EuMA | European Microwave Association

Whitepaper

For a strong & competitive European wireless technologies ecosystem

January 2020

Foreword

It may be stating the obvious if one emphasizes that the onset of the "smart world" and the so–called digitisation revolution is dramatically impacting our societies. However, most of us may be less aware that the conditions for making this revolution happen are not yet completely fulfilled.

In 2016, the European Commission has set up the Digital Economy and Society Index, DESI[1], stating that the digitisation revolution can be assessed in each Member State by means of the following criteria:

- ***connectivity;***
- ***human capital;***
- ***use of internet;***
- ***integration of digital technology;***
- ***digital public services.***

Those criteria demonstrate that the digitisation of the economy encompasses a broad range of aspects, technical issues as well as regulatory and societal ones. But it is obvious that to make digitisation happen we need also to provide both appropriate connectivity technologies and the technological means to sense and capture our environment.

GEOGRAPHICAL

A smart and connected economy is key to preserve - or enhance - territorial equality between communities at local, regional and European level. The European Commission perfectly knows how important it is to support all EU regions and Member States to face globalisation and to activate their potential for innovation, competitiveness and sustainable growth. This objective is at the core of several concomitant initiatives, be it the Smart Specialisation Strategies resulting from a renewed Cohesion Policy or the Investment Plan for Europe. But all of them require a powerful infrastructure for communication as well as appropriate sensing technologies for information gathering, and without proper access to wireless technologies, too many territories will lag behind the smart revolution.

ETHICAL

In Europe, we are keen to preserve the balance between the need for data gathering, data protection and the potential of progress given to us by big data technologies. For this purpose, it is essential to master technology and connectivity. The discussions we had to agree on the new General Data Protection Regulation (GDPR) and the ones going on concerning the draft ePrivacy Directive demonstrated two opposing trends: on one hand, the need to adapt our legal environment to the technical revolution we are facing and, on the other hand, the necessity and the increasing difficulty to preserve the European democratic conception of privacy. If we want to be able to fight for our conception of democracy and for a safe, secure and sovereign Europe, we have to be able to design the norms and standards of future emerging technologies. Therefore, we have to maintain and foster our investments in research & innovation to lead ICT, wireless and sensing technologies.

[1] https://digital-agenda-data.eu/datasets/desi/visualizations

ECONOMICAL

If we want the digital revolution to bring benefits to as many of our people as possible and to allow an inclusive growth, Europe has to further enhance its strength and its assets in wireless technologies. During the last 50 years Europe has been able to develop a competitive and leading industry, thanks to strong capabilities in radio frequencies (RF) and microwaves R&I policies. However, the 4th Industrial Revolution we are currently facing integrates cyber-physical systems, the Internet of Things, big data and cloud computing, robotics, and artificial-intelligence systems. Together, they both require and generate unprecedented flows of data. Compared to previous industrial revolutions, the 4th one is evolving at an exponential pace. Our infrastructures have been the foundation for the workflows of data generated during the last 20 years. Now, they are seriously threatened by their lack of capability to cope with the enormous data streams. Similarly, our leadership in terms of data acquisition and sensing through advanced technologies is being increasingly challenged by South-East Asia and countries across the Atlantic.

For the "smart world" to become reality in the way European population is entitled to expect, connectivity and situation awareness are key. Today, connectivity in most cases means wireless connectivity and, hence, it is wireless technologies which will enable all those innovations. Situation awareness, on the other hand, is well represented by RADAR technologies for example, which are safety enablers in the automotive area today and will become even more important for future mobility by autonomous driving. These technologies are also pure wireless-based innovations on which Europe today still has a grip. European research is indispensable to tackle the issues arising from the current revolution: keeping a strong technological place in advanced sensing, and addressing the needs for low power and energy-efficient technologies, for high speed, low latency, and better coverage in challenged areas.

Wireless technologies have been key drivers of innovation for the last 50 years but this was nothing compared with what they shall help us to achieve now. And it is high time to realise that European previous successes should not be taken for granted and that there is an ongoing need for investing massively in wireless technologies in Europe.

If we want to reach the promises of the digitisation revolution, preserve our European Industrial leadership and, at the same time, be able to build a smart, sustainable and inclusive growth, we have to stay committed to strong innovation policies in wireless technologies and to a decisive implementation strategy.

The objectives of this whitepaper are to highlight the role of wireless technologies as enabling technologies for the digitisation of the European society and to emphasize the need for relevant and consistent investments in those technologies - investments that are not reflected sufficiently today in the European discussions concerning our future Research & Innovation policy.

Frank VAN DEN BOGAART
EuMA President since 2019

Wolfgang HEINRICH
EuMA President 2010 - 2018

Table of contents

Foreword 2

I. Wireless technologies are strategic to support European 4th Industrial Revolution 5

II. Breakthrough innovations in wireless technologies are required to enable the digitisation of the European economy 11

A. Wireless technologies are more than connectivity 11

B. Need for performance improvements in wireless technologies 12

III. The expected impact of the European next-generation wireless technologies on the European economy 15

A. Wireless technologies address all social priorities of H2020 15

B. Some case studies of wireless innovation business impact 17

C. The economic impact of wireless technologies and innovation 19

IV. EuMA recommendations to embrace the new challenges of next generation wireless technologies 20

Wireless technologies are strategic to support European 4th Industrial Revolution

The "Europe 2020 strategy" guiding the European Commission and Member States policies since 2010 aims at creating a smart, sustainable and inclusive growth in Europe. In this respect, the European Commission clearly identified the potential of digitisation and of the Information & Communication technologies (ICT) to facilitate the achievement of its objectives. The European Commission made the Digital Agenda for Europe one of its 7 flagship initiatives[2] and a connected Digital Single Market[3] one of its 10 priorities.

Digitisation is acknowledged as a tremendous opportunity to generate growth by structurally modifying our societies, creating new business models, new services and new jobs. However, while digitisation is considered as a highly desirable expression of modernisation and sophistication that we all should have access to, it is commonly admitted that there are still many challenges for the 4th Revolution to really spread over all our societies. The European Commission has undoubtedly taken the full measure of the way forward and allocated a significant amount of money to enable our societies and our industries to embrace this revolution. However, what does not seem to be acknowledged in the same way is a clear vision of the technical challenges ahead, which includes the need for strong Research & Innovation investments in wireless technologies as well as the need to foster strong skills among European engineers in this field.

Digitising European industry requires new wireless solutions

In the framework of the Digital Single Market Strategy, the European Commission has set up ambitious plans to address the issue of the digital fracture within European population and within European industry.

Considering the increasing heterogeneity between European countries and European industries in the adoption of digitisation technologies, the European Commission has launched in 2016 the Digitising European Industry (DEI) strategy. This strategy is an ambitious industrial coordination scheme which aims at facilitating the digital transformation of European companies.

If investments in digitisation are recognised for enabling growth as well as creating jobs and new business opportunities, investment in ICT research and innovation is key to a more competitive and inclusive Europe. The DEI strategy is mobilising €5 billion of EU investment from Horizon 2020 between 2016 and 2020[4].

Nevertheless, the need for dedicated investments in wireless technologies does not seem as obvious in European Commission policy. Rather, those radio-frequency and microwave-based technologies seem to be taken for granted. Neither are they considered as technical and societal challenges as such nor as critical technologies - technologies essential to allow the radical switch in current infrastructures that the exponential data traffic growth requires or to address the mandatory need for advanced sensing that our increasingly smart and connected economy will rely on.

EuMA wants to pinpoint that wireless technologies are prerequisites for the strategic priorities of the European Commission to reach leadership in the 4th Industrial Revolution. Those technologies are literally key enabling technologies for digital technologies to emerge and they should be considered as such by the European Commission.

[2] EUROPEAN COMMISSION : 'A strategy for smart, sustainable and inclusive growth
[3] EUROPEAN COMMISSION PRIORITIES Digital single market
[4] EUROPEAN COMMISSION: Digitising European Industry, progress so far, 2 years after the launch, March 2018.

*W*ireless technologies are the key to support emerging technologies

In 2009, the concept of the key enabling technologies, KETs, was defined by the European Commission, as "*knowledge intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly-skilled employment. They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration. KETs can assist technology leaders in other fields to capitalise on their research effort*.[5]

Surprisingly in this context, wireless technologies had not been considered as KETs[6] and **it has to be made clear that the digital technology building blocks like smart sensors, robotics components, artificial intelligence modules and mobile communication systems cannot provide their intended potential without a breakthrough in wireless technologies**. As it is developed further in the whitepaper, those wireless technologies are essential to support the development of new applications in the "smart world", including those required for developing Industry 4.0.

Considering the far-reaching and fast changes in the industrial and technological environment, a High-Level Strategy Group on Industrial Technologies has been set up to review the list of identified technologies and to advise policy makers on how to maximise the industrial deployment and on how to maximise the benefits for the European economy, society and citizens. In a report published in February 2018[7], the High Level Strategy Group proposed a new broader definition of the KETs based on four criteria defined as follow:

- **Impact**: ability to create high quality jobs, to improve people's life, to create future prosperity
- **Relevance**: ability to impact product development, to ensure Europe remains a leader across industrial value chain and to support democratic engagement
- **Key capacity**: ability to improve people's health, safety and security, to enable sustainable development and to secure connectivity and communication among systems and individuals
- **Enabling power**: ability to enable multiple and cross-sectoral industrial applications, to help to generate excellence in new knowledge and new forms of participation and to create economic progress, reduce inequalities, support circular economy and green growth

It is a major European challenge to consider now next generation wireless technologies as part of this new KET definition.

Investing in digitisation without considering the need for innovation breakthroughs in wireless technologies will be very hazardous for European growth. Through this whitepaper, EuMA wants to highlight the level of investment in next generation wireless technologies that is required for the digitised technologies uptake to become reality and for the 4th Industrial Revolution to arise.

[5] EUROPEAN COMMISSION: 'A European strategy for Key Enabling Technologies – A bridge to growth and jobs'
[6] The six KETs identified in 2009 were: advanced manufacturing technologies; advanced materials; nanotechnology; micro- and nano-electronics; industrial biotechnology, photonics.
[7] http://ec.europa.eu/research/industrial_technologies/pdf/re_finding_industry_022018.pdf

Next generation wireless technologies as new Key Enabling Technologies

IMPACT	
Creating high-quality jobs	Wireless technologies require strong engineering competences especially in electronics engineering. Europe has to improve (Science, Technology, Engineering and Mathematics –STEMS) education from school to PhD.
Improving people's life	Advanced wireless technologies will allow for new mobile and sensing solutions, from communications and health to autonomous driving.
Creating future prosperity	Wireless technologies are a key part for the information and communication industry and support its digitisation. We have already seen exponential growth of new business models through the development of the internet. The same is true for advanced sensing and positioning technologies, which already today are indispensable in industrial production, transportation, safety, and environmental protection.

RELEVANCE	
Impacting product development	Wireless technologies are more than connectivity: they enable us to communicate, localise, sense, and act depending on application fields, thus representing the majority of the industrial action chain process (cf. figure on p. 10).
Ensuring Europe remains a leader across the industrial value chain	Wireless technologies are essential capabilities for the information, communication, defence and security industries. Thus, they are of utmost importance for Europe's strength and autonomy. But with increasing digitisation, wireless technologies become a key also in almost all other industrial sectors, from machining to logistics and transportation. Europe has to make strategic choices which parts of the wireless technology value chain are key for their industries, focus on them, and spend the necessary efforts in order to ensure our autonomy and leadership.
Supporting democratic engagement	Wireless technologies, smart economy, internet and broadband access to everyone is a must for an inclusive society. Connectivity is a strong requirement for the digital progress to empower people. Similarly, autonomous systems and new applications will allow reducing social, physical and geographical inequalities.

KEY CAPACITY	
Improving peoples' health, safety and security	Wireless technologies through advanced connectivity and dedicated sensors, are of crucial importance for the development of eHealth, e-monitoring functionality allowing personalised medicine and healthy ageing. Wireless technologies through advanced sensing, lead to autonomous and thus towards accident-free driving. Thus, they are expected to have a very high social and societal impact saving human lives and reducing medical cost. Furthermore, wireless technologies are of prime importance in the area of security electronics, e.g. in civilian and military sensor systems with innovative solutions to counter evolving threats.
Enabling sustainable development	Without breakthroughs in wireless technologies, the connectivity required for the smart world and the 4th industrial revolution will cause a dramatic increase in energy consumption and carbon footprint. Thus, advances in the wireless infrastructure equipment are indispensable to make digitization sustainable. Beyond this, advanced sensing and smart industries / smart transportation enabled by wireless technologies have the potential to drastically improve efficiency in all aspects, thus resulting in less energy consumption and a better use of natural resources.
Securing connectivity and communication among systems and individuals	The increase of mobile services related to digitization and of electromagnetic-based sensing causes crowding of the frequency spectrum and requires co-existence of various wireless services in the same or closely spaced parts of the spectrum. With the present technologies this is not feasible, or only at the cost of a reduced level of security for each service. Hence, new concepts and realizations of wireless systems need to be developed to maintain secure co-existence of the different use cases of digitization.

ENABLING POWER	
Enabling multiple and cross-sectoral industrial applications	New wireless technologies are critical to support the 4th Industrial revolution and the development of new applications relying on smart technologies.
Helping to generate excellence in new knowledge and new forms of participation.	Wireless technologies offer new capabilities to build and manage knowledge. To master connectivity and sensing obviously requires that we all improve our digital skills but it also provides us with an unprecedented access to science and knowledge allowing new education solutions.
Creating economic progress, reducing inequalities, supporting circular economy and green growth	Wireless technologies and connectivity must be considered as a strategic way for Europe to build an inclusive science and knowledge-based economy in order to compensate the lack of natural resources.

THE EUROPEAN MICROWAVE ASSOCIATION (EuMA)

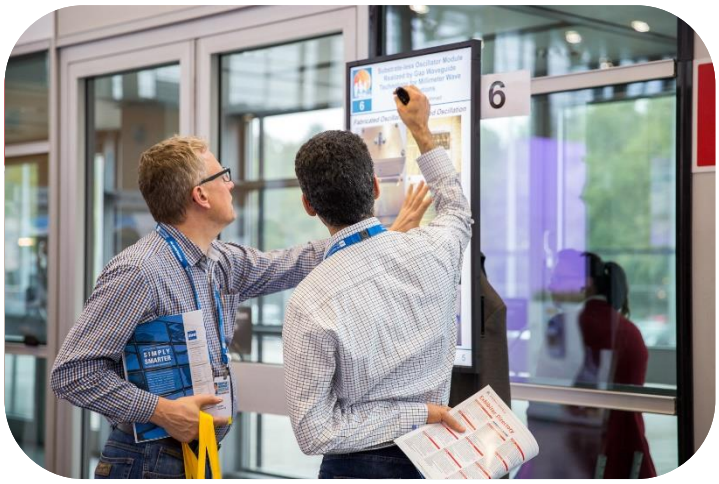
EuMA *is an international non-profit association with a scientific, educational and technical purpose. The aim of the association is to develop, in an interdisciplinary way, education, training and research activities. The association members are industrials and researchers in wireless technologies.*

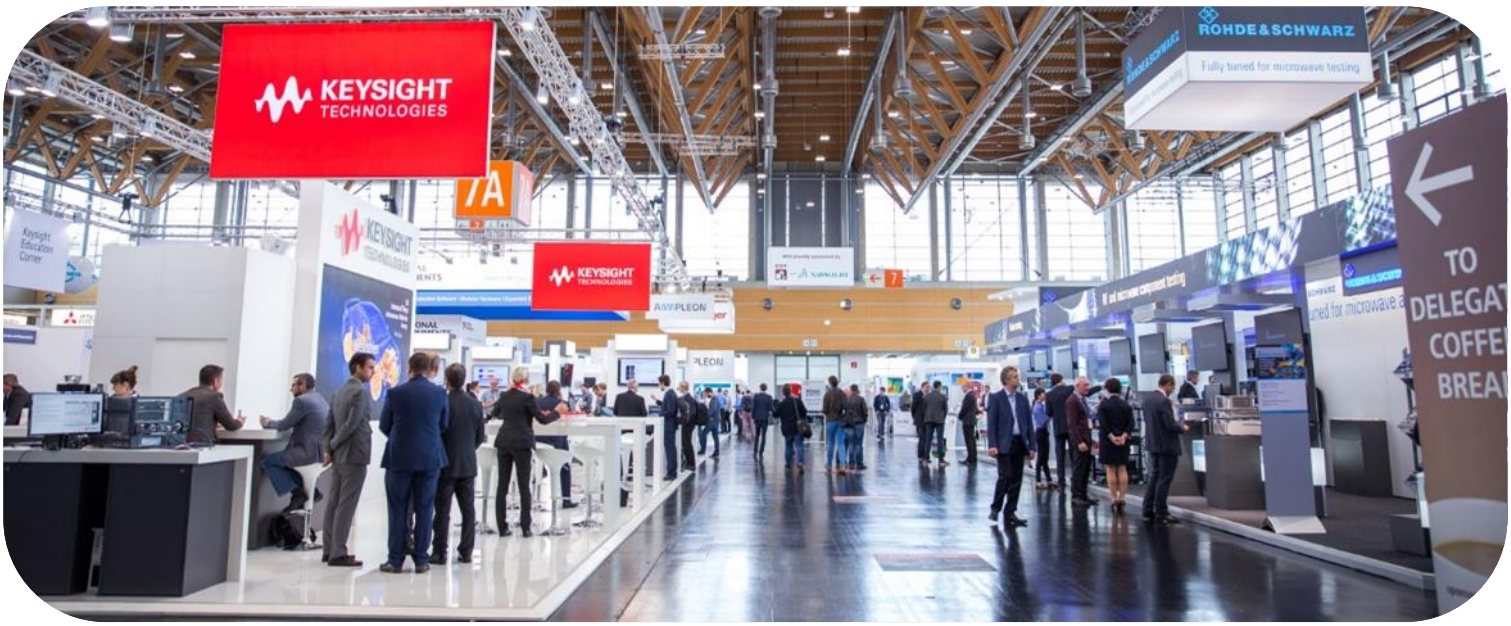
Every year since 1998, ***EuMA*** *organises the* ***E****uropean* ***M****icrowave* ***W****eek (EuMW), as well as various associated events and workshops. Gathering more than* ***5000*** *representatives of the industrial and academic community of radio frequencies and microwave technologies, those events are inescapable meetings to stay tuned with the last innovations in wireless technologies.*

This large ***EuMA*** *community is a good illustration of the major importance of innovation in wireless technologies. Gathering* ***75% of industrials representatives*** *and* ***25% of academics****,* ***EuMA*** *has a unique responsibility to advocate for investing in next-generation connectivity.*

This whitepaper is the result of a EuMA working group dedicated to strengthen awareness of the strategic importance of radio-based research (RF, microwave, mm-wave and THz) for European growth. It relies on interviews with key actors of wireless technologies in Europe. EuMA would like to thank those who accepted to participate to this reflexion process and to share their vision of wireless technologies.


PPER MOUNTAIN
TECHNOLOGIES


6


KEYSIGHT
TECHNOLOGIES
ROHDE&SCHWARZ
Fully tuned for microwave testing
TO

EUMW 2017

Breakthrough innovations in wireless technologies are required to enable the digitisation of the European economy

WIRELESS TECHNOLOGIES ARE MORE THAN CONNECTIVITY

For the digitisation strategy of the European Industry to become a success, Europe has to reinforce its position in wireless technologies. The wireless challenge is quite well expressed by the European Commission but concrete actions and support to reach the European leadership in next generation wireless technologies are required.

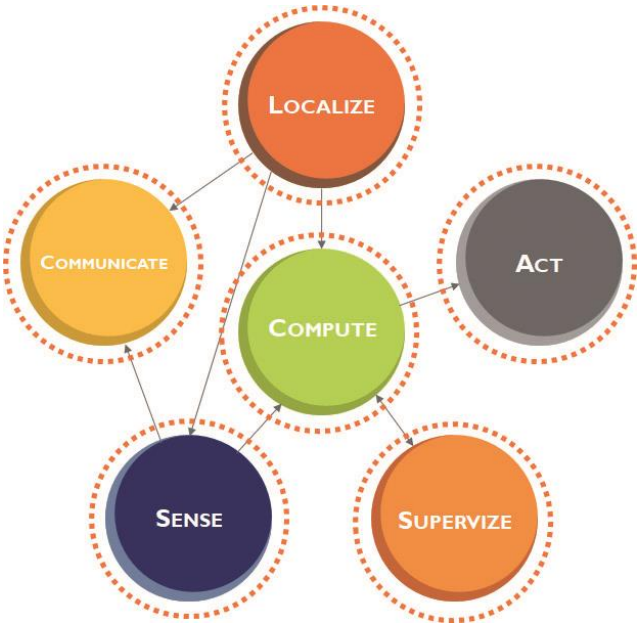
The European Commission[8] acknowledges that: *"State of the art digital infrastructure and **harnessing appropriate spectrum resources** are essential both for the development of ground-breaking digital innovations such as additive manufacturing or automated driving, as well as for a wide roll-out of digitisation to all parts of our economies and to citizens."*

*"**Next-generation connectivity** – especially 5G – is the foundation on which future business models will be built. Autonomous vehicles, the Internet of Things and countless other applications that future industrial strength will hinge or simply cannot be realised without faster and seamless internet speed. The efforts to expedite 5G adoption are formidable, but so are the potential rewards which can give European industry a first-mover advantage and global competitive edge."*

EuMA greatly welcomes this position of the European Commission but wants to highlight that the "potential rewards" are not yet reality.

There are still significant technical challenges ahead to make the promises of 5G happen to their full extent. And, as far as the "next-generation connectivity" beyond 5G is concerned, the challenges are even greater.

Furthermore, next generation wireless technologies will not be limited to connectivity only. They provide core functions enabling smart, autonomous and digitized solutions: Sense – Communicate – Localize – Compute – Act – Supervise. The next generation wireless brings intelligent functions to connectivity. Depending on the applications, it covers nearly all of the smart systems core functions enabling efficient digitisation.



Wireless technologies within the digitisation action chain

Wireless technologies functions

Source: Yole Développement 2018

[8] EUROPEAN COMMISSION: Investing in a smart, innovative and sustainable industry

Moreover, the European Commission states for EU industrial policy strategy that:

"To ensure a highly competitive manufacturing sector in Europe, a successful strategy must build on Europe's strengths and assets in strategic value chains of new technologies and make these more robust. This often requires joint, well-coordinated efforts and investments by public authorities and industries from several Member States."

This is precisely what EuMA wants to advocate with this whitepaper. The value chain of wireless technologies is strategic and has a strong convergence between the European industrial policy and the European research & innovation programme. It is of high importance to achieve the required technology maturity for the next-generation wireless to enter into application smoothly.

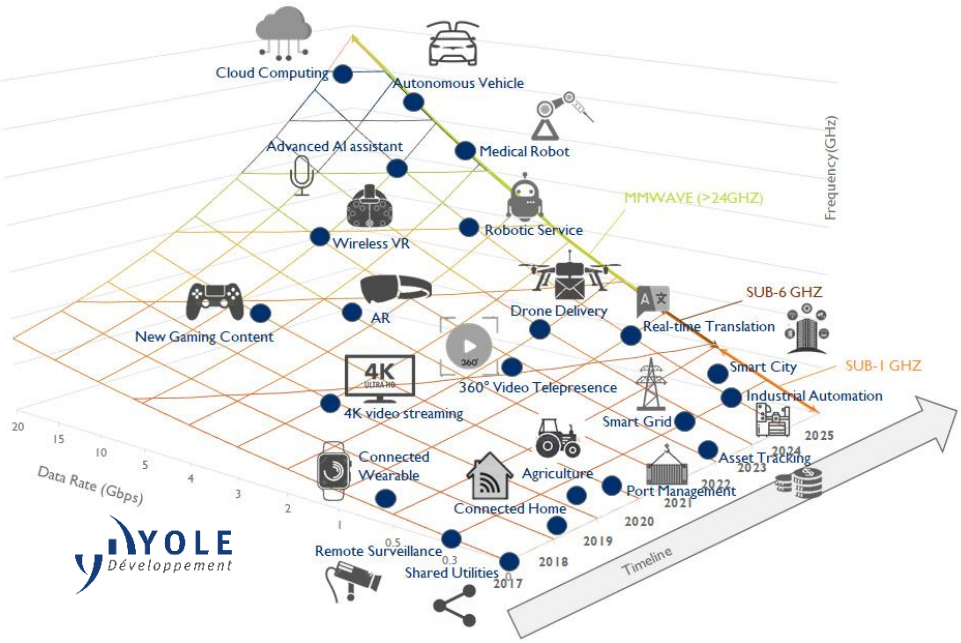
Need for performance improvements in wireless technologies

Wireless technologies are the key for data transmission at an affordable cost in many environments. Without wireless technologies, none of the digital transformation goals would be possible. However, although wireless technologies today form the core of digitisation, they cannot simply be scaled up to satisfy the needs of the upcoming era. Rather, essential performance challenges need to be solved:

- speed of data transfer;
- accommodating the orders of magnitude increase in the numbers of network nodes associated with the IoT;
- accessibility during mobility, for indoor location and other challenged areas;
- realizing all these benefits without an increase in power consumption.

For all these challenges, improvements in existing technologies and partly disruptive solutions are required to drive and operate the digitisation of the European industry.

Wireless applications: timeline and main technical specifications



Speed of data transfer

The deployment of new applications and connectivity systems such as Artificial Intelligence, autonomous vehicles, Industry 4.0, but also robotics and networked sensor systems will require ultra-high speed and seamless communication links. They will rely on technologies that can provide real or fast-time responses with low latency. Among others, the most promising way to address this requirement is to use new spectrum at higher frequencies, particularly in the millimetre wave and Terahertz frequency range.

Millimetre-wave communication covers the frequency range from 30 to 300 GHz and is presently a subject explored intensively. Development is ongoing on fixed wireless access points at 28 GHz, for instance. Strong focus on handset user and base-station equipment is happening right now at 28 and 39 GHz, which will add extra speed to mobile communication links, also using technologies such as beam-forming. Wireless transmission between the base stations and to the core network, which we call wireless backhaul, is developed for several frequency bands (60, 90-100 and 140 GHz). The higher the frequency is, the higher the capacity to carry information is but the shorter the spatial coverage can be. These very wide wireless data pipes are required to deliver the desired high data rates to the end user.

Accommodating more network nodes

IoT leads to a dramatic increase in the number of nodes in a wireless network, by at least one order of magnitude. Present networks cannot accommodate this. Instead, improved ways of sharing the spectrum need to be developed.

The frequency spectrum is *a "natural resource*". Thus, it is physically limited in range and must be handled very cautiously. Frequency allocations are a sovereign regulatory activity subject to government control. But whatever the international and local tools for coordination are, e.g. WARC - World Administrative Radio Conference - as the worldwide regulatory body, they cannot abolish the laws of physics. Co-existence of different systems in the same frequency regime, based on internationally regulated system specifications is a first step only. Adding new frequency bands for local networks and introducing frequency-agile radios to better exploit the presently allocated spectrum are possible technical solutions. There is an urgent need for breakthrough innovations to optimise the use and share of the frequency spectrum.

For network capacity increase, the most efficient way is to stack several portions of the available radio spectrum to carry data which we call carrier aggregation. In addition, it is possible to multiply the number of spatial beams to transmit and receive the data which is exploited by the so-called massive MIMO technology. Simply speaking, massive MIMO allows focusing the transmitted energy into a desired direction, thus establishing spatially diverse links to different counterparts (spatial diversity). Carrier aggregation and massive MIMO are the key technologies that should be pushed on top of additional spectrum to improve the overall network capacity which is required for the digitization of the European economy. Not to forget: the available frequency spectrum is a limited and a "natural resource".

Enabling autonomous driving and IoT through smart sensing

Both IoT and autonomous driving are acknowledged by the European Commission as ground-breaking digital innovations. These applications require smart sensing, e.g. imaging capabilities that provide a good capture of the environment, or sensing capabilities that can be wirelessly transmitted thus allowing to implement functions not feasible otherwise. For example, progress in RADAR sensing has enabled the development of advanced driver assistance systems (ADAS) in the automotive industry, thus increasing safety and paving the way towards autonomous driving (AD). On the other side, new wireless communication protocols and miniaturized systems have allowed for numerous wireless sensor applications in industrial production, from quality control of thicknesses to embedded concrete maturity sensing.

Wireless technologies as a whole are technology-enablers for smart sensing; they offer sensing solutions for critical applications such as automotive safety as well as material testing in industrial production. These technologies will be key development factors in the Industry 4.0 and it is important for Europe to keep a leading position in this field. The industry is rapidly evolving and supporting European leadership in both RADAR and IoT fields is important.

Power consumption: towards sustainable technologies

The power consumption of wireless systems, the mobile ones and even more the infrastructural side (base-stations) is still relatively high, in spite of the improved intelligent power management architectures used today. Increasing data rates without a breakthrough in wireless technology will inevitably lead to a growth in energy consumption. Hence, it is of crucial importance to improve energy-efficiency of wireless systems in order to cope with the conflicting demands to increase connectivity and, at the same time, to reach a low-carbon economy and to meet the targets of the Climate Action and the new European Green Deal.

Low-power wireless digital front ends must be developed for object communication in order to ensure long battery life with high computing capability, being included in very small volumes. This is particularly true for the manufacturing industry and even more in healthcare. Moreover, already now most of the energy needed for the mobile communication is consumed by the base-stations. With the denser network required for next generation networks and IoT, this will further increase significantly. Therefore, improving energy efficiency of the wireless infrastructure is essential in order to keep the situation stable and the carbon footprint low enough.

WIRELESS TECHNOLOGIES ADDRESS KEY INTERNATIONAL SOCIETAL CHALLENGES

Wireless technologies address social priorities of H2020

Wireless technologies and especially their next generations as described previously are addressing all the social priorities of H2020 Research and Innovation framework program:

- Health / Demographic change/Wellbeing;
- Food security / Sustainable agriculture;
- Secure, clean and efficient energy;
- Smart, green transport;
- Climate, resource efficiency, raw materials;
- Social exclusion inequalities / Education;
- Secure societies protect freedom and security.

Challenges for wireless technologies within the H2020 European social priorities

Health Demographic change Wellbeing	Food security Sustainable agriculture	Secure, clean and efficient energy	Smart, green transport	Climate, resource efficiency, raw materials	Social exclusion inequalities Education	Secure societies protect freedom and security
Connected medical devices	Precision agriculture	Smart cities & building		Earth observation	Wireless Internet accessibility	Wireless Security observation
Remote surgery	E-agriculture	Industry 4.0		Weather, climate monitoring	AR/VR	Secure disaster infrastructure
Health trackers for wellness		Smart grid	Autonomous vehicle		Educational robots	
Ambient assisted living		Smart building	Mobility as a service		Autonomous vehicle	
		M2M communication (consumer)	Transport, delivery drones		Mobility as a service	

Addressing all those social challenges will require to target the wireless challenges described in part II of this whitepaper.

Wireless technologies are key enabling technologies for the mission-oriented Horizon Europe and for the United Nation sustainable development goals

The European ambition for the next European research and innovation programme has been stated both by the report *LAB-FAB-APP: investing in the European future we want* published by the independent high level group led by Pascal Lamy and by the report *Mission-Oriented Research & Innovation in the EU* published by Professor Mariana Mazzucato. The idea is to maximise the impact of EU research and innovation programs on the European growth by adopting a problem solving approach when deciding in which innovation to invest. And, to date, the problems to solve are globally identified as building sustainable cities and agriculture, leading digital transformation, allowing access to clean energy and preserve - or restore - oceans.

Advances in wireless technologies are not only key to reach a sustainable European growth, but they are also important to reach the sustainable development goals adopted in 2015 by the United Nation in its ***2030 Agenda***. Further development of wireless technologies will have a massive impact on population's ability to reach, in particular, the following goals:

Goal 3: good health and well-being: ensure healthy lives and promote well-being for all at all ages

Goal 4: quality education: ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;

Goal 7: affordable and clean energy: ensure access to affordable, reliable, sustainable and modern energy for all

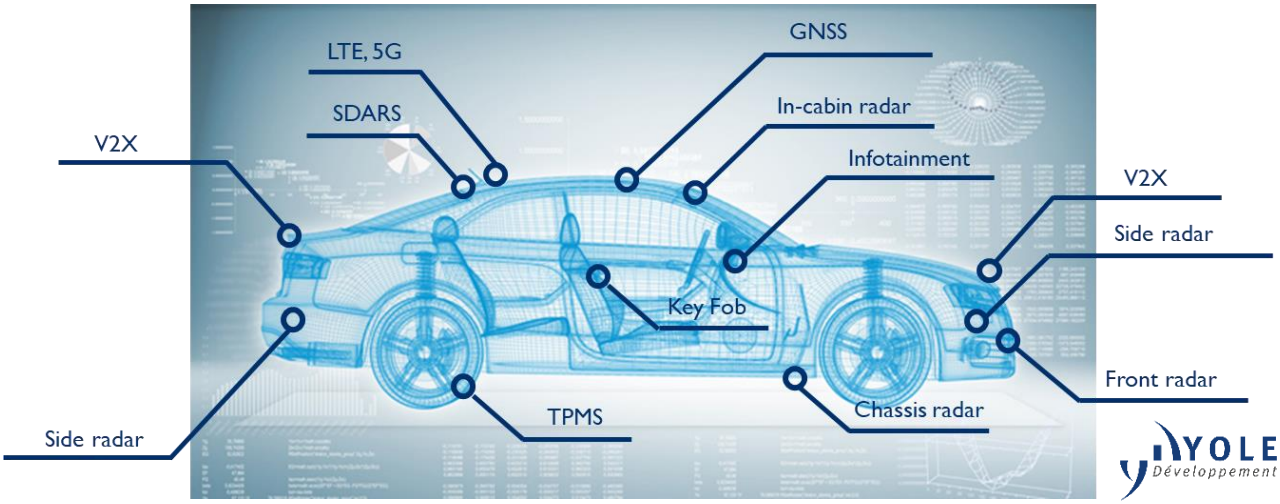
Goal 9: industry, innovation and infrastructure: build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

Goal 11: sustainable cities and communities: make cities and human settlements inclusive, safe, resilient, and sustainable

Goal 13: Climate action: take urgent action to combat climate change and its impacts by regulating emissions and promoting development in renewable energy.

SOME CASE STUDIES OF WIRELESS INNOVATION BUSINESS IMPACT

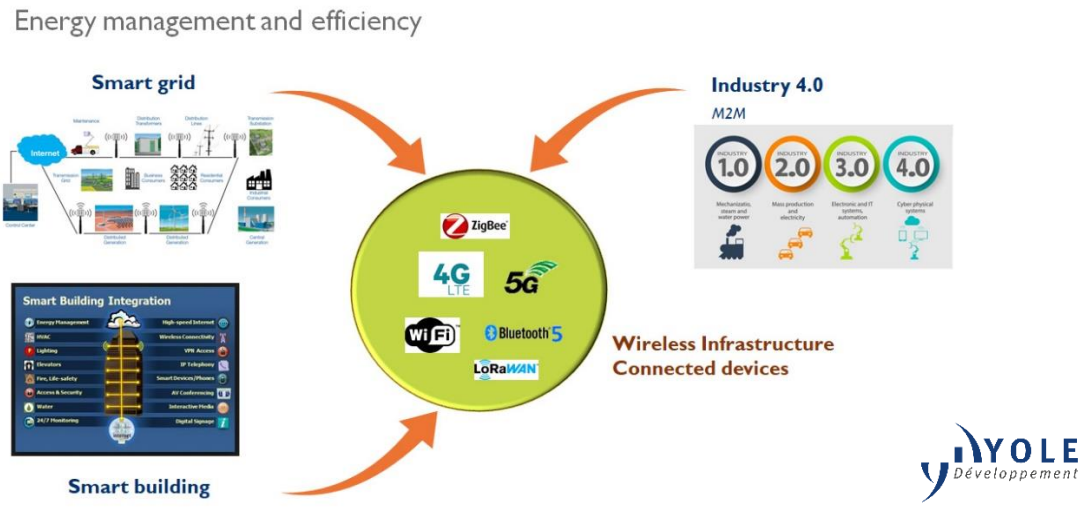
Wireless technologies in the automotive industry



Source : Yole Développement

Wireless technologies have been intensively penetrating the automotive industry, mainly for safety and driver experience oriented reasons, but also with regard to communications. RADAR form already today the backbone of sensing functions around the car and the development of more advanced generations of RADAR sensors is a key enabler for higher road safety and autonomous driving. Other wireless technologies are expected in the future for similar safety-oriented applications, like advanced 5G URLLC links (Ultra Reliable Low Latency Communication). Therefore, wireless technology content in the car is expected to grow significantly in the future. Europe is a leader in the wireless field for the automotive industry, with powerful OEMs providing unique solutions to Asian or American integrators, solutions manufactured in all of the European Union countries. This European leadership may be lost in the short term future without support by the European Union, along with the economic and industrial gains for all of Europe.

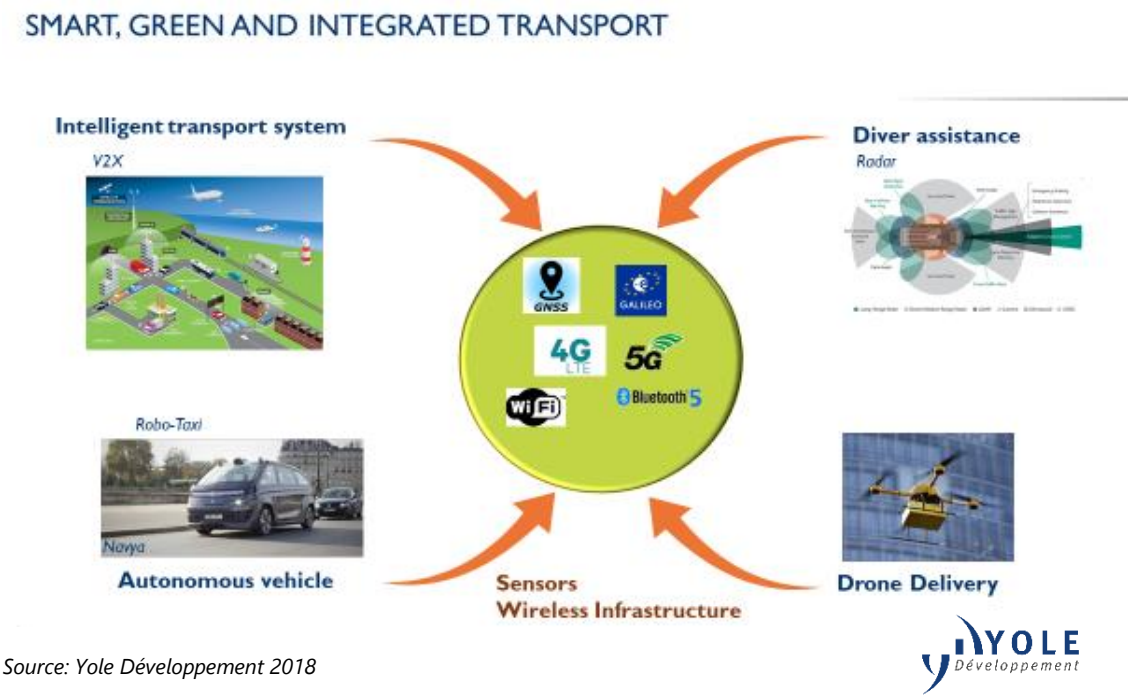
Wireless technologies in secure, clean and efficient energy



To enable the development of new energy distribution networks or the flow of data for the management of industry 4.0, wireless technologies have to provide the required agility to communicate between sensors and central networks. Wireless technologies have to provide

appropriate solutions not only at the factory or the production unit level but they also have to allow the traceability in the complete supply chain. In this sector also connected services and block chain methods are new trends but both require new wireless solutions to be really effective.

Wireless technologies in smart, clean and integrated transport



Source: Yole Développement 2018

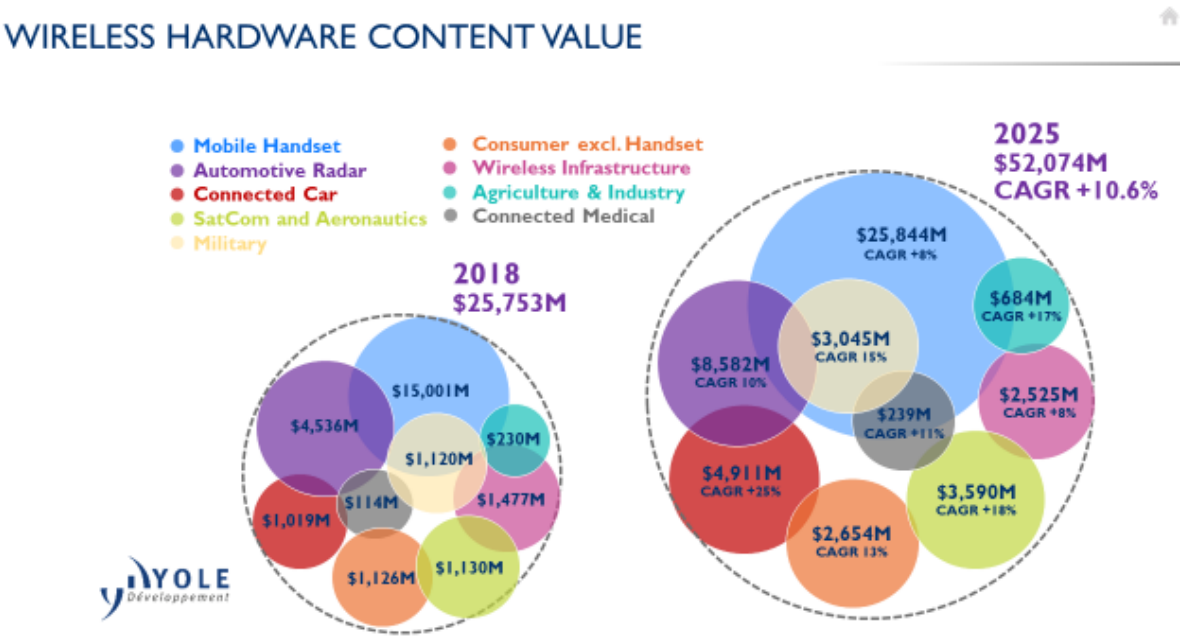
The development of e-Mobility solutions requires a high level of advanced sensing technologies (mostly RADAR-based) and precise geolocation systems in order to provide the necessary situation awareness and thus autonomy and safety. Moreover, high-speed transmission of data with mobile platforms and between vehicles will form a centrepiece for functions such as fleet management and car-to-car communication for improved road safety. All this relies on innovations in the wireless fields. It includes both terrestrial networks and satellite-based solutions, e.g. for geolocation or coverage of remote areas.

THE ECONOMIC IMPACT OF WIRELESS TECHNOLOGIES AND INNOVATION

Among those social priorities, according to Yole Développement estimates, 10 growing market segments will strongly benefit from the wireless industry in Europe:

- Mobile Handset
- Automotive Radar
- Connected Car
- SatCom and Aeronautics
- Military
- Consumer excl. Handset
- Wireless Infrastructure
- Agriculture & Industry
- Connected Medical

Wireless technologies market opportunities



Recent innovations in material and semiconductor technology allow for ambitious project research in wireless technology. This research requires new investments which will have a very positive impact on the European Industry. According to Yole Développement estimations, wireless semiconductor industry would represent €25.75 billion in 2018 at component level, these semiconductor components being essential for systems of much higher value.

However, as stated earlier on, all those growth expectations may not become true if wireless technologies failed to provide the required architecture and resources for those solutions to flourish.

The limiting factors have already been identified. To give only one example, we can note that the IoT revolution is slower than expected. Industrials are already facing difficulties to hire the right profiles. Our education systems are already unable to provide enough qualified engineers. This emphasizes, in this sector as in many others, the need for Europe to invest in education in general and especially in STEMS. For all this limiting factors to be tackled, EuMA wants to advocate for a strong European policy to foster wireless technologies and systems.

EuMA recommendations to embrace the new challenges of next generation wireless technologies

1. **Foster visibility of the positive impacts we can expect from the next generation of wireless technologies**
   Although wireless technologies are a fundamental pillar for the digitisation of our society, progresses in this matter are too often taken for granted or considered as a means and not taken as a strategic objective as such. EuMA considers this to be a major mistake. The presently available wireless solutions will neither allow the 4th Industrial Revolution to take place nor 5G to become reality. There are breakthrough innovations in wireless technologies required for the smart world to arise.

2. **Address the complete value chain of innovation in wireless technologies**
   It is of utmost importance to build a global strategy for the next generation wireless, from fundamental- to applied- and collaborative research together with industry. The means given to one must not be detrimental to the others. For an investment at one point of the value chain the others have to be fostered as well. To make this happen, there is a need for a European and coherent approach.

   As stated in the recommendation of the report *LAB-FAB-APP Investing in the European future we want*[9], it is of utmost importance "to build a true innovation policy that creates future markets" by fostering "ecosystems for researchers, innovators, industries and governments".

   - **Fostering the attractiveness of fundamental research**
     Fundamental research has to be encouraged to foster European Excellence. To maintain a high level of education and skills in wireless technologies, it is necessary to rebuild the attractiveness of the respective scientific fields by giving them visibility and perspectives.

   - **Increasing investment in intermediate Technology Readiness Level 3-6 innovations**
     The main problem wireless technologies are facing in European is a lack of investment in pre-production and access to market for technology readiness levels between 3 and 6. There is a need for more specific actions concerning pre-competitive innovation developments.

   - **Building a strong industrial leadership**
     The European framework programme for Europe's innovation-based competitiveness is crucial and relies on strong academic, SME and industrial collaborations. In order to face the global competition and to allow the Smart World revolution to come true, it is of utmost importance for the entire European wireless technology value chain to highlight the complementarity of its different actors' expertise and to make sure that large corporations can work with researchers, start-ups and SMEs to maximise the strength of the European ecosystem.

[9] EUROPEAN COMMISSION: LAB – FAB – APP — Investing in the European future we want

3. **Invest in the wireless ecosystem**
   Specific budgets are required to drive innovation in wireless technologies for the benefits of the entire value chain: researchers, start-ups, SMEs and large corporations. The Digitising European Industry initiative will invest € 1.7 billion in artificial intelligence, block chain and the digitisation of healthcare. Meanwhile, wireless technologies are not emphasized at all as they should in H2020 communications and programs and they are not visible enough through the diversity of investments programs developed under the H2020 framework. Progress in those technologies is not looked at as such, although there is an urgent need for innovation in this field.

4. **Educate & invest in people**

   EuMA fully supports the third recommendation made in the report *LAB-FAB-APP Investing in the European future we want* to "*Educate for the future and invest in people who will make the change*".

   Companies involved in wireless technologies are already facing serious difficulties to hire human resources with appropriate skills. It is very important that the European Commission and the Member States invest in education and science. The difficulty we face today will increase with the digitisation transformation in our economies and as long as the renewal of the generations will be going on. New generations of students and researchers have to be fostered and educated from school on by encouraging them to develop science, technology, engineering and mathematics (STEM profiles).

5. **Foster the engagement of wireless technologies in a circular economy**
   Not only do we need to reduce the power consumption of wireless networks and the respective functions, but we have to go further into the structure of the entire value chain to bring forward a more sustainable ecosystem.

Rue Louis de Geer 6

B-1348 Louvain-la-Neuve, Belgium

+32 10 39 00 69

headquarters@eumwa.org

http://www.eumwa.org/