

# ICT

Information and Communication Technologies





## **INTRODUCTION TO THE INDUSTRIAL REVOLUTION 4.0**

These didactical materials, which have been developed in the framework of the European project 'Industry 4.0 - INTRO 4.0', funded by the European Commission aims to come up with an overview of what has been done in the European Industry in terms of Industry 4.0.

The content of these didactical materials provides the most relevant and useful information on Industry 4.0 to a target group that includes: adults, educators (VET & Higher Education), teachers, trainers, coaches, employers, employees, the general public, and suppliers of innovative solutions.

This information is rooted within the report 'Current Status Of The Industry 4.0' and the report 'Summary Report of the expert interviews/questionnaires and the specific research on the field of manufacturing companies", both developed by the partners of this project.

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THIS CONTENT MAY BE OF  
GREATER INTEREST TO THE  
COMPANIES



THIS CONTENT MAY BE OF  
GREATER INTEREST TO  
THE GENERAL PUBLIC



## LEARNING OBJECTIVES

- ❖ Understand ICT as an integral factor of society at home, work and leisure.
- ❖ Identify the most valued skills for workers.
- ❖ Recognize ICT benefits for companies.



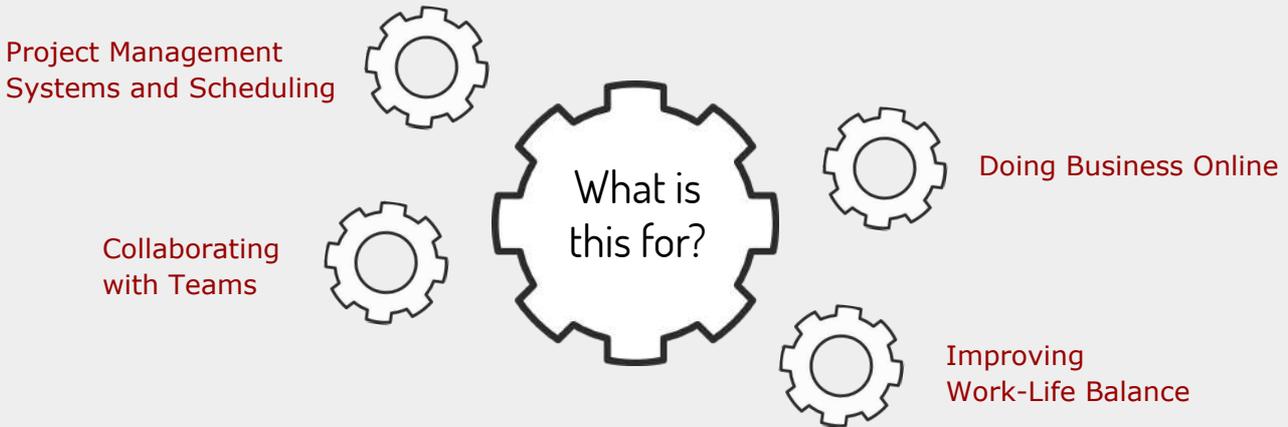
# INTRODUCTION

**ICT (Information and Communication Technologies)** is the integration of information processing, computing and communication technologies.

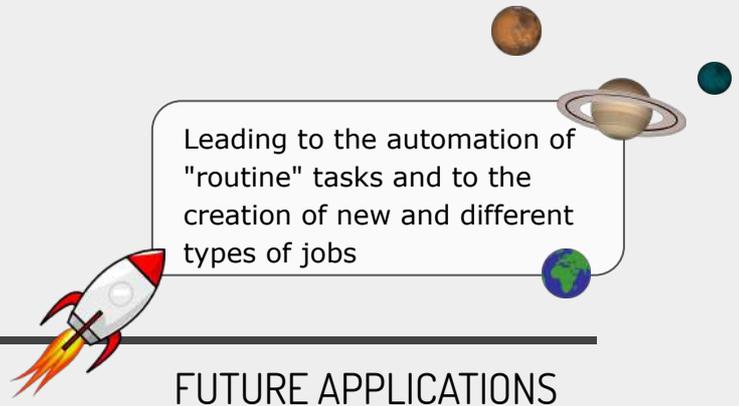


Learning Objectives

- Understand ICT as an integral factor of society at home, work and leisure
- Identify the most valued skills for workers
- Recognize ICT benefits for companies



SOME BENEFITS





## WHAT IS IT?



**ICT (information and communication technologies) refers to the technology technological tools or mediums that aid transfer of information to handle telecommunications, broadcast media, intelligent building management systems, audiovisual processing and transmission systems, and network-based control and monitoring functions.** It is the integration of information processing, computing and communication technologies. Digitalization and the application of ICT allows the integration of all systems throughout the supply and value chains and enables data aggregation on all levels.

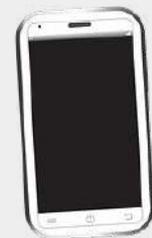


Figure 1. Some electronic devices for digital communication (laptop, tablet and smartphone)

ICT covers **any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form** and is concerned with these products. Importantly, it is also concerned with the way these different uses can work with each other. Information is digitized and the corresponding systems inside and across companies are integrated at all stages of both product creation and use lifecycles.



### THE WORLD WAR II

Alliance of the military and industry in the development of electronics, computers, and information theory



### 1950s

Four generations of computers have evolved. Each generation reflected a change to hardware of decreased size but increased capabilities to control computer operations.



### TODAY

Challenges, such as sensor technology for continuous health monitoring, cyber-physical systems for the industrial Internet, 3D-printing, smart-grids for energy supply, tracking and tracing solutions for mobility.



## WHAT IS IT?



The diffusion of Information and Communication Technologies (ICT) across all economic sectors is placing new demands on workers' skills. The changing skill set is both expanding employment opportunities and imposing new demands on disadvantaged groups. In today's job market, basic ICT skills are considered essential for people entering the workforce and for those trying to get a better job.

A nation's economic well-being depends "on both the effective use of ICT for businesses and industrial processes and on the knowledge, competencies, and skills of current and new employees" (European Commission, 2004, p. 2). ICT skills are not only required for jobs in the information technology (IT) sector. The demand for them cuts across sectors and job types.

### COMPONENTS OF ICT

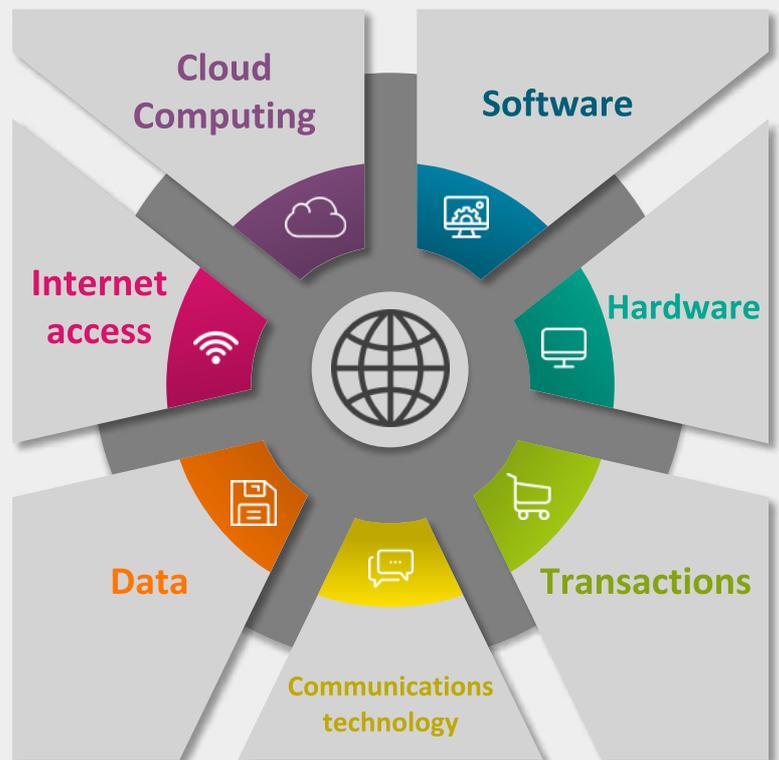


Figure 2. Components of ICT  
Source: self made



## WHAT IS THIS FOR?

### How can ICT help?

#### **Collaborating with Teams**

Team collaboration software and apps have changed the way many businesses operate. Companies no longer need to save multiple versions of documents and spreadsheets, and email them to each other in order to get feedback from their colleagues. With online authoring tools such as Google Docs, businesses can enable multiple team members to work on and review documents simultaneously, saving time.

#### **Improving Work-Life Balance**

While technology can cause employees to be overworked, it also enables many people to maintain a work-life balance. Improved network connectivity allows employees to work from home. Many organizations have full or partial remote offices, while others have policies where their teams can work remotely in cases of bad weather or outside appointments. This saves many employees from spending time commuting.

#### **Doing Business Online**

For many small businesses, technology has opened up a new market online. While many companies still serve customers in person, many organizations have online stores. E-commerce allows small businesses to reach wider audiences that are outside of their geographical area, which can be particularly useful for small niche offerings.

Conducting business online isn't limited to making sales. Technology enables businesses to give prospects the option to book business consultations and service appointments through calendar tools integrated with their websites. This gives website visitors the flexibility to book on their own schedule, rather than having to make a phone call during business hours.

#### **Project Management Systems and Scheduling**

Another use of technology in business is the implementation of project management systems for collaboration among employees. Workers no longer need to be in the same building or sit in a lengthy meeting to share their ideas. Whether they're at the corporate headquarters or working from home, individuals can create task lists, assign work, upload content, set appointments and track progress all in one online application.



## WHAT IS THIS FOR?

### Definition of e-Skills:

We can distinguished between three categories of e-skills:

**ICT practitioner skills:** the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems.

**ICT user skills:** the capabilities required for the effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialised tools supporting business functions within industry. At the general level, they cover "digital literacy": the skills required for the confident and critical use of ICT for work, leisure, learning and communication.

**E-Leadership skills:** these cover a range of skills, attributes and attitudes related to: knowledge of the capabilities and limitations of software systems and information systems in use; ability to quickly assess new capabilities of existing systems and the relevance of offers of software and web services emerging on the market; ability to describe prototype solutions; understanding of the fundamentals of alignment of business and IT functions in an organisation.



## WHAT IS THIS FOR?

### TOP 8 ICT SKILLS FOR WORKERS

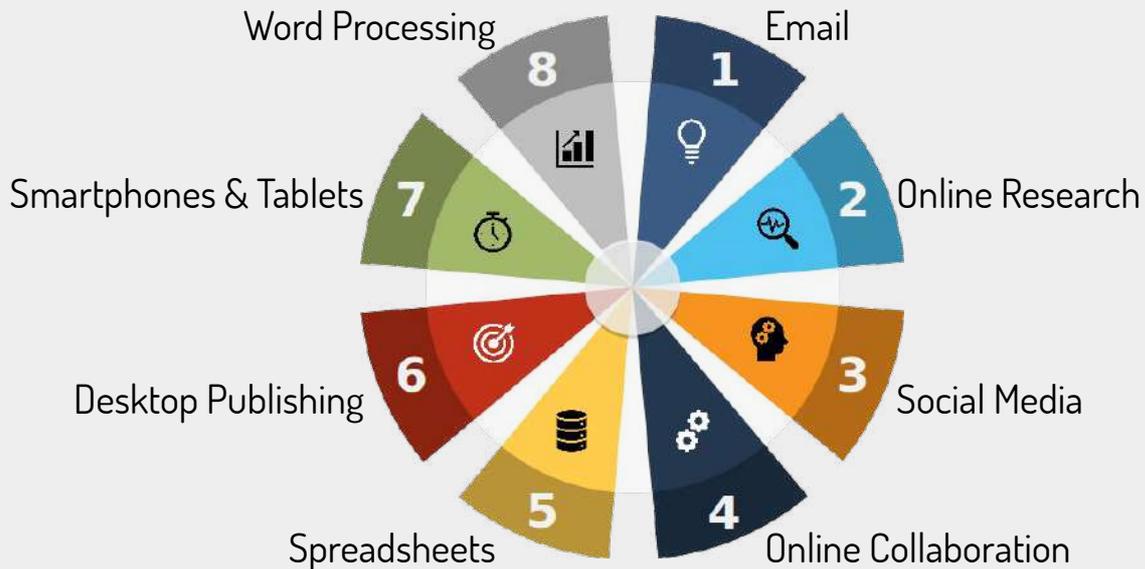


Figure 3. Top 8 ICT skills for workers  
Source: self made

**Email:** Being able to effectively and successfully communicate via email is critical to any job. You will need to send emails to colleagues, employers, clients, vendors, and so on. Companies expect their employees to write professional and well-written emails, as well as respond promptly to messages received in their inboxes.

**Online Research:** Almost every job requires at least some online research. Whether you are looking up new lesson plans in a subject or checking out the latest news on your company's competitor, you need to be able to sift through all the information online to find what you need. This involves basic online information management skills.



## WHAT IS THIS FOR?

**Social Media:** Some jobs require you to use social media. For example, many people working in marketing tend to manage or update a company's social media presence. Even if this is not a critical part of your job, employers increasingly look for employees with basic social media literacy. The more you know about the benefits of and limits to social media, the more you can begin to use that media in valuable ways at work.

**Online Collaboration:** Online collaboration is a broad category that refers to any means of sharing information with your coworkers (or supervisors, or clients) online. This includes adding a meeting to a shared online calendar, providing feedback on a document through a web-based document application, and holding an online video conference with colleagues.

**Spreadsheets:** From researchers to administrative assistants to K-12 teachers, almost everyone now needs to be able to develop and manage data using spreadsheets. Furthermore, they have to be able to analyze that data and recognize trends and patterns. Fluency in programs like Microsoft Excel is critical in today's job market.

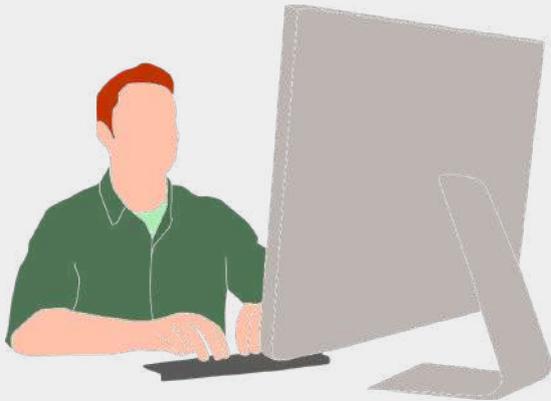
**Desktop Publishing:** Desktop publishing involves the creation of a variety of print materials using a computer. These might include fliers, brochures, newsletters, and other materials that include graphics. Because you can create so many materials using desktop publishing, almost any job requires some basic skills in this field. While people with a creative, artistic eye might be particularly good at desktop publishing, anyone can get better with practice.

**Smartphones and Tablets:** Many employers require that their employees use smartphones and tablets; they might even issue particular phones to employees or state that workers must have be accessible by email during certain hours. For these reasons, it is important to know how to use a smartphone.



## WHAT IS THIS FOR?

**Word Processing:** In this day and age, it is pretty much understood that all job candidates must know how to use word processing technology. Job candidates need to be able to produce written documents (including business letters, meeting minutes, and more) using a computer processor such as Microsoft Word. Candidates also need to be able to type quickly and accurately.



### Most valued skills:

1. Teamwork
2. Customer oriented
3. Commitment to learning
4. Problem solving
5. Negotiation skills
6. Empathy
7. Assertiveness
8. Empowerment



## WHAT IS THIS FOR?

### Potential implications of ICT on employment:

|                         | Positive implications  | Negative implications   |
|-------------------------|--|---|
| <b>Job availability</b> | <ul style="list-style-type: none"> <li>• New jobs likely to be created to design, build, and repair new technology, particularly robots.</li> <li>• New business models and industries are being created that could lead to both direct and indirect job creation (e.g. sharing economy).</li> </ul>   | <ul style="list-style-type: none"> <li>• A significant number of jobs are likely to be made redundant, including predictable, routine tasks but increasingly some higher cognitive tasks.</li> <li>• New industries are expected to be less labour intensive or provide less reliable employment, thus reducing net job creation.</li> </ul>  |
| <b>Job access</b>       | <p>Jobs may become more accessible for certain groups, such as women and people with disabilities, by overcoming social, cultural, and physical barriers to work. Technologies could make the means of production more accessible to small-scale producers.</p>  | <p>Lower-skilled and less educated groups could face particular challenges in filling new higher-skilled roles if efforts are not made to help them grow with the required skills.</p>  |
| <b>Job quality</b>      | <ul style="list-style-type: none"> <li>• Factory spaces may become cleaner and safer, and some of the most difficult and dangerous tasks may be mechanised.</li> <li>• Repetitive motion injuries may be reduced, and sensors and other tools may be used to monitor health and air quality.</li> <li>• Productivity gains, if passed on to workers, could drive higher wages.</li> <li>• Technology can augment human skills, enabling workers to extend their own capabilities and learn new skills, providing more mobility.</li> </ul> | <ul style="list-style-type: none"> <li>• More part-time work and contractor work could mean less access to formal employer benefits and weakened job security.</li> <li>• Downward pressure on wages as a result of competition with 'cheap' machine capital could lead to income loss.</li> <li>• Reduction of available low-skill jobs could reduce negotiating power of workers in remaining low-skill positions.</li> </ul> |



## GOOD PRACTICES



Promoting ICT (Information and Communication Technologies) uptake as an innovative business solution for SMEs (Small-Medium Enterprises) a key factor for success: **software** and **intangibles** combined with adequate investments in **hardware** and **high-speed connectivity** are essential to improve the business of microenterprises and SMEs.



**Microsoft Office Tools** are the most widely used software in business and the office environments. Having the right skills and knowledge is essential if you want to keep up to date with the skills demanded by many employers to progress in your career. Whatever your level Sparsholt Business Training offer a wide range of ICT courses designed to train you in all aspects of Microsoft Office, and the individual programmes it contains such as Excel, PowerPoint and Microsoft Word.



## GOOD PRACTICES



Fabrication labs (or FabLabs) represent prototype environments for promoting innovations and inventions in the fields of modern digital technologies, ICT and IoT applications.

They help increase creative literacy, which means that people can use new high-tech tools. They are dedicated to creators, students, researchers, and entrepreneurs who want to express their creativity in the form of development of innovative products with high benefit. In addition to the basic tools found in classical workshops, FabLabs have modern equipment such as 3D printers, CNC milling machines, and laser cutters.

Modernly furnished rooms represent only the first step; mentors that help creators overcome problems on their way and through education involve inexperienced creators in the FabLab form the second step. The third step represents the linking of creators to groups that encourage the formation of ideas and mutual motivation to stay on this difficult journey. Networks of related laboratories, exchanging knowledge flows, and equipment forms the fourth step, which also opens up important opportunities for linking with the industry and financing the projects in the early stages of product development. FabLabs enable industry, and especially small and medium-sized enterprises, to test their ideas before entering the path of digitization.

## Some leading companies:



HAWKERS



**TOSHIBA**



*General Electric*



**SIEMENS**

**SONY**



Microsoft



Hewlett Packard  
Enterprise

**HITACHI**



## BENEFITS FOR THE COMPANY

### **Meeting Customer Needs**

Customer service is paramount for both big and small businesses today, and the customer experience often begins when a prospect reaches a company website. Web chat software can help small businesses reach out to prospects in an automated but personal way. When businesses are able to offer help and answer questions through a chat solution, prospects may be able to make the purchasing decision sooner.

### **Targeting Audience Segments Effectively**

Businesses can use online search engines such as Google and social media channels such as Facebook to target various segments of their audience with highly tailored ads and content.

### **Make Your Business More Efficient**

You can schedule sales calls and appointments, track employee time, and perform many tedious tasks that once took hours in only minutes.

### **Ensure Computational Accuracy**

Accounting programs like QuickBooks allow you to accurately keep inventory, make and record sales, manage and pay bills, and handle payroll. Consider the time and cost once required to compile financial information. Now, your books can be regularly maintained in a software program and your financial statements can be generated in moments.

### **Be Competitive In the Marketplace**

Use digital marketing to promote your company and online sales tools to sell across the street and across the globe. Embrace Customer Relationship Management (CRM) systems that allow you to track what your customers do and like. Wouldn't it be great if you could target the right customer at the right time in the consumer journey so they turn to you instead of a competitor? You can with technology.

### **Communicate More Effectively**

Whether you instant message or use Slack with a co-worker across the hall or Skype with clients across the ocean, technology has made connecting in real time easier than ever. Follow up that voice or FaceTime call with an email to recap and clarify. Connect on LinkedIn to network interoffice and interindustry. Use Facebook, Instagram and Twitter to communicate directly with your customers. Create and promote your brand and get your message directly to the consumer.



## BENEFITS FOR THE COMPANY

### **Benefits to Communication**

Rapid communications can help increase productivity, allow for better business decision-making and ease a company's expansion into new territories or countries. IT equipment can be used to send business status reports to executives, to update employees on critical business projects and to connect with business partners and customers.

### **Improved Workplace Efficiency**

Streamlined workflow systems, shared storage and collaborative work spaces can increase efficiency in a business and allow employees to process a greater level of work in a shorter period of time. Information technology systems can be used to automate routine tasks, to make data analysis easier and to store data in a manner that can easily be retrieved for future use.

### **Competitive Advantage over Rivals**

Companies using a first-movers strategy can use information technology to create new products, distance their products from the existing market or enhance their customer services. Companies that follow a low-cost product strategy can look to information technology solutions to reduce their costs through increased productivity and reduced need for employee overhead.

### **Cost Reduction and Economic Efficiencies**

Using IT infrastructure, redundant tasks can be centralized at one location. For example, a large company could centralize their payroll function at one location to lower employee costs. Economic efficiencies can also be realized by migrating high-cost functions into an online environment. Companies can offer email support for customers that may have a lower cost than a live customer support call. Cost savings could also be found through outsourcing opportunities, remote work options and lower-cost communication options.

### **Automated Voice Systems Provide Service**

Automated voice response systems are another way to provide customer service while allowing employees to stay focused on other tasks. Instead of a "live person," the automated system handles the call and either directs the customer to the appropriate individual or retrieves data and communicates the basic information requested by the caller. Similarly computer "bots" handle online requests for information through live chats.



## BENEFITS FOR THE COMPANY

### Artificial Intelligence Engages in Marketing

Artificial Intelligence (AI) systems are being used to predict and influence future sales based on consumer preferences. Knowledge of customer preferences in real time can assist marketing departments in determining where to spend their money by tracking trends more closely and adapting promotional and sales efforts. The streaming entertainment industry, for example, suggests additional programming based on shows already being watched. "Because you watched this ... you might enjoy this."

### Easy Collaboration with Remote Workers

The gig or freelance industry has also grown dramatically because of technological advancements that allow talented workers to be hired and perform remotely for an organization. Needs can be posted online and workers hired, sometimes within hours. Freelancers can collaborate with managers and employees through project management platforms, without any one-on-one interaction.

**In business strategy, these reasons lead to a constant search for ideas and a rapid process of innovation:**

Interdisciplinary cooperation to foster innovations

Adaptability to the rapid innovation cycles

Good IT skills and competences

New business thinking

Bursting with creativity

Empowering people to innovate

Creating and applying knowledge

Applying innovation to address global and social challenges

Enhancing the governance and measurement of innovation policies

Figure 4. Reasons lead to a constant search for ideas.  
Source: Self made



## FUTURE APPLICATIONS



The first ICT-Leadership in Enabling and Industrial Technologies (LEIT) Work Programme provides a balanced response to the main challenges faced by Europe in the field: firstly, the **need to maintain a strong expertise in key technology value chains**; secondly, the **necessity to move quicker from research excellence to the market**.

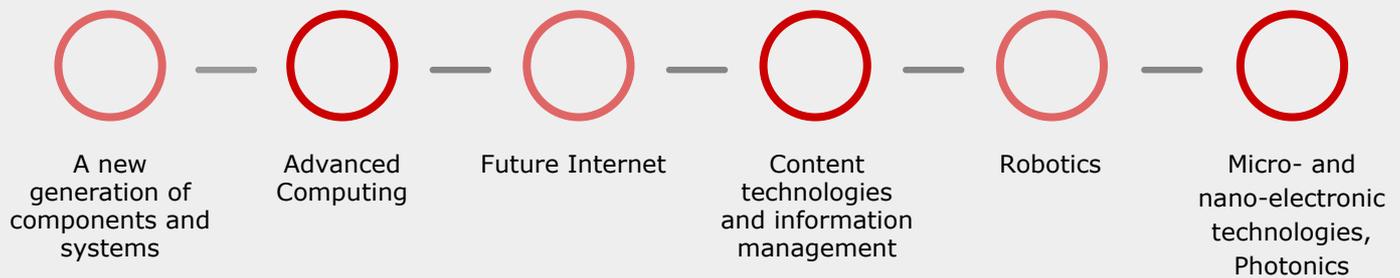


Figure 5. Six main activity lines of technology  
Source: Self made

The full **potential for improving ICT in Europe** remains yet to be discovered and this is why the European Commission is developing policy and supporting research to make learners fit for 21st century life and work.

The spread of digital is having a massive impact on the labour market and the type of skills needed in the economy and society.



## FUTURE APPLICATIONS



Digital technologies, systems and processes are having a massive impact on the labour market and the type of skills needed in the economy and society:

- ❖ Changing the structure of employment, leading to the automation of "routine" tasks and to the creation of new and different types of jobs.
- ❖ Leading to the need for more skilled ICT professionals in all sectors of the economy.
- ❖ Leading to the need for digital skills for nearly all jobs where ICT complements existing tasks. Careers such as engineering, accountancy, nursing, medicine, art, architecture, and many more require increasing levels of digital skills.
- ❖ Changing the way we learn by fostering online communities, by enabling personalised learning experiences, by supporting the development of soft skills such as problem solving, collaboration and creativity, and by making learning fun.
- ❖ Connecting job seekers and employers in new innovative ways.
- ❖ Causing every citizen to need least basic digital skills in order to live, work, learn and participate in the modern society.



## FUTURE APPLICATIONS



ICT combines a strong support to **industrial roadmaps** with **new mechanisms to encourage disruptive innovation**. The former will reinforce medium to long term commitment to industrial strategies and provide continuity and stability. The latter will offer flexibility and openness and will help develop dynamic eco-systems in which innovators can operate. Both strands will require the involvement of new actors, on one hand to exploit and leverage new technologies and on the other to initiate and drive change.

### The six main activity lines that have been identified are:

1. A new generation of components and systems
2. Advanced Computing
3. Future Internet
4. Content technologies and information management
5. Robotics
6. Micro- and nano-electronic technologies, Photonics



#### EIC SME Instrument

*The SME Instrument is part of the European Innovation Council (EIC) pilot that supports top class innovators, entrepreneurs and small companies with funding opportunities and acceleration services. The main focus of the SME Instrument is on market-creating innovations that shape new markets and generate jobs, growth and higher standards of living*

In addition, the Work Programme features several cross-cutting topics addressing cyber-security, Internet of Things and research on a Human-centric Digital Age. All activities are complemented with support to innovation and take-up, international cooperation and a dedicated action for SMEs to propose bottom-up innovative ideas, using the **SME instrument**.



## FUTURE APPLICATIONS



### Summary of predictions of the **ICT trends for 2019:**

#### **1. Your app is your brand - digital displaces physical in the connected, software-centric customer experience**

Today, over one-third of shoppers use smartphone apps to browse, research or compare prices before they buy. Almost every organisation already has a digital presence and a digital entrance and apps have become the new 'shop front'. As a result, customers will develop a perception of brand through a digital experience instead of the touch-and-feel experience of bricks and mortar stores and service centres. The app and the brand will become one. The experience delivered by apps will therefore be critical to business and raises the priority level of software development, operation and automation in terms of speed to market, cost, reliability and risk.

#### **2. From mobile-first to AI-first - connected augmented intelligence**

If the trebling of global investment into AI is any indicator, expectations are extraordinarily high. Business focus has shifted from customer connectivity (mobile-first) to what the connectivity can enable and the behaviour it can measure (AI-first). However, 'artificial general intelligence' (i.e. multi-skilled and human-like) is still decades away and when compared to other living beings, we are 'at the worm stage'. On the other hand, 'connected augmented intelligence', intelligence that assists human decision-making, is here now. For example, connected, human-driven, intelligent vehicles are in widespread operation today, whereas autonomous vehicles are only in limited deployment.

AI is advancing rapidly across areas such as sensory systems, predictive analytics, image analysis, speech recognition and machine learning. AI commoditization through plug-and-play solutions will accelerate as leading technology providers, notably Google (e.g. Google Assistant, TensorFlow), Microsoft (e.g. Cortana, Azure Machine Learning) and Amazon (e.g. Alexa, SageMaker), make new announcements almost weekly. Surprisingly, business adoption is lagging but this is not expected to last long.



## FUTURE APPLICATIONS



### 3. Infrastructure as code - connected intuitive infrastructure

Despite retail outlets struggling, shopping is as popular as ever. The in-person shopper experience is making way for digital and software is dominating design and deployment of shopping malls as well as almost all physical infrastructure, from buildings and transportation to IT itself. Connected intuitive infrastructure enables sensing, analysis and action that leverages a combination of networking and AI. IT infrastructure is shifting from a system of physical boxes to just one or a few software entities and operated as code. This transition began a few years ago in the data centre/cloud and in several telecommunications networks. It is now expected to take hold in the WAN and access networks.

2019 will be the 'year of SD-WAN' with an expected 37 percent compound annual growth rate. Hardware will undergo its own transformation with massive advancements such as 7nm chips, 3D chip stacking, optical-photonic integration and a new generation of AI-specific silicon. Despite an unsteady start, confidence in IoT is high. It is an integral part of connected intuitive infrastructure, with an expected economic impact of \$11 trillion by 2025.

### 4. Tech reality bites - economic dislocation

Existing challenges such as unemployment (through automation), unemployability (which is worse), cyber risk, fake news, algorithmic accountability and digital distraction will be more obvious and acute. New challenges are also emerging. Power is shifting from government into the hands of a small number of powerful multi-national technology organisations based in the US or China. Trust in institutions is at an historic low. Government intervention for law enforcement (encryption), national security, data protection, ethical AI (AI-to-human and AI-to-AI), data/algorithm bias and copyright will escalate alongside new regulation. The shortage of women in technology is a priority especially as demand for technology-based jobs grows at the expense of other traditional, manual types of work.



## FUTURE APPLICATIONS



### **5. Expanding to Cloud - telemetry, policy and AI are key**

Even public cloud providers now understand that it may take longer, if ever, to expand to public cloud. This realisation has impacted expectations such as timing and investment and market dynamics, such as supply-side technology relationships (e.g. Cisco with Google, Microsoft and Amazon). Nevertheless, cloud continues to disrupt IT innovation, consumption and the industry itself. Cloud capabilities such as serverless computing, edge computing, containers, microservices and AI toolkits provide compelling options for rapid, cost-effective development and deployment of modern software and applications. Expanding to cloud will require a sharper focus on telemetry, policy and AI to manage, secure, orchestrate and automate operations.

### **6. Cyber defence is a system and culture, not a product - perimeters shift closer to the entities they protect**

It is estimated that there are more than 120 million new variants of malware every year and that the cost of cyber-crime is now in the trillions. Nation-state attacks are being called out by governments under attack and state actors are being arrested. Anyone still buying discrete appliances to combat cyber-attack will fall behind - defence is a system and a culture, not a product. It is complex and remediation can be costly if not, devastating. Re-architecting cyber security will gather pace. Zero trust networking with a security posture of default deny, will be the first step to continuous risk/trust assessment. The hype around "perimeter-less" networks is misguided as there will actually be an increase, not a decrease, in the number of demarcation boundaries of trust.

Small-to-medium businesses (SMBs) that thought they were not worth attacking will need to think again. SMBs by definition, have fewer resources and therefore represent a large number of small 'soft' targets. They will therefore require a solid approach to threat intelligence and management.



## FUTURE APPLICATIONS



### 7. Faster and wider - 5G and nano satellites

Anticipation and expectation of 5G is probably higher than any other new technology in history. Governments believe 5G will affect national security and economic performance in decades to come and several mobile operators are literally betting their businesses on it. While it promises higher speed and other benefits such as lower latency, 5G raises many questions around its commercial value proposition against existing options including 4G/LTE and Wi-Fi variants. 5G is also headed for a collision course with fixed-line broadband threatening its business case.

2019 will be a year of marketing (and politics) and figuring out the use-cases and business case. Full-scale deployment will follow, probably slightly delayed. At the same time, satellite will step back onto centre stage for two important reasons – coverage and cost. Massive cost reductions through efficiencies in rocket launch and re-use as well as technology advancement, promise to enable a new generation of nano-satellites to belatedly and cost-effectively connect some of the most remote places on earth.

### 8. The value of data - now to control and monetise

Amidst so much change, one thing we can predict with certainty – production and demand for data will continue to soar. Global IP traffic will grow three-fold to 2022 and mobile data will grow seven-fold. Economies are transitioning from human-scale to machine-scale, which means that more decisions are being made by machines, and that machines and AI will thirst for more data. The value of data is clearer than ever, as machines with the right data help us make smarter, quicker decisions.

Traditional organisations like banks and telecommunication operators are acutely aware that they have stimulated data production and consumption while someone else has been taking advantage of it at their expense. The challenge is how to control and monetise it. As data becomes more personalised, it generates numerous opportunities as well as challenges for consumers, businesses and governments. Tension will rise between government and consumers and we can expect more regulation not less.



## FUTURE APPLICATIONS



### **9. Decentralised Web and the Internet of Blockchains – Web 3.0 and distributed trust**

In less than a decade, the World Economic Forum expects that 10 percent of global Gross Domestic Product (GDP) will be stored on blockchain. However, in 2018, crypto-currencies such as Bitcoin that use blockchain, have been in turbulence, turning the curious into sceptics and in some cases, disbelievers. But we should not be side-tracked by crypto-currencies. Blockchain itself is a serious, secure, distributed ledger and digital cryptographic platform. Venture capital and other investment is consistently growing. Blockchain offers distinct value to supply chains – trust enshrined in decentralised crypto-algorithms. Its credentialing capability is more secure and robust than alternatives, it is open source, collectively owned, decentralised and neutral – critical ingredients for Web 3.0 and the 'decentralised Web' (DWEB). While it has massive scope, we can expect initial use cases based on permissioned access (i.e. private) blockchain. The huge disruption to business models will push out public blockchain deployment by at least 3-5 years.

### **10. Anywhere, anytime, any mode transport as-a-service – connected and autonomous vehicles**

The vehicle industry is a beacon for how technology can transform an entire sector and impact adjacent ones too. Although autonomous vehicles (AV) seem to attract the most attention, other transitions within the industry are taking hold and impacting consumers much sooner. Electric vehicles (EV) are more of a given now than a bold vision and although it will take some years, the move to EV is certain. Connectivity technology will undergo a disruptive, winner-take-most battle between the well-known and universally supported Dedicated Short-Range Communications (DSRC) technology and the relative newcomer (and incompatible), cellular vehicle-to-everything (C-V2X) alternative. Vehicle ownership will decline as the shift towards shared platforms and Mobility-as-a-Service (MAs) accelerate. These platforms are spawning new forms of transport including electric bikes and scooters.

You can also watch the Top 10 ICT Trends video here:

<https://youtu.be/dzRovkW7qbM>



## ADVANCED CONTENT

The **ICT innovation vouchers' scheme** is a useful instrument to include in strategies for innovation and growth implemented at local and regional levels. It enables regional and national authorities to facilitate SMEs' access to digital know-how and technology by giving them the incentive to connect with ICT knowledge and service providers. The aim is to encourage the use of new ICT-based business models.

The objectives of implementing ICT innovation vouchers in EU regions are: to improve the competitiveness of microenterprises and SMEs by developing new products, processes and businesses; and to stimulate demand for a large range of innovative ICT-related services – notably e-commerce including cross-border online sales – and thus contribute to reaching the Digital Agenda for Europe's priorities.

### What is an ICT innovation voucher?

It's a small credit line dedicated to micro, small and medium-sized enterprises (SMEs) to help them innovate their existing business through ICT uptake.

The voucher will be funded through the EU Structural Funds (ERDF). Implementing body delivers vouchers to SMEs who buy ICT services from local providers.

### Who are the beneficiaries ?

- Microenterprises and SMEs
- ICT knowledge/service provider

### What are the services offered under the ICT innovation voucher?

1. "From No-web to Low-web" for SMEs seeking a presence on the web and/or with low ICT knowledge.
2. "From Low-web to Medium-web": SMEs that want innovate by using the web and other ICT tools to expand their production/sales processes.
3. "From Medium-web to High-web": SMEs pushing ICT innovation to its limits.



## ADVANCED CONTENT

**Standardisation** is the process by which specifications are set. The majority of ICT specifications help ensure that devices, systems and services retain the ability to connect and interoperate with each other, boosting innovation, and keeping ICT markets open and competitive. A specification is a document that outlines the agreed properties for a particular product, service, or procedure. In ICT, specifications are primarily used to maximise interoperability – the ability for systems to work together –, which is essential to ensure that markets remain open. This allows consumers to have the widest choice of products possible and gives manufacturers the benefit of economies of scale.



Figure 6. ICT Standards. Source: <https://ec.europa.eu/digital-single-market/en/standards-digitising-european-industry>

The Commission's initiative on standards is proposing **two lines of action**:

- to focus resources by concentrating standard setting in a set of core technologies will be the building blocks of tomorrow's technologies - 5G, IoT, Cloud, Cybersecurity and Data Technologies. These are increasingly part of the traditional industry strengths in Europe – e.g. connected cars, eHealth, smart energy:
- to propose a series of measures to ensure R&D results are better linked to new standards, as well as for improved collaboration between standard-setting organisations in Europe and internationally.

The results of today's plan will ensure that European standards are in place quickly enough to allow future devices to connect smoothly across the Digital Single Market.



## ADVANCED CONTENT

**Innovation procurement** can deliver solutions to challenges of public interest and ICT can play a major role in this.

*How public procurers and suppliers have implemented innovation procurement*

<http://eafip.eu/resources/videos/>

*The eafip Toolkit provides support to policy makers in designing PCP and PPI strategies, and to procurers and their legal departments in implementing such procurements*

<http://eafip.eu/toolkit/>

- **Public Procurement of Innovative solutions (PPI)** is used when challenges can be addressed by innovative solutions that are nearly or already in small quantity in the market and don't need new Research & Development (R&D).
- **Pre-Commercial Procurement (PCP)** can be used when there are no near-to-the-market solutions yet and new R&D is needed. PCP can then compare the pros and cons of alternative competing solutions approaches. This will in turn enable to de-risk the most promising innovations step-by-step via solution design, prototyping, development and first product testing.

The ICT innovation strategy under Horizon 2020 focuses on ensuring that the rapid changes occurring in ICT technology develop into tangible benefits for European citizens.

*PPI happens when the public sector uses its purchasing power to act as early adopter of innovative solutions which are not yet available on large scale commercial basis.*



*PCP is an approach to public procurement of research and development*



## ADVANCED CONTENT

### SOME ICT TECHNOLOGY TOOLS:

#### CLOUD STORAGE

|  |  |           |   |
|--|--|-----------|---|
|  |  | Dropbox   | Multiplatform file hosting service in the cloud. Free up to 2 Gb  |
|  |  | Gsuite    | Multiplatform file hosting service in the cloud. Free up to 15 Gb |
|  |  | One Drive | Multiplatform file hosting service in the cloud. Free up to 5 Gb  |
|  |  | ICloud    | Multiplatform file hosting service in the cloud. Free up to 5 Gb  |

#### PROJECT MANAGEMENT

|  |  |          |   |
|--|--|----------|---|
|  |  | Basecamp | Task management for everyday users. Small to mid-sized companies                      |
|  |  | Evernote | Project collaboration, scheduling and task management functionalities within a suite. |
|  |  | Asana    | Team collaboration. Small to mid-sized companies                                      |
|  |  | Trello   | Collaborative brainstorming. Small to mid-sized companies                             |

#### COMMUNICATION

|  |  |            |   |
|--|--|------------|---|
|  |  | Skype      | Voice/video chat and 1-to-1 presentations at a specific time                              |
|  |  | Blackboard | Structured teaching sessions, external access without login, interaction beyond text/chat |
|  |  | Hangouts   | Voice/video chat, utilising existing Google circles/groups                                |



THIS CONTENT MAY BE OF GREATER INTEREST TO THE COMPANIES



THIS CONTENT MAY BE OF GREATER INTEREST TO THE GENERAL PUBLIC



## EDUCATION



The prototype of an online landscape, self-assessment tool and web portal is offered to stakeholders interested in its further development and enhancement, with a view to creating a fully-fledged service in the job placement, recruitment, e-skills development and certification market.

*Self-assessment tool:*

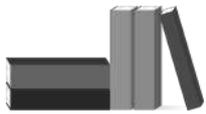
<http://www.e-competence-quality.com/>

### MOOCS:

- ❑ Information and Communication Technology (ICT) Accessibility (edX) - Coursera
- ❑ Technical Support Fundamentals - Coursera
- ❑ System Administration and IT Infrastructure Services - Coursera
- ❑ Digital Transformations - Coursera

### EXTERNAL MANUALS FOR MORE INFORMATION:

- ❑ PANORAMA. ICT practitioner skills and training: automotive industry
- ❑ Towards European e-Skills Quality Labels for ICT Industry Training and Certifications
- ❑ SMEs Going Digital - A Blueprint for ICT Innovation Vouchers



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## SELF APPRAISAL



- ★ After reading this text, do I have a clear idea of what ICT is?
- ★ What skills should I improve in my work?



- ★ Do I know the benefits that ICT can bring to my company?
- ★ How could I detect any training need for my team?



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## INTRODUCTION TO THE INDUSTRIAL REVOLUTION 4.0

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