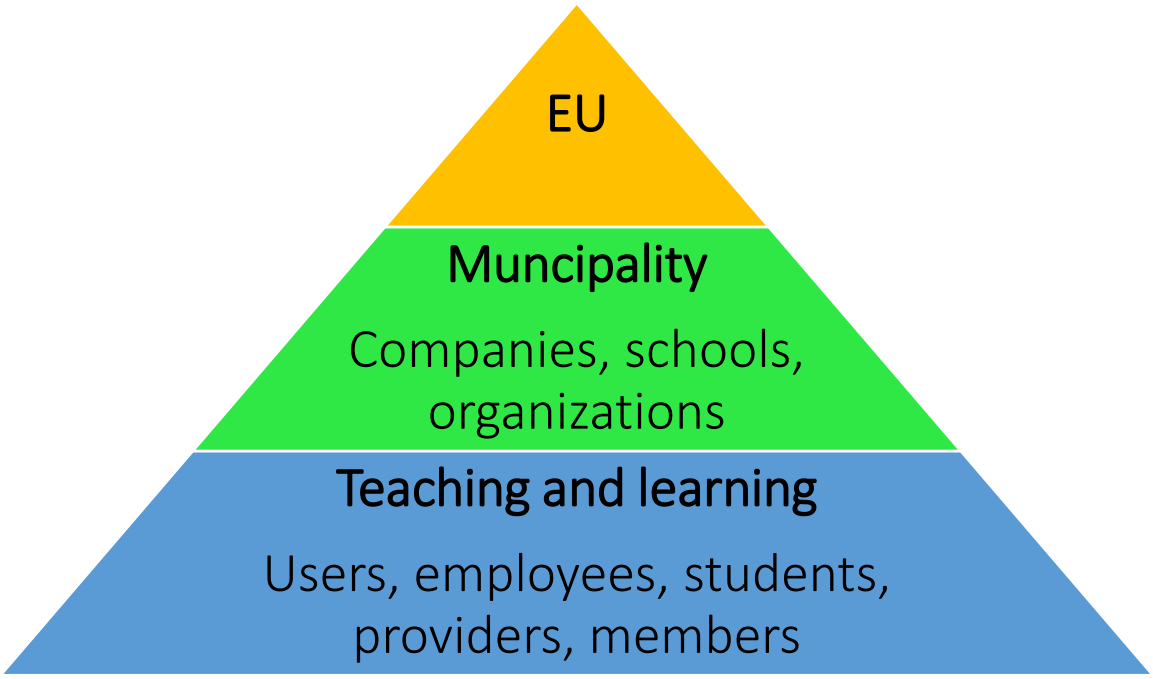


Figure 2 Stakeholders

It is expected that the actions of the Network will highlight the need for dialogue between stakeholders, the need for policies and the promotion of programmes involving public authorities, providers and stakeholders in the fields of education, training and youth, which is essential for developing the capacity of stakeholders to actively support policies.

The IIoTNet raises awareness and contributes to the development of the human capital through upskilling and reskilling of the employees among European Companies (including micro companies and SMEs), professionals and VET providers. Membership of the network will provide access to training, which will enable the receivers to adapt and adopt a new common framework of best practices of the modern IIoT know-how, which, in turn, will allow to combine effectively knowledge and fundamental principles from various areas of

expertise on cutting edge technologies in the IIoT sector and gain a competitive advantage in the respective career path offered by the member of the network.

Membership of the Network

There are three types of membership:

- Organizational members;
- Individual members (upon invitation by the Steering Committee);
- Observers.

All members have the same responsibilities towards the Network.

Organizational members. Interested organizations and institutions are eligible to become members, if they fulfil the following criteria of membership:

- Signature of the Letter of Intent;
- Provision of the necessary information as specified in the application questionnaire;
- Appointment of a contact person;
- Compliance with the responsibilities of their membership as defined in these Terms of Reference.

Organizations and institutions whose activities or goals are contradictory to the goals and standards of IIoTNet are not eligible for a membership of IIoTNet. Applications will be assessed on a case-by-case basis.

Individual members. Interested individuals are eligible to become members upon invitation by the Steering Committee. The same eligibility criteria apply for individuals as for organisations.

Observers. In exceptional circumstances, an observer status will be granted. This may be, for example, to ensure strong links with other organisations or individuals, or in case eligibility for full membership is not given. Members of other global or regional IIoT promotion networks recognized by IIoTNet can also apply for an observer status in IIoTNet. Observers do not have active or passive voting rights and are not eligible for reduced participation fees in IIoTNet events.

Membership Applications will be assessed by the Steering Committee. Successful applicants will be given a status of temporary membership, until confirmation by the Network at its next annual meeting. Following that meeting, accepted members will receive an official letter of acceptance.

Members of the Network are expected to contribute to the goals and objectives of the Network. Although the Network decided that no compulsory membership fee will be requested from its members, it strongly encourages and welcomes voluntary forms of contributions either on a regular basis or as a single contribution.

The initial composition of the IIoTNet illustrated in Table 1.

Table 1

Name of the organisation	Type of organization	Country
Institute for Training of Personnel in International Organisations (ITPIO)	Association of VET providers	Bulgaria
Vocational Education Association (PIB)	Association of VET providers	Latvia
Tiber Umbria Comett Education Programme (TUCEP)	Association of VET providers	Italy
Halsingland Education Association	Association of VET providers	Sweden
Anonimi Ekpaideftiki Etairia (AKMI)	Sectoral network of VET	Greece
Institute for Postgraduate Studies (IPS)	VET/AE provider	Bulgaria
Research Innovation and Development Lab P.C. (ReadLab)	VET/AE provider	Greece
DIMITRA Education and Consulting (DIMITRA)	VET/AE provider	Greece
Center for Social Innovation	Research Centre	Cyprus

IIoTNet will enter into enhanced cooperation with a wide array of partners (other training providers, institutions and agencies, associations), demonstrating its leading role in the area of European IIoT training.

A Drafting Committee (Working Group) will prepare the founding document for a network of European IIoT training providers. In 2021 this group will present the first Charter and organisational structure of the European IIoT Training Network to a conference.

IIoTNet will be registered as an international non-profit association governed by the provisions of Bulgarian law relating to such associations. IIoTNet is a unique association bringing together IIoT vocational education and training institutions from all EU Member States.

Roles and responsibilities

The Steering Committee constitutes the principal executive body for the IIoTNet and it is responsible for providing guidance and strategic directions to the activities of the Network.

The Steering Committee will be composed of ten to fifteen member organizations of the Network. At least two thirds of it will be founding members of the IIoTNet. In particular, the Steering Committee will:

- Give direction and support to the Network to ensure effective functioning;
- Facilitate co-ordination and links with other relevant networks or international activities to promote synergy;
- Manage the financial resources of the Network;
- Identify appropriate sources and mechanisms for funding the work programme of the Network and ensure the effective functioning of the Network;
- Organize the annual meeting of the Network and support the identification of dissemination opportunities;
- Promote the development of and approve proposals for activities and projects to be implemented as part of the Network's programme of work;
- Monitor progress of the implementation of the Network's programme of work and the related projects;
- Prepare assessments or reviews of progress and propose new priorities and actions, if needed;
- Establish ad-hoc working groups, task forces and other bodies as needed to implement the activities agreed under the work programme of the Network ;

- Support the Chairperson (Secretary General) of IIoTNet in carrying out his or her duties, in collaboration with the Secretariat;

- Contribute to the dissemination of the Network activities.

The Steering Committee will make decisions on a consensus basis, will be able to define its own structure, and will be assisted by a Secretariat. The Steering Committee may appoint an Executive Member to support the implementation of its decisions and programme of work. Nominations for membership of the Steering Committee are made by members of the Network, at least two weeks before the last meeting of the Steering Committee before the annual meeting.

The Steering Committee will be chaired by the Chairperson (Secretary General). The main roles of the Chairperson are: 1) to provide advice for the implementation of the work programme, working in close collaboration with the Executive Member, the secretariat and the Steering Committee; and 2) to represent IIoTNet publicly in different fora, events and meetings.

Nominations for the Chairperson can be made by members of the Network to the Steering Committee at least two weeks before the last meeting of the Steering Committee before the annual meeting. The Steering Committee can make recommendations to the Members based on the nominations.

The Chairperson is elected and can be re-elected to serve a 2-year term by the confirmed members of the Network. A maximum of two terms may be served. The most recent past Chairperson may serve as vice-chairperson for one 2-year term. An additional vice-chairperson can be appointed as decided by the Steering Committee.

After resignation or end of their mandate, past members and Chairpersons of the Steering Committee become Fellows of IIoTNet, serving as senior advisors to the Network.

Ad-hoc task forces and Working Groups (WG) may be established based on a proposal by the Steering Committee to be endorsed by the annual meeting of the Network, for example to facilitate the implementation of specific projects and activities, as agreed in the work programme of the Network. The Terms of Reference of these task forces and Working Groups will be defined according to the specific needs of the tasks to be implemented.

The impetus for IIoTNet's capacity to play an active role and to coordinate its programme of activities are found both in the commitment of all of its members to provide the relevant expertise and active participation necessary to develop its offer of training activities and in

the financial support of the European Commission, which is essential to ensure this development under the best possible conditions.

Commitment

By joining the Network, members express their willingness and commitment to contribute to the goals and objectives of the Network.

By joining the Network, members also agree to:

- Fulfil the criteria for membership;
- Apply for membership by providing the information required in the application form;
- Contribute to the Network, through technical or other contributions as appropriate, to support the implementation of the Network activities, as described in the programme of work; and
- Disseminate resources (information and other products) from the Network to their partners.

For members for which no current contact person could be identified within six months, membership will be terminated. Members of the Network have the right to withdraw from the Network any time if they do not wish to continue their membership by giving a one-month's written notice.

Members confirm their endorsement of their current role, which allows each organisation to get involved as and when it wishes. The highly egalitarian and open functioning of IIoTNet enables all members to find a fitting role, regardless of the potentially vast differences in status, size and capacity. There should, therefore, be no limitation of participation in the Working Groups. Newcomers to the Network will have the right to join a WG at any time and will not have to wait for the next elections.

All members emphasize the demanding nature of participating in IIoTNet activities, be it participation in the General Assembly or the Steering Committee, working within Working Groups, hosting training events domestically, or disseminating information and promoting IIoTNet training services. In order to enhance the level of commitment of the members and share the burden of the executive work in a more balanced way, when applying for a WG, members will have to make clear to what extent they will be able to participate, and if they are willing to provide the same personnel for the term of the Working Groups. The total of such 'pledges' should be sufficient for the activities of the IIoTNet.

The IoT is the catalyst for many companies and entire industries to create new business models and transform their competitive strategies. IoT market is rapidly changing and constantly evolving — especially in the smart home and consumer electronics market, therefore, it is a moving target that businesses need to understand (as illustrated by Figure 3 below).

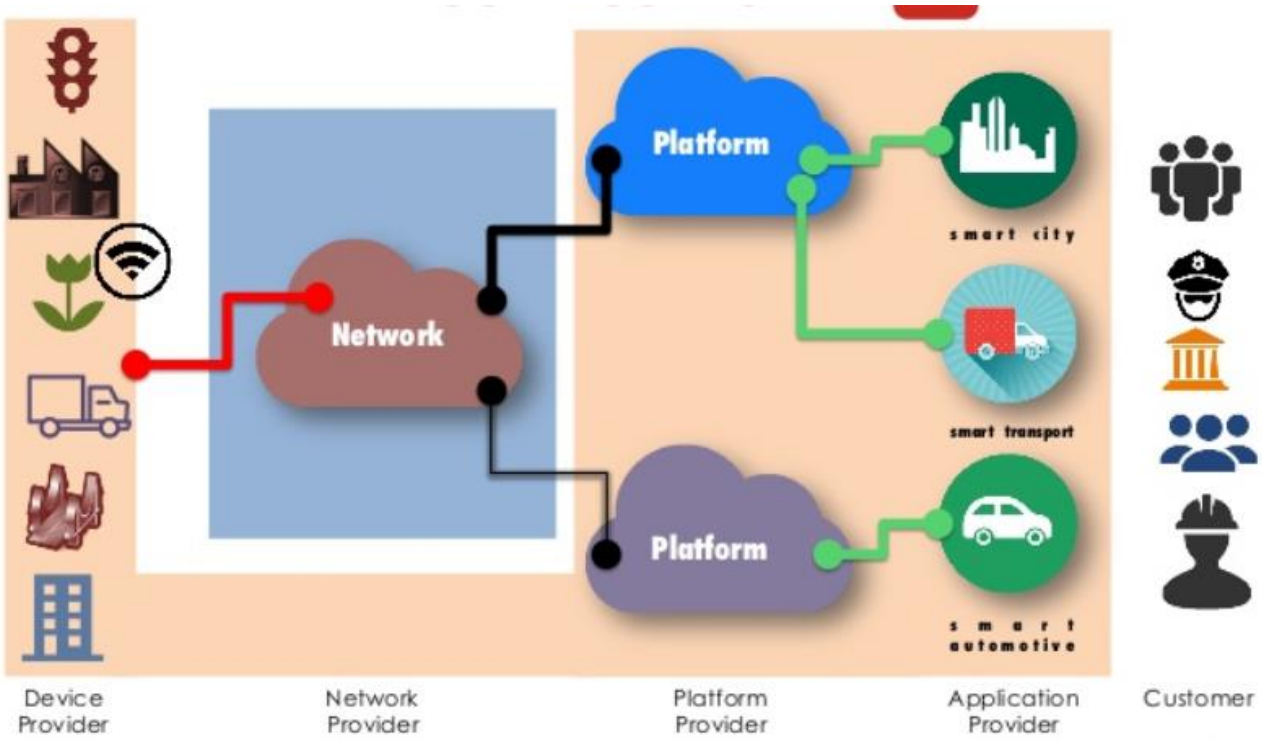


Figure 3 IoT Business Model [4]

Members will continue to play a crucial role between the network and its main audience. To get the right audience for participants in IIoTNet activities, it will be made clear for every activity which target audience the training offer has been devised for, the general or specific topic, and also what prerequisite knowledge is expected: basic, advanced or expert level. It will also be made clear whether an activity is a "new" one, or whether it is a repeated activity. In the latter case, repeated participation, or in any case the participation of professionals of the wrong profile should be discouraged.

Each member is responsible for disseminating the calls for training to practitioners with the appropriate profile (particularly for special and "niche" topics) and for selecting participants accordingly. IIoTNet reserves the right to signal to the member that an application does not correspond to the target group, or that the same practitioner is

[4] https://steemit.com/life/@alfarisi/internet-of-things-iot-learn-scope-in-future

applying for a repeated activity. It should then be up to the member to decide how to deal with it.

Access to all activities for all members is a fundamental principle of IIoTNet, although the option remains to develop regional or subject-focused activities to a limited extent.

Partnerships

It is expected that IIoTNet members will foster cooperation among European umbrella organisations of VET providers, while supporting policy reflection at a European level as well as outreach capacity to their national members or affiliates. The project consortium will seek to involve new stakeholders in collaboration activities. It will reach out to academic communities, government agencies responsible for IIoT, and donors providing development assistance.

IIoTNet proposes a close cooperation with other European networks and associations in the digital field (e.g., Alliance for the Internet of Things Innovation, European Digital SME Alliance, Small Business Standards, European Cyber Security Organization, EU Gateway/Business Avenues Initiative, and European Artificial Intelligence Alliance); to this end, a Memorandum of Understanding with the respective partner will be signed. This framework is aiming to promote cooperation stakeholders with an interest in European IIoT training.

Cooperation with these partners is important, as it helps to adapt IIoTNet's training offer to the needs of the end users, to benefit from partners' expertise and to improve the design and cross-promotion of training programmes, taking into account the interests and priorities of IIoTNet and its members.

National institutions in charge of IIoT training in countries that are negotiating their membership of the European Union are entitled to be admitted as observers of IIoTNet; institutions in charge of IIoT training in other countries may also be admitted as observers. The IIoTNet Steering Committee will adopt a transparent policy on the admission of observers. Observers' interest in concrete participation in IIoTNet activities is expected to increase. Sharing of IIoT training know-how is growing, and the benefits will attract more and more institutions. IIoTNet on an *ad hoc* basis will exchange expertise with IIoT training entities from different parts of the world.

03 Target groups

Identifying target groups of the IIoTNet helps both to create a targeted promotion of the Network (receiving a higher return on investment) and to speak the "language" of potential customers. Different target groups will appreciate the different benefits. The consortium — stakeholders — must offer a product package that meets the values of the "individual" targeted market participant.

IIoTNet has identified the need for new target audiences for training courses at several levels. In order to address the risk that only participants, who are used to working internationally will derive a benefit from these sessions, three avenues were identified for attracting new colleagues:

- Promoting training courses in a larger number of languages;
- Improving the circulation of information about the training on offer;
- Incorporating IIoTNet training in all course offers from IIoT training providers to the greatest extent possible.

Overall, there are two primary target groups of the IIoTNet:

1. VET providers and learners, teachers, trainers, mentors and/or VET leaders within and outside the project partnership. This target group is involved in:

- Collaboration with partner VET providers and enterprises, focused on identifying common challenges, developing and implementing development projects for mutual learning and capacity building, specialized IIoT training and development of trainees' skills. The intention is to create possibilities for international collaborations by involving institutions beyond the partnership.
- Use and update/development of the IIoT teaching /learning resources.
- Enrichment of database of IIoT good practices.
- Cooperation between members of the IIoTNet.

Trainees and trainers constitute a part of the IIoTNet target audience, securing the multiplying effect of the training.

2. Micro companies and SMEs engaged in IIoT processes and their managers and staff. This target group participates in the development and maintenance of the innovation and knowledge flow of the specialized social media online platform, IIoT Body of Knowledge, IIoT Certification scheme, Online tool IIoT Learning Project Explorer, integrating career

guidance, training and mentoring, tracking of career progress, and new learning resources in the areas of IIoT. Micro companies and SMEs are involved in:

- Collaboration, IIoT training design and delivery;
- Enhanced knowledge exchange with VET providers;
- Sharing knowledge related to IIoT markets;
- Receiving business support from VET providers.

Joint development and delivery of training activities — VET providers, SMEs, and stakeholders will participate in the design, delivery and assessment of IIoT training activities, tailored to identify skill gaps and training needs. Stakeholders will be invited to contribute to the IIoT curriculum content and learning goals, to participate as guest lecturers, to provide case studies, or to organize practical training.

Secondary target group includes public agencies responsible for IIoT development, authorities responsible for regional and local development, and local communities. These agencies benefit from IIoTNet through IIoT VET providers' investment in community wellbeing and sustainable local and regional development, in particular through improved employment prospects of youth, intensified knowledge exchange and support for enterprises and citizen- and public-sector organizations.

Stakeholder co-creation will be encouraged; the target groups' needs and requirements will be continuously considered.

Parallel to the Network's increasing range of activities, it will be possible to gradually expand the concept of IIoTNet's target audience, even if the institutions responsible for their domestic training are not members of the Network. An Exchange Programme will be opened to members of the IIoTNet partnership. Similarly, IIoTNet will approach non-member institutions in charge of IIoT training to facilitate their involvement in IIoTNet exchange and training activities.

04 Training methods, tools, and principles

The training methods used to achieve the aforementioned objectives of the IIoTNet vary and include exchange programmes between professionals, classroom-based training and e-learning, as well as work-based learning or other forms appropriate for the achievement of the set goal. The Network is aware of the need to be attentive to educational challenges and different learning methods. Recent research into the functioning of the human brain should guide us in determining the most effective and appropriate learning methods.

IIoTNet members have noticed the extent to which developments in distance learning and the use of different technologies in the learning process create new prospects to improve the teaching and learning approaches. Some members have already taken innovative and effective steps in this direction.

The IIoTNet training activities apply a number of learning methodologies — practical, experiential, learning-by-doing, in-person, etc. They take into account and reflect the developments in adult learning.

IIoTNet strives to deliver increasing quality and innovation in all its projects, programmes, and activities. Employing a systematic approach to canvassing feedback, the added value of IIoTNet's activities becomes apparent from the participants' evaluations of previous years' programmes, ensuring continued robust growth in terms of the number of people served and the quality offered. All implemented activities will undergo an evaluation by the members (experts) of the appropriate Working Groups, applying a Training Evaluation Model, with the aim of introducing changes to the programme and methodology in order to constantly improve the quality of the activity provided.

Training tools

The IIoTNet Exchange Programme will be a flagship activity. This highly acclaimed programme will include IIoT professionals' exchanges and study visits to foreign IIoT training providers. The IIoTNet Exchange Programmes between experienced practitioners is expected to become recognised as a useful way to build mutual trust within the European IIoT community. By building knowledge through observation and direct access to colleagues from another country, these exchanges foster understanding of IIoT training.

Continuous training seminars

The activities proposed by the Network demonstrate the core of its strategic direction, i.e. an organisation that trains IIoT professionals. Hence, the Network's activities are intended to:

- Facilitate and improve IIoT training providers' cooperation;
- Contribute to the construction of a common European IIoT training area, based on the application of shared standards;
- Promote a common concept and shared values of the IIoT VET.

The Network believes that training of practitioners at a European scale improves the quality of the IIoT practice overall.

Seminars organised by IIoTNet are fundamental to the Network and one of its most visible types of activities. The collaborative approach to the development of these activities must become IIoTNet's trademark.

A catalogue of existing continuous training seminars and workshops will be developed.

Initial training

The training of future and early-career IIoT professionals and IIoT cooperation is a key issue for the IIoTNet. The objective is to contribute at the earliest possible stage, as to develop a common understanding of IIoT and as to build mutual trust, or as to identify the desired changes needed in order to build this.

The Exchange Programme for Young Practitioners will enable future and early-career professionals to gain an initial experience on the IIoT field. Through a 5-day-long exchange at another training institution, young practitioners will be given the opportunity to enhance their knowledge of EU cooperation, learn about the IIoT system and exchange ideas with European counterparts. This Erasmus-like programme for IIoT practitioners will help to establish links between European business and training, and will foster mutual trust between them.

Complementing the Exchange Programme, the summer schools are seminars aimed at trainees and newly appointed professionals on specific topics deemed relevant to their capacity building, such as (a non-exhaustive list of examples):

- Emerging IIoT technologies, technology applications, specific innovations, such as AI and digital twin, specific use cases, connectivity challenges, interoperability issues;

- Security, safety, privacy, resilience and reliability in IIoT;
- New business models and business best practices for the IIoT lifecycle;
- Industry-specific discussions;
- Best practices in IIoT training.

It is planned that the content of the five-day, face-to-face courses developing the participants' IIoT skills by combining information and exercises in a practical and dynamic way will contain themes, such as consultation and implementation of cyber-security services for automation data networks and IT data for the protection of various industrial production, infrastructure and network data; offering experience exchange to companies, demonstrating network and information security needs in planning and, if necessary, also in testing network activities; organizing certified user training and advise the customer throughout the project life cycle, if necessary, carry out the full implementation and installation of the enterprise solution; offering maintenance and technical support that provides software support and version management around the world.

Training principles

IIoTNet has the ambition of establishing core principles of IIoT training. These principles are intended to provide Europe's IIoT training providers with a foundation and source of inspiration for managing their own IIoT training needs, and Europe's IIoT training institutions with a common foundation from which to plan and deliver IIoT training activities.

The IIoT VET training principles are:

1) IIoT VET is a multidisciplinary and practical type of training, essentially intended for the transmission of professional techniques and values complementary to engineering education.

2) All IIoT professionals should receive initial training before or on their appointment.

3) All IIoT professionals should have the right to regular continuous training after appointment and throughout their careers, and it is their responsibility to undertake it. Every member should put in place systems, which ensure that IIoT professionals are able to exercise this right and responsibility.

4) Training is part of the normal working life of an IIoT professional. They should have time to undertake training as part of normal working time.

5) In accordance with the principles of training providers' independence, the design, content and delivery of IIoT VET are solely for the national institutions responsible for IIoT training to determine.

6) Training should primarily be delivered by IIoT professionals who have been previously trained for this purpose.

7) Active and modern educational techniques should be given priority in IIoT training.

8) Member States should provide the national institutions responsible for IIoT training with sufficient funding and other resources to achieve their aims and objectives.

9) Public authorities and business should support IIoT training.

05 Sustainability

IIoTNet has the ambition to continue to develop and promote different activities and projects long-term. The development opportunities focus on the *what, how* and *with whom* the strategic aims and objectives set out above are to be met.

Governance

IIoTNet is intended to grow into a non-profit international association.

This association will retain the freedom to set its own priorities, and any external partners or entities should not interfere in setting the content of training activities or with IIoTNet's aims and objectives. The programme of work provides an overview of the main planned events and activities of the Network. The programme is adopted by the members of the Network at their annual meetings, based on a proposal developed by the Steering Committee. The maintenance of IIoTNet's autonomy and independence will be asserted on the basis of the IIoT Training Principles.

IIoTNet should act as a think tank, an advocacy provider, an expertise and knowledge-based provider setting priorities in its own area, in short as a scene setter. IIoTNet's role is extended to setting European IIoT training policy, and the Network should be opened to deliver expertise and support in the development of the priorities of IIoT training.

Governance structures based on the principle of one vote per member organisation are considered appropriate.

Working Group

IIoTNet is to be an organisation that develops by learning itself. This requires paying attention to scientific developments, practical knowledge, and its members' requirements in order to best adapt the services it offers. To this end, the establishment of the IIoT Training Methods Working Group will constitute a basis for achieving this strategic objective.

Participation in the WG will be voluntary, but all efforts shall be made to ensure even participation and representation across all members and sectors to ensure the highest compliance of the training with the current needs. Once elected and approved by the Steering Committee, members of the WG shall remain active for three years with tacit extension for up to further two years maximum. Newcomers to the Network will have the right to join a WG at any time and will not have to wait for the next elections.

IIoTNet is to accumulate in-house expertise in training methodologies, used for the purpose of developing training activities and providing support to its members. New formats for training activities should be designed, tested and implemented.

It is necessary for IIoTNet to:

- Produce an inventory of e-training and e-resources requirements;
- Determine the appropriate arrangements for coordination with classroom-based training;
- Acquire the specific teaching and technical skills required.

IIoTNet will continue to develop, implement, and promote evaluation tools and methods.

Language policy

The working language of the IIoTNet is set to be English. All internal documents, communication, and policy development is to be translated into English for circulation among the members of the network.

Looking more broadly, the IIoTNet recognises that the top priority in terms of successful achievement of the aims and objectives and the depth of the impact of that achievement is the need to overcome the language barrier. Many still cannot communicate in a common language, therefore a more frequent use of interpreting services is recommended. Mini-sessions and e-tools could be considered locally, to introduce the IIoT system in more than one language.

In order to promote the removal of any language barriers that may hamper access to IIoTNet's activities, the IIoTNet intends to address advanced and technical language training needs within its remit, in order to complement and support the basic language training primarily provided by its members at national level. IIoTNet's added value notably lies in the tools provided to all its members. Hence, the promotion of existing tools that support the linguistic strategy must be ensured, i.e. training activities in linguistics, available handbooks and glossaries, self-assessment tests and marked tests available as e-learning modules.

IIoTNet will develop further tools to support efforts and promote basic language training provided at national level.

Exchange Programme

A few routes are identified for leveraging the effects of the Exchange Programme. A new generation of exchanges seeks to go beyond exploring other IIoT systems:

- Subject-focused exchanges are expected to be highly successful and are meeting a growing need. They make it possible to disseminate inspirational practice in different fields. This type of exchange should be offered more systematically and with a larger scope, to make cross-border cooperation in special IIoT fields more effective.

- Exchanges between training providers' managers will be much explored. This programme addresses multipliers who help to propagate the network's ideas and acceptance. This action will be developed further.

- The development of bilateral exchanges based on specific subject areas is recommended, to bring about in-depth knowledge of another country's IIoT framework. Enabling cross-professional delegations, these exchanges also serve as an important tool for integrating the network's future target groups.

- New formats and contents of exchanges will be tested and implemented.

The Exchange Programme will be invigorated through standardisation, aimed at improving the content of the programmes and the number of participants. Efforts are required to achieve a common and more integrated methodology, making it possible to identify a training schedule and associated requirements. Identified best practices to increase the quality of the Exchange Programme should be implemented by all members. IIoTNet should identify and encourage the multiplier effect of the exchanges. IIoTNet should avoid overlaps between summer schools and the Exchange Programme.

Training activities

IIoTNet is committed to the highest quality of its training on offer. Quality has to remain at the highest standard, firstly, to improve the efficiency and functioning of IIoT business and training in the Member States and, secondly, to attract customers to attend these training courses. Increasing the number of training sessions on offer must not result in any decline in training quality, on which IIoTNet's credibility to a large extent relies.

The required high quality of IIoTNet continuous training seminars should be secured:

- By applying an exhaustive training needs analysis;
- By training the trainers; and

- By applying modern evaluation tools to assess participants' satisfaction, benefits and the impact on their daily work.

The following general principles should be borne in mind in terms of ensuring the highest quality and relevance for any training activity conducted under the umbrella of IIoTNet:

1) The Network's training courses should cover major fields of IIoT Body of Knowledge, including (non-exhaustive) VPN remote routers, mobile modems and IoT management software and it is essential that these subjects remain the priority.

2) The quality of the professional skills, behaviours, and attitudes of IIoT practitioners are of the utmost importance for the construction of the European IIoT area. To ensure the uphold of the standards set by the Network, the working methods of the practitioners, as well as the questions of ethics and professional practice are placed at the very centre of the relationship of cooperation, understanding, and trust between trainers and trainees. These issues should remain at the forefront of each IIoTNet training activity.

3) IIoT Body of Knowledge is considered an important area where the competencies of IIoT practitioners should be developed by training offered by IIoTNet.

4) The development of the summer schools for early-career professionals, as a distinct activity from what already exists in the area of initial training, should be seen as a possible response to any challenges identified in training at EU level.

5) Last but not least, the development of language skills is essential to enable exchanges between training institutions and individual trainees and trainers, paving the way for mutual trust and a better understanding of contemporary IIoT (see Language policy above).

External and internal expertise

Should the IIoTNet's bodies overseeing the design of training activities conclude that there is a need for *ad hoc* expertise to design these activities, they will be entitled to request the appointment of and to supervise the use of such external expertise for the content of IIoTNet's training activities.

Expertise on training methodologies should, however, be available in-house, providing advice to Activities Coordinators. Appointing an expert in methodology to the Secretariat should be envisaged.

Cooperation

IIoTNet partners

It is absolutely vital for IIoTNet's training offer that there is close cooperation with partners across varied sectors and industries, including EU institutions and agencies, training networks and associations, non-EU entities with relevant expertise and/or mandates in the field.

IIoTNet will, hence, continue its well-established tradition of collaboration with trusted partners to provide expertise in designing and cross-promoting training programmes, and to deliver top-quality IIoT training to Europe's IIoT practitioners.

IIoTNet should provide a continuously updated overview of existing and potential cooperation possibilities. The current cooperation scheme should be developed further in line with IIoTNet objectives, as well as systematised and regularly evaluated.

Cooperation outside the EU

IIoTNet will seek to extend the scope of its activities outside the EU member states. To this end, it will reach out to agencies and organizations that provide support and cooperation opportunities outside the EU area. The most notable potential partner in this regard is the European Training Foundation (ETF) that provides support to countries surrounding the European Union to reform their education, training and labour market systems. The Network will seek all opportunities to establish close ties with the industry and government representatives in order to promote its aims and objectives world-wide.

Knowledge management

In order to ensure the widest possible dissemination of materials and deliverables of the Network, the IIoTNet database material will be made available to members' knowledge databases, either directly or by way of referring to links in the Network database.

In every activity, participants will be encouraged to disseminate the materials to their countries and colleagues. Members are also encouraged to assess at national level any need for translations of IIoTNet material into their own language(s).

Resources and budget

The Network has no compulsory membership fee. However, the Network strongly encourages and welcomes voluntary contributions, either on a regular basis or as a single contribution, such as:

- Financial contributions;
- In-kind contributions in terms of time and expertise, e.g. through the participation in the Steering Committee, working groups or projects;
- Hosting of meetings of the network or working groups;
- Clearing house function for the collection of documents or case studies; or
- Representation of the IIoTNet Network at expert meetings and conferences.

Contributions made to the Network do not imply a commitment for further contributions by the donors.

The general financing strategy will be described in a separate document.

Interactions and meetings

The Network members are invited to the annual meeting of the Network, which is usually hosted by a member. The purpose of these meetings is to:

- Review and discuss recent, relevant international developments as well as national approaches with regard to IIoT promotion,
- Accept new members;
- Elect the members of the Steering Committee;
- Decide upon changes in the Terms of References of the Network or its financing;
- Adopt the annual work programme (plan);
- Review progress on ongoing activities;
- Establish new ad-hoc task forces and working groups as necessary.

Under the coordination and guidance of the Secretariat, meetings of ad-hoc task forces and working group will be organized as needed.

In order to support collaboration with other international organisations and institutions, the Steering Committee may establish new structures and organisational bodies to promote linkages, communication and regular exchange.

Other topic-oriented meetings, e.g. congresses or conferences, can be recommended, supported, or organized by the Network upon decision by the Steering Committee.

06 Key risk areas

Risks in relation to the IIoTNet

In the following analysis of the risks in relation to the IIoTNet, three main sources were used as an aid for structure and guidance: INGUARD, an insurance and risk management firm[5]; Network World, which provides domain expertise on the modern enterprise data center, including the latest networking, storage, servers, and virtualization technologies[6]; and i-SCOOP, the digital business and transformation hub[7].

Implementation commitment of Network stakeholders (Low Risk)

The implementation of the Network development plan set out in this Terms of Reference will require full participation of all Network Stakeholders. Their commitment is primarily required in three areas:

- To ensure consistency between the strategic objectives, the performance plans, and the Network Operations Plan and Members Action Plans.
- To adopt "network minded" decision making when addressing operational issues.
- To have the financial resources to fulfil the obligations, while still maintaining the cost-efficiency targets.

The risk will be mitigated by close support from Network Management for the preparation of the local performance and operational plans as appropriate, and by monitoring the actions. Effective monitoring and reporting will be required to ensure that deviations in performance are identified and resolved. The risk of lack of commitment will be mitigated through either bi-lateral discussions or by strong involvement of members in decisions impacting on the Network.

The sustainability of the results is not ensured (Low Risk)

The IIoTNet should ensure the sustainability of any results it achieves through its members, partners, associated partners and other shareholders involved in the activities of the

[5] http://www.inguard.com/newsroom/the-hidden-and-not-so-hidden-risks-of-the-industrial-internet-of-things/

[6] https://www.networkworld.com/article/3243928/what-is-the-industrial-internet-of-things-essentials-of-IIoT.html

[7] https://www.i-scoop.eu/internet-of-things-guide/industrial-internet-things-IIoT-saving-costs-innovation/#Industrial_Internet_of_Things_adoption_barriers_the_major_challenges

Network. Wide publicity for any actions is required and dissemination of results should be included in any activity as a prerequisite for its aims.

EU rules and regulations (Low Risk)

There is a possibility that some activities that are planned by the Network might me hindered by applicable rules and regulations of the EU law. Also, any changes in the respective laws might occur after an activity has been decided upon but not finished yet. In order to mitigate the risk, the Network must ensure that its leading structure is aware and follows closely all relevant regulations in the area.

Insufficient competence (Medium Risk)

The Network is open to anyone who wants to join it. However, the Network has the requirement that any training activities conducted under its umbrella should be provided in the highest quality possible. This requires a common understanding and equal application of quality standards, which should be continuously revised and updated. To mitigate the risk, the Network must ensure that only those organisations that have received a proper external quality and competence recognition are allowed to conduct any training.

Incorrect assumptions and changes to the objectives (Medium Risk)

The implementation of the aims set herein requires clear and unambiguous communication; failing this, members of the Network can act under incorrect assumptions or simply remain in the dark with regard to any changes due to occur or occurring to the objectives.

To mitigate this risk, a clear and unambiguous communication is required. It is advisable to establish a feedback loop in order to ensure that the recipients of the message have understood it correctly and are acting correctly.

Non-compliance with deadlines (High).

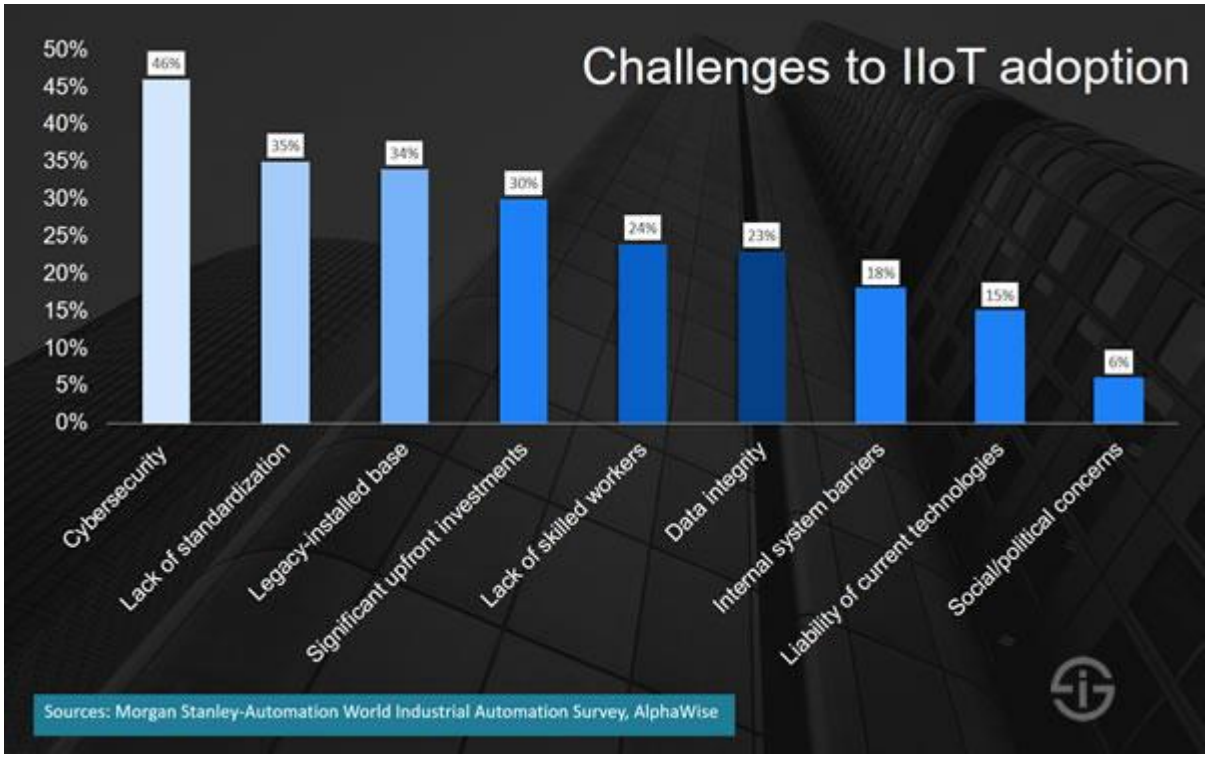
In order to avoid set-backs and disruptions to any training activities or other arrangements, it is necessary to ensure deadlines are communicated clearly and accepted by the respective partners/members. Should a situation arise where the deadline set is impossible to observe, the person/organisation responsible should notify the shareholders involved in the activity and arrange for a mutually agreeable alternative deadline.

Risks in relation to IIoT

The industrial IoT presents many serious risks to companies, industries and economies. Not addressing these may hinder the proper functioning of the IIoTNet and the successful achievements of its aims and objectives. Therefore, keeping these risks in mind and working diligently on reducing them is of utmost importance to all stakeholders of the Network.

IIoT devices are networked, often over the public Internet. The access technologies used in IIoT include wireless or mobile communications such as Bluetooth, 3G, 4G-LTE, 5G, and even 2G and older legacy wireless protocols. These access networks connect to corporate, government, domestic, and global backbones. All this interconnection, if not adequately secured, can result in substantial risks.

There are several hidden—and not-so-hidden—risks and challenges that should be seriously considered before making any decisions on using IoT-enabled machinery, some of which are highlighted below. According to a survey by Morgan Stanley the top 5 challenges to IIoT adoption are, respectively, 1) cybersecurity (46 percent), 2) lack of standardization (35 percent), 3) the legacy-installed base (34 percent), 4) significant upfront investments (30 percent) and 5) the mentioned lack of skilled workers (24 percent).



- Cybersecurity is **crucial** everywhere in this digital economy and it certainly is a major challenge in IIoT as well. Amidst the ongoing digital transformation initiatives in

manufacturing, logistics, transportation, healthcare and other industries, which are typically categorized under the Industrial Internet label, data breaches and all kids of cybercrime and cyber threats are on the rise. In the end, the IoT, also in the industrial context of Industry 4.0 is essentially about the movement to information-driven ecosystems of value. And when one talks about information, data and value, one inevitably talks of growing risks as they are key assets and drivers of the industry.

- Lack of standardization. As an attempt to draft newer technology onto old, there is a huge range of different designs and standards for everything from transmission protocols to ingestion formats.

- Legacy-installed base. Lots of older equipment is not designed to provide data in a format that it legible for modern IIoT tech, so getting a decades-old power station controller to talk to a sophisticated new IIoT infrastructure could require some translation.

- Significant upfront investments. As both of the above points highlight, fully embracing IIoT requires new hardware, new software and a new way of thinking about technology. The idea is to make money, but plenty of people are understandably worried by the up-front costs.

- People/Lack of skills. Getting the most out of IIoT often requires expertise in machine learning, real-time analytics, and data science - to say nothing of cutting-edge knowledge of networking technology. Limited access to the right skills and expertise is a problem for 36 percent of respondents. This issue of lacking skills is not just one of data integration, but also one of other skills, which are needed for the IIoT. It is clear in this age of digital transformation and of the Industrial Internet of Things that no organization can do it all alone and networks, ecosystems and platforms of partners are extremely crucial to succeed.

- Espionage. Espionage activities are a significant concern in the era of the Industrial IoT; this can be performed both by government actors attempting to damage corporations in a foreign enemy's country and by competitors influenced either by their own desires or foreign governments.

- Cyberterrorism. Hackers and terrorist groups have caused billions of dollars in damage by disrupting websites and web operations. The industrial IoT now makes the digital weapons these groups wield effective against physical infrastructure and assets.

- Data Privacy. Facilities with industrial IoT technology open the door to malicious or opportunist data thieves that would profit by owning or publicizing product designs, machinery specifications, facility output data and more.

- Data integration. Industrial data is complicated and it is the eternal challenge of moving from data to business value, which becomes clear in the IIoT context. However, data and more specifically insights and knowledge in ecosystems of sharing are where the future revenue opportunities reside.

- Supply Chain Risks. IIoT devices are sourced in many different countries and contain many components including hardware, software, and firmware. Each of these devices and components have a supply chain that can be compromised at many points including by the manufacturer, the software libraries, the shippers, the distributors and more.

Managing any of the above-mentioned risks includes an enterprise or organizational risk-management perspective, which includes assessing and prioritizing the impact and cost of downtime. Some approaches to managing risk include business impact analysis, disaster recovery planning, recovery time objectives, alternate or manual operations, etc. Incident response and disaster recovery plans should be defined, documented, implemented, and tested.

07 Definition of terms

Industrial Internet — Internet of Things, machines, computers and people, enabling intelligent industrial operations using advanced data analytics for transformational business outcomes

Internet of Things — A system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Industrial Internet of Things — A system that connects and integrates industrial control systems with enterprise systems, business processes and analytics; it refers to interconnected sensors, instruments, and other devices networked together with computers' industrial applications, including manufacturing and energy management. This connectivity allows for data collection, exchange, and analysis, potentially facilitating improvements in productivity and efficiency as well as other economic benefits. Typically, these are large and complicated system.

Big data — Extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions.

Machine learning — The study of computer algorithms that improves automatically through experience. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or infeasible to develop conventional algorithms to perform the needed tasks.

Operational Technology — The hardware and software dedicated to detecting or causing changes in physical processes through direct monitoring and/or control of physical devices.

Industry 4.0 — The subset of the fourth industrial revolution that concerns industry. Industry 4.0 is the trend towards automation and data exchange in manufacturing technologies and processes, which include cyber-physical systems (CPS), the Internet of Things (IoT), Industrial Internet of Things (IIOT), cloud computing, cognitive computing and artificial intelligence.

Machine to machine — A direct communication between devices using any communications channel, including wired and wireless.

Know-how — A term for practical knowledge on how to accomplish something, as opposed to "know-what" (facts), "know-why" (science), or "know-who" (communication).

Umbrella organisations — An association of institutions, who work together formally to coordinate activities or pool resources.

A wireless ad hoc network (WANET) or Mobile ad hoc network (MANET) — A decentralized type of wireless network. The network is *ad hoc* because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity and the routing algorithm in use.

Learning by doing — A hands-on approach to learning, meaning students must interact with their environment in order to adapt and learn.

Work-based learning — An educational strategy that provides students with real-life work experiences where they can apply academic and technical skills and develop their employability.

Distance education or distance learning — The education of students who may not always be physically present at a school. This usually involves correspondence courses wherein the student corresponds with the school via post. A distance learning program can be completely distance learning, or a combination of distance learning and traditional classroom instruction.

Cybersecurity or information technology security (IT security) — The protection of computer systems and networks from theft of or damage to their hardware, software, or electronic data, as well as from the disruption or misdirection of the services they provide.

Risk — Effect of uncertainty on objectives.

Risk assessment — Overall process of risk identification, risk analysis and risk evaluation.

Risk management — Coordinated activities to direct and control an organization with regard to risk.

Digital economy — An economy that is based on digital computing technologies, although we increasingly perceive this as conducting business through markets based on the Internet and the World Wide Web.

Firmware — A specific class of computer software that provides the low-level control for a device's specific hardware. Firmware can either provide a standardized operating environment for more complex device software or, for less complex devices, act as the device's complete operating system, performing all control, monitoring and data manipulation functions.

2G — Second-generation cellular network.

3G — It is the third-generation of wireless mobile telecommunications technology.

4G — It is the fourth-generation of broadband cellular network technology, succeeding 3G.

4G LTE — A standard for wireless broadband communication for mobile devices and data terminals, based on the GSM/EDGE and UMTS/HSPA technologies. It increases the capacity and speed using a different radio interface together with core network improvements.

5G — The fifth-generation technology standard for cellular networks. All 5G wireless devices in a cell are connected to the Internet and telephone network by radio waves through a local antenna in the cell. The main advantage of the new networks is that they will have greater bandwidth, giving faster download speeds, eventually up to 10 gigabits per second (Gbit/s).

Computer software or software — A collection of data or computer instructions that tell the computer how to work.

Computer hardware — The physical parts of a computer, such as the case, central processing unit (CPU), monitor, keyboard, computer data storage, graphics card, sound card, speakers and motherboard.

Annex 1 REVISION HISTORY

Table A1.1 Revision History

Revision	Date	Editor	Changes Made
V 1.0	2020-07-09	PIB	Initial release

Annex 2 REFERENCES

1. http://www.mhi.org/media/members/15373/131111777451441650.pdf
2. https://www.trendmicro.com/vinfo/us/security/definition/industrial-internet-of-things-IIoT
3. https://www.i-scoop.eu/internet-of-things-guide/industrial-internet-things-IIoT-saving-costs-innovation/industrial-internet-things-IIoT/
4. https://steemit.com/life/@alfarisi/internet-of-things-iot-learn-scope-in-future
5. http://www.inguard.com/newsroom/the-hidden-and-not-so-hidden-risks-of-the-industrial-internet-of-things/
6. https://www.networkworld.com/article/3243928/what-is-the-industrial-internet-of-things-essentials-of-IIoT.html
7. https://www.i-scoop.eu/internet-of-things-guide/industrial-internet-things-IIoT-saving-costs-innovation/#Industrial_Internet_of_Things_adoption_barriers_the_major_challenges