EUROPEAN DIGITAL FORUM

Digital Minds for a New Europe

Leading thinkers look at the challenges ahead – and the solutions digital technology will provide

Foreword by Neelie Kroes

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Foreword: Digital minds for a new Europe

By Neelie Kroes and Sigrid Johannisse

First of all, I would like to express my intense gratitude to all the "digital minds" who have shared in such a generous way their inspiring visions to "boost a new digital Europe." It is impressive what has been accomplished within a short period of time. To me, the variety of articles – a product of crowdsourcing – show the recognition of Europe's potential, and even more so the ambition, dedication and commitment to making change possible. That is the one area everyone agrees on: Europe needs to change and is able to do it! The vision and energy is there. Now we have to make it happen.

It is essential to understand where we are coming from, to grasp the situation in which we find ourselves in today. Only about a century ago, the world was at the beginning of what we now see as "global connectivity." Through the adaptation of new technologies being converted into cars, film, telephone, photography, radio and airplanes, different ideas, cultures, landscapes, visions and knowledge were spread faster and with greater impact than ever before. Would the First World War have left such a lasting impression and scar on the history of civilisation without the media? Would Martin Luther King's "I have a dream" speech have had the same impact on society without radio, film and television? Would Malala Yousafzai have been able to really fight for education for girls if she hadn't been able to travel or use social media? Would we be able to take classes at Harvard while sitting behind a computer in Rome? Just consider the fact that algorithms in search engines display and combine endless sources of information to everyone.

Nowadays connectivity has become such an intrinsic part of our existence, through the World Wide Web and mobile communication, that we hardly realise that we already are moving into a third phase. With the Internet of Things, big data and cloud computing we are entering a whole interconnected, data-driven universe.

'We don't want to own knowledge and keep it to ourselves. We provide it to others and try to evolve and spiral upwards together.'

Why am I going back in time to introduce you to the near future? Because I have the idea that society and the economy at large need to catch up with technology in a completely different way than before. We are not only influenced by it, or simply benefit from the new opportunities it creates to broaden our scope and knowledge. More than ever, it is possible to use technology to influence the world by ourselves. That is why I am always emphasising the importance of coding being part of school curricula. Our virtual reality and physical reality are gradually converging, both locally and globally. We are not only just users and consumers, we are also becoming inventors, creators, artists and producers. We can share data, experiences, networks and ideas to co-create, to co-share, to co-invent, to co-produce. We crowdsource, crowdfund. We like to experiment because that is what makes us thrive. We develop the sharing economy on the basis of existing concepts, but from a totally different angle and we are open to change. We don't aim to buy, own or possess. We rent or lease services and share them to become more innovative and efficient. We don't want to own knowledge and keep it to ourselves. We provide it to others and try to evolve and spiral upwards together. We put trust in the digital economy and invest in it and in the necessary skills to exploit it to the fullest. We don't develop linear production lines. We develop circular ones, so we can reuse materials and rely much less on our scarce resources. These are the new societal and business models. This is the major step Europe at large still has to make, especially if we aim to play a leading role in the third phase of connectivity.

More than ever, new technologies are empowering citizens, society and businesses to explore and shape new ways of thinking and working together. To join forces. With increasing connectivity, we are coming full circle with the technologies available to us on an unprecedented scale, speed and impact. It provokes cross-sectorial and cross-border cooperation. It demands cross-disciplinary thinking and using both the left and right part of the brain. In many different ways, we can now truly connect with technology. That is, if we do it in the right manner and use new modes of thinking. Because at the same time these technologies, if we are not careful, can make the world feel more abstract, intangible and could eventually alienate people.

'Fast growing, innovative companies are key to Europe's future.'

We have to strike a new balance and evolve into a new mind set together. Technology should serve humanity, support human values and address societal – as well as economic – challenges around us. Only this way we can maintain the necessary trust in the digital opportunities. Trust should be a guiding principle. It will require an integrated way of approaching digital opportunities from all parties involved. Not by defending existing frameworks, but by creating new ones. Breaking through all layers in society or existing silos to co-operate in a complementary manner. I think by nature Europe is very well placed to do this. Over centuries, we have proven ourselves able to make new combinations and create synergies in daring and ground-breaking ways. From Isaac Newton to Marie Curie to Albert Einstein. The basic principles of the telecom sector with Antonio Meucci, Guglielmo Marconi and much later 3G were developed on this continent. Fantastic startups like Rovio or King were born here, not to mention Tuenti who left the United States and preferred the European culture and way of thinking. So why not do it now? We have to dare to explore new grounds, in our own manner, and take more risks. Appreciate failure as a normal and extremely valuable part of the road to success. Not only share best practices, but also bad practices to speed up the learning curve.

We don't have to look far to tap into a new mind set which breathes change. We can be inspired by the flexibility, openness and creativity which is radiated by Europe's startup culture. It is just amazing to see what is going on there – in London, Amsterdam, Berlin, Madrid, Athens, Warsaw, Lisbon and Stockholm, among others. New concepts, technologies and business models are bubbling up. The Internet is their home and their neighbours come from all over the world. They disrupt, because they are doing what comes naturally to them. We should learn from their experiences, views and level of ambition.

New seeds will not sprout, nor saplings will grow, if they have to fight for survival in the shades of old – but respected – trees and if they are surrounded by dense forests of regulation and hampered by persisting European fragmentation. Europe needs to make systemic changes, instead of incremental steps. Europe needs to make real and daring choices to speed up innovation and become globally competitive. Fast growing, innovative companies are key to Europe's future. For startups to grow they will need high speed broadband all over Europe – a connected continent for the telecom sector to sustain the digital single market; a supportive fiscal system; an Internet which is safe and secure; large enterprises to assist them on the road to growth; an open data and open government culture; higher investments in the development of skills. You can read it all in the Startup Manifesto which was produced by the Startup Leaders Club in 2013 and I am sure this will be high up on the agenda of the new European Commission.

Looking at recent developments around Uber, or Airbnb, the main question we should ask ourselves is, are we going to be excited by startups and make it work for them? Or will we exhaust them and eventually ourselves, by holding onto vested interests and protecting old-fashioned business models and legislation? We have to break through established, old-fashioned interests and frameworks that hamper innovation, and aim for smarter synergies if we want to spark a true digital Renaissance in Europe. We must dare to put our businesses and values in the new digital context of connectivity and foster a culture of sharing and collaborating. Build the infrastructure, break down barriers and let new models evolve, based on principles of trust, transparency of information, level playing field, cooperation and sharing, accountability and above all: risk-taking. Stand out! "Adapt or die."

Europe needs to connect, share and combine opportunities. Use smart city concepts and create living labs for startups with lighter-regulation zones. Pool expertise, talent and investments into startup hubs and let the new European creative class flourish. We should really dare to tap into the minds and talents of the young generation and give them the space to evolve into a digital, connected and globally competitive Europe. It is all possible. Think change! We should not only do it for the new generation – we should think new generation! Only then we can leap ahead.

'We have to break through established, old-fashioned interests and frameworks that hamper innovation, and aim for smarter synergies if we want to spark a true digital Renaissance in Europe.'

Boosting digital Europe: visions for the new digital era

By Irina Bokova

Irina Bokova is director-general of the United Nations Education, Scientific and Cultural Organisation (UNESCO), a specialised agency that promotes peace and security through international collaboration.

The Greek philosopher Heraclitus of Ephesus famously declared, "the only thing that is constant is change," and this is certainly true today. Unprecedented change is under way across the world and across the board, stemming from and magnified by new information and communication technologies. New words seem to enter our lexicon – cloud computing, big data – before, in the blink of an eye, fundamentally altering the way we live and work.

These changes unfold so quickly that we do not always have time to reflect on where we are heading. Too often, it feels as if we are being led by technology rather than the other way around. At UNESCO, we work to ensure this is not the case by supporting technological change as a force for equity and social justice. This starts with education.

When talking about technology and education, people often begin by asking what an existing tool, device, software or service can do to advance learning. The question is better framed in reverse – it is not what technology can do, so much as how education has to change to meet today's needs.

To move in the right direction, we must start from the right point. Education is a basic human right that is a force for human dignity and gender equality, as well as a driver for inclusive sustainable development – this is the essence of UNESCO's contribution to support states in shaping the new global sustainable development to follow 2015, with education at its heart. This requires new approaches to designing education systems, in ways that leverage digital technologies for the benefit of all. Far from resisting transformation, I am convinced that education must embrace change in order to shape it in positive directions.

> 'It is not what technology can do, so much as how education has to change to meet today's needs.'

Universal broadband is the megatrend for digital learning, but it is also a way to accompany the transformation of education. This is one of the goals guiding the *Broadband Commission for Digital Development*, set up by UNESCO and the International Telecommunication Union in 2010, chaired by President Kagame of Rwanda, and Carlos Slim, businessman and philanthropist.
As we move forward, we must ensure that all citizens, regardless of generation, gender and income, can benefit from ubiquitous and relevant learning opportunities. Change must bridge divides, not deepen them. Technology must empower all, not some.

In promoting accessible and universal broadband, we must not only connect all schools but also all homes with schools, to create a new learning environment that spans the school, the virtual and the real-life space. We must redesign schools to facilitate innovative digital learning, to encourage girls and disadvantaged students to use technology and to promote responsible and ethical uses of the Internet.

The fundamental point is that we must not just invest in technology but rather in an ecosystem. Supporting infrastructure must be accompanied by support to applications and services, with investment in relevant content, in local languages, drawing also on indigenous and traditional knowledge. New digital competencies are essential for learners to make the most of new technologies as fully engaged citizens.

Mobile devices open vast horizons for digital learning – anytime and anywhere. This requires new approaches for teachers to become facilitators of more collaborative and project-based learning, to create new and wider communities of learners, and to make learning more relevant to personal needs and to the labour market. New technologies cannot be simply bolted onto existing systems – they must be integrated as part of a comprehensive approach that includes guidelines for teachers to develop digital skills and competences.

To these ends, the *UNESCO Policy Guidelines for Mobile Learning* recommend that all governments sharpen their policies for teacher training, develop strategies to provide equal access for all and promote gender equality. UNESCO's annual *Mobile Learning Week* has become the moment on the global calendar to explore these issues and shape new policies in response.

Open educational resources are also transforming learning. These resources consist of teaching, learning or research materials, tools and practices that are in the public domain, or released with an intellectual property license, such as Creative Commons, that allows for free use, adaptation and distribution. They can be accessed at no cost and often adopt open licenses that allow users to access, edit and redistribute learning materials. UNESCO has pioneered the development of these resources – embodied most recently in the 2012 *Paris Declaration on Open Educational Resources* – to share knowledge and information for the benefit of all. Just recently, UNESCO launched the UNESCO Chair on Open Technologies for Open Educational Resources and Open Learning at the Jožef Stefan Institute, Ljubljana, to catalyse research networking and cooperation in this key area.

Today's knowledge societies require talented, skilled and competitive workforces. This calls for robust but also flexible education systems, including higher education, capable of adjusting to meet new expectations and to promote learning that is relevant, accessible and innovative. The world is changing – education must change, too. At the same time, in the midst of change, our compass direction must remain firm – to empower all women and men, to build more resilient societies, and to craft more inclusive and sustainable pathways to development.

'Our compass direction must remain firm – to empower all women and men, to build more resilient societies.'

e-Government: a mentality shift and change of culture

By Michał Boni

Michał Boni is a member of the European Parliament and former Polish minister of administration and digitisation.

The digital impact on every aspect of our life is crucial for future multidimensional development. One of the most important factors for a better future for our societies is an effective state. The efficiency of administrations is also crucial for better regulation and full transparency of the state. Transparency supports honesty of public policies. The use of digital tools opens up opportunities for e-government and modern e-governance as they are much more adjusted to the citizens and business needs.

It requires a mentality shift and creation of new cultural patterns. They encompass new orientation in delivering public services – based on simplification of the procedures, the use of integrated registers, electronic identifications and signatures, which might speed up services and make them much more user-friendly. Orientation towards citizens is an essential objective of responsible public services provided by administrations. And, obviously it can improve the trust between authorities and citizens. Trust is a key factor for building and developing social capital, which is fundamental – together with knowledge capital – for innovative leverages of growth.

From a technical point of view this shift needs better interoperability. The bureaucratic institutions very often maintain fragmentation of the administration and differentiate their various responsibilities, creating a risk of "silos." It is not easy to break them up and start delivering public services with the use of much more integrated forms. Many institutions want to keep full ownership of their activities and are not open to cooperation and exchange of information. Changing that requires not only a new mentality and a fresh point of view, but most of all new technological tools. This means, of course, interoperability in all hardware and software. Such solutions should be secured not only through security certifications but also via the implementation of the new models – security by design.

From the civic side, a mentality shift and new culture of delivering administrative, and broadly speaking all kinds of public services, needs serious data and privacy protection. In Europe, we should approve and implement fast-harmonised legislation on personal data protection. However, not only is the new law necessary to ensure much more secure data protection. We need, at the same time, to create balanced models of business responsibility for privacy protection, based on the principle of risk-based approach. We should begin public actions and raise awareness of the problem of privacy protection in the network among various groups of users.

E-government and all e-public services, especially digital education and digital healthcare services, make a big difference in our quality of life. The reason is – new opportunities stemming from possible personalisation of services, which is much better addressed towards individuals. Moreover, digitisation of public services has a positive impact on the cost effectiveness of the functioning of the systems.

We must develop this notion and the real functioning of e-government for better social feeling and dissemination of an "open-mind" attitude. This will lead us to open governments. Open governments are crucial for participatory democracy development on the one hand, and for digital share economy growth on the other. In the digital age we need full access to all public information and data sources, also for open, non-paying re-use. It is important for new forms of business services in many areas and for big data sector development.

What's more, it is the background for refreshing the democracy. Internet channels give us the opportunity to look at decision-making processes and allow us to build participatory democracies, as I mentioned earlier. We can take crowdsourcing and e-consultations forms as a method for solving many problems by proper use of citizens' knowledge. This is the added value for its development.

'We have to ensure the full accessibility of the Internet with high quality parameters.'

Having said that, we should remember two things. Firstly, if we want to build the new model of governance through e-government, we have to ensure the full accessibility of the Internet with high quality parameters. One hundred megabytes per second is necessary to make all kinds of services easy to obtain: administrative with full interactions, educational with opening huge resources, and for free processing the data, which we want to process and use. And secondly, from a societal point of view, everybody should be equipped with digital skills, if we want to avoid digital exclusion, especially among the older generation, which lacks practical skills and understanding of the digital world. We really cannot afford to have second-class citizens! That is why, on the other side of e-government programmes, we need investment efforts and "4G or even 5G Europe," as we need to level the educational playing fields.

It is clear – in the digital world we have a new mentality. And we should be able use this new mentality and the new skills of people to change the culture of functioning of the administration and the state.

If in the economy we talk about the sharing economy, I hope that soon the time for sharing governments will come.

Making European cities smarter

By Roland Busch

Roland Busch is global CEO of Siemens Infrastructure and Cities, a Siemens division that aims to improve life in cities through sustainable technologies.

Cities are currently experiencing a transition driven by technological advances, which will bring the citizen closer to the city. Digitalisation is changing the way people live their lives, giving them a voice and an opportunity to participate in the delivery of public services. Citizens are no longer just consumers of energy, transport and other city services, they are also at the heart of the production process. From passing on vital live information whenever traffic, water and electricity networks are congested, to feeding in electricity to the network from their very own homes, citizens are increasingly at the heart of delivering or improving the very same services they are consuming.

As a major technology company, we see that every single piece of technology that we produce can increase efficiency and offer better value to the city by tapping into this "citizen gap." Across Europe, cities are engaged with the private sector in demonstration projects illustrating the innovations in digital technology, making Europe the best place to develop a "public Internet of Things," where large pieces of public infrastructure communicate with one another and citizens to provide savings for businesses and households.

Urban development

'Citizens are increasingly at the heart of delivering or improving the very same services they are consuming.'

Many cities are experiencing unprecedented rates of urbanisation and population growth, while others are experiencing a shrinking population. Many of the challenges, however, are omnipresent: people are living longer, leading to increased demands on healthcare; the climate is changing, resulting in extreme and often catastrophic weather events; and globalisation is resulting in constantly changing cities, which are evolving faster than at any point in their history. Between now and 2030, an estimated minimum of $50 trillion [€39.7 trillion] in infrastructure investment will be required to fuel global development. The scale of the challenge calls for a new, more intelligent approach to infrastructure: Infrastructure 3.0.

Faced with a wealth of challenges, which are often elusive, cities are expected to manage and control the change to allow their communities to have a standard of living that meets modern-day expectations. Regardless of how a city is affected by these changes, one thing remains constant – the need to provide critical urban infrastructure and deliver municipal services as efficiently and cost effectively as possible. Mature cities are experiencing the need to upgrade their failing and ageing infrastructure, and developing cities are now seeking to establish new infrastructure and city systems that will enable transition and position them as global leaders and next-generation city metropolises.

Cities today are motivated by their need to drive economic growth, increased investment and job creation, allowing for better standards of living, and the financial capability to manage the city infrastructure that serves the wider urban environment. In response to this, city competitiveness is a subtlety that is emerging across the world – how to attract financial investment and human capital, and how to deliver services more efficiently. To do this, cities need to understand the fundamental concept of sustainable development to give investors the confidence that the emerging challenges are understood and can be managed. Digitalisation is the key to unlocking these challenges, coupled with electrification, which enables city-wide management, and automation, which allows for infrastructure optimisation.

Cites do now need to operate in a global connected marketplace, competing with and depending on other cities, and optimising their greatest assets to best advantage while evolving to meet the needs of the digital generation.

Urban challenges

Delivering effective, intelligent urban infrastructure is essential to provide the city backbone, from which economic success and prosperity can grow:

- A faster and more efficient transport and mobility infrastructure with sufficient capacity to cater to growing and changing populations
- Robust and reliable energy infrastructure that provides power to meet the most critical needs
- Efficient buildings that help people manage their energy, allowing for demand response
- A safe and secure environment in which people can live and work with confidence

Dealing with these new challenges is becoming ever more complex – staying ahead of emerging trends and delivering a holistic approach to urban management is the new urban dynamic. Cities need to show strong leadership in developing and selling their city vision, and ultimately cities need to create a quality-of-life proposition that exceeds that of their closest competitors and provides a tantalising offer that investors and prospective residents can't fail to ignore. At a time when public budgets are diminishing, intelligent infrastructure solutions will provide cities with an investor-ready proposition, reducing costs of operation and improving efficiencies, and leading to long-term financial savings for the city and the citizen.

'Integrated multimodal mobility systems bring huge benefits to the city through the creation of an integrated mobility platform.'

Current projects

For instance, transport is one of the major factors of a city's competitiveness but, due to financial constraints, cities are often unable to invest in their transport networks. A recent study by Credo illustrates the economic benefits to cities that investments in transport would bring, such as higher productivity and new economic activity. It states that in many European cities, greater benefits would arise through investment in quality: "Technology can maximise the potential of existing systems. This might include modern communications-based train control (CBTC) signalling to increase reliability and train frequency, or integrating technology such as shared payment systems to encourage customers to use multiple modes and so ease the burden on high congestion routes. Technology can also improve the customer experience, e.g. introducing WiFi, helping to drive increased public transport usage." In London, with the additional 10% capacity on the public transport system being delivered by Crossrail in 2018, the long-term direct economic benefits ratio is slated to be up to 7:1.

Paris' large-scale investment in 200 kilometres of new metro line will help to drive down its economic cost of transport by roughly one percentage point of gross domestic product per capita and generate annual economic benefits, including wider economic impacts of $2.7 billion [€2.14 billion]. With this level of potential economic benefit, it would take roughly 13 years to pay back the estimated investment cost of $36 billion [€28.6 billion] and in addition generate an economic added value of $46 billion [€36.5 billion] over the estimated 30-year life of the project. And yet, even for those cities with strong future plans, there are still further opportunities to gain economic benefits from investments in transport improvements. Paris is also upgrading its metro

by introducing a driverless system, which will carry an additional 70,000 passengers at peak time on the city's oldest and busiest line, removing hundreds of cars from the city's roads.

The market is huge, domestically and globally; the potential economic opportunity from investing in transport in cities globally could be as much as $800 billion [€635 billion], or around 1% of global GDP.

Integrated multimodal mobility systems also bring huge benefits to the city through the creation of an integrated mobility platform, providing people with real-time information on the fastest journey routes, and the ability to integrate ticketing and payment solutions. Such incentivisation increases the use of public transport systems, with greater revenues for the operators and greater control for cities of their transport networks. The wider impacts also bring economic benefits as a result of reduced pollution, leading to reduced costs of healthcare. Berlin's Traffic Information Centre already integrates all transport modes and operators, resulting in an optimised transport network that is reaping huge benefits across the city.

Reductions in city air pollution can also be achieved through intelligent infrastructure interventions, such as low-emission zones. In London, the low-emission zone reduced airborne particulate matter of less than 10 micrometres (PM10) by nearly 25% after three years' implementation. The London congestion-charging scheme further reduced PM10 by nearly 5%, reduced traffic by 20% and commuter times by 17%, and also resulted in an annual reduction in carbon emissions of 150,000 tonnes. These are the multiple benefits of intelligent infrastructure, illustrating their importance to our modern-day cities.

In cities today, up to 30% of traffic can be looking for a parking space. Advanced parking management infrastructure with a sensor-based system can collect real-time information on parking vacancies and send this directly to drivers through their mobile devices. This reduces road traffic, congestion and air pollution. Glasgow is testing this solution with an integrated payment system, which also allows it to monitor the wider city capacity. Whether linked to existing traffic management solutions or a multimodal transport platform, or as a stand-alone system, the integrated parking solution will be a valuable contribution to effective city management, and with its multifunctional overhead sensors is a cornerstone of the future digital city.

'Reductions in city air pollution can also be achieved through intelligent infrastructure interventions.'

As energy supplies come under increasing pressure, decentralised energy management systems integrated into the local infrastructure and smart grid will help cities take control of local energy supply. Buildings can be fitted with smart-building solutions, such as smart meters to measure energy consumption, and monitor thermostats to easily adjust ventilation and indoor temperature. Lights and other sensors can also be controlled through one main, integrated building-management system. Taipei 101, the world's tallest certified green building, uses automated controls throughout, which has resulted in a reduction of energy consumption by approximately 30%.

The smart infrastructure described above is being incorporated into a city district in Malmö, allowing for communication between building technologies and the energy grid, which is leading to reduced losses and higher energy efficiency, and helping the city meet its carbon-reduction targets. The system gives residents greater control of their energy use, enabling them to monitor consumption and make the necessary changes to reduce their energy costs.

Infrastructure 3.0

But the future integration of infrastructure is brought to us through digitalisation. Infrastructure 3.0 connects the different infrastructures in a city through a digital platform or "urban operating system" that provides information in real time, allowing cities to predict outcomes and take pre-emptive actions to see the bigger picture and manage systems as a whole.

The examples contained in this essay illustrate some of the benefits to be reaped by a city across its critical infrastructure, but these examples also illustrate the cumulative benefits that can be achieved through digitalisation. When these infrastructures are optimised through a city-wide network, the city will be enabled to take far greater control of its assets.

By embracing advances in infrastructure technology through digital systems, cities will realise efficiencies that hitherto have been beyond imagination.

The digitalised world will continue to evolve and develop through time, and European cities have a role to play as clusters of innovation by demonstrating the potential within this sector. In doing so, they will continue to build their own competence to capture the lion's share of this global market.

The rapid pace of global change requires everyone to operate differently, tread unknown territory and do things that sometimes feel disruptive. Without this ability to adapt, cities will continue to struggle with the increasing challenges, and those that do not act may be left behind.

Digital challenges and policymaking

By Pilar del Castillo Vera

Pilar del Castillo Vera is a member of the European Parliament and chair of the European Internet Foundation.

The potential that the digital revolution has to offer in terms of growth, employment and competitiveness has no precedent. The figures are indeed impressive. Half of all productivity growth derives from investment in information and communication technology (ICT). Internet traffic is doubling every two to three years and mobile Internet traffic every year. By 2015, there will be 25 billion wirelessly connected devices globally – doubling to 50 billion in 2020. Mobile data traffic is expected to increase 12-fold between 2012 and 2018, and data traffic on smartphones to increase 14 times by 2018. There are more than four million ICT workers across many sectors in Europe and their number is growing by 3% annually despite the crisis.

On the other hand the digital economy evolves extremely fast and innovation is its true nature. It is astonishing to look back only 15 years and see where we are today. Currently, every day more than 144.8 billion emails are sent, more than 2.9 billion Google queries take place, more than 500 million photos are uploaded and we see over 340 million tweets. Every single minute, the world generates 1.7 million billion bytes of data, equal to 360,000 DVDs, this works out at over six megabytes of data for each person every day.

But this is just the tip of the iceberg; the digital economy continuously offers new developments or technologies with the potential to disrupt entire business models. It is estimated that the total potential economic impact of cloud technology could be $1.7 trillion [€1.35 trillion] to $6.2 trillion [€4.9 trillion] in 2025, with $1.2 trillion [€952 billion] to $5.5 trillion [€4.3 trillion] in the form of surplus from the use of cloud-enabled Internet services and $500 billion [€397 billion] to $700 billion [€555 billion] from productivity improvements for enterprise ICT. Regarding the Internet of Things, more than nine billion devices are currently connected to the Internet, and this number is expected to increase dramatically within the next decade to an estimated 50 billion to one trillion devices. If we talk about 3D printing, it could generate economic impact of $230 billion [€182 billion] to $550 billion [€436 billion] per year by 2025. All of this without mentioning the potential of technological developments such as artificial intelligence, or advanced robotics in healthcare, manufacturing, and services that could result in significant impact, from saving and extending lives, to transforming both product creation and service delivery.

‘The digital economy evolves extremely fast and innovation is its true nature.’

The constantly dynamic nature of the digital environment is its true essence, and consequently policymakers must be extremely cautious when establishing any kind of regulation, in not hindering its perpetual potential for contributing to the growth and competitiveness of our economies, in other words to our wellbeing. Regulating any aspects of the digital environment requires us, policymakers, to be extremely sensible when fine-tuning the digital regulatory framework. The “New World” that represents the digital environment has in reality a very delicate and fragile ecosystem almost entirely based in its innovative capacity, and consequently its innovative nature needs to be preserved.

With these premises in mind, we could picture the digital world as a puzzle, where every piece represents an area (be it e-commerce, research, or smart cities among many) or new development (such as big data, cloud computing, the Internet of Things or 3D printing), and that consequently attention must be focused on every individual piece, but without losing sight of the final picture.

In other words, each piece cannot be seen in isolation, and consequently, as an example, policy regarding big data would not be efficient if we were to disconnect it from research or cloud computing.

It must be added that it is a very special puzzle. Each individual piece may vary in size depending on how much of its potential we manage to exploit. Otherwise stated, the final outcome of the puzzle in its integrity will vary in size and beauty for it depends on the aggregation of all the pieces.

In addition, this very peculiar puzzle has the specificity that it has to be put together in a frame which is constituted by factors such as the level of broadband deployment or the legal framework, meaning among other things regulation in ICT-related areas. In conclusion, we need the proper frame in order for the pieces of the puzzle to fit.

'A regulatory framework that is ill-adapted to new technologies and innovations would constitute a huge barrier to reaping the benefits of the digital economy.'

Lastly, to add more complexity to the situation, the puzzle is a lively one. It is continuously evolving and new pieces do not cease to appear (new technological developments, new business models, etc.). At the end of the day this means that the shape, size and frame of the puzzle are not carved in stone. Policymakers must always be aware that a regulatory framework ill-adapted to new technologies and innovations would constitute a huge barrier to reaping the benefits of the digital economy.

Inclusiveness, the art of dialogue, and the search for truth in the digital era

By Archbishop Claudio Maria Celli

Archbishop Claudio Maria Celli is president of the Pontifical Council for Social Communications.

When we think about the changes in communication, what some commentators call the "digital revolution," it is natural to focus on technological developments. We are fascinated by the speed with which communication devices are becoming more powerful, smaller, more connected and accessible. While this focus is understandable, the truth is that the most profound change is not technological but cultural: the real challenge is to appreciate how much is changing in the ways that people, especially young people, are gathering information, being educated, expressing themselves, forming relationships and communities. In this reflection, I would like to invite people to think about how we can ensure that the new emerging culture of communications can be a power for good in our world.

I believe we should begin by recognising and celebrating the potential of these technologies to facilitate human communication, to allow for the sharing of words and images almost simultaneously across enormous distances and with people who might previously have been isolated. This in turn allows people to use the technologies to promote greater understanding and harmony among people, *creating a sense of the unity of the human family which can in turn inspire solidarity and serious efforts to ensure a more dignified life for all (Pope Francis, 2014)*. In 2009, Pope Emeritus Benedict XVI described these technologies as being "truly a gift to humanity" and earlier this year, Pope Francis said that the potential of the Internet to foster a culture of sharing and encounter allows us to conclude that it *is something truly good, a gift from God*.

The technologies, however, will not automatically lead to a change for the better: there is a need for a determined commitment from individuals and institutions if this is to happen. *It is not enough to be passersby on the digital highways, simply "connected;" connections need to grow into true encounters. We cannot live apart, closed in on ourselves. We need to love and to be loved. We need tenderness. Media strategies do not ensure beauty, goodness and truth in communication. The world of media also has to be concerned with humanity, it too is called to show tenderness. The digital world can be an environment rich in humanity; a network not of wires but of people (Pope Francis, 2014).*

> **'It is not enough to be passersby on the digital highways. Connections need to grow into true encounters'**
>
> Pope Francis, 2014

Commentators frequently speak of "user-generated content" with reference to the social networks, but we must remember also that the very culture of the social networks is user generated. If the networks are to be spaces where good positive communications can help to promote individual and social well-being, then the users – the people who make up the networks – need to be attentive to the type of content they are creating, promoting and sharing. All of us are aware of cases where social media have been abused, where people have been attacked, ridiculed and had their privacy violated. There is a role for governments and international organisations to play in regulating this environment but there is an equally important moral or ethical obligation on all of us as individual agents to ensure that these environments are safe and humanly enriching. *All users will avoid the sharing of words and images that are degrading of human beings, that promote hatred and intolerance, that debase the goodness and intimacy of human sexuality or that exploit the weak and vulnerable (Pope Benedict XVI, 2009).*

Communication will only be fruitful when we avoid aggressive forms of expression. People will only express themselves fully when they are confident that their views are welcomed and not merely tolerated. As a community, we can only grow in knowledge and insight if our contributions are offered with honesty and authenticity. A sense of personal responsibility is especially required of those who engage anonymously in discussions and debates. Although social media often offer greater visibility to those who are most provocative or strident in their style of presentation, true understanding is best nourished by reasoned debate, logical argumentation and gentle persuasion. The more we grow in appreciation of that mutual understanding and solidarity that is achieved in authentic communication, the more we will desire that it is truly inclusive and that our conversations are accessible to all. This inclusiveness requires that we are attentive to ensure that the developing nations are not excluded from those digital networks which are promoting development and educational opportunity; in the developed world, we must also be careful that the increased digitalisation of governmental services does not serve to deny access to the elderly, the poor and the marginalised.

If digital networks are to achieve their potential in promoting human solidarity, then we must recover the art of dialogue. When we listen to the "other" and allow his or her voice to breach our defensiveness, we open ourselves to growth in understanding. If we are willing to listen to others, we will learn to see our world with different eyes and we will grow in appreciation of the richness of the human experience as revealed in other cultures and traditions. The more we grow in knowledge of another, the more we grow also in self-knowledge. Our engagement with others will alert us to those basic desires to love and be loved, for protection and security, for meaning and purpose that are shared by all humans. Attentiveness to our human condition, and to the one world which we all share, alert us to the truth that ultimately these desires can only be satisfied if we construct a society that is committed to a shared concern for the well-being of all rather than to an ethos of unbridled competition where the happiness of some can only be achieved at the expense of others.

'The more we grow in knowledge of another, the more we grow also in self-knowledge.'

Many of the greatest threats to our future from climate change to food insecurity, and from war to criminality, can only be addressed by dialogue and agreed forms of action. It is self-evident that at the heart of any serious reflection on the nature and purpose of human communications, there must be an engagement with questions of truth. A communicator can attempt to inform, educate, entertain, convince and comfort; but the final worth of any communication lies in its truthfulness. Dialogue is at its most fruitful where it is rooted in a commitment to search together for truth. If there is no such thing as truth, as right or wrong answers, then dialogue becomes meaningless. It is a shared commitment to searching for truth which gives human dialogue and debate their ultimate value; otherwise, they become exercises in coercion and manipulation in which each seeks to assert his or her own view without any reference to the claims of truth.

I would like to conclude this reflection with some words more explicitly related to my Christian faith. I hope that they will inspire those who share this faith, but I also hope that they may be of inspiration to those with a different belief, as well as to those who do not feel part of a religion at all.

I am convinced that believers must be present in the social networks and that we should work with all people of good will to construct a forum which will promote goodness and cooperation. Believers, I would argue, have a particular obligation to seek to contribute to the construction of a culture of encounter. It is at the core of God's self-communication that we are made in his likeness

and image. We believe that all human beings, whether they realise it or not, are created as sons and daughters of the one God and that a yearning for connection, friendship and community is imprinted in our hearts. Human society and solidarity are not the products of blind evolutionary forces, nor do they represent some form of historical construct to facilitate minimal human cohabitation. Rather, they are part of our destiny and are necessary for individual well-being and for the flourishing of the human race.

At the heart of our faith is the conviction that we are loved by God, and we are blessed with the joy and hope that comes with this realisation. When we recognise God as the one who has reached out to us, who loves us in our brokenness and who wishes to embrace all people, we discover our mission to be servants of communion and the culture of encounter. Our faith cannot be a refuge, a place of comfort, which somehow exempts us from the struggles of those who share our world and our journey. We are called to engage with great tenderness all those we meet along the way. We must learn to be attentive to their suffering and pain, and to listen to what they have to say about their hopes and concerns, their fears and aspirations. *The revolution taking place in communications media and in information technologies represents a great and thrilling challenge; may we respond to that challenge with fresh energy and imagination as we seek to share with others the beauty of God (Pope Francis, 2014).*

Internet governance is our shared responsibility

By Vint Cerf

Vint Cerf is vice president and chief Internet evangelist at Google. In the 1980s, he played a key role in the development of TCP/IP technology and the original architecture of the Internet.

2014 marks 40 years since Bob Kahn and I published the design of TCP in the IEEE Transactions on Communications. TCP eventually was split into TCP/IP. Those two complementary protocols define how computers and computer networks communicate with one another in the Internet, and they therefore remain at the core of the Internet's architecture today.

Both TCP/IP and the ARPANET – the Internet's immediate predecessor – owe their origins to research carried out for the US Department of Defense, but European contributions should not be overlooked. There were the contributions of Alan Turing and other Britons to the creation of the first electronic computers and to the foundations of computer science. Early research in the use of packet switching for computer communication was pursued in the US by Larry Roberts, then at Lincoln Laboratory and Leonard Kleinrock at Massachusetts Institute of Technology, by Paul Baran at RAND, by Donald W. Davies and this team at the UK National Physical Laboratory, by Louis Pouzin and his colleagues at IRIA [now INRIA] in France and by Peter Kirstein and his team at University College London.

We should also recognise the work of Paul Otlet and Henri La Fontaine, two Belgians whose Mundaneum may well have been the most ambitious attempt to catalogue the world's knowledge between the ancient library at Alexandria and the explosion of information assembled on the Internet when it gained significant usage. Of course, the World Wide Web, one of the most popular aspects of the Internet, was itself a European creation, having been developed by Tim Berners-Lee while he was at the European Organisation for Nuclear Research (CERN). Europe continues to have a fundamental share in both the future of the network and in securing the benefits it offers for itself and its citizens.

> 'The World Wide Web, one of the most popular aspects of the Internet, was itself a European creation.'

When we began developing what would become the Internet, we strongly felt that its adoption and use depended on making its design freely and openly available to any interested party. Over four decades, by working together with a variety of stakeholders, an informal coalition has built and maintained the governance systems and standards that support a free and open Internet. We are approaching an unprecedented moment in human history: an era in which all the knowledge we possess as a society and as a species could become accessible to everyone. Already, some three billion people are online, and I hope that in the decades to come we will see advances in access that will allow the whole of humanity to tap into, and contribute to, the content accessible through the Internet and the World Wide Web.

But we must not take these advances for granted. If our global society is to fully enjoy the opportunities offered by the Internet, we must continue to work towards two interconnected goals. On the one hand, we must keep the Internet free and open. On the other, we must ensure that it offers the security protections essential to maintaining the trust people place in the network and its applications.

Keeping the Internet free and open requires that we build and maintain a credible and robust multistakeholder model for the Internet's global governance. The openness of the Internet has been the key to its growth and value. "Permissionless innovation" is the mainspring of the Internet's economic power. By giving anyone connected the ability to communicate with anyone

else on the network, the Internet has decreased barriers to entry and democratised access to opportunities once reserved for a privileged few – opportunities to speak and be heard, but also opportunities to turn a good idea into a business, to compete for customers, or to help build a better tomorrow.

As Internet policy discussions become more global in nature, stakeholders should continue to rely on the evolving structures that have allowed us to develop global policies that benefit all users. New institutions have been created as the need has arisen, demonstrating the adaptive power of the existing distributed and multistakeholder governance system. Intergovernmental treaties may be needed when state cooperation is required to improve the safety and security of the Internet, but we need to guard against the imposition of inflexible and brittle rules on a dynamic technological and social environment. The Internet governance model was designed to allow all stakeholders to participate on an equal footing, but the current model needs to be improved if it is to ensure that all stakeholders, particularly those from developing economies, are able to meaningfully participate in the governance process. It is incumbent on participants within the current governance model to bring in new stakeholders whose voices may not be effectively heard in the current conversation.

'We need to guard against the imposition of inflexible and brittle rules on a dynamic technological and social environment.'

We need a general framework for a global, multistakeholder Internet governance that preserves the free and open Internet and provides transnational protections for the rights of its users. The framework has to enable the evolution of the Internet and be able to adapt to it. We need therefore an adaptive or layered approach to Internet governance:

- The first level is enhanced communication, which proposes that "all stakeholders have the possibility to make their arguments to all other stakeholders."
- The second level, enhanced coordination, would involve partners engaging more closely, "stakeholders seek to divide challenges into 'thematic work packages' which are assigned to the appropriate institution."
- The third level of cooperation, enhanced collaboration, would involve a set of stakeholders developing a joint solution and new practices (and possibly a new institution) supported by the cooperative group in question.

Among the mechanisms that should be reinforced and supported, I would single out the Internet Governance Forum, which has illuminated our understanding of the opportunities and challenges arising from the global growth of the Internet. It needs financial support and a properly staffed secretariat, and it deserves a permanent mandate from the United Nations. The digital future will be built, in part, on mobile technology, rapidly dropping costs of Internet-connected equipment and boundless development of new applications. The global Internet Governance Forum and its regional and national counterparts can, with an appropriate mandate, become an ever more helpful mechanism for highlighting issues, tracking their resolution in appropriate forums and driving forward new governance approaches when necessary.

Preserving effective multistakeholder governance also requires that all Internet institutions embrace transparency, so that stakeholders can understand both the substance of decisions and the process by which they were made. Failing to do so effectively prevents new constituencies from participating in the decision-making process in a meaningful way. For example, when the US

government ends its contractual relationship with the Internet Corporation for Assigned Names and Numbers (ICANN), assuring the organisation's adherence to principles that have made Internet infrastructure robust, global, and beneficial can be accomplished most directly by reinforcing and improving its existing accountability and transparency mechanisms.

'Governments and companies need to work together to ensure and harmonise the rule of law online to make the Internet safer and more secure.'

In addition to keeping the Internet free and open, though, we need to preserve trust in the network if it is to continue to drive the digital economy. Cybercrime and other safety hazards are serious threats to both individual and national security, as well as the open Internet and the free flow of information online. As more people get access to the Internet, criminal activity will inevitably increase on the network. Governments and companies need to work together to ensure and harmonise the rule of law online to make the Internet safer and more secure.

To combat cybercrime, we need existing laws to be effectively enforced and new rules to carefully define and police crimes that only exist online and crimes that have counterparts in the offline world. Laws should be technology neutral so that crimes, definitions and penalties are not fragmented as technology evolves over time. For example, fraud online should not be prosecuted any differently than fraud by mail catalogue, telephone, SMS or other channels. That said, new technologies may create new categories of crimes, like computer intrusion. In those cases, it is important to take into account the nature of the action (for example, whether engineers are hacking with the intention to steal information or to discover and patch vulnerabilities) and the proportionality of any proposed penalties.

Since cybercrime has no physical boundaries, governments should ensure that they are able to offer each other expedient assistance in investigations through mechanisms that respect the laws of both countries and outline the solemn promise of governments to follow the law when seeking user information.

In the same vein, laws around the world that allow governments access to private information need to be stronger, to protect Internet users' privacy and security. The number of government requests Google receives for user data has increased by more than 70% since we launched our Transparency Report in 2010. While law enforcement agencies must be able to investigate and prosecute illegal activity to keep the public safe, it's also important that laws protect citizens against overly broad requests for their personal information. Much of the public debate has been focused on the US in recent years, but its powers and activities do not differ substantially from other western democracies, including those in the EU.

Looking back on the decades since the emergence of the Internet, I am gratified that it has become an increasingly universal space that people expect to remain open, free and borderless. Unlike many other human creations, the Internet is both a technology and a socioeconomic space. The Internet is not like a traditional commons with limited resources because its capacity is capable of growing at the will of those who use it and the entities that invest in its expansion. As a shared environment, the decisions made on a sovereign basis in one geography may affect Internet users in other geographies – users in the rest of the world's Internet ecosystem. The complex challenges of governing the Internet as well as the aspiration to maximise the Internet's utility for all humankind allows only one conclusion: the Internet and its governance is our shared responsibility.

The next wave of the Internet

By John Chambers

John Chambers is chairman and CEO of Cisco Systems, a multinational corporation that designs, manufactures and sells networking equipment.

Out of every 1,000 devices that may one day be networked, only six currently are. Think about that opportunity. All of these connections are creating a massive amount of digital data. With analytics, data can be turned into intelligence and even wisdom, enabling countries worldwide to enhance decision-making, processes, productivity, scenario planning and experiences for their citizens, whether at work, leisure, school or home.

And while the opportunity may seem far off, it is actually a reality. For Europe, this opens the door to an estimated $4.3 trillion [around €3.4 trillion] in economic value for the private sector alone over the next decade. That value derives from reduced costs, employee productivity, the supply chain and logistics, customer experience and innovation.

But we should not just think about this in terms of statistics. It is about solutions that change the lives of real people. "Internet of Everything" (IoE) solutions can help tackle real urban issues – job creation, urbanisation and global warming – as well as reshape how we think about the urban experience. They can reduce traffic congestion and save lives, monitor threatened environments, reduce waste of valuable resources in agriculture and support better energy practices by encouraging energy efficiency in the home, enabling clean-energy technologies and optimising the efficiency of existing products.

'"Internet of Everything" (IoE) solutions can help tackle real urban issues, as well as reshape how we think about the urban experience.'

Cities and leaders are charting a new course in this area. Barcelona and Nice, for example, have embraced the IoE vision. They have implemented smart solutions for traffic and parking management, lighting, waste management and environmental monitoring. And it is working: sensors in Barcelona recognise whether a parking spot is taken and share that information with citizens. Parking is getting easier in the city and revenues are increasing by approximately $50 million [around €39.4 million] a year. Smart lighting that adapts to the environment and among other capabilities dims in times when traffic decreases and allows for remote monitoring for maintenance has decreased lighting costs in the city by one third. The smart-city pilot in Nice is assessing how cross-fertilisation can spur new insights and how data produced by such solutions can be combined and reused. Data from traffic sensors, for example, may be usable beyond smart parking, to optimise waste collection or monitor the environment.

This IoE is the next wave of computing and the Internet. In the late 1990s, we moved from fixed computing – where we went to the device – to mobile, where the device came with us. Early this century, we moved from mobile to the Internet of Things, the age of devices. But now we are entering a new phase, the IoE, where it is not just about things being connected, but about people, data and processes, too. It is about machine-to-machine, but it is also about person-to-machine and person-to-person connections. It is about converting data into intelligence to make better decisions and processes – delivering the right information to the right person (or machine) at the right time.

This development is being driven by technology. We are in a world of shrinking form factors. Formerly, a computer would sit on a desk (or even fill a room); today, computers the size of a grain of salt can have a battery, memory, pressure sensor and wireless radio and antenna. Sensors no larger than a speck of dust can detect and communicate temperature, pressure and movement. Computing is getting more powerful and cheaper, including processing power, storage and bandwidth.

All these technological trends are converging: cloud and mobile computing, network programmability and big data analytics. They are all part of the same ecosystem. And there is still plenty of room for improvement. While 90% of the world's stored data were created in the last year alone, only 0.5% of all data are currently being analysed for insights. Applying analytics to a greater share of current data could lead to productivity improvements, economic growth and societal developments.

'Europe has the choice between being a leader or a laggard. The opportunity is there, to embrace and plan for.'

The result of all this is growth. Europe's Internet Protocol (IP) traffic will grow two-and-a-half times between 2013 and 2018 to reach 25 exabytes a month – or, to put that another way, the data equivalent to five times all the words ever spoken by humans. Broadband will become faster, from 19 to 48 megabits on average; content will become richer, with video making up 75% of traffic; and the number of devices will grow – to approximately five connections for every person in Europe.

So what's the role for policymakers in this success story? Well, Europe has the choice between being a leader or a laggard. The opportunity is there, to embrace and plan for. Four properties of the IoE will determine how successful it can be in Europe, and around which government policy can be shaped.

1. The Internet of Everything needs to be built on a sound base.

Traffic growth dictates the need for greater network bandwidth; hence there is a need to create the right policy framework to stimulate investment in higher speed and more robust broadband networks. All types of technology will have a role to play, but it's clear that Europe needs fibre, and governments need to support this transition. Radio spectrum will also need to be made available to deal with a wireless world. The IoE includes all kinds of networks and so radio spectrum also needs to come in all shapes and sizes. Internet Protocol Version 6 is the addressing system for the IoE, and we need to ensure all parts of the ecosystem are adopting it. The IoE will create new demands on the workforce, and the public and private sectors will need to work together to ensure we are prepared. Finally, a review of regulated sectors should be coordinated to ensure no sector-specific rules impede IoE development.

2. The Internet of Everything needs to be smart.

Intelligence is built in throughout the network, including at the edge, in order to make the right decisions in the right place, at the right time. To do this, we need to get rules for traffic management and net neutrality right, in a way that opens the door to network management, specialised services and new business models, and does not close them off.

3. The Internet of Everything needs to be trusted.

With the network playing an ever-greater role in our lives, we need to know that services are reliable and resilient. Citizens need to know that data about them are being used in ways they support and feel comfortable about, and that it is being kept in a secure manner. Security is a joint effort, and we will need to work closer together, both across industry and between the public and the private sectors, to get it right in the new era. It will also be necessary to adopt data protection rules that allow the IoE to reach its potential, as its very value is dependent on the ability to cross-reference or re-use data in new ways.

4. The Internet of Everything needs to be open.

We should recognise that IP is becoming the common language for most data communication. Electricity grids, building systems, industrial manufacturing and oil systems are all shifting from proprietary networks to IP. While the IoE is a network of both closed and open networks, to maximise its potential we need to adopt open standards in existing global forums, based on transparent licensing terms. Open standards are key to driving interoperability and the consequent benefits for the quality and capabilities of analytics.

The bottom line is this: policymakers can lead this success story. This year signals a major inflection point for the IoE, which I believe will have a much bigger impact on the world and its cities than the Internet had in its first 20 years. And I am excited by the ways that it is going to transform our lives. Europe is well placed to seize the opportunity, and technology leaders stand ready to work with business and government leaders to help Europe head and embrace this vision.

‘Security is a joint effort, and we will need to work closer together, both across industry and between the public and the private sectors.’

It's time to disrupt Europe: digital first

By Kumardev Chatterjee

Kumardev Chatterjee is founder and president of the European Young Innovators Forum

Change is not luxury but mandatory. The alternative is significant loss leading to oblivion. That is the inevitable conclusion one can draw from the new Living Planet Report released by the World Wildlife Fund. The report calmly but clearly explains how our current way of doing business has led to the destruction of 52% of the world's wildlife in just 40 years. We have beaten evolution at its own game, and we will all collectively pay the price for it.

Much the same can be said of the innovation mindset in Europe over the last 30 years, and the impact is clear. Not only is our old and current way of doing business not improving our innovation capacity or competitivity, we are in fact doing much worse than we were before. We are trailing the major industrial economies in innovation and in recent years have actually slipped further down the ladder, the combined innovation performance of the European Union's 28 member states continues to lag the traditional leaders – the United States and Japan – and now also lags South Korea, a country that was not even on the global innovation leadership horizon a decade ago. Meanwhile, emerging innovation leaders like China and India are steadily marching up the bridge, looking to bypass us soon.

The failure to innovate better and faster, particularly in the digital space, is both our principal undoing as well as the central threat to Europe's digital future, prosperity and role in the world. Reversing these trends means things must change in Europe significantly – and soon. It is time to disrupt Europe – digitally first – starting with digital innovation and entrepreneurship.

The root cause of our innovation distress

Societally, Europeans have grown increasingly risk averse in the last 30 years. Innovation and entrepreneurship, digital or otherwise, principally requires a mindset with two main elements: fear of failure is no reason for not trying, and a simple idea can be developed into a successful project. Yet by tradition, young people in Europe are encouraged to eschew risks and follow safe paths to jobs and security. Such cultural and societal bias has led a generation of highly educated but risk-averse youth to shelve their creativity and entrepreneurial ideas in pursuit of secure and "respectable" careers, which themselves are becoming increasingly rare.

Structurally, Europe has also been slow to encourage and reward risk-taking. Young people who have an innovative idea typically cannot get the necessary access to finance, customers, markets, resources or the skills and infrastructure to develop their idea, and are held back by the lack of a supportive unified regulatory environment across Europe. Just try to register a startup and business bank account in a member state different to your "home" member state and you will understand in a snap what the "single market" actually means on the ground.

Not surprisingly, Europe is losing the digital innovation and entrepreneurship race against its global competitors.

In spite of more than 20 years of research and innovation funding and much talk about the vibrant startup "scene" in Europe, when it comes to global top ten lists Europe usually merits around two major digital startup hubs (London, Berlin), and to a lesser extent Stockholm, with its two innovative digital startups currently valued at more than a billion dollars (Spotify and Zalando) and to a lesser extent, Delivery Hero. In contrast, China, a much later entrant into the digital startup scene in general, and with much less history of innovation funding and international market access in particular, already boasts comparable figures (Beijing, Shanghai, Sogou, Jingdong and VANCL).

Disrupt Europe, digital first

There is increasing awareness and common understanding of the severity of the situation across broad segments of society, government and industry in Europe. What is much less clear however is agreement on the direction to chart and the decisions to take. The case is made by some that incremental change or in real terms, tinkering with current systems will somehow unleash Europe's locked potential. This is canard and one that deeply disserves Europe. No, we don't need more re-configurations of existing non-functional systems and ways of doing business, we need disruptive change and one that puts digital first and at the heart of the European endeavour.

Who should drive this change and who benefits? The answer must be citizens in both cases, with government playing an important supporting role. Innovation ecosystems across the world consist first and foremost of people, citizen innovators, and a significant percentage of them are young. Just close your eyes for a minute and think of the major innovations you use in your daily life, from communication means to productivity tools to heath management, travel and the sharing economy. It will be immediately clear that a large majority of the innovations are both digital and the outcome of startups, many of whom did not exist even a decade ago. Further, a significant number of these startups were created by young innovators.

This is precisely what we need in Europe today, an attitude for digital first in our innovation and business narrative and an attitude and environment for risk-raking, where failure is embraced and success celebrated. As Neelie Kroes said at the Young Innovators Unconvention, "It's about the things that matter to every European, the boost that matters to every business, the ingredients essential to innovation. Not just big global giants, but millions of tiny startups, any of whom could become the next big thing. Digital is everywhere. And it matters. But here's what I know Europe needs most of all – the right mindset, people prepared to take a risk, people prepared to do things differently, people prepared to be "unconventional," people like you."

Let's start with a vision for 'disrupt Europe'

The European Young Innovators Forum vision is a Europe that supports startups and entrepreneurs, and particularly digital startups through the full stage of the innovation lifecycle, from ideas to market take-up, powered by the talents, energy, enthusiasm, and innovations of young Europeans, and supported by the necessary regulatory frameworks, access to finance and markets and environment for innovation ecosystems.

Europe for StartUps 2020's overarching goals should aim to create and sustain a vibrant digital startup economy in Europe that generates:

- 10,000 new startups a year
- 2,000 new seed stage funded startups a year
- 1,000 growth stage funded startups a year
- four startups a year in global top ten lists
- three startups every two years on average with billion dollar exits

- 250,000 new startup jobs per year
- 2.5% of the job market covered by startup jobs
- 9.5% of total European GDP from startup activity (including exits)

with at least 70% of each of these metrics in the digital space.

The engagement, employment, volume, momentum and economic weight generated by the appropriate implementation of this vision will serve to firmly place Europe in the global digital economy, boost our prosperity and strengthen our weight and role in a globalised world.

From ideas to actions and roadmap to disrupt Europe

Changing the mindset for innovation and entrepreneurship in Europe is absolutely key to achieving this vision. This change starts with young people who are the most likely innovators, entrepreneurs and disruptors of today and tomorrow. They need to be empowered to transform the future by turning their talents, energy, enthusiasm, and innovative early-stage ideas into successful projects, businesses, products and services that will stimulate the economy and generate new employment.

The first step is to encourage young people to overcome their traditional risk-aversion and move out of their comfort zone to embrace the opportunities and challenges of innovation and entrepreneurship, including failure. This can be achieved by sustained ongoing promotion of an entrepreneurial, risk-taking culture, raising awareness so they consider alternatives to traditional careers; increasing access for young innovators to skills training, mentors, finances and other resources; showcasing successful entrepreneurial role models and innovation ecosystems; encouraging their creativity with initiatives such as pan-European competitions for early-stage ideas, festivals and road-shows and providing networked facilities to help them develop their early-stage ideas into projects.

> ‘We need disruptive change and one that puts digital first and at the heart of the European endeavour.’

Equally and in parallel, European governments, businesses, societies and individuals need to support and reward risk-taking. They can do so by creating and sustaining an ecosystem for entrepreneurs that helps young people acquire the right mentors and access to finance, customers and markets for their ideas and businesses.

The European Parliament and European Commission in particular need to create and adopt a unified regulatory framework tailored to the needs and conditions of startups that supports the creation of new startups from early-stage ideas and their growth, market penetration and scaling-up, with specific policy instruments that provide them concrete resources.

A Europe that puts digital first will be a Europe that fundamentally changes the game when it comes to innovation and leadership, boosting prosperity and strengthening its relevance to be a Europe that works for its citizens and one that they can believe in. This is the Europe we at the European Young Innovators Forum are striving to build.

Let’s join forces. Let’s disrupt Europe.

Europe cannot lag behind

By Zaryn Dentzel

Zaryn Dentzel is CEO and founder of Tuenti, a Spain-based social networking service.

The Internet is one of the key factors driving today's economy. No one can afford to be left behind. Even in a tough macroeconomic framework, the Internet can foster growth, coupled with enhanced productivity and competitiveness.

The Internet provides opportunities for strengthening the economy: How should we tackle them? While Europe – and Spain specifically – are making efforts to make the best possible use of the Internet, there are areas in which their approach needs to improve. Europe faces a major challenge, and risks serious failure if it lets the United States run ahead on its own.

The Leaders Club in the Startup Manifesto suggests that the old world be more entrepreneur-friendly. The proposal is backed by companies like Spotify and Tuenti. Europe lacks some of the necessary know-how. We need to improve in financial services and in data privacy, moving past the obsolete regulatory framework we now have and making a bid to achieve a well-connected continent with a digital single market for 4G mobile connections. We need to make it easier to hire talent outside each given country.

The use of e-commerce should be encouraged among small- and medium-sized enterprises so that growth opportunities can be exploited more intensely. Following the global trend of the Internet, companies should internalise their online business. And much more emphasis should be placed on new technologies training in the academic and business spheres.

Modern life is global, and Europe is competing against all regions and countries in the world. I do not believe in defeatism or victim culture. Optimism should not translate into callousness, but I sincerely believe that if you think creatively, if you find a different angle, if you innovate with a positive attitude and without fear of failure, then you can change things for the better. Europe needs to seize the moment to reinvent itself, grasping the opportunities offered up by the online world. We need to act, take decisions, and avoid "paralysis through analysis." I sometimes feel we are too inclined to navel-gazing. Europe shuts itself off, fascinated with its own contradictions and local issues, and loses its sense of perspective. Europe should open up to the outside, use the crisis as an opportunity to do things differently, in a new way – creating value, underlining its strengths, aspiring to be something more.

'Europe should open up to the outside, use the crisis as an opportunity to do things differently.'

In the United States, for instance, diving headfirst into a personal Internet-related startup is regarded as perfectly normal. I'm glad to see that this entrepreneurial spirit is beginning to take hold here as well. I believe in working hard, showing perseverance, keeping your goals in view, surrounding yourself with talent, and taking risks. No risk, no success. We live in an increasingly globalised world. Of course you can have a Spain-based Internet startup. There are no frontiers.

We need to take risks and keep one step ahead of the future. It is precisely the most disruptive innovations that require radical changes in approach and product, which might not even find a market yet ready for them – these are the areas providing real opportunities to continue being relevant, to move forward and "earn" the future, creating value and maintaining leadership. It is the disruptive changes that enable a business, product, or service to revolutionise the market – and, particularly in the technology sector, such changes are a necessity.

The future of social communications, innovation, mobile technologies and total connectivity in our lives

The development of the Internet today is being shaped predominantly by instant, mobile communications. The mobile Internet is a fresh revolution. Comprehensive Internet connectivity via smartphones and tablets is leading to an increasingly mobile reality. We are not tied to any single specific device, and everything is in the cloud.

The future of social communications will be shaped by an always-online culture. Always online is already here and will set the trend going forward. Total connectivity, the Internet you can take with you wherever you go, is growing unstoppably. There is no turning back for global digitalisation.

'Mobile connectivity is bringing about a new revolution.'

Innovation is the driving force of growth and progress, so we need to shake up entrenched processes, products, services, and industries, so that all of us together – including established businesses, reacting to their emerging competitors – can move forward together.

Innovation is shaping and will continue to shape the future of social communications. It is already a reality that Internet connections are increasingly mobile. A survey we conducted from Tuenti in 2013 in partnership with Ipsos found that 94% of Tuenti users aged 16 to 35 owned cell phones, 84% of users connected to the Internet using their phones and 47% had mobile data subscriptions for connecting to the Internet. A total of 74% of users reported connecting to the Internet from their phone on a daily basis, while 84% did so at least weekly. Only 13% did not use their phones to connect to the Internet, and that percentage is decreasing every day.

Mobile Internet use alters the pattern of device usage. The hitherto familiar ways of accessing the Internet are changing too. The smartphone activities taking up the most time (over three hours a day) include instant messaging (38%), social media use (35%), listening to music (24%), and web browsing (20%). The activities taking up the least time (under five minutes a day) are: SMS texting (51%), watching movies (43%), reading and writing e-mail (38%), and talking on the phone (32%). Things are still changing.

Smartphones are gaining ground in everyday life. Many of the purposes formerly served by other items now involve using our smartphones. Some 75% of young people reported having replaced their MP3 player with their phone, 74% use their phone as an alarm clock, 70% use it as their camera, and 67% use it as their watch.

We have been observing these shifts for a while, which is why we decided to reinvent ourselves by placing smartphones at the heart of our strategy. I want to use this example as a showcase of what is happening in the world of social communication and the Internet in general. Mobile connectivity is bringing about a new revolution. Tuenti is no longer just a social network, and social media as a whole are becoming more than just websites. The new Tuenti provides native mobile apps for Android, iPhone, Blackberry, Windows Phone, as well as the Firefox OS app and the mobile version of the website, m.tuenti.com. Tuenti is now a cross-platform global service that lets users connect with their friends and contacts from wherever they may be, using their device of choice. A user with a laptop can IM in real time with a user with a smartphone, and switch from one device to another without losing the thread of the conversation. The conversations are in the cloud, so data and contacts are preserved independently of the devices being used.

This means the experience has to be made uniform across platforms, which sometimes involves paring down functionalities, given the processing and screen size limitations of mobile devices. Facebook, Twitter, Instagram, Linkedin, and so on are all evolving to become increasingly cross-platform experiences. But Tuenti is the first social network that has also developed its own Mobile Virtual Network Operator (MVNO)—the company is an Internet service provider over the mobile network. Tuenti is an MVNO with a social media angle, and this may be the future path of telecommunications, integrating services such as VoIP calls or cloud phone features.

Obviously, the Internet and digital economy also create challenges for policymakers due to the speed they disrupt established markets and its global reach, which goes across national jurisdictions. Telefónica has recently published its "Digital Manifesto" where it lays out recommendations and its interesting vision of how to create an open and safe digital experience for its customers before the backdrop of this epochal change.

Social media are evolving to become something more, and innovation must be their hallmark if they are to continue being relevant. Tuenti now embraces both social communications and telecom services provision, offering value added by letting you use the mobile app free of charge and without using up your data traffic allowance, even if you have no credit on your prepaid card – this is wholly revolutionary in the telecom sector. The convergence of social media with more traditional sectors is already bringing about a new context for innovation, a new arena for the development and growth of the Internet.

'The future will be shaped by innovation converging with the impact of mobility.'

Just about everything in the world of the Internet still lies ahead of us, and mobile communications as we know them must be reinvented by making them more digital. The future will be shaped by innovation converging with the impact of mobility. This applies not just to social media but to the Internet in general, particularly in the mobile and social communications field. I feel that many people do not understand what we are doing and have no idea of the potential development of companies like ours at the global level. Right now, there may be somebody out there, in some corner of the world, developing the tool that will turn the Internet upside down all over again. The tool that will alter our day-to-day life once more. Creating more opportunities, providing new benefits to individuals, bringing more individual and collective well-being. Just ten years ago, social media did not exist. In the next 10 years, something else radically new will emerge. There are many areas in which products, processes, and services can be improved or created afresh. The future is brimming with opportunities, and the future of the Internet has only just begun. Europe cannot afford to lag behind.

Research in the digital age

By Robbert Dijkgraaf

Robbert Dijkgraaf is a Dutch mathematical physicist and string theorist. He is professor at University of Amsterdam, Leon Levy professor and director at the Institute for Advanced Study in Princeton and president of the InterAcademy Partnership, a global network of 130 advanced scientific institutions.

This summer an important symbol of the modern age of connectivity was reached – the number of mobile phones in the world now equals the number of people on the planet. The digital revolution, which promises the elimination of the physical limits of information, delivering all knowledge to anyone, anytime, and anywhere, is a major cultural turning point. It is the defining element of our century. The science fiction vision that by now we would all be zooming over the Earth in flying saucers appears further away than ever – especially if you are trapped again in a traffic jam. But the need for flying saucers has long since become obsolete, because we can travel the world much more efficiently by electronic means, almost as fast as the speed of light. If a time machine could bring a person from a previous century to the year 2014, nothing would be more impressive than the sight of a smartphone, providing access to all the information of the world with a few key strokes.

Digital technology has also changed the face of research beyond recognition. Nature magazine recently spoke of "the fourth era of research." After the individual, the group and the nation, now the time has come for international and interdisciplinary collaboration as the natural unit of research. Technology makes possible collaborations of a size that until recently were unimaginable. It is no accident that the World Wide Web originated in the particle laboratory of the European Organisation for Nuclear Research (CERN), where more than 10,000 scientists and engineers collaborate, and a single paper can easily have 3,000 authors. In fact, in the original version of the web that particle physicists developed, you could not only read each other's pages, but also edit them. Similarly, the amount of bits generated in the experiments in the large hadron collider can only be absorbed and processed by distributing among the laboratories of the world.

The new digital age provides immense opportunities for research in Europe. It is good to remember that modern science is essentially a European invention born out of a culture of collaboration. In the 17th and 18th century republic of letters, ideas were exchanged continuously between the leading scholars in all the European intellectual centres. Each of them was performing calculations, observing planets and stars, grinding lenses, developing philosophical ideas, and writing letters to communicate all their findings with colleagues. It is often difficult to point out the exact location, time and person involved in a specific scientific discovery. In many town squares you find a statue of "the" inventor of the telescope or the printing press. And in some way, they are all right. Perhaps this frequent and close contact, this network of interconnections, this idea of a European conversation, is the most lasting impact of that remarkable revolutionary time.

One can argue that the diversity of Europe, this unique mixture of competition and cooperation, has been and will be a strong driving force for the progress of science, scholarship and innovation. It is no accident that two of the shining examples of international scientific collaborations, the particle accelerator CERN and the space and astronomical organisations European Space Agency (ESA) and the European Organisation for Astronomical Research (ESO) are European inventions.

But the digital world is not only a shining light. Many doomsayers warn us that it also has deep shadows. It is claimed that the permanent flow of information from e-mails, tweets and text messages make us more superficial and restrain us from our deeper thoughts. Now, any claim that we live in a time of cultural impoverishment and decline should be approached with a healthy amount of scepticism. For what is more tempting than to declare that the new times, and particularly the young people who embody these times, are superficial and frivolous? If previous

‘Modern science is essentially a European invention born out of a culture of collaboration.’

generations obviously have a lower level of development, and if future generations are taking a step backwards, then the inevitable conclusion is that the current generation is the absolute pinnacle of civilization – how convenient!

Fortunately, historical examples abound showing that statements of decline can be easily premature. The ancient Greeks thought that a written text was a cheap alternative to a well-trained memory that made the mind lazy. When the printing press was invented, people screamed bloody murder, because the access to texts was seen to undermine society. In the 17th century, scholars complained about the overwhelming flood of new books that appeared. From the present perspective, it is striking how difficult it is to assess the enormous benefits that technological breakthroughs can bring at the moment of inception. Writing, books, the printing press and the Internet have all proven to be powerful and liberating intellectual instruments. And nowhere have they been more transformative than in the world of academia.

But it is fair to say that the digital revolution can indeed be a double-edged sword. With the advent of the web, we are suddenly passed from the narrow channel of controlled communication to the wide ocean of information. The digital world is also an ocean in the sense that it is difficult to find any traffic signs. And you can both drown and die of thirst in the midst of all that water. It requires higher navigation skills to maintain a steady course.

So the question is legitimate if the immense gains in speed, scale and collective brainpower, do not come with a loss in concentration, focus and individual choices. For example, is it still possible today for a scientist to think undisturbed over many years about a single problem? It is significant that three of the greatest mathematical achievements over the past 20 years – the proofs of Fermat’s last theorem, the Poincaré conjecture, and the (generalised) twin prime conjecture – were all obtained by mathematicians who worked for over a decade in secret and silence, shielded from the outside world and their colleagues.

The digital impoverishment that the doomsayers warn about is therefore also within science a real danger. The regression to the means that comes with universal connectivity can threaten the natural diversity of methods, personalities and questions. It would be a substantial impoverishment of the intellectual sphere when there is no more room for a long and winding path or a deep and original thought.

Increased diversity clearly is the solution to the digital dilemma. There should be no need for a definite choice between fast or slow, embracing or rejecting the modern era, but options should be provided for a variety of tempos and modalities. We should build opportunities to connect and to unplug in the digital world. A fragmented world that is constantly churning with the speed of light needs periods of rest and counterbalance. Younger generations need to appreciate both the advantages of high-speed connections and the blessings of slow thinking.

Europe with its rich mix of cultures, languages and histories might be perfectly attuned to address this modern dilemma. The push of new technology and the pull of old traditions might produce a balanced ecosystem that creates a maximal biodiversity. Europe is a unique experiment in multinational cooperation. It is what we physicists lovingly call a “toy model” for global collaboration. It has all the features, yet is limited in scope and complexity. In science, you first try to solve and understand the toy model before you step up to the next level. To find this solution requires a combination of pragmatism and idealism. The world looks with great interest at the European experiment, because if Europe cannot find a solution, how can the world?

The challenge for Europe is to embrace the old and the new, and make the digital age a true new republic of letters.

Connected commerce: creating a more inclusive and prosperous economy

By John Donahoe

John Donahoe is president and CEO of eBay, a multinational e-commerce company.

Policymakers across Europe and around the world are searching for economic models that can spur sustainable growth and development. Increasing cross-border trade is a proven catalyst for economic expansion. However, the downside of expanding traditional trade flows has been a concentration of wealth and income by the largest businesses because only they had the necessary capital and infrastructure to take on the investments required to engage in trade on a truly global scale. Enter the Internet.

The emergence of a truly interconnected, global digital network, and the global platforms and services that operate over that network, has revolutionised the global opportunities available to small- and medium-sized enterprises (SMEs) in Europe and around the world in ways that are only now being seen. These emerging trends and opportunities are unprecedented; the economic and social implications are only starting to be grasped, and the advances have largely occurred without overt or conscious promotion by governments. It is increasingly clear that the Internet and mobile technologies are transforming global commerce in ways that will expand growth, promote sustainability and, maybe most important of all, make globalisation a more inclusive phenomenon. Now the challenge is to maximise this great economic and social opportunity.

> 'The Internet is fundamentally changing the way global trade is conducted.'

The Internet provides businesses with an instant global platform and access to three billion users, three billion potential customers, around the world. What is particularly exciting about the Internet model is that an SME with access to the Internet, based anywhere in Europe, even in a remote region or emerging economy, has access to exactly the same potential customer base as that of a large business in a major city. Thus, any enterprise can now enjoy the benefits of "going global" while remaining local, and bring the benefits of that commerce back to its local communities.

At eBay Inc., through our online marketplaces and payment platforms, we are able to witness how the Internet is fundamentally changing the way global trade is conducted. Moreover, eBay has a sweet spot when it comes to empowering SMEs; many of our users are high-street retailers that have between five and 10 employees. These businesses are discovering a new growth engine by leveraging the Internet to find customers across national borders. "Trade in goods and services that is conducted via electronic means has grown exponentially, and businesses can today connect with consumers in foreign markets in ways that were not previously possible. Small businesses in particular have gained from this, having, in the past, lacked the necessary resources in order to export to foreign markets," writes the Swedish Board of Trade.

Research on eBay Marketplaces transactions over the last several years reveals tremendous insights about the impact that technology is having on SMEs in Europe, and around the world. In France, for example, only about 15% of traditional businesses engage in exporting. On the eBay Marketplace, 98% of French technology-enabled SMEs export. Of the traditional businesses in France that do export, they only export to two different markets per year. Technology-enabled exporters based in France reach an average of 14 different national markets. Technology-enabled SMEs also survive longer than their offline counterparts. The European Commission reports that the five-year survival rate for enterprises founded in 2005 was 46%. The five-year survival rate

for French technology-enabled SMEs is 60%. Finally, not only is technology-enabled trade more robust than its traditional counterpart, it is also more inclusive. The largest 5% of businesses in France account for nearly 90% of its exports. The largest 5% of technology-enabled businesses on eBay Marketplaces only account for 55% of the total export market share. In short, technology allows more growth, more opportunity and a more open and inclusive economic model.

The specific figures above compare traditional business in France with Internet-enabled businesses in the country, but those results hold in each country where we've examined SME data, including Chile, Germany, India, Indonesia, Jordan, South Africa, Thailand, Ukraine, the United Kingdom and the United States. In short, Internet and mobile technology services open global commerce to SMEs no matter where they are based in the world.

Coming down from high-level statistics to a specific case study helps to magnify the impact that the Internet is having on small businesses across Europe. Adam McKay from Torquay, UK, spent nearly 15 years as an engineer before he was bitten by the entrepreneurial bug. In 2009, he launched a business focused on the sporting goods industry, offering about 800 different products through eBay Marketplace. Currently, he employs 10 people and sells approximately 20,000 unique products through a number of channels, including eBay and his own website. About 50% of his sales on eBay are to customers outside the UK, and he has sold to customers in 88 countries. "Selling internationally is key to our survival in the current economic climate," says Mr McKay, director of BlueWaterSports.com.

Traditionally, SMEs have been limited in their participation in the global economy largely to being suppliers of large multinational corporations' supply chains. Technology and the Internet are creating a parallel model for emerging global trade where a business of any size can directly access consumers around the world through an Internet connection, Internet intermediary services and logistical providers. This model is more efficient and inclusive than the traditional one. The 2013 World Economic Forum Enabling Trade: Valuing Growth Opportunities report found that the use of technology platforms can reduce the burdens small businesses face when selling overseas, increasing cross-border small-business sales by 60-80%.

The potential for technology-enabled SMEs has not yet been realised. A European Commission report found that only 12% of consumers had made a purchase from another European Union country in the prior 12 months. OC&C Strategy Consultants has estimated the value of cross-border online trade in the US, Britain, Germany, the Nordic countries, the Netherlands and France at $25 billion [around €19.7 billion] for 2013, and estimates that the value of technology-enabled exports from these markets will grow to $130 billion [around €102 billion] by 2020.

The potential gains from Internet-enabled global commerce are so great in part because so much can be done to make the logistics of this SME trade work more smoothly. A number of frictions and pain points inhibit technology-enabled SMEs from maximising business opportunities. The Internet provides an instant global connection to potential, willing buyers across Europe and around the world, but the system for physically moving an SME's products across borders is not nearly as efficient as the Internet. Survey research commissioned by eBay that looked at technology-enabled SMEs in Germany found that 73% of respondents believed customs and tariff barriers were the number-one obstacle to exporting more outside the EU.

'The Internet provides an instant global connection to potential, willing buyers across Europe and around the world.'

Technology-enabled SMEs have a different trade pattern than their traditional counterparts; exports tend to be low-value shipments, and businesses often trade with many different countries. Twentieth-century trade policy was not crafted with such a model in mind. "The fast pace of innovation is at odds with the outdated trade disciplines that still govern us," says Roberto Azevêdo, director general of the World Trade Organization.

To create the ideal ecosystem for these trends to continue, we believe that countries need to have the right policies in place to enable four key factors: 1) the Internet; 2) the services that exist on top of the Internet; 3) the small-shipments logistics network that carries the physical products being traded by technology-enabled SMEs; and 4) the educational infrastructure for SMEs to learn about online opportunities and be educated on how to leverage online tools. The biggest policy hurdles exist for factors three and four.

Policymakers can spur sustainable and inclusive economic growth by focusing on the removal of red tape and friction associated with trading physical products across national borders, both inside and outside the EU. Specific proposals to facilitate technology-enabled SME trade would include:

'Technology and the Internet are creating a parallel model for emerging global trade.'

- Raising and harmonising de minimis levels (the level below which customs duties and paperwork are exempted)
- Supporting cross-border delivery services through harmonised standards and formats, tracking and data interoperability, and partnerships between commercial couriers and national postal operators
- Developing trusted trader schemes adapted to micro- and small firms, treating the different exporting profile of and tools used by technology-enabled businesses as strengths and not weaknesses
- Promoting "multilateral consumer rights" by applying the idea behind the Common European Sales Law to international transactions
- Supporting omnichannel trade that addresses mobile roaming between the EU and its key trading partners so travelling consumers are able to use their smartphones effectively and retailers can engage with visiting consumers most effectively via mobile devices
- Disseminating information to businesses about how the Internet can be leveraged for growth. Policymakers should revisit their export promotion programmes to ensure that businesses are being educated about online tools and services.

We are at the dawn of a potential new era of a much more inclusive version of globalisation. Instead of a global system open to only a relative handful of the largest global multinational corporations (MNCs), the Internet and mobile technology could enable five million, or even 50 million, micro-MNCs all over the world. The evolution of this technology-enhanced, SME-driven global marketplace is good economics because it means more growth and wealth creation; it is good global politics because it responds to questions about the current state of globalisation; and it is good for society because it is a more inclusive global economic model. This is part of the vision we call connected commerce.

The dawn of cognition

By Steve Furber

Steve Furber is professor of computer engineering at the University of Manchester.

You may be forgiven for thinking that, because computers are everywhere and everyone has a smartphone in their pocket, the information and communications technology (ICT) revolution is all but played out, but in reality nothing could be further from the truth. Digital technologies are changing faster than ever, and today we stand on the threshold of another major transformation with huge economic and quality-of-life opportunities for those brave enough to lead from the front.

In the past, computers were passive, faithfully implementing detailed algorithms designed by programmers, delivering impressive performance because of the very high speeds of modern integrated circuit technology. But now they are beginning to sense and understand the world around them, and soon they will augment those senses with the ability to learn, analyse and ultimately understand and control their environment. This is not artificial intelligence in the sense of machine sentience – so called "strong AI" – that is still somewhere over the horizon. But it is the dawn of machine cognition.

With a new awareness and ability to interact with their surroundings, the nature of machines and our relationship with them will change dramatically. Of course, all new technologies bring challenges as well as opportunities, and we need to start thinking about the implications of these changes before they catch us unawares. But changes there will be, and they are likely to start as we share our primary senses with machines, beginning with enabling them to understand what they see.

Setting things

A major driver along the road towards machine cognition is the need to give machines sight. Cameras are already cheap and ubiquitous – every phone has one, if not two. But taking a photo or video is a long way from understanding what the camera sees. The problem is complex, since the view is relative to the camera position, and the machine starts with prior knowledge neither of the camera position nor of the environment. The trick – called "simultaneous localisation and mapping (SLAM)" – is to build up a probabilistic model of position and scene using all of the available information. As the camera moves through the scene, the information builds to the point where confidence in both the position and the scene is high.

Computer vision is important for many areas of product development, perhaps most obviously for driverless cars and domestic robots. Both of these technologies depend on the machine having a good understanding of a potentially very complex environment, which seems most naturally to be achieved through a vision system.

Building brains

Vision is, of course, an ability where nature excels. Our eyes and brains allow us to see and understand very complex scenes apparently effortlessly, yet this continues to be a huge challenge for machines. Why is this?

The answer is, as yet, unknown, because we still do not understand the information processing principles at work in biological brains. Today there is significant research activity aimed at closing this gaping hole in scientific knowledge. In the EU, the €1 billion ICT flagship Human Brain Project

is focused on assembling what is known about the brain into computer models that can be used to test hypotheses about what isn't yet known. Complementary projects in the United States, Australia and elsewhere around the world suggest a consensus that this is a quest whose time has come, but the brain is very complex, and success is by no means guaranteed.

However, building efficient cognitive systems – including computer vision systems – will likely rely on making best use of what we do understand about how the brain tackles such problems, and new algorithms and computer architectures will be required to deliver optimal performance. Arguably current SLAM systems already do this at the algorithmic level, constructing probabilistic networks in a way that is analogous to current hypotheses of brain function.

IBM's recently-announced TrueNorth chip is an example of a radical computer architecture based more closely on the brain, and it has already demonstrated vision capabilities. TrueNorth integrates a million digital neurons on a single (large!) microchip, organised as 4096 cognitive cores. Exploring the full capabilities of this novel cognitive resource will take some time, but I believe it is a sign of things to come.

General knowledge

At the high end, IBM is also blazing the trail with its Watson system, which created a stir in 2011 when it beat human competitors in the US TV general knowledge programme "Jeopardy." Watson employs a number of advanced computer science techniques such as natural language processing and machine learning on a very large purpose-built cluster machine, and it is claimed that it can process the equivalent of the contents of a million books per second. Watson is now being applied to more important tasks than winning TV quiz shows, and its ability to contribute to healthcare applications is being explored.

'Digital technologies are changing faster than ever.'

Watson exemplifies the "brute force" approach to knowledge processing, in contrast to the very energy-efficient small-scale characteristics of the TrueNorth chip. There is a very large chasm between these two approaches, both of which are being pursued within IBM's cognitive computing programme. Bridging this chasm represents a grand challenge for IBM and for computer scientists in general. Where a resolution of this challenge will lead is at present entirely unknown.

SpiNNaker

Our own approach to understanding cognition at Manchester is exemplified by the SpiNNaker (Spiking Neural Network Architecture) project. Over 15 years in conception and eight years in construction under funding from EPSRC – the Engineering and Physical Sciences Research Council in the UK – SpiNNaker is a form of high-performance computer incorporating a million ARM mobile phone processors. The major innovation in SpiNNaker is the communication infrastructure that connects these processors together, allowing neural "spikes" to flow between neurons modelled in software in biological real time. This will enable models of brain regions of up to a billion neurons to be modelled and analysed with the goal of increasing our understanding of the principles of neural computation and natural cognition. It will also allow those models to be "embodied" in robotic environments.

The SpiNNaker platform is being made widely available to the European neuroscience and neuro-robotics communities through the Human Brain Project, and we are also using it ourselves for research programmes funded through the European Research Council and other sources. Alongside the other HBP platforms and related projects, Europe has a strong position in brain-

modelling and brain-inspired ICT, and provided we can use this position to educate a generation with expertise in cognition we are well-placed to remain at the forefront of this new wave of technological development.

Biology vs. engineering

Whether breakthroughs in building cognitive systems come from advancing our understanding of biological cognition, or from plugging away at engineering solutions based on present knowledge, only time will tell. But the present rate of progress on all of these fronts suggests to me that breakthroughs are imminent, and when they come they will have a major impact on all of our lives. The transition from dumb (albeit stunningly fast) technologies to technologies that have some degree of understanding of what they are doing will be transformative. Initially this understanding will be limited in extent and in domain of applicability, but the boundaries will expand rapidly once the fundamental principles are within our grasp.

Living with cognitive systems

The prospect of machines that can learn about and adapt to their environment brings with it many attractive potential benefits. We could move much of the onus of learning to use new technology from the user to the machine itself. Why is it my job to learn to use every new gadget I buy, rather than its job to learn how to be useful to me?

'With cognitive capabilities come new applications, such as the driverless cars.'

With cognitive capabilities come new applications, such as the driverless cars that are already appearing on our streets. These have many potential advantages in terms of safety, resource efficiency and reduced congestion, not to mention mobility for those unable to drive themselves due to age, infirmity or disability. The prematurely heralded "personal digital assistant" of the 1990s could become a usable reality, and robot companions for the elderly would become a practical solution to at least some aspects of the issues of dealing with an increasingly ageing population.

Societal challenges

The widespread deployment of cognitive systems will bring not only benefits but also significant challenges for society at large. We can already see some of these emerging – who is responsible if a driverless car is involved in an accident that results in death or injury? Or if an elderly person trips over a robot companion? In the near future, my smartphone may make my travel arrangements based only on very high-level instructions, but who pays if my return flight is booked to Manchester, New Hampshire instead of Manchester, UK? Cognitive systems will make judgements and decisions based on statistical evidence, not on mathematical certainty, and they will therefore sometimes get things wrong.

Of course, there is also the real prospect that cognitive technology would be applied to weapons systems. Most drones today have a remote human operator, but there is already an active debate about the ethics of autonomous weapons systems. One major argument against autonomous weapons is that current cognitive systems aren't nearly good enough to be trusted with controlling a weapon, but that may change in the scenario I describe above. And what then?

At a deeper level, as our devices become smarter, will we feel more stupid and that our natural intelligence has been devalued? Today's generation is already much less capable at mental arithmetic than their forebears, since calculators make developing the skills seem pointless to

many. Why should we learn facts when they are instantly available on Wikipedia? In the future, we may feel that organising our own lives is pointless because our phones can do it for us better than we can do it ourselves.

The history of human civilisation and technology is a story of a constantly changing relationship between the individual and their environment. Once it was feared that travelling faster than a horse could carry you would be harmful to your health. Now most of us live in cities so full of cars that the cars rarely travel faster than a horse and, yes, they are harmful to our health! That's progress...

'The widespread deployment of cognitive systems will bring not only benefits but also significant challenges for society at large.'

A modern approach to maximising spectrum utility and economic value

By Mark Gorenberg

Mark Gorenberg is a member of the United States President's Council of Advisors on Science and Technology (PCAST) and founder of Zetta Venture Partners, a venture capital firm specialising in early state enterprise investment.

The rapid creation and explosive use of new wireless applications has spurred economic growth and service improvements across a variety of sectors, such as transport, environment and health. In Europe, as in the United States, new devices, applications and services, combined with unforgiving consumer expectations regarding seamless connectivity, continue to drive bandwidth demand across the continent.

All of these innovations, however, rely on a finite and valuable resource – access to electromagnetic spectrum. While almost all the spectrum in the range suitable for today's wireless broadband services has been assigned, in many instances, the assigned spectrum is not fully utilised. While we can't create new spectrum, new technologies and new policies can maximise the usefulness of what's available. Responding to that challenge has been the subject of different policy initiatives in the US and in Europe.

In July 2012, the US President's Council of Advisors on Science and Technology (PCAST) released a report entitled "Realising the Full Potential of Government-Held Spectrum to Spur Economic Growth." The premise of the report is simple: in order to meet today's growing demands for spectrum, foster economic growth and develop technological leadership, the US and other nations must find ways for different kinds of users to share spectrum effectively.

Thankfully, the technologies to enable sharing already exist. For instance, modern databases can enable commercial use of spectrum that historically has been dedicated exclusively to governmental purposes, when and where the government doesn't have immediate need for it. The PCAST report outlined a new three-tier "dynamic sharing" Spectrum Access System (SAS) that makes spectrum sharing by federal users the norm, and also allows sharing with commercial users. Under the SAS, federal primary systems would receive the highest priority and protection from harmful interference; secondary licensees would register deployments and use in a database and receive some quality of service protections, possibly in exchange for fees; and general authorised access users would be allowed opportunistic access to unoccupied spectrum when no primary or secondary access users are using a given frequency band in a specific geographical area or time period. For example, a shipboard radar system may depend on spectrum, but that same spectrum can be made available by the SAS for commercial purposes at other times and places or when the ship is away from port.

> 'New technologies and new policies can maximise the usefulness of what's available.'

In the US, the regulatory process for accommodating such sharing is already underway. The White House, The National Telecommunications and Information Administration (NTIA) within the Department of Commerce, and the Federal Communications Commission (FCC) have all taken significant, concrete steps in furtherance of PCAST recommendations. For example, about five months after the PCAST report, the FCC initiated a rulemaking proceeding in which it proposed a new three-tiered form of spectrum management based on the PCAST model. If finalised later this year as planned, this initiative will create the initial rules to allow industry to start building and implementing spectrum access systems for an initial 150 MHz of spectrum.

In June 2013, less than a year after the PCAST report, the White House issued a presidential memorandum adopting a number of the other PCAST recommendations or variations thereof, which are now being carried out by the new White House Spectrum Policy Team (the formation of which was itself prompted by PCAST), NTIA and other federal agencies. For example, the NTIA has now identified a total of 960 MHz that could be candidates for spectrum sharing using SAS technology.

Sharing between government agencies and consumer devices is a win-win solution: governmental entities can continue to use their spectrum and lower costs by taking advantage of the commercial equipment. For network operators and end users, sharing makes additional spectrum available for wireless services more quickly than if existing users had to be relocated. Spectrum sharing minimises delays by leaving incumbent operations in place.

'As dynamic sharing evolves, spectrum can be reused in smaller and smaller cells, improving capacity effectiveness thousands of times.'

While the PCAST report outlined sharing between government and commercial users, the same concepts can be expanded to sharing among commercial users. This was a very interesting aspect of the European Commission's policy communication on spectrum sharing from September 2012, soon after the PCAST report. It made a case for enabling more sharing possibilities based on sharing contracts between users operating in the market. This new model allows flexible commercial use of the spectrum, where the database can mediate between uses like mobile wireless that require certainty around their access, and other uses like Wi-Fi that can better tolerate disruption if enough spectrum is not available for all. This approach is a natural extension of the spectrum policies that have served both the US and Europe very well: licensed access allows operators to offer a predicted quality of service, while licence-exempt access fosters widespread contributions to innovation and fast-paced investment in emerging technologies. By enabling both types of access to the same spectrum, we can get the best of both worlds and thereby maximise opportunities for innovation.

Experimentation with sharing among commercial services has been flourishing around the world. For example, numerous countries have pursued regulations or trials that enable licence-exempt, Wi-Fi-like devices to access vacant spectrum in the television broadcast bands. These patches of vacant spectrum between broadcast television channels are often called "white spaces." The US and Singapore have adopted rules enabling licence-exempt use of white spaces, while Canada is in the process of doing so. The United Kingdom, Japan, Korea, the Philippines, Kenya, Tanzania and Malawi are all piloting this technology. The technology has been used in a variety of ways, including improving Internet access in schools, facilitating the delivery of government services and establishing communication channels in the wake of earthquakes and typhoons.

As dynamic sharing evolves, spectrum can be reused in smaller and smaller cells, improving capacity effectiveness thousands of times. Innovation in wide area mobile communications, sensor networks, and whole new industries and products that we cannot foresee will emerge.

In July 2014, the NTIA and the FCC issued a notice proposing the establishment of a Model Wireless City, based on another PCAST report recommendation. The public notice seeks comment on how the FCC's rules could be applied or modified to promote the early-stage rollout of innovative technologies and business models in real-world urban environments, as a means of expediting eventual widespread commercial deployment.

To be sure, a more aggressive approach to spectrum sharing has its challenges, particularly from the perspective of incumbent commercial or government users who are reluctant to give up their exclusive rights to individual spectrum bands. Yet technology is being developed and deployed to allow for such sharing by new entrants without risking interference to the incumbents' systems. And the investment in that technology will open up spectrum to highly productive and innovative new services and applications supporting every sector of the economy and create great returns.

Spectrum is the engine of the wireless economy. By managing it efficiently and maximising its use, we can transform the availability of this natural resource from scarcity to abundance and maintain the innovation in wireless that is boosting economies and improving daily life.

A new privacy paradigm

By Gerard Grech

Gerard Grech is CEO of TechCity UK, an East London-based organisation providing a voice of advocacy to digital entrepreneurs.

We are in a period of seismic change. Not since the advent of the Industrial Revolution has humanity witnessed comparable levels of innovation and technological advancement. As the digital sector grows exponentially, and with it the amount of time we spend online, the process of debate and policy implementation is often forced to exist in a reactive rather than proactive state.

It's hardly surprising. With technology developing so fast, it's hard to take stock and reflect on the impact on our society, and what the long-term implications of the digital revolution might be. And it's easy to be blinded by all the benefits. Digital technology is democratising education, revolutionising healthcare, increasing competition in e-commerce to the benefit of consumers and vastly increasing the ways in which we communicate with each other and with organisations.

But along with all these benefits, a thorny question has yet to be resolved. Given the startling level of transparency the Internet is producing, what happens to our privacy? How do we, as a society, recalibrate our treatment of personal data for the 21st century?

We have entered a complex system of information flow, in which the channels are as varied as the content rushing through them. And the pace of change is relentless, as innovators seek to meet the demands of consumers, businesses and government, and to fast track the exchange of information and data.

Never before has our personal information been so widely disseminated. Where once our private data was obtained through coercion, we now readily hand it over for access to a digital network, product or service. Significant amounts of this data is now in the hands of commercial organisations.

'With technology developing so fast, it's hard to take stock and reflect on the impact on our society.'

We can, quite literally, be watched.

Putting a value on privacy

Think about it for a minute. Not many of us would invite a big brand into our private home, to monitor our movements as we walk from kitchen to bedroom, switching on the TV or opening a magazine. Yet that is exactly what is happening as we go online and browse. Yes, we can go into our online settings and opt out – but how many of us take the time?

There is a real issue to be resolved here. Yet frustratingly, the debate around privacy has thus far centred around three simplistic viewpoints.

In one corner stand the civil-liberty protestors, waving their flags against the growing invasion of our personal life, angry at the lack of regulation, which they claim allows unscrupulous business practices to proliferate.

In another corner smile the business-minded pragmatists, who believe that targeted advertising and preference mapping are creating a totally personalised consumer experience, with spam advertising now replaced by individually relevant content. What's not to like about that?

Then there are the digital enthusiasts, proclaiming the dawning of an age of ground-breaking information equality, in which emerging technologies have placed unprecedented power in the hands of individual to hold political and corporate leaders to account.

But these simplistic positions are yesterday's news. They may even be stifling real debate. It's time for the privacy wars to move on.

In truth, the picture is tantalisingly complex. In today's digital age, privacy can no longer be an all-or-nothing scenario. On the contrary, I believe we could be moving into an era in which privacy becomes commoditised.

You want it, I've got it

What if, in this new digital era, privacy becomes a personal asset? Could my personal data, much sought after by others, become a virtual currency that I use to barter and negotiate with?

Like the systems of commercial exchange that started centuries ago at the dawn of capitalism, we may now be entering an era of privacy negotiation.

Companies are desperate for our personal data. It's the lifeblood of their commercial strategy, allowing them to segment, target and convert browsers into buyers. But individuals own this information, along with the physical devices that get us online to start with.

What if we could set the parameters of our online experience directly with programmatic exchange networks and digital service providers in a process of mutual negotiation? Not simply by ticking boxes, but by engaging directly with individuals behind the digital services we use. You create the terms of access, you set the business rules, you decide the level of personal data that is handed over – you, the user, are empowered.

'Companies are desperate for our personal data. It's the lifeblood of their commercial strategy.'

In this new world, the individual could decide what level of privacy he or she forgoes in order to access a digital service. Depending on the level of personal data they are willing to share, they create a personalised portal. Less privacy, less access to the network; more privacy, more access.

It's time for an intelligent data exchange. There is the potential for real benefit if we accept that a new privacy culture exists, and that there may be tangible ways of making it work for everyone.

What shape the new system will take, what technology it will use and how it will work, no one yet knows. Yet at the rate digital technology is moving, I'm willing to bet that someone is working on it right now.

The secrets of our success: the Angry Birds story

By Kaj Hed

Kaj Hed is chairman of Rovio Entertainment, a Finnish video game developer and entertainment company.

In 2009, a small independent video game studio in Finland called Rovio is on the brink of bankruptcy. It employs a dozen young people; one of them is my own son, one my nephew; none of them have any previous corporate experience.

I believed in their dream, invested in it, but still at the time of their 52nd mobile game, Angry Birds, it was make-or-break time for the company.

Over the following four months, Angry Birds is downloaded one million times on the Apple App Store and becomes the next mobile hit. Not even I believed this could happen. Yet it did.

The Angry Birds mobile games have been downloaded over two billion times and counting, and are in the *Guinness World Records* book. Angry Birds has evolved from a mobile game into a globally recognised entertainment brand and a pop culture icon. According to surveys, 90% of Americans are familiar with it, 94% of the urban population in China knows about it and 60 million (out of a total of 65 million) inhabitants have played it at least once in South Korea. Merchandise, consumer products of all kinds, books, comics and an animation series on our own channel, Angry Birds Toons, which itself had been viewed billions of times by the end of 2013, expand the universe, with a feature-length motion picture poised for a summer 2016 release. Rovio Mobile has become Rovio Entertainment, and in early 2014 employed nearly 900 people in Finland, Sweden, the United Kingdom, Belgium, the United States, Japan, Korea, China and India.

> 'There is always a bit of luck involved in the process of making a genuine hit.'

During this transition, Rovio has been the centre of countless celebrity endorsements and made a number of cameo appearances in show business. Red, the iconic leader of the flock, has toured the world, showing up in iconic landmarks such as Times Square, Red Square, Shanghai's Oriental Pearl Tower, the Space Needle Tower, Rio de Janeiro's Maracanã Stadium and the White House, to name but a few. Angry Birds has also enjoyed a tie-in with George Lucas' iconic *Star Wars* series. It's one of the few topics on which the governments of China, Russia and the US are all in agreement.

How did Rovio do it? How did such a small and young outfit from a country of just five million inhabitants break through the glass ceiling and maintain their momentum for so long? There is always a bit of luck involved in the process of making a genuine hit – that is true in any entertainment industry. However, it's what you do with that luck that is important – what you do to sustain it over time and how prepared and informed your next steps turn out to be.

What we have learned

Every business story, successful or otherwise, is a distinct tale. A company is an ensemble of individuals and the different personalities of the people involved greatly influence a business. But we have found the following:

- **Make awesome products and awesome services for your awesome fans:** If you build it, they will come. This is the core foundation. It all starts there.
- **Strong recognisable characters:** This opens a whole lot of opportunities.
- **Storytelling works better than factual PR:** When you're building an entertainment franchise, beyond your unique sales propositions, connect and engage with the fans on their level.
- **Timing is everything:** As we've seen, the advantage of innovators and pioneers is that they grow with the market. They also back new technologies and platforms early on in their life cycles. They place a few bets and by the time the platform or technology is proven, others are already too late to the party.
- **Rhythm matters:** Think big, but care about the small repetitive steps. Working hard implies that it's not always fun. It's not just about the amount of hours you put in, it's what you do with them. Do your homework, every day. There's no such thing as a silver bullet. Pile up efforts. Persistence pays, so don't be afraid of engaging too much. Socialising on Twitter is not spam.
- **Look out the window:** Stay in touch with the evolution of your sector, but also look beyond your present position and your microcosm. Don't be afraid to branch out. Get out of your comfort zone! Don't just stare at the stars, study their trajectory. Don't overlook what the giants and leading companies are doing or have been doing to get to where they are. There must be one or two things they are doing right and you can take from them. There must be a source where all those dollars of theirs come from. Analyse and observe. Make partnerships – as many as you can.

'Stay in touch with the evolution of your sector, but also look beyond your present position and your microcosm.'

- **Adapt or die:** There's no third option, natural selection is Darwinian. Google has built a dinosaur statue in their garden in front of the Googleplex to make sure that they never forget this fact. Adapt to the platform. Adapt to the target audience. Adapt to market changes. Adapt to new generations. Adapt to technology. Adapt to consumer demands. Adapt to different cultures (that's what "thinking global" truly means). No, that won't make you lose your personality – it will grow it. "Artistic integrity" can't be the cop-out answer for self-indulgence, laziness, amateurism, immaturity or capricious behaviour.
- **Challenge conformism and conventions, be disruptive:** Once you master the other parameters, once you dominate the format and the rules, the time comes to bend and break some of them – then and only then. You need to know what you're talking about first. Challenging conventions for the sake of challenging conventions is absurd. If the convention is good, keep following it. But if you can come up with a better alternative, don't be afraid to challenge authority.
- **Stay humble but don't be too modest:** Be tough enough in negotiations. Don't sell yourself short. If you're going to have a bring-it-on attitude, be sure to carry strong statistics, impressive facts and/or great ideas as leverage. It's not arrogance if you have the goods to back it up. In other words, if your bold claims turn out right, they become prophecies. But make sure you have a great team that can deliver on time the things that you promise. Otherwise, ridicule is just around the corner.

- **No self-indulgence:** Look at yourself carefully in the mirror. If you're too close to the material, ask somebody lucid for an honest review of your work and listen to him or her with an open mind to criticism. If your product is going to wow millions, you might as well start with the one doubter currently in front of you. That critic is always going to turn up anyway. Question your road-map plan until you truly believe it will work. Question the quality of your product until you're sure it's excellent, because good enough is not enough. Finally, question yourself, question your instincts, question your flaws – you're not always right.
- **A scandal is bad, but a bit of controversy is good for business:** This is especially true if you're positioned as the underdog.
- **Build an audience first, monetise second:** Don't focus excessively on the short term and the bottom line. Building a fan base comes before that. Build the love. Money can't buy that. Of course, you can't overlook monetisation entirely. If you're running a business, as opposed to practising a hobby, then you can't afford to spit on money.

'Those experienced people around you are useful only if you have the humility to trust and listen to them.'

- **Internal structure is important:** This is your foundation. All your big dreams will falter if you build on quicksand. While on this topic, also resist the dictatorship temptation. Those experienced people around you are useful only if you have the humility to trust and listen to them.
- **Rovio is and remains a "learning company":** Don't think you know it all just because you gathered some early success. You're always only just getting started. Also keep in mind that learning is not a pure theoretical process: practice is necessary. Trial and error means taking calculated risks. Fail fast. And fail cheap. Do regular clean-ups and thorough, honest audits. In other words, manage your risks, but take some. And learn along the way. The status quo is your worst enemy.
- **Stand out in your marketing:** The work you are doing is not worthy of being called "marketing" if you are not standing out. If you don't stand out, you're essentially bland – you don't exist. Secret trick: when you have a low budget, be funny. And if you are beginning to experience what looks like the beginning of a ride, throw curve balls from time to time. You have the stage all to yourself, now be spectacular! Surprise your opponents and delight the crowds in the stands!

To paraphrase the wise words of the philosopher Socrates: Rovio can't really teach you anything, they can only make us think. So think away, fellow entrepreneurs, creators and dreamers of all kinds. Good luck. And good preparation!

Digitisation and democracy: the challenges of shaping the digital society

By Jeanette Hofmann

Jeanette Hofmann is director of the Alexander von Humboldt Institute for Internet and Society, honorary professor of Internet Politics at the Universität der Künste Berlin and head of "The Internet Policy Field" project group at WZB Berlin Social Science Center.

The current decade is seeing a fundamental change in the relationship between the Internet and society. At the start of the new millennium, the Internet was still a virtual space, which we deliberately accessed by logging in via a computer. In other words, we could also decide to be offline. With the expansion of Internet-enabled smartphones and the advent of the "Internet of Things," the notion of the Internet as a stand-alone social space has become obsolete within the course of a few years. The new communication services, tailored to the mobile Internet, develop their utility as "life assistants" particularly if telephones are permanently switched on and exchanging data. The simultaneous expansion of the digitisation of things via chips and sensors is leading to the creation of new digital infrastructures and a constant increase in data and information flows, which in turn bring about new analysis and evaluation methods. Our social reality is increasingly being mediated and contributed to by the Internet: the digital society is emerging.

We can still barely assess the consequences of digital penetration into more and more sectors of life and work. Some observers are forecasting that this change will be every bit as radical as that of the emerging industrial society. What is important from the social science angle is that these processes are not understood to be primarily driven by science and technology, but as flexible and open to social shaping. Lawrence Lessig's familiar dictum "Code is Law"[1] suggests that technology is an autonomous force subject to its own development logic. But just like laws, technical infrastructures are not merely created by humans, they are also interpreted, put into practice and evaluated by humans. In this respect digital technology is more flexible than many analog technologies and Internet users have long been exerting a major influence on its development.

'The development of digital societies is being accompanied by new forms of political organisation and regulation.'

In fact, the new information infrastructures and services are not only opening up major potential for commercial innovation, they are also showing the increasing need for national and transnational regulation, as witnessed by the public controversies about regulating information flows. Topical examples are the relationship between data protection and state surveillance, or the "right to be forgotten" in the context of the right of freedom of expression, so fundamental to the Internet. Common to these controversies is the issue of the relationship between digitisation and democratic organisation. The thinking in Europe is that the exercise of democratic rights unavoidably requires effective data protection. The development of digital societies is being accompanied by new forms of political organisation and regulation. Here are two very different examples of this trend:

- The rise of digital technology to a new method of algorithmic regulation
- Multi-stakeholder procedures aimed at including business and the civil society in political decision-making processes, especially at inter- and transnational levels.

Both modes of socio-political ordering differ from our traditional notions of political organisation in that they fall outside democratically legitimised processes and structures.

1 Lawrence Lessig, *Code and Other Laws of Cyberspace* (New York: Basic Books, 2006).

The regulatory power of algorithms

One consequence of digitisation is the ever more significant role of algorithms in business and society. Algorithms determine the relevance and order of search results, select Facebook's news feed, permit high-frequency trading and are responsible not only for the ranking of products and services but also for the rating of users, clients and candidates. They are even an integral component of dating agencies nowadays.

Algorithms are defined as a set of instructions or rules that precisely defines a sequence of operations. Smart algorithms use iterative processes to adapt their operations to the changing database and the results of their own actions and are therefore subject to constant adjustments. Given the increasingly pervasive flows of information they have become indispensable powerful structural aids for routine activities in business and society, which are increasingly taking on regulatory tasks. For instance, public authorities are experimenting with the potential uses of smart algorithms, one example being "predictive policing" in the United States, a method of crime prevention. Crime statistics are tied to large datasets on local social structures, urban and traffic development and the like in order to spot spatial and social patterns of deviating behaviour. In this way, public authorities hope to make more efficient use of public resources for crime prevention in the future. Evgeny Morozov describes such methods as "algorithmic regulation" and links them to a new individualised concept of social welfare.[2]

Smart algorithms have become a public issue because of their power. The neutrality once ascribed to them has become dubious, and the assumptions, assessments and objectives that form their basis are increasingly debated and criticised. This new scepticism is not primarily driven by the suspicion that algorithms use their power to manipulate us. Rather, the intention is to question their efficiency-increasing and action-structuring impact in terms of their relationship to fundamental democratic norms. To return to the example of predictive policing: Social behaviour deviating from the norm is not in itself a crime. On the contrary, social creativity and economic innovation are based on the very fact that human beings take the risk of questioning conventions, acting differently and thinking in novel ways. The question is whether the algorithms used for predictive policing are able to do justice to the broad range of deviant behaviour and actually focus on those forms of it which are unlawful. Another question is whether the algorithmic identification and linking of criminal characteristics will not result in a large-scale discrimination against social groups and neighbourhoods thus creating the opposite of the actually intended effects.

Algorithms often present themselves as a black box, doing their work without being understood by those affected. To take an example: a bank is not obliged to explain which credit card applications it rejects and which ones it accepts. Not even the bank employee will be able to fully explain the bank's decision to the customer. The algorithms' mode of operation remains a secret, partly because they are predominantly developed by private industry and are therefore business secrets. Critical observers refer to this as the "transparency paradox."[3] Given their increasing significance as "operating systems" of digital societies, it is time we subject our knowledge of their *modus operandi* and inherent assumptions and objectives to a critical examination. Informatics and social sciences should cooperate more closely in the future for this purpose, for example in interdisciplinary research projects.

Digitisation encourages new alliances and forms of cooperation not just in academia, but also in other areas, above all in Internet policy.

2 Evgeny Morozov, "The Rise of Data and the Death of Politics," *The Guardian*, 20 July 2014.

3 Neil M. Richards and Jonathan H. King, "Three Paradoxes of Big Data," in *Stanford Law Review Online*, Vol. 66, Issue 41, 2013 http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2325537

Multi-stakeholder processes

Even in its infancy, the Internet served as an experimental medium for innovative forms of social organisation and decision-making processes. An important reason for this lies in the peculiarities of the Internet itself. The technical standards constituting the Internet are often not protected by copyright; anyone can make use of them. In addition, the data lines and networks are owned and operated mainly by the private sector. So in order to draft rules for further developing the Internet and its communication services there needs to be cooperation between various actors beyond the bounds of countries, stakeholders and sectors. Whereas the telecommunications sector had sought a multilateral solution for the necessary international coordination, the founders of the Internet adopted a new, non-intergovernmental route, the organisation and procedures of which have up to now undergone constant change.

'The digitisation of society permits new forms of organisation and at the same time creates new sources of power.'

From a political science perspective, this process involves expanding democratic decision-making principles to transnational areas where national democratic procedures such as elections and majority voting are absent. The multi-stakeholder approach – first used in connection with the Internet at the UN World Summit on the Information Society in 2003 and 2005 – forms an important element of this development.

The multi-stakeholder approach involves the interaction of governments, international organisations, civil society, industry and scientific actors to develop jointly and on an equal footing solutions to problems that are beyond the scope of national regulation. Examples of the institutionalisation of the multi-stakeholder method are the Internet Governance Forum (IGF), the Internet Corporation for Assigned Names and Numbers (ICANN) and, most recently, the NETmundial Conference held in spring 2014 in São Paulo, which demonstrated new opportunities for cross-sector consensus-building with the inclusion of governments.

The multi-stakeholder approach is now a widely accepted concept in the western world. Many governments along with the Internet industry and civil-society groups are actively participating in multi-stakeholder processes. However, critics attribute this broad acceptance also to the fact that the approach is more about consultation than decision-making and that its emphasis is more on participation and integration than on binding regulation. From that perspective, the opponents of global regulation of the Internet could be regarded as the actual beneficiaries of such processes. But would it not be possible to further develop multi-stakeholder processes so that they could take on tasks beyond the exchange of views and information? Could not this approach help us to extend the democratic self-determination of the people beyond national borders?

Although the multi-stakeholder approach has been in use for more than a decade in Internet governance at global, regional and national levels, there has yet to be any systematic analysis of its capacity and effectiveness. Could multi-stakeholder processes be used to lay the ground for or even adopt binding political decisions? Can they create relevant opportunities for social participation and significantly increase the accountability of governments, industry and other stakeholders? Could they thus provide new forms of legitimacy and expertise for tackling complex issues even beyond the regulation of the Internet? From the point of view of transnationalising democracy, these questions are highly significant and point to a genuine research gap in Europe.

The digitisation of society permits new forms of organisation and at the same time creates new sources of power. The challenge is not to merely marvel at this transformation as a spectator but to actively shape it and critically question the compatibility of its individual facets with established democratic norms. Academic research should play its part in this endeavour.

Why we need high speed broadband in Europe now

By Werner Hoyer

Werner Hoyer is president of the European Investment Bank (EIB).

The financial industry has always been a consumer of data and a driver of advances in communications. Naturally, things have evolved since the days when Julius Reuter, founder of the news agency of the same name, used pigeons to bridge missing links in Europe's telegraph network to move information more quickly between trading centres. But in an industry where knowledge is not only power but also profit, the search for a technological edge remains relentless.

Today, hedge funds and banks use computers to process continuously news headlines or price movements to watch for potentially market moving patterns or events, and trade on them, sometimes automatically.

According to the Bank for International Settlements, the think tank owned by the world's central banks, it can take as little as one millisecond in the high frequency trading segment of the foreign exchange market to detect and then act on a profitable opportunity. In contrast, it takes a human being around 150 milliseconds to blink an eye.

'In an industry where knowledge is not only power but also profit, the search for a technological edge remains relentless.'

Acquired assets can be held for as little as one second before being on-sold. Physical location of servers and speed of connections can all make a crucial difference. In summary, in the financial industry, high-speed communications has a clear business case and revenue stream to back up the investment that is required to deploy it.

But what of the rest of us?

Without doubt, broadband networks are now an essential infrastructure in any modern knowledge-based economy. They are the enabler of measureable, beneficial spillovers not only for private-for-profit sectors, such as financial services and manufacturing, but also for public services, including health and education. In short, they are essential for competitiveness. Consequently, there is a risk in delaying high-speed broadband build out that the European Union will fall behind on two fronts:

- on the supply side of infrastructure, because telecommunications operators may not be able to develop and deploy advanced services, while equipment providers may not develop appropriate standards and technologies;
- on the demand side, as the adopting sectors may not be able to benefit from the productivity enhancing features of information and communications technology (ICT), with the perspective of declining social welfare and diminished ability to innovate.

Europe is already missing out on growth opportunities because of relative under-investment in broadband infrastructure, in particular next generation access, such as fibre to the home (FTTH), characterised by much higher transmission capacity than copper wire-based technologies. The benchmark countries have become Japan, South Korea and, increasingly, the United States. It is urgent that we address this deficit.

> ‘The increased roll-out of broadband infrastructure, also using the highest performing technology, pays off economically.’

Though connections are getting faster, most EU broadband lines are still based on digital subscriber line (DSL) technologies which have inherent technological limits. Thus, average speeds are usually lower than in other regions of the world with next generation broadband local access infrastructure based on fibre.

In 2013, there were 5.4 (up from 3.4 a year before) subscriptions of at least 30 Megabits per second (Mbps) per hundred people in the EU, which corresponds to an estimated household penetration of 14%. In the US this is more than twice as high, and in Japan and Korea more than two thirds of broadband subscriptions are based on fibre. In comparison therefore, ultrafast connections (at least 100Mbps) are still rare in the EU; penetration – subscriptions as a percentage of population – stood at just 1.2% in July 2013.

Research shows that, under a relatively broad range of assumptions on benefits and cost, the increased roll-out of broadband infrastructure, also using the highest performing technology, pays off economically.

But because of the generally very long payback periods and low financial returns, a major part (about two thirds) of investments – especially those located in medium to low population density areas – is not financially viable in a pure market environment and hence requires additional support from public sources.

To be commercially viable, revenues raised from operating a FTTH network need to be sufficiently high to pay for the necessary capital expenditure. Financing gaps arise when this is not the case. This is mainly a function of population density. In urban areas, cost levels between €150 and €540 per home are typical. In suburban areas this rises to between €540 and €2,700 and higher in rural areas. Generally the market is only prepared to finance investments in urban areas. Hence to pursue the policy goal of high speed broadband coverage entailed by the digital agenda requires some form of subsidy in the remaining regions.

The EU budget for 2014-2020 foresees €1 billion for ICT under the Connecting Europe Facility (CEF). Most of this funding is in principle earmarked for support to digital services – only €150 million for infrastructure. Unfortunately, this is far less than originally envisaged by the European Commission, but it will nevertheless provide the opportunity to launch some pilot activities that may be scaled up at later stage in case additional funding may become available. Clearly, mainly national funding has to be used. However, many countries are severely constrained on this by the limits to government spending.

Apart from investment in infrastructure, investment in R&D and innovative activities is also of crucial importance in the ICT sector. R&D shares largely exceed the average shares of most other industries – yet here Europe also lags its competitors. Stimulating R&D in ICT is crucial to reviving the continent’s productivity.

Broadband deployment now forms a regular component of most standard European Investment Bank – the EU bank – loans to telecom infrastructure operators. For example, a €500 million loan signed with TDC in Denmark in June 2014 includes fibre access, vectoring and also coax cable networks. As a result, the project will help to expand the availability of and enable the provision of broadband services up to ultra-high speed. Similarly, a €150 million loan signed with Jazztel

in Spain will support rolling out a fibre optic network from the backbone infrastructure to three million homes. The loan will also finance the expansion of network and ICT systems to cover all of Spain's major cities, including Madrid and Barcelona.

The EIB has also supported ICT investments by user industries and in e-services, for example, in the area of healthcare, intelligent transport management systems, smart metering of energy consumption and innovative projects in the ICT components/hardware industry.

But to help try and bridge the financing gap, for example in the area of research and innovation, the EIB has also developed in partnership with the European Commission a number of joint financial instruments. These can be used to support both the infrastructure supply side – for example the Axione Infrastructures project signed in France in July 2014, which aims to bring broadband to a number of low population density areas – or the demand side for services, for example a loan to digital games developer Rovio Entertainment Ltd. in Finland for its R&I.

Using funds set aside in the EU budget, these joint financial instruments allow the EIB to take on greater risk. For example, the Axione financing arrangement formed part of the EU's pilot "Project Bond" initiative that aims to encourage long term investors to back project management companies. These companies are able to issue investment-grade bonds that are attractive for this class of investor thanks to the EIB providing riskier tranches of funding backed partially by pre-defined EU budget funds. The pilot phase of the Project Bond initiative ends in December 2014 and it will be up to EU member states and the European Parliament to decide whether to extend it, but the EIB's view is that this could be a suitable mechanism for reaching large-scale broadband projects with investment needs exceeding €300 million to €400 million.

For smaller projects geared towards research and innovation, the EIB can also provide direct or intermediated loans under the "InnovFin – EU finance for innovators" initiative backed by funds from the EU's Horizon 2020 research budget. It can also co-finance large or smaller projects as part of EU countries' structural fund programmes – and is currently assessing a number of these for the 2014-2020 programming period.

Digitalisation has become one the main drivers of global competition. More than ever before, growth and prosperity in Europe depend on digital infrastructure and services to further refining our skills, expanding our knowledge and the translation of both into new products and services. While Europe still has one of the best science and research systems in the world, its position is being increasingly challenged. For more than a decade, Europe has fallen behind other economies in the competition for leading-edge digital products and services. This can only stop if Europe decides to massively invest in the digital economy.

'Digitalisation has become one the main drivers of global competition.'

To countervail these trends and to support Europe's efforts in catching up, the EIB will focus its financing on projects that help to:

- accelerate the roll-out of very high-speed broadband networks;
- stimulate the creation and adoption of productivity enhancing digital services;
- close the digital gap in rural areas for high speed access;
- enhance the security and resilience of ICT networks and applications through investments in EU-based infrastructure.

Cities that are truly "smart"

By Rem Koolhaas

Rem Koolhaas is an architect, architectural theorist, urbanist and professor in practice of architecture and urban design at the Graduate School of Design at Harvard University.

I have a sinking feeling when I listen to talk by prominent figures in the field of smart cities, because the city used to be the domain of the architect, and now, frankly, they have made it their domain.[1] This transfer of authority has been achieved in a clever way by calling their city *smart* – and by calling it smart, our city is condemned to being stupid. Here are some thoughts on the smart city, some of which are critical; but in the end, it is clear that those in the digital realm and architects will have to work together.

¥€$ regime

Architecture used to be about the creation of community, and making the best effort at symbolising that community. Since the triumph of the market economy in the late 1970s, architecture no longer expresses public values but instead the values of the private sector. It is in fact a regime – the ¥€$ regime – and it has invaded every domain, whether we want it or not.

This regime has had a very big impact on cities and the way we understand cities. With safety and security as selling points, the city has become vastly less adventurous and more predictable. To compound the situation, when the market economy took hold at the end of the 1970s, architects stopped writing manifestos. We stopped thinking about the city at the exact moment of the explosion in urban substance in the developing world. The city triumphed at the very moment that thinking about the city stopped.

The "smart" city has stepped into that vacuum. But being commercial corporations, your work is changing the notion of the city itself. Maybe it is no coincidence that "liveable" – flat – cities like Vancouver, Melbourne and even Perth are replacing traditional metropolises in our imaginary.

Apocalyptic rhetoric

The smart city movement today is a very crowded field, and therefore its protagonists are identifying a multiplicity of disasters which they can avert. The effects of climate change, an ageing population and infrastructure, water and energy provision are all presented as problems for which smart cities have an answer. Apocalyptic scenarios are managed and mitigated by sensor-based solutions. Smart cities rhetoric relies on slogans – "fix leaky pipes, save millions." Everything saves millions, no matter how negligible the problem, simply because of the scale of the system that will be monitored. The commercial motivation corrupts the very entity it is supposed to serve... To save the city, we may have to destroy it...

When we look at the visual language through which the smart city is represented, it is typically with simplistic, child-like rounded edges and bright colours. The citizens the smart city claims to serve are treated like infants. We are fed cute icons of urban life, integrated with harmless devices, cohering into pleasant diagrams in which citizens and business are surrounded by more and more circles of service that create bubbles of control. Why do smart cities offer only improvement? Where is the possibility of transgression? And rather than discarding urban intelligence accumulated over centuries, we must explore how what is today considered "smart" [compares] with previous eras of knowledge.

1 This essay is adapted from a talk given at the High-Level Group Meeting on Smart Cities in Brussels on 24 September 2014.

If mayors ruled the world

The smart city movement is focusing on the recent phenomenon that more than 50% of the world's population lives in cities. Therefore, mayors have been targeted as the clients or the initiators of smart cities. Mayors are particularly susceptible to the rhetoric of the smart city: it is very attractive to be a smart mayor. The book *If Mayors Ruled the World* proposes a global parliament of mayors.

This confluence of rhetoric – the "smart city," the "creative class," and "innovation" – is creating a stronger and stronger argument for consolidation. If you look in a smart city control room, like the one in Rio de Janeiro by IBM, you start to wonder about the extent of what is actually being controlled.

'Smart cities and politics have been diverging, growing in separate worlds.'

Comfort, security, sustainability

Because the smart city movement has been apolitical in its declarations, we also have to ask about the politics behind the improvements on offer. A new trinity is at work: traditional European values of liberty, equality, and fraternity have been replaced in the 21st century by comfort, security, and sustainability. They are now the dominant values of our culture, a revolution that has barely been registered.

Courtroom

The car is a key element in the smart city. It is now being equipped with increasingly complex monitoring devices. On the one hand, the devices improve the driver's behaviour, but on the other hand they create a high degree of surveillance. I'm not convinced that the public will welcome this degree of monitoring. I prefer the car not to be a courtroom.

Faraday cage

In the past two years we have, with the Harvard Graduate School of Design, looked at the architectural elements – like the wall, the floor, the door, the ceiling, the stair – and seen how they are evolving in the current moment. If the city is increasingly a comprehensive surveillance system, the house is turning into an automated, responsive cell, replete with devices like automated windows that you can open but only at certain times of the day; floors embedded with sensors so that the change in a person's position from the vertical to the horizontal, for whatever reason, will be recorded; spaces which will not be warmed in their entirety, but instead will track their inhabitants with sensors and cloak them in heat shields. Soon a Faraday cage will be a necessary component of any home – a safe room in which to retreat from digital sensing and pre-emption.

Politics

The rhetoric of smart cities would be more persuasive if the environment that the technology companies create was actually a compelling one that offered models for what the city can be. But if you look at Silicon Valley, you see that the greatest innovators in the digital field have created a bland suburban environment that is becoming increasingly exclusive, its tech bubbles insulated from the public sphere. There is surprise that the digital movement is encountering opposition on its own doorstep. Smart cities and politics have been diverging, growing in separate worlds. It is absolutely critical that the two converge again.

Human society in a digital world

By Neelie Kroes and Carl-Christian Buhr

Neelie Kroes was vice-president of the European Commission responsible for the digital agenda (2009-2014). Carl-Christian Buhr is a member of cabinet for Phil Hogan, European commissioner for agriculture and rural development; formerly, he served a member of Vice-President Kroes' cabinet.

The world is changing all around us. It is happening in so many small ways it can be easy to overlook the long-term implications. Are we becoming the proverbial frog who boiled to death because he failed to jump out of the boiling water in time? Or are we on the road to the digital nirvana – where reality is starting to look like science fiction's predictions of yesteryear?

Will the world be totally digital? With all objects connected, with "body area networks," with everybody talking to swarms of smart objects (or even smart dust) at all times, enhanced with silicon-based technology, or whatever comes after the physical limits of classical integrated circuits will have been reached – perhaps very soon. Will we have tiny repair robots in the blood stream, perhaps? Will we reach immortality, even?

Or will it just be the games that get more real, the kids spending more time in virtual worlds than on social media (or in social virtual worlds?), the gadgets becoming more powerful as they always do, and the machines becoming more electronic each generation, while most of our lives continue as normal?

Or are these just two different perspectives on the same development, differing in tone and perhaps by a few years, but not in any fundamental way?

We have had these questions in our mind about the last five years of digital policymaking – and about the way ahead. If we are serious about wanting to successfully ride the wave of the digital development toward more growth, more jobs, more competitiveness and a better society in Europe, then we need to start thinking about them right now.

How we transact

Our work, our lives are moving online. We already have online identities, but they are dispersed. The services you deal with now increasingly know you and your profile. Some even help others to know you for example by using a single sign-on. And, of course, regulations, infrastructure and technology are underway to provide hardened, individualised, public online identities. But this is only the start.

A passport or ID card does not protect us from being exploited or simply underserved by companies and service providers in the bricks and mortar world. And the same is true online, only that the environment is still far less mature. If one or two services make it very simple for us to seamlessly integrate a device with a data stream, an online profile and a database of past actions, etc., then that is deemed convenient. If 10 or 20 do it, it is complicated. If 100 or 200 do it, we are lost and things become unmanageable, and massively inefficient – and not only for the person concerned, but for the overall system.

'Our work, our lives are moving online. We already have online identities, but they are dispersed.'

It is not a good thing for data to be locked up in domain-specific systems rather than being under the control of the customer, liquid and mobile. Holding data in proprietary tools and formats might do the job at hand, but that does not mean we are maximising its utility. It is the

equivalent to CD-ROMs, or paper, gathering dust on shelves and in drawers. Of the museum items that sit in storage instead of on display. Companies fold, passwords get lost, ideas are forgotten. Then the meaning and value eventually ceases to be retrievable as proprietary file formats change; our identity and the value fades away.

That is just one of the problems. Here is another: suppose services are linked in cascades, each one building and depending on other services' outputs. Being in good relations with one service provider as the *sine qua non* of continuing even to exist for others. What if a computer bug could revoke your identity, your credit, your access to your tools, data, contacts, everything? This is not just about the danger of criminal intervention or wilful sabotage. The sheer complexity of the system becomes a source of problems and danger.

One way to address such problems and risks is to go "back to the future" – a future of "walled gardens," people deciding to source all or almost all their relevant online identity and services from just one, very large provider.

'The sheer complexity of the system becomes a source of problems and danger.'

But we don't think that's the way it should go. Firstly, those walled gardens will just become "too big to fail" like some banks were in 2008 – we don't need an Internet crisis like the financial crisis that followed those mistakes (not to forget the ease of spying on users when all are in one place). Secondly, and more fundamentally, we are convinced that we have to stick to the principles of the open Internet and the World Wide Web – decentralisation and the ability to move ahead without asking for permission.

We should see a new class of digital tools and services that do not depend on advertising or other forms of side monetisation. Such tools would directly charge for what they do, namely to provide a user-controlled online space for data, identities etc. Everyone's own private locker in the cloud. Think of a safety deposit box for the 21st century, as safe and secure as in banks, but connected to everything else. Why should we have to give up our privacy for a "free" service if we prefer to pay for that same service with cash and keep our privacy?

In the long run, as the amount of data and the ability to process and glean knowledge from it will skyrocket, such a decentralised set-up will also mean a better overall efficiency and effectiveness of use. Users becoming more comfortable with sharing data, information and access where they believe it is beneficial (e.g. anonymised health records for medical research or location information to optimise traffic management systems). And those making sense of data (scientists, market researchers, marketing professionals, increasingly everybody) will be able to more comfortably use and exploit such information, in legal certainty.

In Europe, we currently have a public debate about certain large American companies, their behaviour, and what they mean for the European media and telecoms sectors. There is a related debate about access to knowledge and culture. One company in particular is often criticised for not correctly playing its role as the map of the web: Google.

It would not be right to criticise Google simply for being successful. And it is not realistic to expect Google to act like a public service. Google the company is not a public service. It is not in the business of providing objective statistics about the online landscape. It monetises eyeballs via advertisement and therefore it is in the business of keeping those eyeballs happy and coming back. (And apparently it is quite successful doing just that, especially in Europe.)

If it is collectively felt that this is not good enough, or not all there should be, perhaps it is time to rethink what online search is or could be. Can there even be "objective" search results? And if yes, would they help real people who search something online? What role should the public sector have, if any?

Imagine a public agency whose first task would be to create and maintain an index of the World Wide Web, a mirror of what is out there at any given moment, as up to date and complete as possible. And whose second task would be to make that index available for re-use, enabling competition on the basis of that shared resource. A resource that is not accessible beyond a small number of companies today because the costs to build the necessary infrastructure are daunting for new entrants. This would be "big data" as a public service. And it could allow new search engines – horizontal and vertical ones; language-specific ones; free and fee-charging ones – to bloom, compete and improve based on this collectively maintained core. Could this be done, technically, legally and financially? And what would it mean for the current debate?

How we sense

We have seen a steady evolution in the means in which information can be displayed or otherwise transmitted to people. Jumping over the oral tradition and a few centuries of books, this has boiled down to ever larger, thinner, more colourful digital displays.

We won't need resolutions to get much higher before we can reproduce pictures at a par with what we see with our naked eyes. But the development will not stop there. Already now we talk about information overlays, augmented reality and, perhaps soon, fully virtual surroundings.

Now an immersive Virtual Reality (VR) experience would for sure blow a number of things out of their familiar waters – starting with gaming, television, videoconferencing and conferencing as a whole. Think about a videoconference that in all respects looks and feels as if everyone really is in the same room – for the price of a VR-Headset and a fast Internet connection.

'What are maps and pictures of street scenes today may become our daily surroundings tomorrow.'

Not just phoning anywhere, but "being" anywhere. What are maps and pictures of street scenes today may become our daily surroundings tomorrow.

When this trend becomes widespread what will it mean for the way our cities are organised? Our working life? Will we need physical offices at all anymore? Will there be a new body/brain divide – a need to keep the body healthy even though the brain is mostly elsewhere?

Maybe right now it is still a bit too early to discern the public policy questions that will arise on the back of this development. But arise they will.

How we live

Speaking about the body, we know that it is made up of very tiny parts – a lot of them – and science is understanding those parts better each day. And we finally start to be able to build machines at comparable nano-levels, predicted since the 1980s, that can work inside the body.

Think about a lab on a chip. A blood-stream filter that hunts individual cancer cells. Smart pills that navigate their payload to the right place in the body. And so on. But also think about prosthetics – artificial limbs which get connected to severed nerve ends so that they can be stimulated by

muscle movements, or thought alone. Will this stop at handicapped recipients? Stories abound of "makers" who are already busy "improving" their bodies. Why just increase the hearing capability of the impaired? Wouldn't it be nice to be able to hear long-distance? Dozens of meters – or through walls, if needs be? The technology is there already. Will it be allowed to be used? It certainly is not forbidden today. And where are the principles that could orient regulation in this area?

'The technology is there already. Will it be allowed to be used? It certainly is not forbidden today.'

Should there be special rules for children or for people in formal settings such as education? Surely, yes. But what should they be?

Imagine a system in which information retrieval is stimulated by thought (as prostheses are today) and the results are than laid over one's vision through a smart lens. If working reliably, this system could end learning by rote. Why deprive our kids of an opportunity to use their time on other things, things that machines really can't help them with? Think about the past: people used to buy and carry around tables of logarithms to simplify other mathematical calculations. Today only few even understand this concept. There's certainly a cultural loss in this, but nobody can say it isn't progress.

But what if such systems could not be afforded by many? That is a distinct possibility. A new digital divide could arise, much wider than anything we have seen before. It would not be a divide between the processing power of one's device or the bandwidth of one's connection and those of others, but the difference between a normal human life and an enhanced one. Between one world and two worlds.

Plus none of this looks as if it would stop at intellectual use. The body itself could become the target for optimisation. If all its parts become repairable or even replaceable, could we ultimately avoid death? What if it can be fought back, e.g. in the way drug cocktails today can curtail previously terminal illnesses virtually forever? How would a society have to look in which increasingly many people stop dying of anything but accidents or violence?

How we socialise

We have described a number of possible, even probable, developments. If even some or part of each really came to pass, they would point towards a whole new chapter in the development of human civilisation. A relentless acceleration that public policy will struggle to keep up with. And changes may continue to come faster than ever before because that is the nature of exponential processes such as Moore's Law (the observation that, on average, over the last few decades processing speeds of computer chips have been doubling every two years).

What, if anything, can or should public policy do to prepare us, or to act early?

We already struggle with how to regulate messaging services and mobile roaming. How on earth should it be done for virtual reality, drones, recording glasses, driverless cars, 3D printing, connected everything, and all at the same time?

We see the risk that the new technology could completely change the younger and new generations even while politics in Western countries remains geared towards the elderly (and in particular those already elderly today). That could lead to a very dangerous democratic divide on top of a digital one. We will see new classes of social behaviour emerge, new social and cultural norms, and we will see clashes with the old ways.

But it goes even further than that.

What is human?

One could say that being human is what most people consider to be human in 2014. It won't be that simple in the future.

Who is to say that it should be Man's destiny to forever stay bound to Earth, limited by biological decay, not in charge of his own future? Put differently: would carrying a mind-enhancing implant (whatever the details) be a travesty or a dream come true?

I'm sure many will come down strongly on either side of these questions, making the transition, or the management of the co-existence of new and old, a public policy challenge. Today we may think, at least in parts of the world, about atomic fission, or genetic engineering, as topics that are likely to generate heated public debate. But prepare for much higher temperatures when electronics and genetics merge to allow people to transcend thousands of years of biological history. Mind in silicon. Mind in artificial bodies. Will it become possible? We don't see why not.

'Mind in artificial bodies. Will it become possible? We don't see why not.'

Would such a development be good or bad? That's the wrong question – it will just be. Its different impacts may variously be good or bad, depending on the details and the perspectives.

Human life, happiness, dignity; democracy, solidarity, fairness: what will they mean, what should they mean when silicon meets flesh, when virtual reality overlays our senses, when manual labour could be a thing of the past because of robots, when we could truly live the life of mind – if we choose to?

These are all huge questions. Where to begin, practically, from today's perspective? For starters, we know we could not stop the technological development even if we wanted to and therefore should not lose time trying. We should work on equipping our institutions and processes for societal decision-making to take up these developments early and thoroughly: New approaches to communicating about issues, in a two-way fashion. Faster, more frequent, more reversible decisions. Rules and regulations that leave more room for more differences between individuals. New types of protections for new types of minorities. Bringing John Stuart Mill's *On Liberty* into the 21st century.

Dangers

We like to think that we are optimistic realists when it comes to technology. Not all problems will vanish, not all will be good. And things might even go seriously wrong, but we still need to accept that these technologies will advance to some degree. But to what degree?

New devices might continue to require specific ingredients that come from war zones, or countries bound to translate their natural resource wealth into geopolitical control and other forms of power (e.g. "rare earths" materials used in mobile devices today). More research and development is almost certain to find ways around this – in the middle and longer term. But markets may have moved by then, monopolies created, history changed.

A near universal experience with high-tech over the last decades, especially general-purpose computing devices from the personal computer to the smartphone and tablet, has been obsolescence, ever faster obsolescence. Exponential increase in computing power also means that the time it takes for your latest shiny device to look positively stale will continue to plummet.

And the markets on which this takes place today are global, sometimes boasting unit figures in excess of the human population. So we need to address the issue of electronic waste, gigantic amounts of it, with heavy metals and other toxic substances. If recycling and reuse does not become much more prominent, the Internet of Things may end up being just a gigantic health hazard.

By some measurements the Internet is already responsible for a significant fraction of the Earth's energy use. Putting the other half of humanity online in the next few years, plus all their data into the cloud, will mean further rapid increases, as will the smartening up of our environments, all objects equipped with sensors, connected and constantly exchanging data. Ambitious research is underway for more energy-efficient computing and self-sufficient components that can harvest ambient energy. But also here it looks like a race between the economic juggernaut of new gadgets finding (or founding) global markets rapidly and fascinating research that will take time to reach the scale and cost figures needed to compete.

And finally, perhaps most importantly, advancing virtual reality – starting with overlays, heads-up devices, clunky VR goggles and stopping... who knows where? – sets humanity as a whole on a course into the unknown. There are reasons to expect adaption even to completely new experiences, as with the first trains in the 19th and the first planes in the 20th century. But we can't be sure. And tricking your own brain into thinking that a computer-generated picture is your own body, an artificial surrounding is a "place," and so on, certainly affects us in much deeper ways.

For decades there has been debate on the effects of video-gaming on the behaviour and personality of gamers. It seems like a sure bet to see many of the arguments and research used and performed there to come back with a vengeance for everything related to VR.

But this is not just about human physiology, whether our sensory apparatus can keep up with novelty while also keeping us sane. It is also about fundamental changes in what it means to be human among humans. Even today, in principle everyone could reach everyone else in a matter of seconds. The problem becomes filtering and finding – not talking, seeing or even touching, once found.

'If recycling and reuse does not become much more prominent, the Internet of Things may end up being just a gigantic health hazard.'

The discussion of societies with themselves, formerly done in institutions, books, newspapers and other media, is moving online and speeding up. It puts a strain on control mechanisms. It is not anymore the slowness of the medium that can guarantee a certain amount of reflection. Plus we will increasingly see artificial agents acting on behalf of people, and acting at their own speed that is measured in micro-seconds. If automatic trading, software agents acting on behalf of banks, are feared to even today have the potential to bring down the global financial system if only a small number of bad constellations coincided, what will such more general-purpose agents be capable of doing once there are seriously many of them and they all react to the same stimuli, in no time?

The future combines enormous promise with completely new challenges. Digital is here to stay, but the future is open. So we can't allow ourselves to stall in closed environments – closed by geography, by restrictive copyrights, by ignorance, by bad laws. Let's get to work shaping our open world. Making it work for us, with a full sense of ourselves as humans and a full view of the good society we would like to build and enhance and not damage or destroy. We want to be improving details without forgetting about the big picture. And let's always keep our sense of wonder.

No one left behind

By Martha Lane Fox

Baroness Lane-Fox of Soho, CBE is chair of Go ON UK, the UK's digital skills alliance.

Over the next decade, hyper-connected digital technologies, platforms and services – accessed across an increasingly globalised information environment – will continue to transform every aspect of our lives. Innovations such as the Internet of Things, big data, open data, and online education resources will all unlock a kaleidoscope of new opportunities capable of transforming Europe's capacity for future job creation, innovation, economic growth and competitiveness.

And yet, in 2014 as we celebrate the 25th anniversary of the web, 110 million Europeans have still never used the Internet, and 246 million people (nearly 50% of the population) across the EU have either no – or low – digital skills. A quarter century since the arrival of the web, it is clear that we must work harder than ever to prevent a two-tier digital society. This isn't just the responsibility of policymakers and industry leaders. Most of us have the potential to become digital champions and help our friends, family, neighbours and work colleagues get online and begin their digital skills journeys.

So for individuals, organisations and countries to fully exploit and enjoy these new digital opportunities, we urgently need to address this growing digital skills gap. This involves tackling our deficit of high and intermediate level digital skills, and ensuring that every citizen can achieve the basic level of digital skills they need to benefit from these new products, platforms and services.

The Internet has already had a remarkable impact on all aspects of our lives. Yet it is salutary to remember that this remarkable invention is only 25 years old. When Brent Hoberman and I started Lastminute.com in late 1997, we were on an evangelical mission to convince investors, suppliers and customers that the web was here to stay and was not going to implode. Imagine the landscape then – no Google, no Facebook, no Twitter and certainly no smartphones. All this has changed in such a short time. Indeed, by historical standards the rate of Internet adoption is taking place at warp speed. Radio took 38 years to reach 50 million users. Television took 13 years to do the same. In contrast, the web took four years and Facebook took a mere 10 months to reach those usage levels.

Perhaps surprisingly, the over 55s are the fastest growing demographic using social media. The fastest growing levels of web usage are in Africa with Nigeria hosting the largest numbers of new users, with 47% accessing the web via their phones. More than 55,000 projects have received funding from the crowdsourced finance platform Kickstarter – almost all of which would never have been launched without it. In the UK alone people have earned £4.6 billion [around €5.9 billion] from sharing their own products and services through sites such as Airbnb and Zopa.

> 'Millions of so-called citizen-scientists are plotting cancer gene patterns via online games.'

Right now the explosion of shareable and measurable information and data is helping us rethink our approaches to some of health's greatest problems. Millions of so-called citizen-scientists are plotting cancer gene patterns via online games. In addition, early intervention approaches for individuals likely to develop dementia are becoming more common after the success of online early screening tests. Even those amusing animal videos posted online – much mocked by some – are now enabling scientists to gather meaningful data from around the world about animal relationships that would never have been accessible before the dawn of the web.

The disruptive effects of the web are being felt across all industries and sectors. Education is being opened up on a global scale through the use of Massive Open Online Courses (MOOCs) – from Khan Academy's tutorials to Coursera's degrees. Farmers in Ghana are saving time and money by using their smartphones to trade their products before the long walk to market begins and under-privileged women in South Africa are breaking out of poverty after receiving training that means they can answer tech queries from US customers.

In the UK, the Internet now forms the backbone of our rapidly-evolving digital society and economy. Products and services delivered online now account for at least 10% of UK gross domestic product (the highest proportion of all G20 countries), and the British are the most enthusiastic online shoppers on the planet (in 2014 e-commerce will account for about 20% of total UK retail sales). Indeed in the UK the Internet sector is bigger than the health or education or construction sectors.

Despite all the exciting digital opportunities unfolding around us, 22% of the EU population (110 million people) have still never used the Internet. In the UK there are 9.5 million adults who lack basic online skills. 50% are over 65, but the other 50% are of working age. This is simply not a sustainable situation, given that a quarter of all new job vacancies are now only advertised online. By 2020, the UK will be seeking to fill an estimated one million technology sector job, and Europe is already bracing itself for looming deficit of 900,000 information and communications technology (ICT) professionals by 2020.

In the UK, only 30% of small businesses are capable of marketing themselves and selling goods online – which excludes them from significant potential sales and cost savings. Across Europe, the problem also persists with the majority of small- and medium-sized enterprises (86%) hardly beginning to exploit the newfound commercial opportunities of the digital market place. On the basis of current trends, not a single European Union member state will reach the EU average target of 33% by 2015.

Go ON UK (the cross-sector charity I chair) argues that basic digital skills represent a key enabler for future economic growth offered by digital technologies – a dividend which is estimated to be worth up to £63 billion [around €80.5 billion] in additional annual GDP growth in the UK alone. I'm also very concerned about reports that the percentage of women in the UK tech sector is actually falling. If current trends are not reversed, only one percent of the sector will be female by 2040.

'In the UK, the Internet now forms the backbone of our rapidly-evolving digital society and economy.'

We must not create a two-tier society but instead should aspire to a universality of digital skills that will help Europe to grow and prosper at a national level as well as at an individual one. I believe that we will never unleash the potential of all citizens without focusing on all aspects of digital growth – both skills and infrastructure. But despite the European Commission's plans to improve our infrastructure we still lag far behind Taiwan, Korea and Japan in terms of universal provision and leagues behind Singapore or Korea in average available speeds. In the UK, the government has spent £1 billion [around €1.28 billion] in improving our national broadband infrastructure. But without delivering digital skills for all citizens, how can they all benefit from this investment?

Perhaps most seriously, I believe we do not have the skills and understanding of the digital world at the top of our corporate, public and political elite. This leads to a lack of high quality decisions about our future – a future where so much will inevitably revolve around technology. Only four

FTSE 100 businesses have a chief technology officer or digital executive in their boardrooms, and yet all of these businesses are facing potential upheaval.

To add to the complexity, the technology landscape is not remotely stable but is changing at mindboggling speed. We face hard questions as we grapple with the technology we already know about let alone the developments coming in the future. What should be the regulation of personal drones? Of driverless cars? How do we protect against increasing cybercrime? What are the privacy implications of wearable technology? What is the intellectual property of a 3D printed object? How do we teach children about online identity? How do we protect the free flow of information around the world and avoid a balkanised web?

'To add to the complexity, the technology landscape is not remotely stable but is changing at mindboggling speed.'

So how do we make sure we have the understanding and experience to debate these areas effectively? I would construct my answer by going back to what I imagine were some of Tim Berners-Lee's guiding principles in 1989, from which we have strayed far:

- Inclusion – make sure no one is left behind both geographically and demographically
- Freedom and transparency – make sure consumers understand privacy trade off when they consume seemingly free services from global web companies
- Openness – make sure no government can control access and content

The Internet and the web have immense power. I find something new, remarkable and inspiring about them every day. But we also need to find time to pause for breath, and perhaps think a bit more self-consciously about the kind of digital environment that we want to see evolving over the next quarter century and beyond.

Europe's future in the digital age: three paths to explore

By Maurice Lévy

Maurice Lévy is chairman and CEO of Publicis Groupe, a multinational public relations company with its headquarters in Paris, France.

Albert Einstein used to say "imagination is more important than knowledge." One can hardly agree more. By the same token, we cannot but deplore that Europe keeps missing the point in the digital age. Albert Einstein was a European and he had knowledge – that's a fact. More importantly, he pushed the limits of imagination, beyond the comfort zone and courtesy of the brutal power of mind. Fleeing the darkest times of Europe, his imagination served a country of pioneers and entrepreneurs – the United States. Today is no longer about "40 acres and a mule," or even about the US. It's about unleashing innovation on a global scale. Europe boasts magnificent assets, but it still lags behind. It's a call of duty for us all.

The digital tsunami we are experiencing is chiefly a behavioural landslide. Citizens' and the consumers' autonomy is gaining both pace and breadth. Unsurprisingly, insatiable millennials are spearheading this phenomenon, with the exponential growth of sharing means, devices, choice options, co-decision and therefore action – all this being both mobile and horizontal, as witnessed by the "peer-to-peer" mantra. Always-on and empowered, the citizen creates content, compares, blogs, rates, co-own brands and starts revolutions on social networks. Exit mass passivity, the digital era is that of sharing and instantaneity – and therefore of efficiency. With a mechanistic side effect: growing privacy concerns are the flip side of this improved efficiency. You buy online, you use a GPS-based service; and as a result, the NSA and tech firms know a lot about you, your habits and your networks. Potentially forever; unless a right to be forgotten is enforced.

'The digital tsunami we are experiencing is chiefly a behavioural landslide.'

From a bird's-eye view, what are the broad lines of these moving parts? First, the unprecedented pace of changes. 5G technology is beta-tested in Korea when 4G is not yet fully rolled out in Europe; technological leap-frogging means that emerging countries skip the desktop and go directly mobile. Second, boundaries vanish: geography-wise, but just as important for businesses and organisations, hence a massive business disintermediation across-the-board. Third, life and death cycles of businesses are redefined. Some people might say that this is the name of the game: Clément Juglar's cycles, Joseph Schumpeter's creative destruction or Nikolai Kondratiev's waves. Except that digital appears to be a very different animal: large incumbents can be out of business overnight and garage startups can top the S&P500 in just a few years. Instagram's or Whatsapp's developments were light speed. Fourth, the almighty power of new players. The initial public offering of Alibaba, the Chinese e-commerce company, dwarfed previous tech IPOs by closing at $229 billion [around €181 billion] on its first day of trading.

No European economic sector will be spared by these long-lasting trends; all companies will have to face the brutal impact of disintermediation: financial services, tourism, transportation, and all forms of commerce. Think about Uber (the ridesharing service that connects customers with drivers of vehicles for hire), think about Airbnb (a website for people to rent out lodging), think about Indiegogo (the international crowd-funding site), and think about all the sharing economy's daily innovations that can disrupt a whole industry. In the case of mobile, traditional manufacturers like Nokia have had to compete with tech firms (Apple, Samsung and Sony), platforms (Google, Amazon) and even startups like Wiko. The bottom line is it's all about the person that will ultimately match the customer's leading needs – the backyard psyche is dead. To secure relevance usually means to innovate as an entrepreneur – and you better be a first-mover in this digital world that

wipes out the prerequisite in terms of scale and financial firepower. As the saying goes, attack remains the best form of defence to stay in the game.

As a result, the digital transformation calls for us – we, Europeans – to reinvent and to invest massively in order to secure our future in a globalised economy. Today's leaders are North American and they built their supremacy over a decade. New pioneers – Alibaba, Tencent, WeChat, Weibo, Renren – are Chinese and could catch up in no time, given their huge funding capacities, backed by both the power of the state and the humongous size of the domestic market. Make no mistake, a race is on: a race for data and intelligence. It is about data flows and therefore about digital "pipelines." A single datapoint encapsulates it all: a Facebook account allows you to log into almost 80% of the most popular mobile apps.

'The digital transformation calls for us – we, Europeans – to reinvent and to invest massively in order to secure our future in a globalised economy.'

In front of this North-American dominance and this Asian fast ramp-up, Europe unfortunately lags behind, and it has been unable to produce a single blue chip platform company. This is unlikely to change in my view. Where are the rollercoaster investments that will shape our world? Apple just inked a deal with Visa/Mastercard/Amex that turns the iPhone 6 into a mobile wallet. Amazon, Google and Facebook are all investing in drone capacities for super-fast and mass delivery. Where are the Europeans? The Galileo GPS system is a first step but what about the corporates and the platforms?

At any rate, Europe does not lack the talents: brilliant European engineers are countless in the Silicon Valley. Besides, some European companies could instantly become key digital spearheads: Schneider Electric, Vodafone, SAP ... and Publicis as well. However, Europe as a whole does lack imagination and inspiration. Truth be told, it is not fully prepared to support such a sharing economy. Admittedly, we have a nascent BlaBlaCar – the largest car share service in Europe connecting drivers who have empty seats with people looking for a ride – that could be the next big thing after Airnbnb and Uber. But let's not see the forest for the trees. The digital transformation is not about digitising your off-line world using fancy hash-tags and trendy 2.0 concepts. The digital transformation is about a "datafied" world, about thinking data and mastering data. Europe is still far off.

Yet, will we give up or rather never say die? Of course not.

Lots have been done to promote a digital agenda in Europe, and the European Commission has been truly instrumental. Europe is investing in key infrastructures: interoperability, single market, broadband, and literacy. We're already further down the road: major progress on fast broadband, roaming and Internet usage; more modest progress for SMEs selling online or online cross-border buying. This is encouraging. However, this will not fix our pressing need of a vision. Again, imagination.

As the digital agenda continues to make progress in Europeans' service, I would humbly recommend concomitantly exploring three paths going forward.

The first one regards an instant competitive edge we can have: data privacy. Big data are already everywhere: phones, watches, cars, houses, clothes. And this is just the beginning: according to IBM, 90% of all available data have been produced over the last two years. Big data implies the

three-dimensional challenge of the "3V": volume (more data generated, by more devices), variety (everything keeps changing, think about your Facebook account settings) and velocity (the latest piece of news is always the most worthy). As a result, the update challenge for individuals and corporates is daunting.

'While the digital bargaining power is asymmetrical, companies will have to be able to justify what they do, at any time and in public.'

With them come tracking and data measurement that are most and foremost in customers' service. This also raises overwhelming privacy concerns. For cultural and historical reasons, Europe could be seen as a safe berth for corporates – mainly non-US – deterred by US or Chinese monitoring. This is not a philosophical position, this is a hard cash opportunity when US cloud companies would lose $22-45 billion [€17.5-35.7 billion] over the next three years following the NSA scandal, according to the Information Technology and Innovation Foundation. Digital calls for a previously unseen horizontal transparency. While the digital bargaining power is asymmetrical – Wikileaks could publish tomorrow a company's board minutes – companies will have to be able to justify what they do, at any time and in public. On that front, Europe has a tremendous ace up its sleeve.

The second one is about risk-taking, another way to call "imagination." Just like for the confidence we painfully need in Europe, risk is not something you ordain. You can mitigate, balance and diversify risks but risk-taking is a mindset. First, schools: European business schools are highly regarded globally but young generations' exodus keeps going. Second, entrepreneurs' ecosystem: Europe boasts no equivalent to US incubators (such as Y Combinator) or venture capitalists (the US scene is unmatched despite some European initiatives such as Iris Capital, an Orange/Publicis joint venture which is the largest fund in Europe); hence missed positive externalities. Third, corporates: the old dichotomy incumbents/startups is dead when blue chips are replaced by data-driven models overnight. It means that entrepreneurship must be fostered and rewarded – organisations should be able to nurture innovative pockets internally. This is not enough the case currently and it's our task within corporates to change mentalities.

To keep a fresh look means three different things. First, keep a flexible, open and clear-headed mindset: Sony – the designer of the Walkman – should have invented the iPod, but it's easy to ignore new digital "truths." Second, try and learn, while celebrating a right to fail. As this proves counter-intuitive to many European companies – especially French ones – we are structurally hampered in a digital age. Third, be a team player. To a large extent, big data is all about smart data, and the more brains the merrier. Without any doubt, this will be about teaming up with US web giants, but this is also an opportunity to ramp-up European collaboration.

The third one is precisely about collaboration, or the collective push of an ecosystem. I am a strong advocate of the market economy, I extol risk-taking and therefore individual initiatives. I've always been wary of government-driven temptations to foster, organise or ramp-up a sector of the economy. That said, I cannot but acknowledge that a very small country, as populated as a French region, managed to impose itself at the forefront of global innovation. To such extent that high technology goods and services now account for about one-third of gross domestic product. This country is Israel, as you already guessed. At first, there was an agreement between universities, industries, startups and most and foremost venture capitalists. All this being backed by the state – no out-of-pocket penny but the guarantee of investments for some time.
To say nothing of the army that, early on, took very seriously cyberwar, data protection and the importance of dedicated labs. With one distinctive feature: compulsory military service and, for

the most brilliant the cyber intelligence unit 8200. Likewise and despite traditional caveats on bureaucracy, one European Union initiative could create a dedicated agency in order to promote and retain talents, to unleash startups' innovation and to secure large and steady capital inflows. Who knows, we might see in due course a European platform coming to the surface.

I am an optimist and, as such, I am confident that, in this digital era, Europe will play a role that is commensurate with its weight but, as importantly, with its vision of the coming world. Paradoxically, it is the legacy of a dreadful 20th century in Europe: to pave the way for indispensable checks and balances. Democracy and Prosperity 2.0, maybe. Hopefully.

'To a large extent, big data is all about smart data, and the more brains the merrier.'

Shaping an interconnected world, sharing a China-EU common dream

By Lu Wei

Lu Wei is minister of cyberspace administration in the People's Republic of China.

We are entering the Internet age due to the information technology revolution. I learned at the Internet Corporation for Assigned Names and Numbers (ICANN) 50 meeting in London in June 2014 that 72% of the European Union population regularly uses the Internet, and that the EU will be a digital single market by 2015. Creating a real digital single market could alone generate a 4% gross domestic product increase for the EU by 2020. So, with the Internet generating such tremendous momentum for social and economic development, as those in the EU might say, "Internet connections, information technology and telecommunications can enable everyone, old or young, man or woman, to achieve their dreams and ambitions."

Indeed, China has been connected to the Internet for only 20 years. In a mere two decades, the Internet has not only changed the country's economic and social life, but has become an essential part of the Chinese way of life. Now, China has more than six hundred million netizens, who spend more than €1.2 trillion in e-commerce every year, contributing more than one tenth to China's economy. On top of all this, just a few weeks ago, Alibaba, a Chinese e-commerce giant, held the largest initial public offering the United States had ever seen, taking a large step toward achieving the Chinese dream in online success. So the Internet is carrying all aspects of our world, the trajectories of states and societies and everyday life, into a global future.

But the Internet has its own potential for hazards: it could be Alibaba's treasure cave as much as Pandora's box; and that depends on us. Different countries may have different ideas, even disputes at times, on the Internet and its governance, due to their own unique past, present and experiences with it. However, the same end should prevail for all of them, of making the Internet a blessing and a boon, instead of a global ailment, for people throughout the world; an instrument of peace and security, instead of a weapon for interstate conflicts; a way towards the legitimate rights and interests of citizens, not a den of crime, and never a habitat of terrorism. The Internet should be a forum of honest and sensible opinions, not a market of slander and scams. And by offering more positive energy, this ongoing global achievement could help keep and expand the great heritage of mankind, and build the coming generations into something better than us.

China and the EU are, respectively, an important representative of oriental culture and the cradle of Western civilisation. As the world's most representative emerging economy and a group of developed countries respectively, they are two major forces for world peace. China and the EU should answer the call of our time, and strive to build a cyberspace of peace, security, inclusiveness and cooperation. During his visit to Europe in March, President Xi Jinping called for efforts to forge four major partnerships for peace, growth, reform and civilisation between China and the EU. We can utilise the powers of the Internet in cooperation, to inject new horsepower into the four major partnerships and make them even stronger and better.

The Internet could help China and the EU concentrate their strength. Covering one tenth of the world and holding a quarter of its population, China and the EU are key to world peace, and to stability in international affairs. With cyber security already a global issue, both sides could enhance dialogue and coordination for better cooperation on law, regulation and policies regarding cyberspace. Together, they can curb problems ranging from online pornography to cyber crimes and cyber terrorism, protect the legitimate rights and interests of citizens, and make cyberspace a safer and cleaner place for children. There should be more coordination on international Internet governance between China and the EU. With mutual respect for Internet sovereignty, better

information security, and no cyber hegemony, it is very possible for both sides to build a multilateral, democratic and transparent system of international Internet governance.

The Internet should interface our markets. China and the EU are the two most important economies in the world, making up a third of the global economy. With 1.1 billion Internet users, the gigantic market potential of China and the EU is awaiting release. We would like to actively cooperate with the EU in e-commerce and to expand high-tech trade between us in terms of coverage and depth. Both sides could work to serve trade better with improved logistics distribution systems and cross-border service platforms, and big data analysis could help us deal together with risks in finance, the economy and commerce. Should we in China and the EU integrate our cooperation on Internet-related issues with construction of the Silk Road economic belt, and fully engage firms, staff, technology and financial resources for and about the Internet across the Eurasian continent, we will be able to make a new engine for Eurasian economic growth out of the familiar Internet.

> 'There should be more coordination on international Internet governance between China and the EU.'

The Internet should play a role in China's and the EU's reform. Both China and the EU are overhauling themselves as never seen before in the history of mankind. China is currently driving its industrialisation, urbanisation and agricultural modernisation with informatisation, while modernising its system and capacity for national governance. The EU, in a similar manner, made the digital agenda for Europe a centrepiece of its Europe 2020 strategy.

In this environment, China and the EU could cooperate more on improving information infrastructure, working together to build an information superhighway while sharing their experience in expanding Internet coverage. Technological cooperation in Internet communication, cyber security, cloud computing and the Internet of Things may all be enhanced between China and the EU, and both sides should take part in developing important international technical standards together when it comes to information technology and standard-making. It is time for China and the EU to share their achievements in Internet technology and related industrial development by building every kind of information platform on the basis of all-around information sharing – for finance, customs clearance, e-ports, natural disaster warning and assessment, geographic information, and even more, to bring and share more opportunities through more information.

The two great civilisations of China and Europe will be brought closer by the Internet. While China epitomises cultures of the East in many ways, Europe is an important source of Western civilization. Over the course of millennia past, both nourished each other so much. Now, the Internet has opened an expressway for China and the EU to reach and learn from each other in unprecedented inclusiveness. So we should boost online cultural exchanges between us, and enable the ordinary Chinese and European citizen to gain more knowledge about the other's policies, goals, strategic trends and essence of cultures, in order to bring our cultures forward in a diversified and inclusive environment. The Internet should, above all, bridge and bring together the hearts of our young people and the new generation. This November, the first World Internet Conference will be held in China. You are all welcome to attend to make a better future for the Internet.

As an old Chinese saying goes, "If you can one day renovate yourself, do so from day to day. Yea, let there be daily renovation." China and the EU should ride the trend of our time by utilising the full potential of the Internet, and through consensus, sharing, win-win cooperation, innovation and combined efforts, build a bright future for humanity.

Reimagining the role of government in the cyberage

By Jane Holl Lute

Jane Holl Lute is president and CEO of the Council on Cybersecurity, an independent, expert, not-for-profit organisation committed to the security of the open Internet.

What, if anything, is government good for these days?[1] Disturbing patterns of seemingly unchecked lawlessness have emerged in parts of the world, as ruthless terrorist and criminal networks violently reject the current global order in favour of their own, many relatively affluent societies suffered serious shocks and are still reeling from the greatest global economic downturn in almost a century, and billions of people around the world have discovered new power in their hands with the miraculous invention of the Internet. What role should we ask our governments to take to ensure that societies can remain secure and free to establish conditions of well-being and pursue opportunities for prosperity unhindered by significant threats that can generate economic chaos, violent social upheaval and, even for some, an abiding insecurity? Will it ever be the case that only military might in the hands of government can underwrite the integrity of a population's safety, political stability and economic prosperity? Below, I aim to address these issues and discuss the challenges our governments face as we enter, full on, the cyberage.

The cyberawakening

Roughly 100 new connections to the Internet are made every minute – a phenomenon of scale and speed more suited to scientists than policymakers. Nearly 80% of the population of North America, 70% of Australia and Oceania, 65% of Europe, and nearly 45% of Central and South America can access cyberspace. Fully half of the population of China is online and, in country after country, the numbers are rising. In fact, the Internet's penetration of the global population is rocketing toward three billion. Some keen-eyed observers of these trends predict that the population of the entire planet will be online by 2020.

'Roughly 100 new connections to the Internet are made every minute.'

More than one billion people in the world have joined Facebook – in less than 10 years since it was founded in 2004, and Yahoo! is not far behind. Only the populations of two countries – China and India – can claim those numbers, and neither state knows its citizens at the level of detail that these Internet companies know their users. In contrast, states have yet to establish a clear value proposition for themselves in this realm, in truth because they do not – by a long shot – have a monopoly on the power here that matters.

Simply put, it is the power to connect, not the power to protect that matters in cyberspace.

The major cyberpowers in the world today are not governments, but tech giants – Google, Microsoft, Twitter, Facebook, Yahoo!, Apple, Siemens, Alibaba, and others. Of course, there are states with important and significant cybercapacity, but states in general have no corner on the market when it comes to cyberpower or, consequently, on the power to set the rules and, in this respect, international order in the physical world has no parallel in cyberspace. And while we have come to learn a lot about people as they access the Internet, our understanding of people is almost entirely as consumers, not as citizens.

1 This essay draws on material and ideas previously presented by the author in other written and spoken contexts and does not reflect the official position or view of any government or organisation.

Think, for a moment, about the typical online session of a person in the developed world – people are shopping, sharing, learning or leering! Many of us are connected online for hours and hours each day and, yet, relatively little of what we do there relates to our civic identities. In fact, most of us cannot even vote online yet. In stark contrast, governments relate to their populations principally as citizens first, and this disconnect between understanding and engaging people as consumers versus understanding and engaging them as citizens may help explain some of the latency in governments playing a more meaningful role in cyberspace. Perhaps nowhere is this latency more vivid than in cybersecurity.

'The law is not keeping up with the rapidly unfolding cyberuniverse and, consequently, power and practice are filling the void.'

In general, security is something societies typically assign to their governments to handle. For example, we want safe streets – we turn to government to make the laws and run the police; we want our nations to be secure in a challenging world – we turn to governments to oversee the military and negotiate treaties. So governments are used to being the key players in the security space. However, this assignment has not been given to governments when it comes to cyberspace. In fact, large portions of the world's population are extremely wary or even openly opposed to governments taking on such a role, not least because in many parts of the world government institutions have not proven very reassuring means by which secure control is established and order is maintained. What is already clear is that the familiar security role that governments play in the physical world will not translate simply into cyberspace. Yet, governments cannot simply sit on the sidelines; the potential for truly dangerous things to happen is too great.

One problem inhibiting a more effective role for governments in cyberspace may be that they simply cannot agree on what role they should play – either because they lack the relevant power or because they lack a common strategic framework to organise the way they think about what's happening in cyberspace. In consequence, no two governments are approaching the Internet or cybersecurity in the same way, and hardly any of the international institutions that might help states organise their thinking or collective efforts have been given any latitude to do so.

Moreover, when it comes to cyberspace, it's particularly unfortunate that the only thing moving more slowly than the speed of governments is the speed of law. The real strength of the law lies in its ability to anticipate the familiar and rationalise the unprecedented. However, in almost every dimension of the cyberexperience – from data to property to exchange to value to rights – while lots feel like it ought to be familiar, lots more are really brand new. The law is not keeping up with the rapidly unfolding cyberuniverse and, consequently, power and practice are filling the void. When governments finally do get fully in the game, their burden will not be to fill a vacuum but, rather, to displace those actors and processes that are already filling the space – a much harder task. The Internet genie is out of the bottle, and there's no going back.

Finally, commercial and other non-state actors have become powerful in cyberspace while many states have themselves remained weak, not simply because these companies and actors have had first-move advantages but, rather, because they have a better understanding of power in this space. They also are better at reading the dynamically evolving social landscape wrought by the public's interaction with technology and information, and that understanding has allowed them to harness the magic of data liquidity. Governments won't catch up if they can't catch on – but the institutions societies rely on to make sense of a demanding, complex world have proven, to many, disappointingly unworthy of continued reliance for this, as for many other tasks.

The decline of public trust

The past half-dozen years have seen a visible rise in public anger across the globe. While the particular issues animating unrest across the globe may vary, this equal-opportunity anger is widespread. People don't seem to trust any of the institutions that have come to anchor modern life – the markets, the media, the banks or business. They are sceptical of the medical profession, distrustful of the legal profession and wary of law enforcement. They question the soundness of the dollar, the euro and the yen, and in many cases they lack trust in their own governments, religious institutions and even cultural icons. It seems that no institution has been immune; even the Catholic Church has fallen, as it were, from grace. In addition, a seemingly endless parade of senior public officials across the globe have become embroiled in embarrassing scandals, and the public-sector workforce is itself often derided by the very public it serves as bloated, inefficient and worse. In addition, significant disconnects often exist between public mandates and money, responsibilities and resources and, as a result, public institutions frequently fail to meet the public's expectations.

Perhaps the cycles of social discontent have been ever thus, and perhaps we are just nearing the end (or approaching the beginning) of a narrative that has played itself out many times before in history. But the stakes seem higher now. In 1950, only two states had nuclear weapons and fewer than a dozen of those weapons were in existence. Today, there are four times as many states with nuclear holdings that collectively number in the thousands, and the allure of this most dangerous technology remains. Sixty years ago, the world's population hovered around two-and-a-half billion. Today, it is over seven billion and rising. In 1950, the world's political club had 99 widely recognised sovereign countries wielding the considerable power of states; today, there are roughly twice that number. Against this complex global backdrop, the institutions that were designed to help us cope with these and manifold other challenges facing the world are now frayed and deeply doubted.

Now what?

If cyberspace is exploding and public institutions are imploding, the conventional approaches of strategic government problem-solving anchored in geography and interstate geopolitics may need to be rethought.

During the Cold War, the imperative to contain and defeat communism dominated US and European security policymaking and exercised an almost magnetic pull on resources. But no more. Too much is happening, too fast, to rally the masses under a single banner. Indeed, people are looking for something to be for, not just against. At the same time, the toxic combination of terrorist organisations, criminal networks, technology, wealth and arms poses threats in the physical world and in cyberspace that no one should ignore. While the cyberawakening may signal the dawn of a new Cyberage, the fragile state of our institutions may be a sign that we are not, as yet, fully ready to take it on.

'The Internet genie is out of the bottle, and there's no going back.'

To navigate the challenging waters that lie ahead, governments must do no less than examine their fundamental value proposition of providing threshold security, well-being and justice for their citizens. The key will be to effectively engage their citizens – to treat them as an asset, not an obstacle – in pooling strengths to share burdens. The run of the established order may not be finished yet, but life in the Cyberage is, for all of us, inspiring new ways to frame issues, solve problems and improve the human condition. We'll need every bit of that energy and ingenuity to help our governments keep up.

Big digital science – a roadmap for the brain

By Henry Markram, Richard Frackowiak and Karlheinz Meier

Henry Markram, Richard Frackowiak and Karlheinz Meier are co-directors of the Human Brain Project, an ambitious multidisciplinary endeavour to understand the brain.

In the last 200 years, new technologies have changed the way we work and live at an unprecedented rate. There are many examples, including electricity, the internal combustion engine and television. With the Internet revolution, this phenomenon is repeating itself. Radically new information and communications technologies developed over the last 20 years have brought with them new patterns of employment, new structures of economic power, new forms of politics, new threats and new opportunities. Some of the biggest effects have been on the world of science.

Science starts as a cottage industry

Thirty years ago, high-energy physics and astronomy had big teams and expensive equipment, but the bulk of research was the work of highly skilled individuals, in small labs, based in developed nations. Neuroscience, basic and clinical, was no exception. Focus was an essential element for success with grant applications. Most of the world's 100,000 neuroscientists still dig deeper and deeper into one focused problem. Networks and consortia are emerging but stay largely within the culture of the old paradigm. The results from this approach have been astounding in scope, quality, amount and breadth. All our basic concepts have come from such focused investigations executed within this traditional model. But today, that model faces serious challenges.

Neuroscience – the challenges

Despite strong growth in the number of neuroscientists and papers published, and a global investment of about €7 billion per year (€1 billion in Europe), the benefits to society are disappointing. Finding new diagnostic tools and treatments for many common brain diseases has become increasingly difficult. The number of new drugs coming onto the market is falling; pharma companies have withdrawn investment. Neuroscience has little to say authoritatively about the kinds of nutrition, education or social conditions that might reduce the risk of brain diseases. The culture is to go for "big discoveries." Publish and move on. Neuroscience proceeds without a plan for the growing volumes of data it produces, without a curation process to secure its value for the future as knowledge. Medicine, locked in a symptom-based diagnostic paradigm, struggles forward without a biological classification scheme for brain diseases. These are some factors eroding the impact of neuroscience. Strong foundations will be needed to understand the brain across all scales and levels of organisation. Neuroscience lags behind many other sciences that have already embraced the digital era to build such solid and common foundations for their discipline. Fortunately, new paradigms and change are coming.

'Neuroscience has little to say authoritatively about the kinds of nutrition, education or social conditions that might reduce the risk of brain diseases. The culture is to go for "big discoveries".'

Big science

Big science emerges when a discipline is faced with radical paradigm-changing opportunities that lead to the transformation of approaches and culture. Information and communications technologies (ICT) represent such a transformative opportunity, in the same way that calculus did

in the 17th century. The large hadron collider at the European Organization for Nuclear Research (CERN) brought together physicists from 35 countries to explore the basic building blocks of matter – leading to the discovery of the Higgs boson. The human genome project mapped the whole human genome – immediately giving birth to a myriad of other projects. Launched in 2000, the Sloan Digital Sky Survey mapped every stellar object in 35% of the sky. National Aeronautics and Space Administration built the NASA Climate Simulation Center for scientists to conduct digital experiments, exploring the dynamics of past climate change and future scenarios. Without high performance computing technology to analyse massive data volumes and to run complex simulations and non-linear models, and without Internet communications to enable effective long-distance collaboration and data sharing between scientists scattered across the globe, none of this would have been possible.

'Scientists the world over are gaining access to a body of knowledge heretofore locked up in subscription journals.'

Publishing in the digital era

In parallel with the emergence of big experimental science, the Internet has driven the rise of online open access publishing, making it easier to publish and to access work published by others. The Internet is pushing publishing to the forefront of the digital era. Scientists the world over are gaining access to a body of knowledge heretofore locked up in subscription journals. Big data and Internet technologies empower search and analysis tools that make possible the intelligent assessment of millions of articles, with their data, to produce integrated and connected answers to complex questions. High performance computing and machine learning make it possible to explore all possible associations and interactions hidden in data. The result multiplies the value of heterogeneous data produced by individual labs and standardised data produced by big science initiatives and industry.

Big neuroscience

Big science is knocking on neuroscience's door. Can the human brain be mapped exhaustively with classical approaches? If the challenge is to catalogue its 100 billion neurons, the billion proteins in each neuron and the billions of chemical interactions between them, the trillion or so synapses that connect neurons, that might be just feasible – in a century or two, using futuristic technologies and massive investment. Some big experimental brain mapping has started. The Allen Institute for Brain Science has combined state-of-the-art automated microscopy with digital image processing to industrialise the building of specific, detailed new atlases of mouse and human brains. There are other international brain initiatives under way that are also developing industrial-scale mapping and so laying solid foundations for future research. But there should be no illusion. Mapping the brain in any traditional sense is an intractable problem. The brain is not a static structure. It is more like a symphony written in our genes that plays out for the whole of our lives producing an ever-changing brain.

The Human Brain Project

The European Union's Human Brain Project (HBP) is turning the challenge of mapping the human brain on its head. What we are trying to discover are the basic rules, the design principles that biology uses to construct the brain – at any stage, in any state. To find them, we need a completely new ICT infrastructure to absorb large amounts of data – to analyse them and to derive a first set of rules by simulation. The preliminary set will be continuously refined, iteratively, to produce a better and better blueprint of the functional and structural architecture of the human brain. Such an iterative process is not possible without big digital science technology. With such technology,

we no longer need to wait for an unattainable "complete" set of data. This is what the HBP is doing, not as a substitute for classical approaches, but as a previously untried complement. For Europe, the HBP is a unique bold step. Brain reconstructions built on fundamental principles and fed pragmatically with available data can help us fill vast gaps in our knowledge and accelerate brain mapping. By mining clinical data on Europe's patients, we can similarly search for biological signatures of disease, establish a map of all brain diseases – a completely new foundation for their diagnosis and treatment.

'With a billion billion calculations per second, it is possible to simulate dynamic brain processes at all levels of brain organisation from the microscopic (molecules) to the macroscopic (behaviour).'

Supercomputers have come of age. With a billion billion calculations per second, it is possible to simulate dynamic brain processes at all levels of brain organisation from the microscopic (molecules) to the macroscopic (behaviour). Additionally come opportunities for revolutionary *in silico* experiments, probing mechanisms of cognition, behaviour and disease in ways that would never be possible using laboratory experiments alone. Neuroscience could become one of the biggest beneficiaries of the recent revolutions in computer science. One can imagine building a new generation of computers using design principles of the brain – the age of neuromorphic computing can begin to complement our present binary digital computers.

Opposition to change

Of course, radical changes breed reactionary opposition. As late as 1990, *Science* reported a grassroots effort by the scientific community to stop the human genome project, which detractors considered to be "mediocre science" and "terrible science policy."[1] An influential scientist and critic of ENCODE, a successor project to the human genome project, protested that it was "not the work of scientists," but of a "group of badly trained technicians."[2] The HBP has also been the subject of such polemics, well covered in *Nature*. At the core of the HBP is a large, non-competitive, multidisciplinary team of scientists, engineers and clinicians located around the world, working to a common vision according to a mutually agreed road map, designing, implementing and using a common ICT infrastructure to build, for example, a synapse, a neuron, a whole brain, to analyse patient data, simulate a disease or drug effect, build a new computer or design a robot. This vision represents a major cultural challenge to the status quo. Sharing ideas, knowledge, data and tools before publication is unusual, so the credit and incentive systems are challenged. How will contributions be recognised? Physicists have overcome these cultural changes, so we can look to our colleagues to solve these issues, rather than avoiding them as too difficult to overcome.

Adjusting to change

Big science challenges previous paradigms and ways of thinking – small telescopes are no longer used, individual labs no longer sequence genes by hand. Success, however, generates momentum and enthusiasm for new methods, which have always created new funding opportunities, new jobs, new industries and new avenues for research. Disciplines that have integrated modern data management and integration with calculation power into their culture – particle physics, astronomy, genomics – are flourishing as never before. Without the human genome project, biological and medical research would still be in the dark ages and, crucially, would be without the insight that genetic variation and disease expression do not relate through clear linear

1 Leslie Roberts, "Genome Backlash Going Full Force," *Science*, Vol. 248, No. 4957, p. 804, 1990.

2 Robin McKie, "Scientists Attacked Over Claim That 'Junk DNA' Is Vital to Life," *The Observer*, 24 February 2013.

relationships. The project has given birth to hundreds of new companies dedicated to equipment for genomics research, DNA sequencing and medical diagnostics. According to one estimate, the project has yielded a return of €136 for every dollar of public investment in the United States alone.[3] The announcement of the European HBP has mobilised international communities. Brain initiatives are emerging globally. Nations are giving top priority to brain research, providing new funding for novel approaches. The challenge is enormous, the risks are high but, by not trying, we risk far more. Brain disorders already cost the European economy about €800 billion a year, affecting the lives of some 127 million Europeans.[4]

'Brain disorders already cost the European economy about €800 billion a year, affecting the lives of some 127 million Europeans.'

Public policy

Every new technology raises issues of public policy. For instance, the HBP aims to mine and analyse huge volumes of patient data in hospital archives to identify biological signatures of brain disease. Obtaining these data has already cost trillions of euros of public money. It now just sits there, unused, and fades away. Exploiting these data could bring added value to the public-health agenda and yield enormous rewards in terms of better diagnosis and treatment, and precision medicine. Today, new ICT offers technical solutions to protect patient privacy, paving the way for new policies to open up clinical data for analysis. Maintaining valuable data resources and operating large instruments and infrastructures will require new funding models. Maximising the economic and social benefits of this new model of discovery requires new incentives for the sharing of data and tools as well as new models for joint intellectual property across international teams.

Like other revolutionary technologies that preceded it, big digital science is already part of our lives. In the coming years, its impact will grow deeper and wider. Now it has come to neuroscience, it is giving us keys to understand the brain, which ironically is itself the ultimate big data machine.

3 Batelle Technology Partnership Practice, *Economic Impact of the Human Genome Project* (Columbus: Battelle Memorial Institute, 2011).

4 Anders Gustavsson et al., "Cost of Disorders of the Brain in Europe 2010," *European Neuropsychopharmacology*, Vol. 21, No. 10, pp. 718-779, 2011.

Innovation and big data are the keys to unlocking Europe's economy

By Ron Mobed

Ron Mobed is CEO of Elsevier, an academic publishing company.

As an engineer with many years of experience in the commercial world, I have seen the power of innovation to create jobs, transform industries and improve the lives of people. I am now part of a European technology company that lives both at the centre of the scientific community we serve and at the centre of the world of innovation. A fundamental part of our mission is to help build the interface between scientific research and its implementation for the benefit of society.

We should be highly optimistic about Europe's future as a force for knowledge creation and the diffusion of innovation. We also need to be acutely aware of the challenges we face together to achieve that mission. All participants in Europe's knowledge ecosystem – whether information users, researchers, clinicians, educators, investors, policymakers or businesses – must grapple with rapid technological changes. We have a responsibility to get it right.

'We should be highly optimistic about Europe's future as a force for knowledge creation and the diffusion of innovation.'

Europe has always been a generator of ideas. We are today the most productive continent in scholarly output, surpassing both the United States and China. Our contribution to science, health and human progress is unique, something to be proud of.

New technologies and technology-enabled services hold tremendous potential for change and for expanding Europe's capacity to lead. Digitisation, search and indexing were the game changers of the last century, putting vast stores of information at the disposal of knowledge creators and users. Today, transformation is coming from the expansion of technology-enabled collaborative networks and the explosion in the availability of new sources of data. Big data has huge potential – and presents an entirely new set of challenges – for professionals working to extract insight and value from the mountains of data that are becoming available across every geography, demographic and discipline. And while collaboration and communication have always provided the neural links scientists need to build upon the work and experience of others, our data show that collaboration is increasing and that collaborative research, especially across national borders, is delivering better, more impactful research. Social media is making the knowledge ecosystem vastly more open, more global and a more potent source for generating and diffusing new ideas. It allows participants to create their own groups and networks, to selectively interact, collaborate and lead across disciplines and geographies. This in turn will call into question the very idea of knowledge "centres" in Europe, or indeed anywhere.

We consistently hear from researchers that their work is becoming increasingly data-centric and that sheer volumes of data and connections are presenting some formidable challenges. Researchers, clinicians and other decision-makers are under enormous and increasing pressure to draw from a wider body of knowledge and use it to produce better outcomes, faster and at lower cost. A large volume of highly complex data sets is of little value without the technology to make it useful or the tools for turning it into meaningful insights and applications. Nor is it of any value if the user cannot rely on its sources or accuracy. Much of the output of the Internet is trivial, self-serving or inaccurate, though it still often finds its way to the surface where it takes on the patina of authority. That is unproductive and even dangerous in fields of endeavour like science, medicine and technology, where professionals need to know with confidence what is truly authoritative,

where it originated and whether it is truly relevant. Technology and associated investment must play a key role in providing professionals with these essential services and assurances.

That is why many companies like Reed Elsevier have become so focused on investing in both talent and the technologies that empower the creation of knowledge and the diffusion of innovation (notably including our intensive investment in big data technology platforms like HPCC (High Performance Cluster Computing)). We are certainly not alone among European technology companies in this regard. The well of technology capacity and talent in Europe may be underappreciated because it is deeply embedded in the work of technology-enabled content creation. Reed Elsevier does not, for example, appear on the global list of the top 20 technology companies, since this includes mostly companies whose model is based on technology-enabled, content-agnostic advertising platforms. However, when you look at a measure like our output of digital paid content, we would be Europe's largest digital company and the fourth largest in the world. We are not alone. But the many successful European digital companies, large and small, new and old, are Europe's unsung achievements, in the shadows of the consumer-driven Silicon Valley successes. We need to be bolder and braver in promoting our successes. And we also need to look at what we can do to build on this success and avoid missing the opportunity that stands before us.

'The many successful European digital companies, large and small, new and old, are Europe's unsung achievements.'

So what does all this mean for Europe and for European policymakers?

First of all, we should acknowledge what Europe has already done in this field. In the area of telecoms and mobile connectivity, it is leading the way, recognising that networks here are also crucial if people are to be more efficient and effective. Europe can also lay claim to a broader leadership role because of our rich history and culture of cultivating knowledge and disseminating knowledge. From this base of strength, Europe can influence how that ecosystem evolves, through education, promoting creativity and entrepreneurship, the protection of ideas, technology and public finance. The challenge is to nurture all elements equally without compromising it at all. That is a tricky balancing act. Decision-making in such a multidimensional knowledge ecosystem is extraordinarily complex as the resources required are substantial, trade-offs considerable, and risks of failure and neglect huge.

Cultivating knowledge creation requires an excellent, well-supported education system. Many aspects of education in Europe are still planted in the "old world." Europe therefore must continue to embrace new, more adaptive ways of learning and new education technologies. Education needs to develop a culture of risk-taking as well, allowing the cycle of error, learning and success that is fundamental to creation and innovation.

Cultivating knowledge creation requires sustained investment in basic research, along with the risk associated with making the necessary resource commitments in such a complex and rapidly evolving environment. Researchers and the institutions that support them are under enormous pressure to find and vie for scarce funds, especially for the basic research that drives long-term advances in science, medicine and technology. They compete for private capital and for public funding that is increasingly constrained by the trade-offs between taxation, tax avoidance and public investment. Vigorous funding of research and education is not optional for Europe if it is to remain at the forefront of knowledge and innovation, and if Europe is to continue to make the outsized contributions to society that it has done over many centuries.

Cultivating knowledge creation requires investment in the technology, tools and infrastructure that enable researchers and content creators. That will be extremely important to the long-term competitiveness of Europe. We need to put high-performance computing capacity and analytical tools at the disposal of Europe's researchers, which is fundamental to their success and competitiveness, and requires commitment and collaboration among governments, corporations and research institutions on a significant scale. We need to wire Europe's universities and research centres with the technologies to help drive excellence and efficiency. We need to connect universities and businesses with technologies that promote collaboration and ensure that data are interoperable across the value chain of research to implementation. Investments like these will give Europe's knowledge creators the capacity to fully exploit a new universe of data that holds such great promise for advancing science, health and innovation for the benefit of human society.

'Policymakers need to allow a variety of models to emerge and evolve to serve the knowledge sector and not tip the balance one way or another.'

Policymakers need to allow a variety of models to emerge and evolve to serve the knowledge sector and not tip the balance one way or another. That way, knowledge creators can have confidence that their accomplishments and contributions will be recognised and they will have an opportunity to earn the rewards from their effort. The market will likely determine what business models will survive or emerge to support both the cultivation of knowledge creators and the application of technology.

We live by the ideal that innovation can change the world for the better. We have every reason to have the confidence and ambition that we will continue to make that ideal a reality. But we have to be thoughtful and bold in shaping Europe's future as a leader in research, innovation and knowledge creation. We have to get the balance right across a number of dimensions. We must consider many perspectives and viewpoints, and collaborate across a diverse range of stakeholders in the knowledge ecosystem.

In the decisions we make about technology, we also have to keep our focus on a greater goal. Technology does not exist for its own sake; it is only valuable when we put it to use for a greater good. As we consider every difficult choice, every idea and every investment, we have to ask ourselves one critical question: are we building an environment that will nurture our knowledge creators and sustain Europe's indispensable role in the diffusion of innovation? The stakes are high, not just for the future leadership of Europe, but for future generations who will benefit from Europe's tradition and commitment to the creation of knowledge, and its applications to the world's most pressing challenges.

The gigabit gap and some thoughts on how to bridge it

By René Obermann

René Obermann is CEO of Ziggo NV, a Dutch cable-television operator.

Building a state of the art gigabit infrastructure, combining fibre-based (including hybrid) and wireless networks to provide a high-speed Internet access for everyone and every thing is one of the most important European projects of our time. But to fund ubiquitous coverage is very difficult. Telecommunication companies, regulators and governments have to open up and challenge their long-established beliefs in order to achieve a breakthrough in closing the gap towards a gigabit society.

I believe this gigabit society must be inclusive. Every child and student, each citizen, everyone working, retired or in search of work, teachers, engineers, nurses or craftsmen, entrepreneurs or scientists, wherever in Europe they live, wealthy or not, educated or inexperienced, they should all be able to connect and participate.

Key factors of the gigabit society

Seamless connectivity at gigabit speeds will be in high demand and must eventually be ubiquitous, and not just at your well-connected workplace. It will become an indispensable precondition for world-changing innovation, research, modern education such as massive open online courses (MOOCs), Industry 4.0, a connected medical sector, social media, online entertainment such as gaming, ultra HD video and a fast growing number of other over-the-top services. This, of course, applies to urban environments where huge infrastructure investments can be amortised, but it must not stop there.

"Fibre to the farm" is not a joke, even though some people seem to find it funny. They believe it will never pay back. For individual network companies, this is indeed true, but from a societal perspective, it will. The agriculture business as well as the children and people on farms will need their gigabit access just as much as children and businesses in cities do. This applies to every school, business or household in rural areas. Think of the otherwise increasing digital divide. High-speed connectivity will be a precondition to live and work there, otherwise the people will all be forced to move to large cities. We need to put a stop to this exodus of digital diasporas by connecting them to the information highway.

> 'Let's not worry about applications that do not even exist yet. They will be created by a new generation of creative entrepreneurs.'

There is no time to waste. It is urgent to act. If we do not accelerate our efforts, we will fall further behind. All the speed we build will eventually be used, even though some investors may have concerns that applications requiring this kind of speed will not be available. "Marketing experts" sometimes say that more Internet speed will not be a competitive differentiator once 100 megabytes per second is reached... sure, and the earth is flat.

I have heard that "who needs the speed?" argument before. It is as though we do not learn. Fifteen years ago, many questioned the need for DSL. Ten years ago, the app-economy wasn't even born, ultra HD was not at the horizon, neither were Netflix nor Spotify; cars weren't connected and video-conferencing was not popular. Many thought that 3G wireless would never be used much. So let's not worry about applications that do not even exist yet. They will be created by

a new generation of creative entrepreneurs, fostered by open innovation and supported by business angels, venture capitalists, private equity firms and others. Europe is able to attract more investment capital, and the successes of its digital policy should also be measured by the growth of investments in the information and communications technology (ICT) sector.

The gigabit society needs to be inclusive. Over time, it could converge the living standards between rich and less wealthy European countries, link generations, bring together natives and new European settlers. The divide between digital knowledge and practice must become smaller. We need to bring digital education to people of all age groups. The ICT industry is to take on an active role in that and partner up with (public) institutions for education and training. A digital divide exists between generations. Mobile Internet usage, for instance, still seems to be reserved for young people. In 2012, already more than 50% of youngsters used Internet on their mobile devices, while less than 5% of those above 65 years of age did. In ageing Europe, larger parts of society will be left behind unless we put more effort into bringing them back in and keeping them involved in our digital community. That is a moral as well as an economic obligation. High-speed Internet access is not the only precondition for everyone to participate. Usability of technology and its adoption through education and training are key to closing the gap as well. We should, for example, support senior citizens by developing technologies, which improve the ease of use and assist them in learning how to use devices and digital services. Nobody should be left outside the gates of the gigabit society.

'Usability of technology and its adoption through education and training are key to closing the gap.'

Closing the gap by new industry cooperation and regulatory changes

The telecoms community must cooperate more in order to improve the economics of infrastructure, which is build-out in rural areas and ensures a seamless cross-border/cross-network user experience (including cooperating with over-the-top service providers).

While open and competitive markets must be maintained for technology-based innovation to thrive and the benefits of one digital Europe to be unlocked, seamless and ubiquitous connectivity at gigabit speed will become indispensable – and some rules need to be changed. According to expert estimates, such a network requires enormous additional investments, in the order of €300 billion for the whole of Europe. Unfortunately, the path to reach appropriate investor returns is unclear. Even if returns were more promising, we would need more than 10 years to build it. Unless we accelerate our efforts now, we won't be able to catch up with more advanced regions and loose competitiveness for a long time.

Access regulation on what used to be monopolistic resources in years gone by is still being applied, though the market has changed and has become very competitive. While 10 years ago the US took a different, non-regulated approach on next-generation networks, European regulators still pursue ex-ante regulation. At the same time, they want to ensure a large number of (rather small) competitors. Today in the US, there are only a few nationwide network carriers, which, as a result of large-scale effects, can afford immense investments of double-digit billion dollars per year. It is inevitable that such a capital-intense industry will consolidate into a few large players, and it would be wrong and illogical to ignore the need and to prevent that. In the US and in China, a few very large telecom companies not only drive the infrastructure build-out, but they also strongly influence developing technology standards, while European players lack size in the globalised value chain.

The European Commission, while talking about one digital Europe (which I fully endorse), should further reduce the barriers for in-country and eventually European consolidation. Lawmakers and regulators need to face the economic and strategic problems of this fragmented market. While Europe pursues its "small-is-beautiful" approach, the Internet-economy has enabled global giants to emerge – very dominant in their respective fields. The relations between European infrastructure-based operators and these giants are sometimes "tense," to say the least, and definitely not helpful in resolving our network investment problem. Parties need to sit down and figure out ways to share the burden where needed. Neelie Kroes initiated such a "roundtable conference" between the different stakeholders in 2011. Though the outcome was limited, it was a good start and it is worth continuing. Under her supervision, at least the key issues were tabled and addressed by the dissenting parties in a constructive way.

Stakeholders deserve more than just the lowest possible pricing for network access. All will need a superb network infrastructure, a must-have for successful European companies in the digital economy. Next to providing broadband access to everyone, the second largest challenge is to build gigabit wireless networks with excellent coverage. Data volumes are exploding, and so far we only scratched the surface of wireless Internet evolution. Numerous new use cases are emerging. Therefore, the European Commission and member-state governments need to accelerate their efforts in order to free up further radio spectrum in a coordinated way and allocate it smartly.

I strongly believe ubiquitous gigabit access is doable, enabled with a smart technology combination. On top of a well built out fibre network, we have to make best use of different wireless technologies (in licensed and unlicensed bands) and need to allocate much additional spectrum soon to capable operators. So-called "reverse roll-out" obligations, where rural areas need to be covered first, make sense, depending on the characteristic of the available spectrum, of course. And instead of auctioning the spectrum for billions of euros, governments should in return demand a reliable investment commitment – for coverage and quality – from applying operators.

'Data volumes are exploding, and so far we only scratched the surface of wireless Internet evolution.'

Long-Term Evolution (LTE) is a very capable technology. 5G standardisation is already work in progress. As a short-term next step, Wi-Fi must be seamlessly integrated into access networks, and users should not have to worry about which interface to use. They need to have the best connection at all times, without interrupting their sessions. This seamless handover shall become possible within the next two years.

Unless we accept that Europe shall lose its competitiveness, the time for debating is over

First, the European Commission and member states should dare to change their regulatory approach – from a very popular consumer-price focus to a less popular investment focus – knowing that this will cause resistance and protest. In this context, it is important to withdraw from the sector-specific ex-ante price regulation, such as for local loop access, and "only" apply anti-trust legislation. And network build-out cooperations or access in rural areas, where only one fixed-line infrastructure can be financed, should be negotiated between the network operator and the various interested parties who want to provide their services using it, rather than ex-ante price determination by regulators. In case market power is misused, parties can always refer to anti-trust legislation.

Second, in line with a need to stop ex-ante price regulation, structural reforms at the respective regulatory bodies seem necessary too. Potentially by reassigning many of their experts to new, more important tasks, some of which are addressed in this text, such as enforcing the use of cross-sectoral synergies in order to minimise the costs of gigabit connections to rural and remote areas. The groundwork is the most expensive part, and synergies could be simplified, for example by enforcing comprehensive documentation of existing infrastructures (from telecommunications providers, railway, utility companies, municipalities, etc.) across Europe into a centralised database (e.g. the German *Infrastruktur Atlas* model), so sharing those resources for new network build-outs could be enabled. There are many underutilised ducts and other components which are already placed in the ground, thus an enormous saving potential exists.

Third, in areas where the competitive market model does not offer amortisation, we need to allow competitors to cooperate and share the remaining financial burden. Think, for example, about building a common local or regional passive infrastructure and sharing it. It is already common for wireless operators to share sites and related infrastructures for antennas, which proves that the sharing model works. It seems quite complicated to bring telecom providers, regional utility companies, construction companies, municipal councils and so on to the table and get them to agree upon a master plan. But if that can save us a good part of the €300 billion for the build-out, then it is absolutely worth to try hard.

'Creating larger funds for subsidisation is unavoidable. Assigning them in an efficient and transparent way to the appropriate projects is essential.'

And last but not least, creating larger funds for subsidisation is unavoidable. Assigning them in an efficient and transparent way to the appropriate projects is essential. This must follow a strict set of criteria as well as close monitoring, or a lot of money could be wasted and distort fair competition. While I am no advocate of subsidies in general, here we need much more than what is so far provided – even when wireless technologies and bespoke cross-sectoral synergies are being applied. Think about it this way: the annual spending of all 28 EU member states amounts to more than €6 trillion. Take 0.2% of that per year and apply it smartly, and we would obtain this desirable objective much easier: gigabit speeds for all European citizens by 2025. In my view, money wisely spent to build the foundation of a modern gigabit society.

To conclude my thoughts on Europe's digital future, the gigabit society stands for a new way to live and work. New business models emerge, while old models either adapt or die. To quote Marc Andreessen, "software eats the world," which couldn't be more true. The gigabit society, for instance, produces less CO_2 emissions. Smart infrastructures, sharing more than just consumption, predictive maintenance and virtual meetings rather than travelling are merely a few examples. The boundaries between virtual and reality shall blur. Augmented reality becomes a part of life. It means a new way of infotainment, personalised, anywhere, on any screen. If used with media competence (teaching and training needs to be accessible to all people), it can enable us to make very sensible use of our time and could enhance our quality of life. A gigabit society also means better and much more efficient healthcare. Individualised, fast and precise, supported by a connected system of doctors, patients and clinics and super-fast big-data analyses. A gigabit society means better access to education and information for anyone, everywhere, on every subject of interest. It means more innovation, more competitiveness for our companies and more jobs. The upside-list is long and the benefits outweigh the costs and risks by far. Creating this inclusive gigabit society is worth a concerted effort by all stakeholders.

The battle for beauty in a virtual world. How the museum can profit from the digital revolution

By Wim Pijbes

Wim Pijbes is general director of the Rijksmuseum, the Netherlands national museum in Amsterdam.

The Rijksmuseum was the first cultural institution to radically change its digital policy. We took the unusual step of offering high-resolution images from our collection free for everybody to download at no cost. "Sharing is the new having" is our motto for giving unlimited access to over 200,000 works of the renowned collection, including all the masterworks by among others Rembrandt, Vermeer and Van Gogh.

The Rijksmuseum believes that using the advantages of the Internet to share the collection, everyone could participate to bring art anywhere and in any which way into the public domain. And we haven't been proven wrong. Since the reopening of the Rijksmuseum in April 2013 and the launch of our new website and interactive tool https://www.rijksmuseum.nl/en/rijksstudio, Rijksstudio, more than six million visitors and users have taken advantage of the sheer endless new possibilities. T-shirts, car designs, coffee mugs, furniture, fashion and new paint décors originated from the rich Rijksstudio sources. The users of the digital Rijksmuseum triple the "real" visitors to the museum building in Amsterdam. And across the Atlantic, the New York Metropolitan Museum (also known as the Met) reaches 29 million visitors through its website and 92 million people via Facebook. The Met still welcomes six million visitors a year to their Fifth Avenue building. So while the virtual museum is not a substitute for bricks and mortar, these figures clearly show that the actual museum nowadays is much more than just a building.

However, while pushing the limits on both sides of the Atlantic, American and European museums are confronted with restrictions, fear, protective and conservative minds. The enemy lives outside as well as inside of our institutions.

Generally speaking, museums are a conservative breed and one cannot change old habits or the traditional values of the institution overnight. One of those values is motivated by Walter Benjamin's visionary essay *Das Kunstwerk im Zeitalater seiner technischen Reproduzierbarkeit*. Benjamin's text was first published in 1936, but reached its authoritative status with endless translated publications up until the present day. In his essay, Benjamin writes about the aura of the authentic artwork and the relation between the original and its reproduction. Benjamin also tried to frame the kind of artworks that are not limited to a unique, single piece, like cast bronzes or etchings. Already in his time artists were using techniques like lithography and photography which enabled them to create an endless series of the same original. The only control and limitation for the artist (and gallery owner) was to publish signed and numbered editions. Strictly speaking, this was only cosmetic.

'Museums should not be afraid for the loss of the aura of the original work of art.'

Artists themselves have always perceived their environment as inspirational. Manet couldn't have painted his Olympia without seeing Titian's Danae. Rembrandt was inspired by Mantegna, Andy Warhol copied Brillo boxes and Jeff Koons uses the classics as well as the vulgar images from daily life. Collage, copy paste, parody, and reproduction belong to the artistic vocabulary of all great artists. So museums should not be afraid for the loss of the aura of the original work of art, as described by Benjamin: "*Das Kunstwerk ist grundsätzlich immer reproduzierbar gewesen. Was Menschen gemacht hatten, das konnte immer von Menschen nachgemacht warden* (A piece of art can always be reproduced. What people made, could always be reproduced by others.)."

> ‘On the long term tax rules and legislation have negative effects on the growth of the overall art world in Europe.’

Benjamin could not have foreseen that in our times, with photography wide spread, high-end colour printing and even 3D printing and of course the Internet, the possibilities of production and reproduction of artworks are endless. The digital revolution has only just begun, yet the original laws on copyright dates from the pre-digital periods. In many countries, laws on copyright were established during the first decade of the 20th century, almost a century ago. Photography and cinema were just invented and no one could foresee a World Wide Web. Today that web celebrates its 25th birthday and digital cameras are everywhere. The principle of all copyright laws is to protect the author from abuse by other parties on their original idea, invention or work of art – their original creation. That is correct and should be respected. However, not its image but the original artwork should be protected and saved for future generations. And it should be exhibited in such a way for people to truly experience the work of art. This is exactly what museums are for.

Outside of the institution however, museums – as non-profit organisations dedicated to the general public – suffer more and more from a strict copyright policy. The policy is fit to prevent commercial abuse but becomes an obstacle for the free use of art. Different countries have different regulations, and since the copyright lobby is strong, the European Union certainly will develop new ideas in the near future. It won’t get any easier, less expensive or friendlier. On the contrary: it will be more expensive, more bureaucratic and more complex. In the EU labyrinth of regulations and recommendations, lobby groups and politicians not aware of the use of the legislation in practice have prepared copyright legislation. Representatives from museums for instance, were not consulted when new principles for resale rights were launched. Scholars, students, the general public nor anybody else active in the not for profit side of the art world was consulted nor involved. The use of artworks in EU language unfortunately is simply reduced to an economic transaction. Indeed art always has been a business.

If we look at the money side of art, we also see on the long term that tax rules and legislation have negative effects on the growth of the overall art world in Europe. Up until recently, Britain alone owned 70% of the European art market. But one of the key findings in the Art Market Report 2014 proved that the epicentre of the €47.4 billion art market has moved to the US. “Art goes where money flows” is the old saying in the fast increasing new world of dealers, jet set artists and the international elite of buyers and collectors. Art prices go through the roof. Records are broken time after time. A prize bonanza in almost every category: modern classics (Picasso), impressionists (Monet), contemporary (Koons) old masters (Raphael), applied arts, ceramics, African and Oceanic art, even posters and photographs. In this battle for beauty, museums simply can’t compete and are left empty-handed. Yet in this real industry that the art world has become, non-profit museum directors are required to become more and more entrepreneurial businessmen and legal experts. The strict copyright legislation and recent developments concerning so-called artist’s resale rights, *Urheberrecht* or *Droit de suite* are limiting museums in their aim for maximum outreach and to encourage new audiences to commune with artworks in their collection.[1]

1 *Droit de suite*, is a law connected with copyright regulations. The *Droit de suite* is the payment owed to the author of original works and their inheritors upon the resale of their work. In the case of the “American Royalties Too,” *Droit de suite* would be applicable to works sold for $5,000 [around €6350.00] and over (but would not apply to private transactions as in European countries). This is common in France, Germany, Belgium and several other countries. Not in Switzerland and China. The US recently has a new bill concerning visual artists resale right introduced in US Congress. Resale rights might sound reasonable for living artists, active professionals making a living in the uncertain world of creative processes, on their own, depending on time-bound taste and personal preference. An adventurous profession and those who chose deserve respect and support. However, the *Droit de suite* resale rights legislation has been lined up along the logistics and in the vocabulary of the much older and very rigid copyright regulations. Copyright is guaranteed up till 70 years after the year of the death of an artist. In most countries, 50 years was the original period. A strong France lobby made it 70 years, securing the income for the heirs of Leger, Matisse, Picasso and many other French modern classics. Picasso died in 1973, Matisse in 1954, Mondriaan in 1944. Mondriaan will be freed at the end of this year. Mondriaan had no wife, no children. His “rights” are in the hand of the New York-based Holzman estate, invoicing everyone doing anything with Mondriaan, including universities, museums and other not-for-profits worldwide. Lobby groups recently has started to prolongate the period with another 20 years up to 90 years after the death of an artist.

The EU will harmonise all kind of regulations in the field of taxes and of copyright. And it will drain Europe from the art market. It has already. Some years ago, the leading Art Cologne in Germany lost pole position to the Swiss based Art Basel. Sotheby's Amsterdam stopped auctioning in the Netherlands, the London based Frieze Art Fair expanded to New York. The international art world is more and more money driven: high value, low tax. It's hard to say how much and when local or national tax is the argument to move. From 2005 onwards, artworks sold in the EU have an extra tax up to a maximum of €13,000. In France, where *Droit de suite* has been active for many years, 75% of all *Droit de suite* money is going to only ten artists – or their families, widows and grandchildren. In the US with approximately 200,000 artists, the top five is responsible for 31% of all copyright fees. So in practice, the current copyright and resale rights make the rich richer and keep the poor, poor.

Copyright legislation is meant to break the old pattern of museums catering too much to the existing educated elite. There is nothing wrong with trying to break old patterns. But in order to engage a younger and new audience, it's not enough to offer a small selection of poor low-resolution images. Everyone understands that open access is the future, especially for artworks that belong to the world, artworks being part of public collections in museums. And access means to publish the collections at the highest standards, technically as well as aesthetically.

It is time to develop a common European strategy and to reshape copyright laws that respect the authorship of artists and give museums and public collections maximum freedom in using and sharing. Most importantly, any legal framework needs to take account of the needs of society. Limitations and obstructions do not enable creativity. The use of images of any artwork in a public collection in catalogues, publications, posters, invitation cards, websites etc. should be free for the modern connected world. Let us enable people to use their creativity and bring art in new ways into their and our lives. The real profit is in beautiful exhibitions, catalogues and access and use of public collections for anyone, anytime, everywhere. At the end of the day, isn't that what art is all about?

'Everyone understands that open access is the future, especially for artworks that belong to the world, artworks being part of public collections in museums.'

Cybersecurity as a creator of real value for Europe's economy

By Reinhard Ploss

Dr Reinhard Ploss is CEO of Infineon Technologies AG, a German semiconductor manufacturer.

In the past, we used to see the digital world as one thing and real life as another. Today, both are on the brink of becoming one. The increased connectivity between both spheres creates a new quality of interaction, offering numerous possibilities, yet also presenting many challenges. It urgently raises the need for trusted security solutions for exchanging information. As Europe has all the competencies and tools required for implementation, these solutions could give a push to Europe's economy becoming the world's leading "security provider" and creating real value for modern society.

To establish the solutions, we could draw on the extensive expertise of Europe's industries in hardware, software, infrastructure, network provision, security systems and integration of systems, not forgetting such industries as automotive and aerospace that serve the end markets. There are plenty of examples of the great need for security solutions in business and personal life alike – not least, if we strive to turn the visions of tomorrow's connected world into reality, establishing the Internet of Things as a major pillar.

1 The next revolution in industrial production, the so-called "factory of the future" or "Industry 4.0," needs the secure exchange of data. Connecting the different players along the value chain is a sensitive matter. The streams of highly valuable data have to be protected against unauthorised use by third parties; facilities connected to the Internet have to be guarded against hackers.

2 A stable and affordable provision of electrical energy is a key factor for industry. Modern electric power generation and distribution with renewable energies as the main source of supply need a reliable and sophisticated grid that can cope with the volatility of demand and supply, as well as with the evolving plurality of power suppliers and customers. The active management of the electric power grid will lead to the need for an exchange of a vast amount of data, thus raising the need for protection.

3 Managing public and individual transport infrastructure in modern society will create totally new markets for services – and products. Established taxi services will remember 2014 as the year of a rising competitor they had never thought of before. At the same time, public transport providers have to make their services more attractive for coming generations by, for example, developing new ticketing and pricing solutions. Once again, we see new data streams – and potential threats.

4 Connected mobility will offer individual mobility in many different ways, like mobility on demand or the further evolution of the car toward assisted and, finally, autonomous driving. With autonomous individual mobility, time will be given back to people to be used for a better purpose than paying attention to traffic, and infrastructure will be used more efficiently, thus avoiding traffic jams and reducing the death toll and injuries from accidents. This scenario can only become reality on one condition: hackers must have no chance of taking over the control of the cars or parts of the vital infrastructure.

'With autonomous individual mobility, time will be given back to people to be used for a better purpose than paying attention to traffic.'

5 Healthcare of the future can be much more sophisticated and proactive but can also remain affordable, thanks to advanced sensing and telematics systems. Especially in Europe, confronted with demographic change and an ageing society, this will substantially add to a better daily life – as long as no unauthorised person or institution can gain access to sensitive data that must be available for medical services.

These five examples – many more could of course be listed – represent important market segments of Europe's economy, both business-to-business and business-to-consumer. They offer great real economic and societal value with their products and services. As shown in the brief descriptions though, this value can only be fully exploited if the most important common and critical element is provided: security, or, to be more precise in this context, a secure communication backbone – covering point-to-point and cloud communication – that resists cyberattacks, provides trustworthy identification of communication partners, be they people or machines, and enables a secure and protected exchange of information between them.

'The inestimable value of reliable and trusted communication is obvious and is agreed widely among industry and politics.'

The inestimable value of reliable and trusted communication is obvious and is agreed widely among industry and politics. It has also become increasingly common sense in all of society. Cybercriminality is a rapidly growing threat that has to be countered fast and effectively.

There is a joint understanding that Europe has to act to establish a secure common backbone as the prerequisite for communication that is immune to attacks. Such a backbone is potentially not a differentiating factor in itself, since other economic regions will have their own solutions in place. However, if we do not develop it ourselves, we will make Europe either dependent on others or frustrate industries from offering respective products and services, and playing a leading role in pushing the Internet of Things. Europe can establish its own secure backbone. To tap the potential and underpin Europe's relevance, the way is clear: we have to join forces across industries and work closely with public authorities to establish European Union-wide standards and legislation. As mentioned above, we can build on substantial expertise – and strong positions – in such relevant markets as automotive, aerospace and industry equipment.

Despite working on a distinct European answer to security issues, we should always bear in mind: security in the open world of the Internet requires thinking globally. Thus, Europe has to – and can – act self-confidently as a global player. The time has come for Europe to trigger a joint platform that enables cooperation between the leaders of industry and, at the same time, embraces small- and medium-sized companies, helping them to contribute and benefit as well. Politics has to play an active and central role in orchestrating this approach due to its competitive nature.

To complement the approach, selective funding programmes could be established to foster cross-company cooperation – as valuable support within specific phases as well as for selected topics. For example, purposeful funding could be an incentive for comprehensive concepts for the development and implementation of an overarching system. Programmes could also subsequently help to industrialise solutions, establishing "security made in Europe" as a quality label. And programmes should ensure that corporate Europe and political Europe can act as one key player in the pursuit of joint standards beyond our continent. Enabling trustworthiness and secure communication in the digital world will serve to substantially reinvigorate Europe's economy.

Why we need open knowledge societies

By Rufus Pollock

Rufus Pollock is president and co-founder of Open Knowledge, a non-profit organisation that promotes open content and open data.

Every day we face challenges – from the personal, such as the quickest way to get to work or what we should eat, to global ones, like climate change and how to sustainably feed and educate seven billion people on this planet. At Open Knowledge, we believe that opening up data – and turning that data into insight – can be crucial to addressing these challenges and building a society in which everyone – not just the few – is empowered with the knowledge they need to understand and effect change.

In the last decade, since Open Knowledge started work as an organisation, we had the opportunity to help create a diverse, global network in which we work with similar organisations and partners to open data and turn it into useful knowledge. Open has become a buzzword. But while much has been achieved, the world of data and information has become ever more complex. Data is everywhere and we commonly talk of "digital economies" now, of a "networked society." But making sense of data – turning it into knowledge, if you like, and then using it wisely – is still one of the greatest challenges we face as a global and increasingly interlinked society.

What is open data?

Opening data means making data accessible, making our world more transparent. Open also means finding new uses, new applications, new insights from data, creating tools, knowledge, making data and knowledge work for all of us better. According to the "Open Definition:" "Open means anyone can freely access, use, modify and share for any purpose (subject, at most, to requirements that preserve provenance and openness)."

> 'The data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the Internet.'

In concrete terms, the key features of openness are:

- Availability and access: The data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the Internet. The data must also be available in a convenient and modifiable form.
- Reuse and redistribution: The data must be provided under terms that permit reuse and redistribution, including the intermixing with other data sets. The data must be machine-readable.
- Universal participation: Everyone must be able to use, reuse and redistribute – there should be no discrimination against fields of endeavour or against persons or groups. For example, "non-commercial" restrictions that would prevent "commercial" use or restrictions of use for certain purposes (e.g. only in education) are not allowed.

Personal data and privacy

The kind of data mostly in the public eye is personal data – data about individuals, what they do, what they buy, what their loyalty cards or bank statements say about them, where they go, how their mobile apps can trace and analyse where they go, as well as who they interact with, privately

and on social media. Social media, big data, government and corporate interests are all being questioned about what data they hold and how they use it. This kind of data should never be "open" and freely accessible to everyone. Rather, we strongly believe that each of us should control *our* personal data – both to have access to it and to know (and decide) how it is used.

The potential of open data

The movement to create open knowledge is a broad and only partly structured platform, with many different angles on privacy, personal freedom and corporate and government interests. What brings the Open Movement together is a belief that there is huge potential in openness. A large amount of data is not personal: data like governments' or local authorities' budgets, road maps, train times, ingredients in a candy bar, or where those jeans were made, or how much carbon dioxide was produced last year in different parts of the world; data about the quality of schools, data on medical research, data made up of the cultural assets of our societies, which have been digitalised. Much benefit is to be gained from making such data open, transparent and accessible.

'We strongly believe that each of us should control our personal data.'

Giving researchers, campaigners, journalists, non-governmental organisations, companies, policymakers, individuals and citizens access to data means fundamentally empowering our societies and strengthening our democracies. It is not about different sides opposing each other but all sides winning insight and a better understanding, which can ultimately help to better understand and shape the world around us. A key aim of the Open Movement is to encourage and persuade governments and corporations who control publicly useful data to unlock it.

Through openness, we can ensure that technology and data improve science, governance and society. Without it, we may see the increasing centralisation of knowledge – and therefore power – in the hands of the few, and a huge loss in our potential, individually and collectively, to innovate, understand and improve the world around us. With digital technology – from mobiles to the Internet – increasingly everywhere, we are seeing a data revolution. We are living this revolution both in the amount of data available and in our ability to use, and share, that data. And it is changing everything we do – from how we travel home from work, to how scientists do research, to how governments set policy.

Turning data into knowledge

This is what Open Knowledge, as an organisation and as a platform that brings together a wealth of initiatives, research, projects and technical solutions, has been promoting for the past decade. As we enter our next decade, our focus is still on working to get governments and corporations to unlock their data and make it open, accessible and transparent. We are doing this because of the power of open data to unleash innovation, creativity and insight. It has potential to empower anyone – whether it be an entrepreneur, an activist or a researcher – to get access to information and use it.

It is key to remember here that real impact does not come directly from open data itself – no one's life is immediately improved by a new open data initiative or an additional open data set. Data has to be turned into knowledge, information into insight – and someone has to act on that knowledge.

To do that takes tools and skills – tools for processing, analysing and presenting data, and skills to do that. This is why this is another key area of Open Knowledge's work. With projects like School of Data, we are working to teach data skills to those who need them most, and in Open Knowledge Foundation Labs, we are creating lightweight tools to help people use data more easily and effectively.

Policy challenges

But the Open Movement needs the support of policymakers. Policy cannot be guided by individual media stories about data abuse. Data is also not a technical issue that can be isolated in a silo. Data is fundamentally about information, knowledge, about what we know about the world around us, how we interact and how we live.

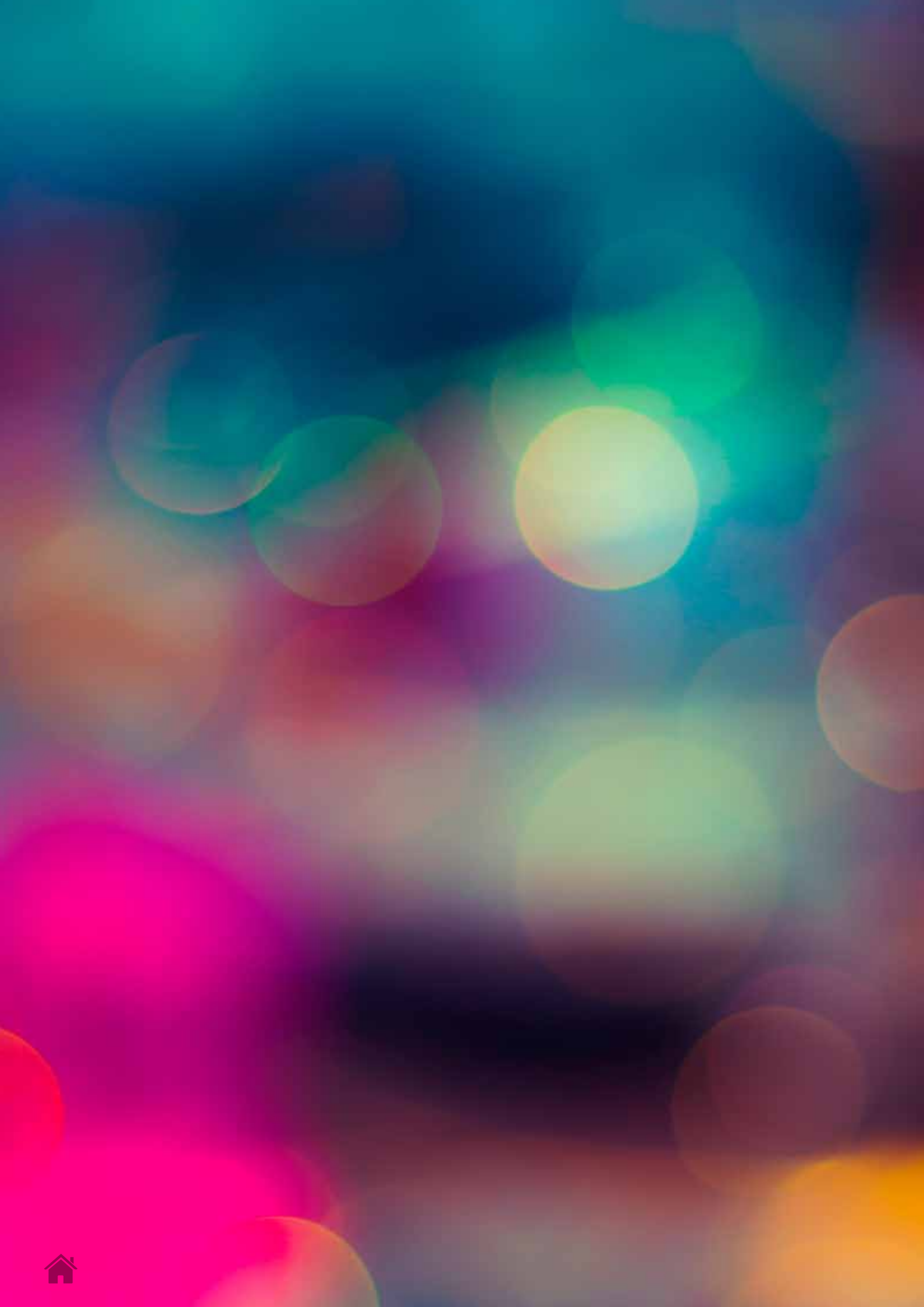
Consequently, the challenges to policymaking are complex. Policymakers who are to regulate data use need to be aware that they face the challenge to create an infrastructure, which balances protection and opportunity. Often data may be very local, and the best use of it may be local in many cases. In other cases, technical solutions can be of use in a variety of settings and be geographically completely independent. And finally, much can be gained from comparing data, learning from insights gained somewhere else.

'Policymakers who are to regulate data use need to be aware that they face the challenge to create an infrastructure, which balances protection and opportunity.'

Any emerging regulatory frameworks need to see data holistically, as the Open Movement has been attempting to do. Data is no longer just an issue "for the information and communications technology department." How we use data influences how we live. Data turned into knowledge gives us insight and improves our personal lives, our communities, our health-care systems, our local government, our central government spending and policymaking, how we consume, how we create markets, how we educate and evaluate our lives, and how we ensure the future of our societies, economies and our environment. Regulators need to work "across departments" to meet the challenge to create fitting policy frameworks that can protect where needed, but also support openness and opportunity where this benefits citizens and society.

Focus on the people

Part of any such regulatory thinking needs to be a focus on people. We need encouragement, enabling, and support for education, so we build a strong skills base in people who use data and people who use the insights from that data to drive change. We need to create a culture of "open data makers," people able and ready to make apps and insights with open data. We need to connect open data with those who have the best questions and the biggest needs – a health-care worker in Zambia, the London commuter travelling home – and go beyond the data geeks and the tech-savvy to make data useful to all.



Education in Europe in the digital age

By David Puttnam

Lord Puttnam of Queensgate, CBE is digital champion for Ireland. He is a distinguished British filmmaker, educator and member of the House of Lords.

It's likely to be commitment to education – and the "wisdom" and "judgment" that hopefully develops from it – that will determine the eventual successes and failures of the 21st century. As we in Europe work our way through the ramifications of the 2008 economic crisis, I'd suggest that wisdom is something we find ourselves increasingly short of. Ever more demanding news cycles, economic and employment figures that are scrutinised every quarter, a world so "interconnected" that a slip of the tongue, or an ill-thought through policy in one hemisphere, can wreak instant havoc in another. This is a tough environment in which to make well-thought-through policy decisions. Yet huge issues, like long-term youth unemployment, demand that we dramatically raise our game. Increasingly, many of the problems we face pit the present against the future, this generation against those as yet unborn. That's why the young need to have a far greater voice, and take far greater responsibility for what will be their future after all.

This, I'm delighted to say, has been a consistent theme of Neelie Kroes' work at the European Commission. As becomes clear from each successive visit I make to Asia, we in the "western world" have become worryingly inward-looking, if not downright complacent. We tend to see China's economic success as more of a short-term economic benefit than any kind of challenge to our supremacy. The truth is that the Chinese have effectively "re-invented capitalism" – but without being able to disentangle themselves from its inherent discontinuities and the problems that will inevitably follow.

'As becomes clear from each successive visit I make to Asia, we in the "western world" have become worryingly inward-looking, if not downright complacent.'

What are the implications of all of this for Europe?

It means a continual need to raise our game in relation to the way we develop and use "digital technologies" – in the broadest sense – to drive the development of learning, creativity and innovation. And in doing so, we can hopefully dig our way out of the hole we created for ourselves during the early years of this century. As digital champion for Ireland, I'm proud of much of the work we are already doing in the nation that I call home.

For example, the department of communications, energy and natural resources has worked extensively with the department of education and skills, and HEAnet, on the provision of 100 megabyte broadband connection to every second-level school. This programme has been successful in providing a high-quality broadband connection right to the school gates. The next step is for similar internal connectivity to be made available to each and every part of that school. More broadly, it is crucial that every teacher and learner in Europe has pervasive access, and that mobile devices are properly supported as part of that process.

For, as we now know, the advent of high-speed broadband opens the door to a faster, richer, more interactive and more informative Internet experience than has ever been possible with lesser capacities. Within education, the streaming of videos, plays, movies, animation, documentaries, concerts and so forth can now be seamlessly incorporated into day-to-day teaching practice. Surely the advent of high-speed connectivity provides the opportunity, and to my mind justifies,

an entirely new plan for the integration of information and communications technologies and e-learning across the whole spectrum of education in Europe.

Progress to date has, for the most part, been far too slow. It's surely not unreasonable to suspect that we may be suffering from an "institutionalised reluctance" – or is it simply resistance among a whole slew of stakeholders, in all countries and all parties, as well as a fair number of teachers and educationalists – to fully embrace and optimise the potential of digital innovation?

Given the unconscionable and socially unsustainable levels of youth unemployment, we cannot accept any solution that simply suggests "more of the same." Partnerships with business unquestionably have a role to play in fostering creativity, confidence and innovation, and helping to overcome some of this resistance. One result of this overall lack of self-questioning, of innovation, of genuine enterprise, is the increasing disparity that's been allowed to open up between life in the lecture hall or classroom, and the daily experience of technology and the real world beyond the school and college gates. To my mind, the roots of resistance to the profound change, which those working in education are having to address, run very deep. But, strikingly, the evidence suggests it's not to do with the reluctance of teachers to embrace change.

'Given the unconscionable and socially unsustainable levels of youth unemployment, we cannot accept any solution that simply suggests "more of the same".'

A report earlier in 2014 by the Gates Foundation on "what teachers want from technology" notes that when asked to name the top three barriers preventing them from using digital instructional tools, fewer than 2% chose the response "I do not see the value of using technology for student learning." According to one survey respondent: "My students are going to be using this technology in their jobs, at home, and in everyday life. [...] We, as educators, need to embrace the technology, to "speak" the language our students understand."

Despite the all too obvious truth of this, I've found it incredibly difficult to persuade policymakers that if we are to win back the trust of our students – and therefore have a better sense of the challenges they face - then we need to engage far more effectively with their world, and learn to view technology, and the way in which they relate to it, through their eyes. And many teachers too, remember, are part of this same "digital native" generation. As that Gates report makes clear, many of them understand and really value technology. It suggests that there are six core reasons why teachers feel technology improves outcomes:

1 By delivering instruction directly to students;
2 By diagnosing individual student "learning needs;"
3 By varying the "delivery method" of instruction;
4 By tailoring the learning experience to meet individual student needs;
5 By supporting student collaboration, and providing interactive experiences;
6 By fostering the independent practice of specific skills.

We have to bring ourselves to see digital technology as "transformative," not simply as some kind of useful "add-on," but as something that's already changed the nature of the way in which young people, and indeed their teachers, go about their daily lives.

I happen to believe that this task of winning back trust and engagement through "pro-active political policymaking" is a desperately urgent one, because without it, the chances of our being able to help young people develop the creativity, the wisdom, the patience, let alone the courage to deal with the world we've bequeathed to them, moves from being difficult to, in my judgment, well-nigh impossible!

The development of creativity through digital technology matters to our collective future, but it most particularly matters to the future of all the young people in Europe, and their prospects of securing the type of careers they really want. A world-class education system, and only a "world-class" education system, can over time offer hope of addressing our present, crippling levels of youth unemployment; delivering affordable world-class health and social services, as well as securing world-class pensions, along with a world-class infrastructure, and the ambition that delivers all of the above. The reverse can never, ever be possible!

The good news is that there are a great number of really outstanding people throughout Europe, people who understand that education at every level is both the cause and the consequence of any possibility of renewal.

Without doubt, the opportunity exists in Europe to establish ourselves as a uniquely high-skilled, well-educated continent, but the time-frame within which to achieve this is very, very short. Other highly competitive nations are not going to sit around waiting for us. They are working to their own ambitious agendas.

For the moment, the ball is at our feet. We would be incredibly foolish to allow an apparent shortage of resources, or the caution of any one element of the teaching and learning profession, to deny the young people of this continent the future they deserve.

'Without doubt, the opportunity exists in Europe to establish ourselves as a uniquely high-skilled, well-educated continent.'

Boosting digital Europe

By Herman Van Rompuy

Herman Van Rompuy is president of the European Council.

What is at stake today is the safeguarding of our European social model through innovation. Innovation that is more than just research and development; innovation consisting of the ability of a system not only to produce new ideas but also to bring them to the market and translate them into economic growth and prosperity. That's why innovation, of which the digital agenda is an essential part, should be the overarching priority in Europe. We need, at the European, national, regional and local levels, a long-term commitment to support innovation. But this is not enough!

We still miss today an integrated model to look at innovation in a global context. Not a model focusing more particularly on this or that instrument, but applying a methodology combining interconnecting instruments that were too often used separately in the past. The European Council of October 2013 insisted on this: "Europe needs a better coordinated use of tools such as grants, pre-commercial public procurement and venture capital, and an integrated approach for research and innovation to market deployment." But this is still not enough!

'We should move away from applying a uniform approach to heterogeneous markets.'

An overarching innovation policy linked with an integrated model doesn't mean a single innovation policy; the innovation policies should be adapted according to both generic and, more so, to specific characteristics of each sector. We should move away from applying a uniform approach to heterogeneous markets. Smart specialisation is needed, sectorial industrial policies have to be promoted, also for sectors which are essential to the development of other sectors, such as the Internet, for instance.

And I am now touching on what is the essence of innovation, to what is usually called "data." Data is the new currency of the economy, or, as Neelie Kroes likes to say, the new oil of our economy. As I said during my opening statement of the October 2013 European Council: "We have got one main question, and that is how to restore Europe's online leadership."

The European Union has to boost digital, data-driven innovation across all sectors of the economy, because a strong digital economy is vital for growth and European competitiveness in a globalised world. One of the questions Neelie Kroes put to me is, "If you, Herman, would have been me, what would you have done over the last five years?" My answer to that question is very easy: "Neelie, nearly the same as you did!" And I am not saying this because we have a good personal relationship, which we indeed have. I am writing this because Neelie did the right thing to boost the digital agenda in Europe. And I supported her as much as I could. I put the "innovation" file on the agenda of the European Council for the first time in February 2011 at the first thematic European Council I organised. I supported strategic technologies such as big data and cloud computing, knowing they are important enablers for productivity and better services. I insisted, at each and every European Council dealing with economic policy, on the necessity to complete the digital single market by 2015 and to put every measure into place to fulfil this ambitious objective. Half of Europe's productivity growth derives already from information and communications technologies (ICT). Creating a real digital single market could alone generate a 4% gross domestic product increase by 2020. Let us remember that the Internet creates five new jobs for every two lost.

To conclude this "digital plea," I would like to be more specific on three issues, issues we need to keep emphasising if we want to be successful in the future:

1. Innovation of the public sector

A growth policy for and in the EU should be supported by innovation of the public sector. The volume of public expenditures is about 45% of the EU's GDP and, as regards public procurement, 17% of GDP. The public sector accounts for 15% of the total employment of the EU. So, innovation *by* the public sector (the public sector giving the impulse) is something needed, but today innovation *of* the public sector (becoming itself more innovative for health, education and government administration) is even more crucial. Public administrations can achieve 15-20% cost reductions by moving to e-government, e-health, e-procurement and e-invoicing, not to mention increasing the skills potential of citizens by more intensively using e-education tools. And this leads me to the second issue:

2. Skills

In 2011, the EU was faced with 300,000 vacancies in the ICT sector; by 2015 this would increase to up to 900,000 vacancies. And by 2020 about 85-90% of all job vacancies are expected to require digital skills. The present skills mismatch is detrimental to our economic and social policy objectives. That's why the European Council insisted on a higher degree of integration of digital skills in education, from the earliest stages of school to higher education, vocational education and training, and lifelong learning. The European Council insisted also on the need for the Grand Coalition for Digital Jobs to be strengthened to address the skills gap. Unemployment today is about poor skills, not necessarily about poor education. Today, the market – but also society in general – puts less emphasis on knowledge standing for itself than on the capacity people have for solving problems. This is why, if we want the EU's economies to grow, we should first look at the "skill supply." We cannot change our economies without changing our skills supply.

'Today, the market – but also society in general – puts less emphasis on knowledge standing for itself than on the capacity people have for solving problems.'

3. Bringing stakeholders together

And last but not least, I would like to put more emphasis on the need to establish a "cooperative model" – a model bringing all stakeholders together in order to create together, shareholders from the private and from the public sectors. The model should encourage an interactive process in which the private sector discovers and produces information about new or renewed activities, and in which public authorities do not only assess the potential but also empower the actors that are the most capable of realising that potential. Clearly, society is better off and economies grow more sustainably where universities, public institutions and industry work permanently and openly together and not separately from each other; when they listen to each other to reach a common understanding and to share a common vision of the sector they are dealing with; when stakeholders agree on a common objective and pull their efforts to reach that objective. That's the model we have to copy.

Interactive landscapes

By Daan Roosegaarde

Daan Roosegaarde is an innovator, artist and founder of Studio Roosegaarde, a social design lab.

"You are not a designer, nor an architect," *The New York Times* journalist says to me. "You are a hippie with a business plan." I am sitting in a room on the 22nd floor in New York where this journalist gives me this "label."

I started to appreciate his incidental comment. Because this is exactly what is needed today. To have new dreams, new ideas. And at the same time to have the desire to make them happen.

Some people are scared of the future in Europe. New technologies are forcing us to rethink our traditions. A new world is still unknown to us, while an old one is crashing. This is our new playground to experiment, to innovate. It pushes us to be creative.

'A new world is still unknown to us, while an old one is crashing. This is our new playground to experiment, to innovate.'

I've always believed this is the essence of design. It's not just about chairs, lamps and tables. Good design is about improving people's lives. Your own fascinations are crucial within this movement. My current one is highways.

Why is it that when we talk about mobility and innovation, almost everyone always focuses on the cars? To make them more glamorous or sustainable? Highways are disconnected from this thinking, yet they determine our landscape much more. Can we make a highway an interface of information and experience? How can we use elements of nature to create interactive environments? What happens when technology jumps out of the screen and becomes part of our landscape?

Smart Highway starts from there, in which we create roads that are sustainable and interactive in collaboration with the road manufacturer Heijmans. For example, we are developing roads with smart paints, which charge at daytime via the sunlight. At night, they give energy-neutral light for up to eight hours. Or how about roads, which charge electric cars while driving, so they can go further without recharging. It's an intense project in collaboration with industry and government in which we work on the future of our landscape, which should be energy neutral and also just incredibly poetic. It's something I like to call "techno-poetry."

As we are testing the first Smart Highway in the Netherlands, local people are getting excited. I see that we are making places where people feel like a citizens again, not just taxpayers. And if that's the case, you can "label" me any way you like.

Embracing a new digital era in Europe

By Eric Schmidt

Eric Schmidt is executive chairman of Google.

Innovation isn't easy. It takes courage to experiment and advance a new idea and determination to ensure its widespread use. Europe has always excelled at this. Radio, television and the standard for second-generation mobile communications, GSM, all originated in Europe. But past success won't ensure that Europe's long tradition of innovation continues.

New technologies require more risk-taking and the ability to launch new products with speed and scale. There is no doubt that Europe is poised to embrace the new, digital world. Its citizens have the education, skills and ambition needed to create great technology companies that will drive economic growth and employment.

At the same time, Europe needs to reform and forge a true digital single market. This will give European entrepreneurs, who have all the right building blocks, the incentive to invest and the ability to achieve global scale at greater speed. Significant political will needs to be mustered to support these changes and ensure Europe's startups succeed.

'New technologies require more risk-taking and the ability to launch new products with speed and scale.'

It's time for action. Instead of riding the wave of technological change and innovation, inaction will put Europe's economy at risk. This requires strong leadership. As European commissioner, Neelie Kroes had the courage to promote new ideas, even if they disrupted existing industries. When a Belgian court banned the taxi sharing service Uber, she cried foul. "We cannot address these challenges by ignoring them, by going on strike, or by trying to ban these innovations out of existence," she tweeted.

The opportunity

Let's look first at Europe's digital opportunity.

On a continent in search of economic hope, the Internet represents the main motor of growth. According to the Organisation for Economic Co-operation and Development, the online world accounts for up to 13% of economic output and is driving the creation of new companies, new jobs and new opportunities. While many traditional industries are facing tough times, Internet companies are pouring billions into new offices, development centres and research laboratories.

The Internet lowers costs, increases access to markets and makes starting a business easier than ever before. It allows, with a few clicks of a mouse, a Greek bed and breakfast owner, a French fashion designer and a Swedish candy-maker to reach a global marketplace. Small- and medium-sized enterprises with websites and online marketing are growing four times faster than those without. Companies that embrace digital, on average, generate 9% more revenue through their existing assets, and their profitability outperforms that of their non-digital peers by 26%.

If Europe's single market becomes truly and thoroughly digital, the macroeconomic benefits would be enormous. Reform could raise the European Union's gross domestic product by at least 4% by 2020, and generate up to €250 billion of additional growth (see highlights of the European Policy Centre digital single market project at http://www.epc.eu/dsm/). Europe's digital businesses

no longer would have to get individual licences to operate in 28 different countries. If regulatory barriers are removed, startups could directly access a half billion European consumers, a market that's larger than the US, where technology companies have the ability to achieve scale before they expand internationally.

'Digital entrepreneurship is central to helping get Europeans back to work.'

Bits and bytes have an impact beyond the established Internet sector, too. Think of energy. Smart thermostats from Nest and Honeywell are already giving people unprecedented opportunities to use energy more efficiently. Since Nest launched its first thermostat in 2011, its customers have already saved about two billion kilowatt-hours of energy compared to what they would have used if they left their thermostats at a consistent temperature. That's enough energy to power more than 180,000 homes for one year. A combination of technological advances will make it possible for Europe to transition away from intensive consumption to a more sustainable and efficient digital-powered energy model.

Getting Europe back to work

Perhaps Europe's most pressing problem is its high unemployment rate, which seems stuck at twice the US level.

Digital entrepreneurship is central to helping get Europeans back to work. Conventional wisdom says that small businesses are the source of new job growth. It's important to distinguish between new firms and small businesses. They are not the same thing. The truth is, studies show that new jobs are not created by small businesses. They are created by new businesses – and in particular, fast-growing new businesses.

Fortunately, the Internet is making it easier and easier to start new companies. To solve its jobs crisis, Europe must encourage the risk-takers. High-tech jobs pay better than low-tech jobs and promote higher wage growth more broadly. Best of all, they have a multiplying function: every high-tech job creates four other jobs in Europe.

Bright signs

Both the EU and national governments have shown a commitment to understanding the potential of data-driven innovation and to supporting digital startups and entrepreneurship. Europe's startup scene is vibrant and growing: Shazam and King in the United Kingdom, Criteo and BlaBlaCar in France, Spotify and Skype in the Nordics, SoundCloud in Germany.

Silicon Valley-style high-density hubs of talented thinkers are emerging. Policymakers are encouraging startup density by creating physical startup centres that drive awareness in the media, foster networks with mentors, and reduce barriers that make it difficult for academics and research networks to connect with businesses. This type of density is already visible in parts of Europe, notably in Berlin and in London's Tech City.

Imagine if this vibrant European entrepreneurial scene could benefit from a digital single market, which would end the need for obtaining different national licences and reduce regulatory red tape. High-growth firms and technology-intensive startups suddenly could scale up and compete more vigorously in the global marketplace.

Much hard work remains ahead

Where does Europe fall short and what else does Europe need to do to embrace a dynamic information society?

Traditional European companies and industries have lagged in adopting new technologies, disadvantaging them in an increasingly competitive global marketplace. A recent study completed by the Lisbon Council and the Conference Board found that information and communications technology represents a much smaller share of total investment in Europe than in the US, and that this has a significant impact on economic growth.

Labour markets are another key area for reform. Most of Europe has the skills and experience necessary to build new products, services and businesses. There's always more to be done in terms of expanding these attributes, but what is equally important is ensuring employees can repurpose their skills, training and expertise in new firms and new sectors. In Europe, flexible labour markets are a particular challenge that deserves serious consideration.

Another important challenge is accepting failure. Entrepreneurs are risk-takers and emerge more readily in cultures where risk-taking is encouraged. Talented and skilled Europeans must see starting their own business or joining a startup as a viable career path.

A thriving startup ecosystem relies on easy access to capital. Europe needs tax incentives and other proactive measures that make it easier for startups to get funding. Governments should think carefully about the balance between driving growth and taxing capital.

'Governments should think carefully about the balance between driving growth and taxing capital.'

Most of all, Europe needs to accept and embrace disruption. The old ways of doing things need to face competition that forces them to innovate. Uber, for example, is shaking up the taxi market – for the good. It offers riders convenience and cheaper fares. Understandably, the incumbent taxi industry is unhappy.

The new European Commission President Jean-Claude Juncker understands these priorities. In *The Wall Street Journal* he recently called for the completion of Europe's digital single market. President Juncker called for Europeans to "tear down our regulatory walls and finally move from 28 national markets to a single digital market. For this to happen, we have to get serious: we have to end the regulatory silos in telecoms and copyright regulation, in data protection and in the application of European competition rules. This requires political determination. There will be resistance, as the current fragmented regime has created very convenient, well-protected comfort zones for some players. But Europe would miss a historic opportunity if we fail to tackle this challenge head-on."

I agree completely. If everything stays the same, innovation will be stifled and startups will be strangled. New businesses promoting new ideas should not be held back by bureaucratic or regulatory hurdles. Success is never guaranteed, especially in an area that is as competitive and fast-changing as technology, but Europe has all the right ingredients. It must redouble its commitment to the single market and steel its nerve to permit disruptive innovations. If the new European Commission manages to introduce effective reform, Europe will play a leading role in the global digital economy and be a better place to work and live.

Embracing the digital era to ensure Europe's competitiveness

By Klaus Schwab

Klaus Schwab is founder and executive chairman of the World Economic Forum, an international organisation "committed to improving the state of the world."

The World Economic Forum has been enriched by the contributions of globally minded and digital innovators. So it is no surprise that I view digital technologies and digitally delivered services as critical to fostering Europe's competitiveness. When governments, companies and individuals embrace the new digital era, they open the possibility of driving innovation through new products, processes and services. They can also enable more inclusive and democratic engagement in the economy for all Europeans.

Receiving an economic boost from the digital era is not a luxury – it is essential to ensure that Europe continues to grow and deliver levels of prosperity that meet the rising expectations of its citizens. As the World Economic Forum's Global Competitiveness Report and The Europe 2020 Competitiveness Report both highlight, the European Union has significant gaps in innovation, both internally between member states and externally compared to other leading economies. In many cases, it is the concerted application of digital technologies – offering new sources of data and methods of analysis, new means of design or construction, expanded opportunities to control quality and new channels to access customers or suppliers – that will help Europe's innovators and entrepreneurs drive inclusive and sustainable growth.

While many of the member states of the EU, including Finland, Germany, Sweden and the Netherlands, are truly "at the frontier" of innovation, that same frontier is continually moving, leaving no room for complacency. Meanwhile, other countries and regions are making rapid progress, catching up and challenging Europe's position as an innovative, high-quality producer of goods and services. Europe's future relies not merely on staying at the frontier of innovation, but on pushing it forward. It can do so through both the basic research that expands our understanding of the world and, importantly, through the commercialisation of new technological applications that improve productivity and create whole new markets.

'Digital technologies with the right set of skills and organisational structures could create jobs and provide an alternative path for underemployed youth.'

Leadership in Europe has not always helped spread a culture of innovation throughout the continent. Many European economies are performing well below average in terms of how they employ digital technologies and innovation to drive growth. Given the integrated nature of Europe's markets and the monetary union, the gaps in competitiveness must be closed. In the majority of European countries that are experiencing high levels of unemployment, digital technologies with the right set of skills and organisational structures could create jobs and provide an alternative path for underemployed youth and other groups to gain new skills and access the labour market.

How to make the most of Europe's digital future

The World Economic Forum will continue to encourage the highest-level decision-makers to embrace a digital future. Until recently, efforts to support digital innovation were seen as a niche, or simply better left to entrepreneurs. As the entire economy becomes digital, that attitude is no longer tenable. Digital issues are now political issues; the entire economy now relies on digital networks and services. Leaders must therefore take part fully in this transformation.

Realising the promise and prosperity of a digital Europe requires European policymakers, business leaders and other key influencers to align policy and practice in three areas.

First, individuals of all ages must have the skills to participate in the digital economy and, wherever possible, in the creation of new services and platforms. Ongoing research on the future of jobs looks at the increasingly important link between shifting technological trends, labour market activity and the demand for skills. As the Grand Coalition for Digital Jobs emphasises, intimate knowledge of digital tools will be an ever-increasing advantage for firms and jobseekers alike.

"Digital natives" may be intimately familiar with digital technologies, but Europe must go further: it needs people across all generations to have digital skills. A deep understanding of coding principles and knowledge of a number of programming languages may well become the most important dialect for Europeans of all ages in the digital era. To paraphrase a recent blog post by former European Commission Vice-President Neelie Kroes, Europe needs to make sure it is "coding its own future."

Second, a new mindset is needed in Europe where public- and private-sector organisations adapt their daily activities and business models to capture the efficiencies and growth promised by digital technologies. A recent World Economic Forum project entitled Enhancing Europe's Competitiveness: Fostering Innovation-Driven Entrepreneurship in Europe highlights the need for large and small European enterprises to adopt digital business models and practices, ranging from the relatively common systems to manage enterprise resources, to more cutting-edge collaboration between entrepreneurs and established businesses. As the European Commission's Entrepreneurship 2020 Action Plan has shown, small- and medium-sized enterprises that embrace novel digital technologies tend to grow two to three times faster. The European Commission has been working to accelerate the transformation of the European business landscape through campaigns such as Watify and the Startup Europe Partnership, leveraging Europe's businesses and entrepreneurs for the next wave of digitally-driven economic growth.

'Small- and medium-sized enterprises that embrace novel digital technologies tend to grow two to three times faster.'

Governments can also achieve significant efficiencies by embracing digital technologies. Estonia's successful e-governance initiative, which delivers online services to citizens, is well known but, as yet, not well replicated. Research reported in "The E-Government Imperative" by the Organisation for Economic Co-operation and Development indicates that EU member states can increase public-service efficiency and impact, better implement reform agendas and raise levels of citizen engagement through the use of digital technologies. With high levels of public debt, a lack of trust in Europe's institutions among its citizens, and an urgent need for reforms, investments in digital governance have never been so important.

Third, a digitally-driven Europe is also one where all Europeans share access to enhanced digital public goods – most importantly, a robust digital infrastructure that keeps pace with the latest technology and demands on bandwidth, coupled with smart, cohesive policies that support the creation and growth of a true digital single market. For example, the World Economic Forum's Global Agenda Council on Europe is working to raise awareness of how important it is for the region to embrace the latest digital infrastructure. It wholeheartedly supports the call from former Vice-President Kroes for Europe to co-develop fifth generation wireless systems, known as 5G. The European Parliamentary Research Service has estimated that not having a digital single market

would cost Europe €260 billion per year in efficiency losses; having a digital single market would raise long-run gross domestic product by at least 4%. This is a growth opportunity that cannot be ignored by European leaders.

From Europe to the world

Capable actors from all backgrounds and regions must step up to meet the digital challenge – by improving what has already been created and by inventing the digital future. This means setting global frameworks for digital governance and closing the digital divide that exists between and within countries.

Take, for example, the new globalNET initiative. Building on the principles established by the NETmundial initiative under the leadership of the Brazilian government, the World Economic Forum will take a leading role to ensure that the Internet remains an open platform for free expression and innovation – through a better multistakeholder system of governance. The Internet cannot become the victim of inertia or the plaything of state actors. Taking advantage of the World Economic Forum's interdisciplinary and high-level multistakeholder communities, the globalNET initiative aims to support broad policy dialogue on key issues linked to digital governance by engaging relevant expertise from ministries, industries, academia and civil society beyond those specialising in the information and communications technology sector and participating in traditional Internet fora.

Activities such as globalNET are important precisely because the contentious issues currently holding back Europe's digital future – privacy and data protection concerns, cybersecurity protocols, the threat of censorship, intellectual property laws, among others – should be seriously negotiated at the global level. Indeed, Europe should be at the forefront of these issues, showing others that it is possible to agree on reasonable, workable standards, to co-develop cutting-edge technologies that require significant investment and, ultimately, to demonstrate the power and promise of a digital economy through a European digital renaissance.

This vision of Europe's digital future will not become a reality until global leaders from all sectors open up to the possibilities that the digital economy brings. Fast, ubiquitous access to information and the ability to shape online contexts in novel ways across traditional boundaries transform not just how we consume and share data but how we structure our economy and live our lives. The digital era creates entire new platforms of economic activity, such as those we see in the fast-growing sharing economy, and platforms yet to be imagined, let alone realised. It offers the chance for marginalised individuals and groups to engage in value-creating activities in environments where race, gender and disability are often irrelevant. It offers the chance for new and established businesses to become more productive, open, global and connected, and therefore to have greater impact. And it provides EU member states and the European Commission the opportunity to be more transparent, accountable, efficient and effective in delivering the services and public goods that European citizens demand and deserve.

'The digital era creates entire new platforms of economic activity.'

I see Europe's digital future as competitive, innovative, inclusive and sustainable. With the right attitude, investments and policy action today, this future can be realised. We are already on the journey towards that future, and I am very much enjoying being a part of it.

The smart, skilled European digital economy: Creating a marriage between industry and education

By Joanna Shields

Baroness Joanna Shields, OBE is digital advisor to the British prime minister.

The UK and Europe have a long history of innovation and design leadership. From the ground-breaking coding of Ada Lovelace, to the development of the World Wide Web and the sleek design of the Apple Watch, European leadership in technological advancement continues apace. As the legacy of innovation progresses, we are faced with new challenges and opportunities for change. From finance to advertising and healthcare, digital continues to disrupt established industries and professions.

Education needs to undergo a similar disruption. It is time to revolutionise traditional education models to meet the demands of the digital economy and to democratise access to digital skills. The strongest way to achieve this goal is through a renewed partnership between education institutions and digital businesses.

As adviser to the UK prime minister on the digital economy, I witness economic development and success stories on a daily basis. But these are not enough: there needs to be a cultural shift in thinking. Ultimately, it is in the interest of all European Union member states.

A European Commission report published in December 2012 identified that Internet traffic is doubling every two to three years; and mobile Internet traffic doubling every year. By 2015 there will be 25 billion wireless connected devices globally, doubling to 50 billion in 2020. Mobile data traffic is expected to increase 12-fold between 2012 and 2018, and data traffic on smartphones to increase 14 times by 2018. There are more than four million information and communications technology (ICT) workers across many sectors of the digital economy in Europe and their number is growing by 3% annually.

As digital becomes part of the core DNA of the European economic model, we are left with pressing questions.

How can we meet the appetite of students and entrepreneurs to develop the skills they need, to become risk takers like Sir Timothy Berners-Lee, who took his idea from the page to the computer a quarter of a century ago? How can we revolutionise the guiding principles through which we educate to ensure digital skills, and the entrepreneurial spirit they ignite, become a central focus across the EU?

A recent Nectar survey found that 80% of young people in Britain would like to start their own business in the next five years. Digital businesses around the UK are calling out for talent: 745,000 additional workers with digital skills will be required in Britain alone to grow the economy over the next three to four years.

> 'The demand for digital skills is greater than the rate of supply.'

But this data highlights a fundamental problem: the demand for digital skills is greater than the rate of supply.

Training and skills are the lifeblood of any agile economy. We can only be as economically innovative and effective as the skillsets of our populations allow. As the rate of digital innovation heightens, with new platforms, networks and products created, it is the responsibility of policymakers and educators to create programmes to tackle digital skills systematically. The future of the smart European digital economy is not five, ten or fifteen years away – it is right now. Therefore, the message must be: "adapt, or get left behind."

So far, the issue of digital skills has been addressed largely by a number of industry-led coding initiatives and through computer science becoming part of education curricula. This is a systemic and innovative way of thinking – built on the recognition that technical development skills must begin early in the education cycle to equip students with the necessary competencies for them to pursue successful careers.

But building a digital economy is not just about coding and computer science. As digital disrupts traditional industries, educators must be aware of this development and think creatively about how to harness it to effect positive change.

One way we do this is by creating sustainable partnerships between the digital business community and third level institutions, to help them understand the new disciplines emerging in the sphere of digital; and to identify the learning gaps that still exist.

Businesses can influence how universities shape their curriculum in a way that is practical - and in a way that is effective for the needs and wants of the digitally enabled student who needs to adapt to a rapidly evolving technological workplace.

Too many students are forced to take courses overseas, or to pay for expensive private alternatives, when they should be afforded the opportunity to be trained in user experience, digital analytics or product management as part of their education. There should be space in the system to build dedicated departments for digital education, forming partnerships with the business community to create a case for the introduction of digital thinking and disruption across all academic faculties, from law and medicine, to humanities and the arts.

At Tech City UK, we, alongside our partners in the UK Government, are launching Digital Business Academy – a unique programme dedicated to meeting this challenge head on. It is the first time that a government-funded MOOC (Massive Open Online Course) has been developed with the specific aim of up-skilling the nation and developing the necessary business skills to succeed in the digital industries.

'Our shared EU vision must be to democratise digital skills and to equip all citizens with the training needed to meet the demands of the digital age.'

The programme brings together the UK's world-class educational institutions University College London and Cambridge University and grassroots digital skills provider Founder Centric in a series of eight courses - all online and accessible to anyone in the UK for free. This connection between grassroots business needs and third-level expertise is an important step. We want the UK population, irrespective of age, economic status, or background, to be able to access the vital training and skills they need to excel in the digital workplace.

Our shared EU vision must be to democratise digital skills and to equip all citizens with the training needed to meet the demands of the digital age. In order to do this we need a revolutionary shift in thinking around how we approach the issue of education in the 21st century.

It is now time to create a marriage between industry and educators, to deliver the skills needed for Europe's future generations of business builders.

A better Europe is a digital Europe – the digital opportunity ahead of us

By Jim Hagemann Snabe

Jim Hagemann Snabe is a member of the supervisory board and former co-CEO of SAP, an enterprise software and software-related services company.

According to the World Economic Forum's latest *Global Competitiveness Report*, many countries in Europe show relatively strong competitiveness. Among the 20 most competitive countries in the world, 10 are European countries. Does this mean that Europe is in good shape? There is no doubt that the standard of living in Europe is high today. But as a former business leader, I know that the short-term performance in a given quarter or year is not a guarantee of strong performance in the future. Sometimes it is even the opposite. Independent of the financial crisis, Europe is facing a number of challenges that will impact its future. One of the most fundamental challenges for the future of Europe is a lack of growth combined with the demographic outlook of an ageing population.
The fact that we currently have high unemployment among young people makes the situation even more worrying. Unless we do something radical now, we will not be able to maintain the high standard of living in Europe – nor will we be competitive in the future.

> 'Unless we do something radical now, we will not be able to maintain the high standard of living in Europe.'

The Industrial Revolution

The Industrial Revolution began in Europe – in Great Britain – around 1800 and spread to Western Europe and to the United States within a few decades. The Industrial Revolution was the transition to new and more efficient manufacturing processes through the use of technology. The logic of the Industrial Revolution was largely based on the logic of "economies of scale," whereby companies gain competitive price advantage through mass production. With relatively high costs of labour in Europe, an "economics of scale" was achieved by adding energy-consuming technologies to replace labour. After many years of productivity improvements through technology, the last phase of labour optimisation was achieved by outsourcing the remaining labour-intense activities to low-cost locations such as China and India. As a result, Europe is today left with a high dependency on energy and a relatively limited manufacturing capacity. With high costs of energy compared to the rest of the world (due to the shale-gas revolution in the US, and the geopolitical situation in Russia and Ukraine), the benefits of optimising labour are coming to an end for Europe. It is time for Europe to find new opportunities for growth and employment – to reinvent Europe like we did in the Industrial Revolution and to look for the next technological revolution to drive competiveness and prosperity.

The digitisation revolution

Through digital technology, we have a unique opportunity to predict demand, deliver individualised offerings, track and reuse materials and eliminate waste across all value chains. A familiar example of this transformation is the music industry – one of the first industries to undergo a highly visible transformation driven by digital technology. The combination of new mobile devices (mp3 players), the connectivity between people (broadband Internet and cloud computing) and the digitisation of the product (mp3 file format) drove a radical change by which supply-chain costs plummeted while consumers gained unprecedented individualised access to music through digital services. The mass production, shipment, distribution and sale of music in physical formats, such as records, cassettes or compact discs, which had been the focus of the industry for over 60 years, became largely irrelevant in less than a decade. Opportunities for optimisation shifted dramatically from the value chain of the physical product to the digital assets of customer data and loyalty, with a radical reduction of costs and resource consumption as a consequence.

A digital vision for Europe

The digital technologies invented during the last 40 years give us an opportunity to rethink and reinvent all industries – like we saw in the music industry.

Imagine the future of banking in a digital world. Traditionally, consumer banking centred on brick-and-mortar banks. Customers visited their local bank to deposit and withdraw money. Expansion required investments of capital and resources to build more physical branches and employ staff to operate them. Today, the Internet and mobile technology are radically changing the consumer banking experience. In less than one generation, consumers have shifted their behaviour to now expect a virtual, mobile banking experience, which is significantly more convenient than the traditional banking experience – and significantly cheaper. In emerging markets, such as Africa and India, banks are adding thousands of customers a month who have no access to a traditional bank. With little more than a basic mobile phone and identification card, clients can open an account in under 10 minutes and transact using mobile payments. The marginal cost of opening a new account is close to zero. "Banking outlets" in the form of corner grocery stores that can provide basic banking services replace brick-and-mortar banks. Traditional labour can be redirected to high-value services and the generation of new business and innovation.

'Traditional labour can be redirected to high-value services and the generation of new business and innovation.'

But let's go beyond industries with digital products. Imagine the future of retail in a digital world. In traditional retailing, the products and the shelves were the assets. With digital technology, retailers are rapidly digitising the shopping experience. They are becoming digital enterprises, where the assets are now customer data and loyalty – just like in the music industry. Point of sales data and social sentiment analysis are creating the opportunity to predict future demand, personalise relevant offers in real time and rethink supply chains. Rather than optimising the operations of their stores, retailers suddenly have the option to remove physical stores altogether, reducing their environmental footprint and putting people into new jobs in areas such as transportation and customer service. Even in manufacturing-based industries, alternatives to mass production are emerging due to digitisation.

Imagine the future of manufacturing in a digital world. With digital technology such as three-dimensional printing, the relocation of mass production to low-cost locations far away from the consumer may become less attractive. With three-dimensional printing, the optimal lot-size in manufacturing is reduced to one product. This will eventually allow individualised products to be produced at the price point of mass production at the location of the consumer – no plant, no store and no distribution required. Or imagine a world where every physical product carries a digital "product passport," which captures all relevant information associated with the product from its initial design to the moment of recycling – cradle-to-cradle – including its consumption of energy, waste, carbon dioxide emissions and environmental footprint. This would allow resource optimisation and reuse across the entire value chain – and transparency toward the final consumer. These new opportunities could bring manufacturing back to Europe, much closer to the consumer and reduce the costs and environmental impact of manufacturing significantly at the same time.

Even resource-intensive industries such as utilities can be reinvented. Imagine the future of utilities in a digital world. Today with solar panels installed on private homes and integrated to smart grids and smart meters, every household also becomes a producer of energy. Using the technology of big data analytics, we can predict demand, predict capacities and calculate dynamic prices.

‘The digital footprint we collect in the digital world is a very valuable asset to predict, target and optimise products and services around individual needs.’

If we add the electric car to the grid, as a storage mechanism for energy, we have an opportunity to take out the peaks in such a system. It is estimated that in Europe alone, removing such peaks could reduce the need for polluting raw materials like coal by up to 15% without reducing the access to energy. Imagine the impact on the economy and the environment when technology is used to optimise entire supply chains and make energy affordable and clean because it is economically attractive to do so.

And maybe the most important re-intention of all is the reinvention of healthcare. Imagine the future of healthcare in a digital world. With modern technology, we have a unique opportunity to leverage DNA information of individual patients, and molecular health and diagnosis databases, in order to diagnose with higher accuracy. Combined with the significant progress in the field of biotechnology, we have an opportunity to individualise therapy for maximum relevance and impact. With real-time data collection from sensors on clothes and on the body, we may even be able to predict and avoid health problems – helping people to stay healthy. The consequences in terms of increased productivity in healthcare would be significant – not to mention the impact on improving people’s lives.

Digitisation is now happening in all industries and will drive a similar radical transformation of most businesses as we saw in the music industry. For the first time in history, businesses can have direct interaction with individual consumers on a massive scale, enabling them to understand and cater to individual needs more accurately than ever before. As a result, the fundamental principles of mass production as defined by the Industrial Revolution are being challenged. Rather than mass production and shipment of generic products in the hope that they will fit a broad market need, businesses can now tailor to individual preferences, predict demands in real time and track materials for reuse across entire value chains. As a consequence, entire value chains can be optimised to deliver better outcomes with significantly less waste – if any.

For the first time in history, we can rethink value chains to optimise what is scarce (raw materials) rather than what is overly abundant (labour). We can even design value chains without any waste, based on cradle-to-cradle design principles.

Need for a trusted digital infrastructure for everyone

While the digital opportunity is significant, so are the challenges. Digitalising individual preferences, behaviours, relationships, health, products and services is not easy and has some significant risks. The digital footprint we collect in the digital world is a very valuable asset to predict, target and optimise products and services around individual needs. However, at the same time, this information can be misused or even altered if the data are not kept safe and digital infrastructure is not secure. But the challenges are not different from the physical infrastructure we use today. The transportation of people and goods on physical roads is enabled by infrastructure such as roads and technologies such as cars and trucks. The benefits are obvious, but so are the risks. To manage the risks, we have agreed global standards on traffic regulation and border controls, introduced global trading and shipping rules, and we have innovated safety technologies for cars and trucks. A similar effort is needed for the future digital infrastructure. For the digital infrastructure to deliver significant benefits, we need trusted global digital infrastructure for everyone everywhere. We need secure infrastructure and devices, strict data protection rules, principles for the protection of privacy, common technology standards and globally affordable infrastructures. While many of the technologies to deliver trusted digital infrastructure are available

today, the needed level of standardisation across technology layers and countries is not. This currently inhibits us from leveraging the digital opportunity beyond consumer entertainment scenarios.

Europe needs to catch up

In Europe, the challenges to unlock the opportunities of the digital technologies are even more significant. In spite of efforts to create a single open market in Europe, the digital market and infrastructure are lagging behind. The digital infrastructure in Europe today is fragmented country by country. The fragmentation is resulting in insufficient investments in next-generation infrastructures and very high costs, in particular when users are crossing borders. Cloud services in Europe are missing scale due to country-specific rules and regulations. As a result, most global cloud services are delivered from the US. Data protection rules in Europe are often outdated. In addition, the data protection rules are different in each country, leading to very high compliance costs and administrative efforts for infrastructure providers. And, most importantly, the massive innovation opportunity driven by the digital technology is primarily happening outside of Europe. Only very few European companies – like SAP – are global digital leaders.

'Cloud services in Europe are missing scale due to country-specific rules and regulations.'

A call to action

For Europe to catch up and become a leader in the digital era, we need strong leadership and fast, focused orchestrated actions. In particular we need improvements in the following areas:

1) Create a trusted digital infrastructure

Significant efforts are needed to create trusted digital infrastructure. We need to define and harmonise security standards. We need to harmonise cloud and data protection rules. We need to define certification levels for digital infrastructures and ensure the needed transparency for users. We need to define Internet governance principles. And we need to invest in next-generation infrastructure – a global high-speed mobile infrastructure that is able to serve everyone everywhere at affordable costs. The good news is that there are already many best practices in these areas – including, for example, the European Cloud Partnership and the Internet Governance Principles defined by the NETmundial initiative. However, an orchestrated effort across countries is needed to eliminate the fragmentation.

2) Develop digital skills

The transition from farming to industrialisation required the reskilling of people in Europe. The same is true for the digital era. Due to the speed of development in the digital world, the skills gap is already significant. Qualified skilled workers from the academic disciplines of science, technology, engineering and mathematics are in higher demand than ever before. One consequence of the lack of digital skills is that there are an estimated 500,000 unfilled digital jobs in Europe. This is a paradox given the high level of unemployment of young people in Europe. These jobs are likely to be filled in other parts of the world unless we rapidly reskill people for the digital opportunity. Again the good news is that there are already many efforts driven by governments, institutions or companies to close the skills gap in Europe – for example, Academy Cube aims to give young unemployed people in Europe skills and jobs in the information and communications technologies sector. Again, an orchestrated effort across countries in close cooperation with education systems is needed in order to progress fast enough.

3) Enable digital innovation

The digital opportunity is a unique occasion for small and medium-sized enterprises to innovate, grow and create new job opportunities. By supporting these innovative enterprises, Europe has a chance to regain innovation leadership and competitiveness – and most importantly reduce unemployment among young people. To be successful in the digital era, innovative small- and medium-sized enterprises need access to capital, resources and markets. This requires the simplification of rules and bureaucracy in Europe, the creation of a digital open market, more flexible employment rules and a cultural shift whereby taking calculated risk is rewarded. The good news is that we don't have a lack of great ideas in Europe. We need to strengthen the ability to scale faster. Again, an orchestrated effort across countries to set the relevant frameworks and incentives is needed in order to accelerate the needed innovation. The European dream to leverage the digital opportunity is significant. However it will only stay a dream unless we are able to progress quickly on these challenges as a united Europe with a global and open approach. Government will play a critical role in defining policies that enable the innovation of the digital future, accelerate the speed of innovation and guide all stakeholders toward more sustainable business models.

It is time for action!

The Industrial Revolution started in Europe over a century ago. The industrialisation drove significant productivity improvements and resulted in the high standard of living we know today. Over two generations, industrialisation caused significant changes to the way people work and live in Europe.

> 'The digital opportunity is a unique occasion for small and medium-sized enterprises to innovate, grow and create new job opportunities.'

The digital revolution most likely represents an even bigger opportunity for Europe than the Industrial Revolution did. For the first time in history, businesses and the public sector can interact directly with individual consumers and citizens based on an accurate understanding or predictions of individual needs. For the first time in history, we can deliver unique individualised products and services at the costs of mass production. For the first time in history, we can optimise entire value chains for minimum waste and environmental impact. And for the first time since the financial crisis, we can create new jobs and opportunities for innovation and growth in Europe. However, the level of change to leverage the digital opportunity is likely to be higher than the changes resulting from the Industrial Revolution. And even more challenging: the speed of change will be much faster – not over two generations, but within one generation. In the digital world, speed matters more than anything. For Europe to take advantage of the significant opportunities that the digital revolution offers, we need to move fast. We need to define and deliver a trusted digital infrastructure in order to enable the digital opportunity in all industries. We need to rapidly close the skills gap so that everyone can participate and take advantage of the opportunity. And we need to support fast-moving companies so that they can innovate and create opportunities for growth in Europe again. This will require strong and focused collaboration between the public and private sectors across countries in Europe and globally. If done well, Europe can remain competitive and find new opportunities for growth and employment based on more sustainable business models to the benefit of future generations.

Boosting digital Europe

By Martin Sorrell

Sir Martin Sorrell is founder and CEO of WPP Group, a marketing and communications services multinational.

Business leaders like to complain that institutions of government are slow, bureaucratic and blind to the "reality" of the marketplace. Politicians and civil servants respond that companies wouldn't have a clue how to manage the complex web of competing demands and impossible choices that governments face. Both have a point.

There is some common ground, though: everyone agrees that being lectured by someone on the other side of the fence is as counter-productive as it is offensive. So I'll try to avoid doing that.

In Neelie Kroes' invitation to contribute to this book, she wrote: "At a moment of transition, the old often has to give way to the new." True, but in our business – and, I suspect, in most public bodies – managing the digital revolution is not as straightforward as all that. Few organisations, public or private, have the luxury of jettisoning their past.

Someone once said that moving from a traditional, "legacy" business model to one fit for the digital age is like changing the engines while the plane is still flying. It's a perfect metaphor for what WPP has had to do. When WPP entered this world in 1985 the web was only a gleam in Tim Berners-Lee's eye. Even as we moved into the 21st century our digital revenues were still little more than a rounding error. Today, digital represents more than a third of our $18 billion [around €14.3 billion] of revenues. Looking at the business more broadly, digital and interactive marketing, programmatic buying and big data account for about three quarters of turnover.

Reflecting on that journey (and for once that term is well used), I think Neelie's diagnosis is correct: success in today's world is not about technology or systems or clever bits of code. It is about outlook, mindset and culture. Technological change isn't just a constant: it's accelerating. Technology will never again change as *slowly* as it does today. Businesses and governments alike need organisations that are built to evolve on an ongoing basis. In that context, principles matter more than plans. We need principles to guide *how* we change; not plans to spell out *what* we change.

> 'We need principles to guide how we change; not plans to spell out what we change.'

So, here are five guiding principles that apply equally to the worlds of commerce and government.

1. Don't wait for it to happen to you

Technological change is inevitable. Our response to it is not. Organisations that thrive in the digital age are those that take control of their own destinies, harnessing digital technology to work for them. The web and related technologies bring untold opportunities – but opportunities not taken rapidly turn into threats.

Amazon's original model depended on selling books printed on paper. When the Internet threatened to erode this market, Amazon created the Kindle. At the same time, bookshops went under in droves. Those booksellers could have created an e-reader. But they didn't – they battled to defend the old order and maintain hard copy sales. A battle they don't appear to be winning.

Not that long ago, the UK's Auto Trader was a magazine for selling second-hand cars. Today it doesn't print a single copy, but it remains one of the most successful classified advertising businesses in the world, recently valued at £1.8 billion [around €2.3 billion].

Why? Because it saw which way the wind was blowing and began single-mindedly, even ruthlessly, transferring its operations from print to digital. Local newspapers, meanwhile, tried desperately to protect their motors revenues in print, and failed to innovate. These revenues (along with those from property and recruitment) disappeared forever to the web disruptors.

Institutions need to see digital as a positive enabler, not simply a threat or an inconvenience to be ignored for as long as possible. To quote the UN's 2014 E-Government Survey, "citizens and businesses are demanding more open, transparent, accountable and effective governance" – via network-based technologies. Woe betide any elected official who fails to deliver this.

2. Listen (and respond)

Digital technology creates new ways to listen to and understand consumers and citizens, paving the way towards more personalised public services. Businesses have harnessed digital to create experiences that are more personal, more engaging and more effective. Many are using "big data" to automatically improve user experiences and to offer people the content or services most relevant to their needs. Wearable and connected devices will create new ways for people to communicate their needs to organisations.

The Netherlands, South Korea and Uruguay top the UN's global league table for "e-participation," but innovation is happening the world over – from Slovenia's "I suggest to the government" online tool and Morocco's e-consultation platform to the UNICEF-backed "Ureport", a free, SMS-based system that allows young Ugandans to "speak out on what is happening in communities across the country and work together with other community leaders for positive change." In Cape Town, South Africa, citizens can report problems with water, electricity and other public services using a platform called "Lungisa" ("fix it" in isiXhosa) with responses from the relevant authorities communicated via web portal, SMS, USSD, Mxit and Facebook. As of October 2013, problems reported using Lungisa had a 73% resolution rate.

3. Acquire a taste for risk (and a thicker skin to go with it)

One of the great clichés of modern business (imported from Silicon Valley) is the mantra of success-through-failure: "fail often;" "fail fast;" "fail better;" etc. For public officials that slogan is much more likely to be "for goodness' sake don't fail – but, if you do, fail as inconspicuously as possible." Electorates, and the journalists who inform their views, are hardly forgiving when government initiatives go wrong.

That said, success in the digital age does need the right institutional attitude to failure and risk-taking, whatever the institution. Not everything will work the first time. That needs organisational cultures with an appetite for controlled risk-taking – ones that can accept a reasonable failure rate, are prepared to stop activity that isn't working and will learn the lessons.

In the marketing industry, for example, digital makes testing much cheaper and faster. We can now sample a large number of variations of content, quickly get data on what's working, and choose the best option. Algorithms that

'In a fast-moving world, governments will sometimes need to step into the unknown without a historical evidence base.'

learn and iterate over time allow us to do this automatically, and we accept the "wastage" of the discarded options as a legitimate cost for a better outcome.

Similarly, institutions can quickly test policy approaches or communications. The UK government saved £30 million [around € 38.1 million] by testing variations of the wording of letters to people with outstanding taxes. In a fast-moving world, governments will sometimes need to step into the unknown without a historical evidence base. Instead, we need pilots and tests that can quickly determine whether a policy is working and how to improve it (and, hardest of all, thicker skins when the brickbats start flying).

Administrations need to be confident enough to innovate in other ways, too. Rob Norman, chief digital officer of WPP's media investment management arm, GroupM, makes a powerful case for the adoption of audience buying or behavioural advertising techniques by governments. Audience buying uses online behaviour to provide consumers with relevant content online and, says Rob, "can enable governments to find and target their audiences with greater precision than ever before." He points to the Dutch government's recent campaign to educate holidaymakers about customs regulations. The campaign tagged users of holiday booking websites and then served them humorous videos reminding them not to bring certain items back into the country.

Audience buying is still a relatively new business model and industry and governments will need to work together to overcome the challenges this presents, but, to quote Rob again, it's "one of the practical applications of big data that is established and works... [which] could make it an interesting sandpit for governments to trial new approaches."

4. Focus on the plumbing, not the water

In a digital world, platforms are very powerful. Some of the most successful digital businesses are those that provide a platform for others to operate: social media like Facebook or Twitter enable people to connect and communicate; eBay enables people to trade; Deezer and Spotify enable people to discover and play their favourite music; Google enables... well, just about everything. None of these businesses produces goods or content (with the possible exception of Google, given its foray into wearable tech and driverless cars). But they are hugely valuable because they provide the right environment and ecosystem for others to flourish.

The best e-government will learn from this approach. Governments should provide a backbone of infrastructure, technology and data that enables citizens, NGOs and businesses to innovate and participate. The UK, for example, has put the idea of "government as a platform" at the heart of its new digital strategy. In Sweden, the SMSLifesaver initiative is a perfect example of government acting as an enabling platform. It allows trained citizen volunteers to enrol to receive a text message when someone suffers a heart attack in their vicinity, so that they can respond and help – often faster than the emergency services. Stockholm County has seen survival rates after cardiac arrest climb to nearly 11%, up from 3% a decade ago.

'Governments should provide a backbone of infrastructure, technology and data that enables citizens, NGOs and businesses to innovate and participate.'

Returning to the subject of Google doing pretty much everything: there's a section of its business site called "Apps for Government" with a page headlined "Governments in 45 states have gone Google." Beneath this is a range of case studies describing how various US public bodies – from the State of Maryland and the City of Boston to the US Army and the National Archives – are using Google as a platform in one form or another. Powerful indeed.

5. Bring code into the classroom

Businesses, governments and populations in general need better digital and programming skills. In the modern marketing services industry, for example, it's just as important to recruit Maths Men as it is Mad Men. The US Department of Labor estimates that by 2020 there will be 1.4 million jobs in computer sciences, but only 400,000 graduates with the qualifications to fill them. Other parts of the world will see this as an opportunity, but only if they have the right educational programmes in place. According to Stanford researchers, the number of computer science and engineering graduates from the elite Chinese universities is more than the total number of such graduates – from all universities – in the United States.

Some argue that this extraordinary statistic comes at the expense of China's second-tier universities and graduates, and therefore the wider economy, but it's a stark reminder of the rising power of the People's Republic nonetheless.

Partly in an effort to compete with fast-growing economies like China and India, England recently made coding a mandatory part of the curriculum. From September 2014, children as young as five began learning programming skills in the classroom. By the age of seven, all English children should know what an algorithm is and how it works – making them considerably better informed than the large majority of the adult population. Whether or not this helps the UK to overhaul the lead established by its Eastern competitors remains to be seen, but it's a long stride in the right direction – one that I expect to be replicated elsewhere in Europe, and beyond.

'By the age of seven, all English children should know what an algorithm is and how it works.'

(Em)powering a digital Europe

By Peter Terium

Peter Terium is CEO of RWE ag, a German electric utilities company that supplies more than 20 million electricity customers and 10 million gas customers each day.

When you look around you, there's no denying the fact that our society and the way in which businesses and consumers interact with one another is changing as a result of ever-evolving digitalisation. So shouldn't electricity and the electricity supply actually also be changing in line with these developments?

In the late 19th century, it became economically viable to generate electricity at central sites, in large power plants and then to transmit this through cables to the place of use. In turn, locally this was distributed to the end users, consumers and businesses.

Partly because of this development, which formed part of the second Industrial Revolution, during the last century our society changed dramatically. Electricity was available to almost everyone in their everyday lives and in Europe today we can no longer imagine everyday life without electricity. We light up our homes with it, refrigerate our perishable food, charge our smartphones, we cook with it and it provides additional comfort within our homes. Without electricity, our household would simply not function.

Towards the end of the last century we entered the third Industrial Revolution, the era of the computer and information processing, which has already resulted in huge developments in terms of communication and digitalisation. Also following the launch and emergence of the Internet, during the past 25 years our communication systems have changed radically. Consumers and businesses increasingly communicate with one another through digital media without the intervention of other parties. This offers all kinds of exciting new opportunities for both consumers and businesses and many sectors have changed for good. Innovative online developments have transformed a substantial part of the retail landscape. Old brands that were unable to adapt no longer exist and in a very short period of time, new brands have become powerful brands.

'Consumers and businesses increasingly communicate with one another through digital media without the intervention of other parties.'

Our online digital society is hyper-dependent on electricity, which for the time being is still for the greater part generated centrally. However, this electricity industry of centralised electricity power plants is today regarded as classic "old" industry. An industry that has to change, that has to reinvent itself to be able to meet new needs and trends. We already increasingly see that generation and consumption of electricity take place at the same location: solar panels on homes, wind turbines almost in the backyard. Following a wave of centralisation of electricity generation since the middle of the last century, nowadays there are increasing numbers of decentralised generation platforms and a change in the energy sector is therefore required.

The large group of electricity producers are currently having difficulties with those changes. The liberalisation of the energy market that started towards the end of the last century turned the sector upside down, the German *Energiewende* accelerated this. The sector faces low wholesale prices, even lower CO_2 prices and the extremely rapid emergence of renewable energy, particularly in Germany. Today, this leads to a number of challenges: rising energy prices for consumers, conventional power plants that are no longer financially viable, and the flexibility of the electricity grid is reaching its limits. We have to improve the sustainability of electricity

generation and by doing so reduce our dependence on fossil fuels and our impact on the earth and its ecosystem.

As well as the need for more sustainable electricity generation, there is even more of a need to continue innovating. Today's consumer is a digital consumer. His life is increasingly online. He is always linked to friends, family and whoever he wants to be. His smartphone is his central communication coordinator and it never leaves his side. He can, of course, use it to make a phone call, but actually he doesn't do that very often. Instead, he sends messages, texts, sends WhatsApp messages, surfs, plays games, buys, rates and monitors activities that determine the daily pattern. This development happened at a rapid pace, many online services haven't yet been around for 10 years, and the speed at which the developments follow one another is accelerating. We now watch television when we want to, IPTV with Netflix, BBC iPlayer or other online platforms. Whilst viewing, we use Twitter or a second screen to share our viewing experience with other, usually unknown, viewers.

We share our lives digitally and through the introduction of Apple's HealthKit and Google Fit, we currently appear to be on the brink of a final breakthrough of the "quantified self" trend – a movement where technology is used to collate information about yourself and your health. The aim is to learn from that and to improve yourself, tapping into technology that is increasingly being integrated into the lives of consumers. Consider, for example, pedometers, blood glucose meters, heart rate meters, etc.

The quantified self trend can also be projected on your home. Perhaps you could then refer to this as the "quantified house," a term also used by Ian Mercer in 2012 in a presentation about his own smart home. A quantified house would mean that increasingly innovative solutions would become available to measure, monitor and analyse all aspects of energy management within our homes. The aim of this would be to use energy more efficiently and in a smarter way. Maybe even an "Internet of Utility Things." If this trend catches on, in the future everyone will be able to see exactly how much energy is used in their homes and whether sufficient power is generated for that. Devices are becoming smarter and indicate how much energy they use and how they can be more economical. We have already seen the initial signs with smart thermostats, the Dutch Domotica Platform becoming more accessible and the fact that almost every device in the home is connected to the Internet – even your lighting.

'The quantified house therefore really is a self-learning smart home, which actively helps its inhabitants to deal with becoming more sustainable, energy consumption and cost control.'

Because of our digitalisation, all of this information is available and therefore offers a plausible basis for the never-ending discussion about big data and customer analytics. The quantified house therefore really is a self-learning smart home, which actively helps its inhabitants to deal with becoming more sustainable, energy consumption and cost control.

Something has to change in order to meet the daily energy demands of our digital lifestyle. Of course, we need electricity in our homes to keep our household comfortable. However, it goes beyond this. It seems as if every device has a plug. Even books are increasingly available in the form of eBooks and they also need power. The never-ending need for power also travels with us to an increasing extent. At home, of course, the refrigerator's plug is plugged into the socket. However, we live a large part of our digital lifestyle with mobile devices that require power "on the

move." All of our smartphones, fitness bands, wireless movement detectors, etc. mainly require power while on the move, or remote power. That is currently our Achilles' heel, because we want to be able to use them more often and for longer than usually permitted by the battery's capacity. Battery technology is improving rapidly, but it is still unsuitable, or insufficiently developed, to store the amount of power required to meet our needs. That applies to our small devices, but also, for example, to storing power that we have generated during the day with our solar panels, so that we can use that power at night when the sun is no longer shining. New innovations and a focus on development must change this and several companies, such as, for example, Tesla (read Elon Musk) are working hard on this.

The changing consumer behaviour in how power is being used, and also the desire for a more sustainable economy, requires a reinvention of the energy market. The *Energiewende* energy policy transition in Germany is already an extremely ambitious project, with challenging objectives for CO_2 reduction, energy efficiency and renewable energy. It has to go beyond merely, for example, monitoring and controlling our energy consumption more actively using smart solutions.

The change that is required from the entire energy sector, from classic fuels to new fuels, from centralised generation to decentralised generation, from classic fixed-line to mobile power, are changes that can and will only happen if innovation takes place. Perhaps the sector should take the digital revolution as an example.

'Our digital society is an international society that has little time for land borders that has grown in an extremely short time.'

Our digital society is an international society that has little time for land borders that has grown in an extremely short time. There are, of course, online initiatives that are localised to a specific region, area or country. There are also many initiatives that have been an international success.

If we want this society to grow and prosper further still, it will help if we also approach our energy sector, with its challenges, based on a "supranational state." If our economy is an international economy, why can't our energy supply be an international energy supply? Efficient energy networks, smart grids, always perfectly balanced, where (temporary) energy deficits in one area can easily be balanced out by surpluses in another area. This may not be the case today, but to my mind that is the direction in which we have to develop. Continued digitalisation in Europe means that this has to be tackled to enable our society to continue to develop without any difficulties and to be able to face up to the international competition.

If we manage to achieve this together, I am convinced that we will (em)power the further digitalisation of Europe.

Europe has media diversity – but at what cost?

By Christian Van Thillo

Christian Van Thillo is CEO of De Persgroep, a Belgium-based media group.

The World Wide Web had its 25th birthday this year. After a slow infancy and turbulent adolescence, it now stands proud – engrained in our working lives and permeating much of our leisure time. Last year, online advertising made up about a quarter of the $500 billion [€394 billion] global advertising business. Mobile devices, the rise of social networks and innovation in the way advertising is traded in real-time will ensure this figure grows fast into the future. Fuelled by big data pools, publishers, advertisers and intermediaries can now bid for digital ads electronically and target consumers accurately according to their interests at the speed of light. Europe's consumers today enjoy unprecedented benefits from the creativity, entrepreneurial spirit and investment of Europe's media and publishing companies, fired by astounding technological innovation both from within our own companies, and through that of our technology partners. The wide array and quality of professionally produced independent media content across all platforms and devices throughout the European Union demonstrates how we are all reaping the benefits of the global revolution in communications. While our popularity and audiences soar, making money is not as easy as some of the ad revenue stats would have you believe especially when it comes to producing news media and entertainment.

The fact is, quality journalistic content is expensive and technology is radically changing the advertising business, with profound consequences for both consumers and companies. Media diversity comes at a cost. Professional journalists need to be paid, trained, resourced and legally protected by their publishers. Original drama, documentaries and children's programmes along with all the content we buy from others costs money. A great deal of money, so that publishers and broadcasters can reach out to all audiences from the most local to the most global. Advertising remains a crucial source of revenues to both publishers and broadcasters and competition for revenues is fierce. Advertisers like scale and precision. We play to the great majority; instantly through our newspaper and magazines brands wherever you are, on any device or in print, and hourly through TV and radio. It is this professional, edited communication with large numbers that makes us unique and which continues to command respect for the role that the media play in our democratic Europe. But what makes us different also presents a major challenge in the digital world of mass, often undifferentiated communications.

For the past 10 years, during an explosion of innovation and many changes in the way we get our news and entertainment, advertisers have been pouring money into digital. With our mass audiences, this should have been a dream come true – but not so because the supply of ad space on the Internet is virtually infinite and prices are low.

> 'The vast amount of data produced by our consumers' digital lives is giving more power to media companies.'

Digital offers new opportunities and modern journalism needs to draw benefits from this. This requires new skills to cope with the new ways content is be enjoyed – instant access to updated information, deployment of content in different formats and on different devices, hosting and moderating blogs with the citizen participating in the debate more actively. Both editors and journalists are being trained almost in real-time to ensure they have all the new skills necessary. Technology offers new ways of strengthening the relationship with the reader, the viewer and the consumer. This is key for our core businesses but also for our diversification strategies into other areas, looking at ways of

increasing advertising revenues to overall better serve the consumer. The vast amount of data produced by our consumers' digital lives is giving more power to media companies because we nurture this direct relationship with our consumers wherever and however they are accessing our content.

As media companies, we have lived through and helped define the emerging media and communications landscapes which are changing dramatically still in 2014. The constant shift of advertising spend, of consumer reading and viewing habits and changes in shopping patterns continue to drive media companies to overhaul their digital media strategies. Following the economic crisis of 2008 and 2009, television, along with the Internet, and now mobile have emerged the victors of the advertising expenditure battle, while many newspapers have suffered devastating setbacks apart from in Central and Eastern Europe, demonstrating the need for new revenue streams through innovation and new advertising genres. Several global research firms report that Internet advertising spend is poised to exceed television ad-spend in many parts of the world before the end of the decade. Mobile advertising is leading the way for Internet ad-spend growth, surging in the double digits.

Traditional media companies – even broadcasters who have been pretty resilient cannot rely on traditional revenue streams to secure their future. A host of other revenue opportunities are emerging: paid content, e-commerce and a variety of non-traditional advertising genres – particularly programmatic, native, video and mobile where in-app advertising is growing fast.

But the most lucrative revenue stream remains advertising, for the past, present and foreseeable future – representing the lion's share of revenues for publishers and broadcasters around the world with four revenue streams in the ascendancy: mobile advertising, native advertising, paid content and e-commerce, all strong opportunities for every media company. Digital advertising is becoming an increasingly larger portion of the advertising portfolio for each media company but be under no illusion: digital advertising in media is still nowhere near enough to offset the loss in traditional advertising such as newspapers, magazines and TV.

'Digital advertising in media is still nowhere near enough to offset the loss in traditional advertising such as newspapers, magazines and TV.'

This is mainly because of competition for ad revenues from the top global websites with their ever expanding global audiences: Google, Microsoft, Facebook and Yahoo!, all of which have between four-fifths and five-sixths of their audiences accessing their sites from outside the United States, command the majority of adspend.

Media companies in Europe, which by necessity of language and local cultures can never compete with this scale, therefore need to invest in new product development and expansion of market share to remain viable. Sometimes this comes through acquisition and geographic expansion. Big data strategies too are driving growth. But the two key issues standing in the way of growth are the entry of new competitors and the competition from free and low-cost alternatives to media companies' products.

Innovation is a broad term when it comes to the news media industry whether it be product development, technology implementation, process re-engineering or training and management restructuring. The process of innovation is a slow, deliberate and scientific process of developing products or services with specific customers in mind.

The danger of the relentless encroachment into the market for professional, quality content by "free" alternatives is the stifling effect on innovation by media companies. The incentive to invest is quite simply dampened when you see the results of your innovation recycled by companies who did not contribute to the investment in new media products but instead very successfully leach commercial value from our work. The long-term deleterious damage is incalculable because we're not just talking about the possible demise of this company or that, but of your favourite newspaper or TV programme multiplied by thousands.

The European policy environment for media companies

There is a long list of policy issues that we must engage with at European Union level that affect both the business of media companies and our audiences alike. Our challenge though is to communicate what it is to be a 21st century media company so that policies remain relevant; we need our politicians to understand what spurs us on; what holds us back; how regulators can best support an innovative independent press across all platforms and devices, and boost a thriving digital economy.

Speaking to the European Parliament as candidate for president of the European Commission in July 2014, Jean-Claude Juncker uses the word "fairness" no fewer than 11 times. Fairness is a very good place to start on all the issues impacting on the media. To thrive in a global digital economy, we all need an open but fair Internet, with fairness and transparency in search, the freedom to advertise, the freedom to license and sell our content and a fair, logical VAT system that extends the reduced or zero rated VAT rates applied to offline books, newspapers, journals and magazines to our online publications; the least Europe could do to boost its digital single market.

But politics and the decisions of our regulators are not what really define us as media companies. Politicians all over the democratic world understand the importance of an established independent free press and the role it plays in underpinning that democracy. On a day-to-day basis, however, they may not always measure the impact of individual policies or regulations on the complex operations of today's media business.

'Copyright has been a highly contested policy area yet it continues to underpin and reward innovation to this day both off and online.'

Copyright has been a highly contested policy area yet it continues to underpin and reward innovation to this day both off and online. The market needs clear rules on what is theft and what is not: the current business model of the dominant players online, where everything is free and where third-party content is being used without permission or reimbursement, must change because copy-paste business models and systematic freeriding is killing professional, quality journalism. Together with my colleagues in the European Publishers Council (EPC), we have been working hard in conjunction with the European Commission and other media sector colleagues to develop the necessary technology to make sure that copyright works on the web, intuitively and effectively supporting our creators and publishers, serving our users and enabling easy access to content wherever you are. This innovative work is progressing through the Linked Content Coalition and the Rights Data Integration Project, a European Commission co-funded project. We must deliver a true partnership between copyright and technology in order to support rapid market developments and consumer demands. Through a truly copyright-enabled Internet, we can look forward to providing a wide array of entertainment sport and, above all, the authoritative, quality journalism that underpins democracy and civilised society, for years to come.

Last year, my company took part in a survey conducted by the EPC and what emerged was a story of a unique business sector: a sector that is diverse and highly ethical, one that underpins democracy, one that is highly innovative and embracing change; but overall one that has integrity and independence at its core. Despite all the business and regulatory challenges, our media companies demonstrate optimism about their place in society, where the values of a free and independent press still come through clearly as the drivers for media business leaders today.

We have a great media business story to tell today. We also want to be able to tell this story in the future, based on a fair online environment in which the free and independent press, professional content and quality entertainment can continue to thrive, to support an informed democratic society and boost the growth of the knowledge economy.

The Networked Society

By Saskia Van Uffelen

Saskia Van Uffelen is digital champion of Belgium and CEO of Ericsson Belux, a provider of communications technology and services.

A few years from now, half the world's population will have access to super-high-speed Internet. In Belgium, and in other European countries, different operators are focusing ever more on making the Internet faster. In our country, the operator Telenet announced at the end of August that it will provide the Internet of the future: a network with a one gigahertz capacity, and an Internet speed of one gigabyte per second.

Today, Belgium is already at the forefront of European broadband infrastructure. This is a result of healthy competition between the historical operator, Belgacom, and the new cable operators, such as Telenet, among others. A study led by the US-based technology company Akamai puts Belgium in the seventh spot worldwide with regard to very fast Internet connections, as reported in its 2013 "State of the Internet" report. Continuing investment in (notably) telecom infrastructure remains necessary for all European countries to either stay at the top or make up for their arrears.

In addition, Long-Term Evolution (LTE) – better known as 4G – and 5G are finding their way to more and more people at lightning speed. LTE is one of the fastest-developing systems in the history of mobile communication. According to the *Ericsson Mobility Report* published in June 2014, there are today more than 6.8 billion mobile subscriptions in the world. By the end of 2019, that total is expected to hit 9.2 billion. It's expected that, by 2020, some 50 billion-odd devices will be connected to the Internet, which will have an enormous impact not only on the lives of millions of people, but also on the world of business and society at large. Today, no less than 91% of the world's population has access to mobile communication. Furthermore, data traffic will do nothing but skyrocket in the future.

'It's expected that, by 2020, some 50 billion-odd devices will be connected to the Internet.'

Even though it may appear that these digital and mobile evolutions are appearing quickly, in truth they will never happen as slowly in the future as they do now. Most notably, the business community has to step up the pace. If all the innovative technologies are truly operational by 2020, businesses won't even be ready for them in 2020.

The Networked Society, in which the Internet is connected to everything and everyone and impacts everything and everyone, isn't as far away as we might think. Thanks to innovation, faster Internet and other technological inventions, the possibilities appear more infinite every day, but businesses aren't capitalising on them, or not enough. They don't give a moment's thought to the nature of their company, their sector, their core business and the competition in 2020, and they barely even consider the impact the Networked Society will have on all of those aspects. Right now, many companies are still focusing on cost management, whereas the focus of the Networked Society is on how we can collaborate, on access to information and the ways in which we can share this information. The Networked Society far outstrips the evolution we're going through right now. In the nascent stages of the Internet, over 30 years ago, digital entertainment and communication products began to influence the economy. Quickly afterwards, channels for conveying digital information, such as forums, blogs, communities and e-commerce started to play an increasingly important role. Today, digitisation is bringing about a second economy, which is sizeable, automated and even invisible. It carries with it the greatest change since the Industrial Revolution.

Digital competencies

In this new economy, startups with innovative and brilliant ideas shoot up like mushrooms. At the same time, big companies, that long ago entrenched themselves in our society and economy, are stuck in a blinkered frame of mind: that of costs. It's no longer just the big companies that should be helping smaller ones with their business plans; the converse is now true as well. The entrepreneurs of tomorrow think differently and are more aware of the digital changes the future has in store for us. The competencies of our workforce may still suffice in our current economy, but not in the digital future. Hyperdigitisation, mobility and the Internet of Things have such a transformative impact that our economy and business models will look completely different 20 years from now. With the skills that are deemed sufficient today, we won't be able to keep pace with these evolutions.

Of course, learning these skills requires considerable adaptation, too. Today's education is insufficiently geared to the (digital) challenges and job contents of tomorrow. A law student is still required to learn entire course books by heart, while this information is just a mouse-click away. The lawyer of the future has to know where to find the information, instead of cramming all of that information into his head. Unfortunately, schools, students, parents and external organisations are only now starting to communicate more digitally, and digital tools are becoming part and parcel of the classroom, and too slowly. It is really time to take action.

To keep up with the pace of current digital changes, every sector, every company needs to gather some serious momentum for its own digital evolution. In addition, companies need to learn to look beyond their own sector. Danger and the competition are – again because of the breakneck evolution of digital technologies – lurking around ever more different corners. Thus, for example, more and more banks are realising their clients ask for more than conventional banking services and, little by little, they're capitalising on this.

'To keep up with the pace of current digital changes, every sector, every company needs to gather some serious momentum for its own digital evolution.'

I see a solution in cross-sector thinking and working. To once again use education as an example: why is there still no initiative today that integrates small companies into end-to-end, bringing together Internet use, smart school and digital apps, the purchase and insurance of tablets and the use of the Windows computer system, all presented in an innovative financial model? This would save everyone a lot of effort, and a lot of money. Systems such as Zoomit and Doccle do exist, but they aren't sufficiently cross-sector in nature. Systems that go further than simply bringing together similar documents are an important challenge in order to meet the needs and demands of our digitised society.

Let's not succumb to pessimism, however. During the past five years, Europe has managed to realise a great deal at the digital level: the abolition of excessive roaming rates, faster broadband Internet, ever more European citizens with access to the Internet and e-commerce taking on immense proportions. These are but a few examples. However, there are still any number of issues for which Europe needs to press home for more far-reaching policies. For instance, e-government still hasn't taken hold and Europe needs to establish a well-defined framework within which member states can operate to progressively become smart cities and smart countries. Another issue is the persistent lack of clear strategy for (personal) data security and privacy. The Googles and Amazons of the world are perceived to be abusing encrypted data, whereas young entrepreneurs and innovative companies are able to develop new business models with regard to those data, adapted to the digital spirit of the times.

Today, individuals and communities are the ones giving impetus to fundamental changes for the future. This drive leads to many possibilities and solutions in the world of business, to tackle global challenges such as urbanisation, poverty, climate change, the use of natural energy sources and access to education and healthcare. I believe information and communications technology is still the missing link to bring about this transformation and progress.

Seizing the digital opportunity

By Ben Verwaayen

Ben Verwaayen is partner at Keen Venture Partners London and holds various board memberships in the United States, India and the Netherlands.

There can be no doubt that digital reality is becoming a dominant factor in our lives. Simply look at the action of non-democratic nations and their efforts to create digital firewalls. Never in our history has the power of expression been so strong as in the digital age. And as a consequence, never in our history can one person influence so many others. In recent years we have seen a great number of striking examples, like the Arab Spring. The lonely voice of one person in the past can now quickly turn into an avalanche.

That phenomenon is challenging the way we organise democracy, create growth and prosperity and look at ourselves and the world around us. In a 24/7, always-on world, news and information is available on an unprecedented scale. Without a filter most of us can access data, video and views from all corners of the world. We can choose if we want to, and if we know how, to select based on our own bias, or we can be open to all points of view. Staying on top of everything is virtually impossible; it would require a 24/7, 365-days-a-year effort.

We turn to others to do that for us. The news media. And not always the same as we used to know or that we used to use. New initiatives are coming up everywhere. And the public reacts strongly and fast, with great enthusiasm. Habits are changing with great speed. Existing global media concerns have to re-evaluate their portfolio and the way they publish. The transformation in that business is a great example of what is about to happen in all other sectors as well. We were quite comfortable up until recently with the rhythm of news: daily papers, weekly magazines and hourly television. Each had his role to play, not in harmony but in a relative balance. Business models were adapted over the course of a few decades to support the existence of changing media. There were lots of complaints over the shift from paper to television, but it seemed slow as a process and therefore manageable.

That has now changed. Print and television alike are being challenged by instant digital media. 24/7, 365 days a year, 60 seconds per minute: no time to waste, immediate distribution to millions and millions of smartphones, tablets and smart televisions. No sophisticated analysis, in most cases, but instant distribution instead. No subscription needed, but business models with extremely low cost of entry and no boundaries to speak of.

In short: an earthquake in the media business with huge impact on society. The main reason why this has happened is technology. The ability to place a relatively cheap computer in the hands of billions of people, mobile and capable of communications. We call them smartphones, but they have little in common with the traditional phone. All corners of the world in a time space of 10 to 15 years are now covered with a network of opportunity.

> ‘Where you needed fully equipped labs in the past, one smart teenager can now do the job.’

Some political leaders feel so threatened that they want to block their citizens from using them as they see fit. But technology is transforming at a pace that will circumvent those efforts. Too many smart people can now innovate on all levels of network and access technology. Where you needed fully equipped labs in the past, one smart teenager can now do the job. What is true for media is also true for other services for society.

Health and education are two examples of sectors about to be transformed beyond recognition by the use of digital technology. Agriculture, chemistry, you name it, will now be useable in a way never seen before. The silos of science are becoming transparent, and cooperation between sectors, seen as totally separate until now, will create breakthroughs.

Simply look at miniaturisation as an example. It started in hardware technology, went into chip technology, and is now the basis of next generation health innovations and medicines. Nanotechnology will transform our view on life and its limitations. This is just an example how far-reaching changes in technology can be.

We live in transformational times. For policymakers and politicians this presents a real challenge. They must decide how to deal with this progress, how to avoid the real risks associated with these developments. Just think about cybersecurity, the ability to provide the same level of protection to the citizens as they have in the physical world. We are not organised for that at all, we underestimate the potential nightmare scenarios that could arise, and we are unable to tackle cybercrime on the same scale as state security.

As people trust their lives and livelihoods on the Internet, shouldn't we be more aware of governments' responsibility to make it a safe environment? The big question is: how to protect and stimulate at the same time? Not by trying to stop developments, that is clear. It is impossible and not desirable. But as we have done over centuries in the physical world, we need policies, controls, rules and sanctions to enable a free and open digital space. We can't do that per individual state, we need critical mass, a natural space for a united Europe to make a difference for the good.

'The big question is: how to protect and stimulate at the same time?'

Create the basis for economic and social growth for more than 400 million citizens by creating a safe, open, innovative and inspirational digital platform, which we call Internet advance. We can't wait until others are in agreement on all aspects, but we can work with others to create a meaningful global process of engagement. In the meantime, if we want to allow our economies to grow again, if we want to stimulate new thinking and innovation both socially and economically, a truly open, safe, transparent, digital platform will inspire the entrepreneurial capabilities of Europe way beyond what we have seen so far.

How do we compete, many ask, when looking at the next decade ahead of us? Here is the answer: by being uncompromising in creating and building the most sophisticated, safe, secure, open digital platform in the world. Yes, it will require out-of-the-box thinking on how to do that: how to finance it, how to manage it. It will require I think a different definition of public-private partnership. A public-private partnership in this case is not straightforward given the existing rules. But think about the opportunity, think about the alternative. Think about the social benefits for society in tackling issues like climate change, education for all or rising health costs. Think about job creation, wealth creation and personal development.

Other parts of the world may have the natural resources as a starting point of creating the next generation of economic growth. We don't have that as a united Europe in a sufficient way to rely on that. So we need another stronghold. We have strong assets: a well-educated, technology-savvy population, great centres of competence both on a university level as in the private sector, a well-developed digital services industry, and many people willing to take initiatives. Concretely, I think that Europe should commit to rebuilding its earning capacity. By building that Internet of opportunity for all, the Internet advances.

We should make positive choices, based on vision and strength. We should build the most reliable infrastructure possible to give people an asset to build on with innovation in all aspects of the economy. We should do it at a pan-European level, not just in urban but in rural areas as well. And we should be willing to use our existing budgets in the public and private domains to be joined-up in achieving that goal.

Will it happen? To be honest, it should but it probably won't. We may be insufficiently aware of the speed of change around us. We don't look enough to the very young kids around us, playing with their tablets and smartphones as the natural thing to do. We underestimate the resolve of other regions and countries and we overestimate the power of the existing economy on which we have relied for so long. But that is how we are in Europe. When the time comes to see the opportunity, we have a unique capability to act decisively and fast.

At least that is what I hope.

A vision for a European cloud

By Robert Verwaayen

Robert Verwaayen is founding partner at Keen Venture Partners, a tech investment firm.

For most citizens, the European Union remains a rather abstract political idea with limited "touch points." Earlier-gained benefits are now taken for granted. Historically, the EU's role has focused on its judicial and executive powers – policy directives being its instrument of choice. The EU's role as a service provider, however, has been an afterthought. In 2014, it remains difficult to "connect" with Europe in a meaningful and citizen-centric way.

Yet the public's identification with Europe is vital for the legitimacy of its political union and the further advancement of its institutions. European Enlightenment philosophers devised the term "social contract" long ago, but today many believe that Europe's social contract is broken.

'The EU should realise a door of great potential has just flung wide open.'

Dramatic or not, this condition clearly needs fixing. For an ailing economy and increasingly complex global competitive landscape, priority rightfully dictates the proverbial duct tape of resolute monetary policy, with structural economic reforms soon to follow. But now is also the time to think ahead in a different direction – how to return concrete benefits, useful in everyday life, to the citizens of the European community. The EU should realise a door of great potential has just flung wide open.

Advancements in cloud computing and the emergence of a "mobile ecosystem" make it possible for billions of ubiquitous, connected smart devices to utilise distributed computing resources. The convergence of cloud and mobile computing provides the EU with an unprecedented opportunity to deliver innovative services with real utility to citizens at a fraction of the cost – anytime, anywhere and on any device.

Consider this hypothetical idea. In 2018 the EU launches "Euro Hub," a cloud platform accessible to every citizen of the EU. Access to Euro Hub comes with the issuance of passports in the form of a digital identification card. The platform provides every citizen with two "cloud tools:" first, their own virtual storage space (a cloud locker) accessible through any device; second, their very own secure EU email account.

Within the Euro Hub environment, users are offered a set of digital government services (apps) that can be accessed from a portal-like user interface. These service apps are built as "software as a service" applications that can operate both on the web and on any mobile device. The applications are logically clustered in categories around the citizen's needs, such as tax, legal and work, rather than being centred on agencies or the organisational structures of the EU.

Here's the good news: the EU already has a vast resource of publicly collected and held data. Various content and "service assets" lend themselves perfectly to be deployed as web and mobile applications, for example Eurostat, historical archives, European ombudsman, the Points of Single Contact network (EUGO) and Access to EU Law (EUR-Lex). But why stop there?

Imagine if European entrepreneurs were enabled to set up a limited liability company anywhere in Europe with a few clicks, or if citizens could obtain a residence licence anywhere in the EU, with instant fulfilment through their mobile phones. Talk about increased mobility! Of course delivering these types of new services requires a great deal of coordination with member states and lower levels of government. Who better than the EU can drive the interoperability of digital services across Europe?

The service apps used in tandem with the cloud tools would give truly interactive power to the platform. The capacity to store data in their digital locker would allow citizens to re-access and share data from their interactions with institutions at a later moment. For example, when a citizen finds a piece of Eurostat data they would like to refer to later, or if they would like to save an interim version of their tax filings, an easy command of "file under my account" will store it in their digital locker under the appropriate folder. Combine that with a digital identification card and EU email account, allowing for secure authentication and communication, and you almost have a state-of-the-art digital services platform. But one piece is still missing.

'Europe has a real chance in taking leadership of the new information-technology paradigm of cloud computing.'

A critical part of the Euro Hub is a dedicated marketplace (or application store) that provides third-party developers the ability to feature innovative applications and "mash-ups" made on the back of open data to Euro Hub users. These citizen developers would get the support they need through a central EU developer hub that provides public data sets, application programming interfaces and other development tools. Sound futuristic? Unfortunately it's a matter of catching up. The White House Office of Science and Technology Policy regularly organises "National Day of Civic Hacking" events, where thousands of citizen developers are challenged to build applications, such as for real-time bus tracking and cybersecurity appliances.

So in summary, the idea is this: a digital service desk with various EU and third-party applications that deliver real utility, integrated with a set of cloud tools for every citizen to store data and communicate securely, with an open architecture so that the platform is enhanced with innovative development.

Surely there are many arguments against building such a platform. Indeed, the execution risk and organisational complexities are high. And what about the costs, not to mention all the pain involved in security and privacy matters? And yes – the EU would compete with private market initiatives. But now consider the benefits of such a project.

It empowers citizens in a way that is fitting with today's consumer expectations of real-time speed. The platform described provides users with a single access point to the EU that is "always on." Indeed, as a positive side effect, digital aptitude will grow considerably. Most important, however, is that citizens can get their dealings with the government done in a matter of clicks, not through long lines and endless paper bureaucracy.

It also greatly enhances market mobility. A recognised obstacle to mobility in the single market is a lack of e-government services interoperability. Much groundwork to address this issue has been laid down by the European Commission's IDABC8 and follow-up ISA9 programme. The idea of a European cloud platform can leverage these standards and put interoperability into practice. When the platform is running at full speed, starting a business, obtaining a licence or registering a life event anywhere in Europe, with the help of digital authentication, should be a seamless and simple user experience.

These benefits mirror the priorities laid out in the European Commission's eGovernment Action Plan 2011-2015. But beyond putting political priorities of empowering citizens and reinforcing mobility in the single market into real-life practice, the building of the platform in itself provides major advantages.

The platform provides a European cultural rallying point. Technology can play an important role in the development of a collective consciousness. As examined by David Nye, the United States' technical achievements, such as the transcontinental railroad, the Boulder dam and the Apollo space missions, had a profound effect in shaping American identity. Although EU member states have their own achievements and "national champions," Europe as a whole is clearly lacking one. A bold and large European technological project, such as building an advanced EU cloud platform, can be an inspiring event for Europe.

In addition, it provides a major boost for Europe's technology ecosystem. Although it may seem archaic to have government institutions spur innovation in a world of lean startups and hungry venture capitalists, history teaches us that government is perhaps the most effective instigator. As former Chief Architect of Microsoft Edward Junge wrote: "The economic planners and policymakers who are chasing Silicon Valley's taillights are learning that they cannot always replicate the entrepreneurial culture and finance mechanisms that flourish there now. But they have forgotten how it all started: guaranteed demand, which stimulates the most ambitious kind of innovation." With the help of a "demand mountain," Europe has a real chance in taking leadership of the new information-technology paradigm of cloud computing.

And perhaps most obviously: in a time of economic weakness, a large public investment in the digital infrastructure of Europe is much welcomed. The scale of this project provides short-term stimulus as well as long-term competitiveness. Roads, railways, and post, telegraph and telephone systems were the backbone of our competitiveness in the 20th century. So the digital domain should be considered in today's world.

The European cloud idea gives back to European citizens and businesses something of real value in their everyday lives. It gives the European community, both literally and figuratively, an "operating system" to help achieve the EU's goals in a cheaper, faster, better and very concrete way. In the process, the EU has the opportunity to catalyse Europe as a technology leader, spur economic growth and solidify its digital competitiveness.

'The European cloud idea gives back to European citizens and businesses something of real value in their everyday lives.'

Of course, this will not be achieved without overcoming tough challenges. Ultimately, one has to trust European talent to make it happen. So for me the silver lining is clear. Rarely has there been a better time for a bold European project.

Through the looking glass of the digitised society

By Vaira Vīķe-Freiberga

Vaira Vīķe-Freiberga is president of the Club de Madrid and former president of Latvia (1999-2007).

The digital age is upon us and already it has created more social change than anybody might have dreamed of even a few decades ago. Both hardware and software have come light-years away from their first, hugely clumsy versions and it would be foolish to try and predict what unprecedented applications will come on the market in the very near future. All one can say with certitude is that the genie has been let out of the bottle and that more and more people of genius will come up with inventions that will surprise, startle and delight us and most definitely change our lives.

Children are now growing up for whom the Internet and mobile communications are as much part of their early lives as mother's milk or the baby bottle. They are supervised by their parents not just in direct contact, but also through electronic means and they are entertained by canned nursery rhymes and ditties more often than at their parents' or grandparents' knee. People on the street have taken on strange, hunched-over postures, with mobile phones glued to their ears and talking to themselves loudly in a manner that would seem demented to anyone not used to these particular technologies. Face-to-face meetings, which still (but for how long?) dominate in the activities of both governmental and non-governmental bodies, are increasingly marred by people present in body, but absent in mind, responding to their e-mail while someone else is presenting a laboriously prepared paper or opinion, or merrily checking on their social networks while someone else is speaking right in front of them. What has remained of old norms of etiquette, when even guests at an official banquet keep peeking at their smartphones under cover of their starched napkins, instead of following the outmoded custom of dividing their attention between the neighbour to the left with that on their right?

'The genie has been let out of the bottle and that more and more people of genius will come up with inventions that will surprise, startle and delight us.'

During the golden age of science fiction, just over half a century ago, the wildest dreams that authors could come up with were either interplanetary and intergalactic travel or thought transmission, including reading the minds of aliens. None of these has come about yet, but there were few intimations in even the most imaginative minds about the enormous changes in our lives brought about by new technologies of communication and information storage, retrieval and transmission. Science has far outstripped fiction and technological change has outpaced changes in national or international politics.

We all have heard the heartening stories about women in remote African villages gaining both income and dignity while getting crucial information about market conditions for their home produce on a simple mobile telephone. The whole world has witnessed the power of social media to multiply the influence of direct contact and contribute to mass uprisings that have toppled even seemingly invulnerable oppressive regimes. In these and other situations, the possibility of instant communication has empowered individuals and groups and freed them from the shackles imposed either by sheer distance or a powerful authority. Yet none of this could have happened without the ground being prepared by access to literacy and the means to acquire even the most democratically priced of modern electronic devices. Digital literacy and the world-wide bridging of the digital divide will therefore continue to remain among the highest priorities of both developed and developing nations.

'On the demand side, no decrease is in sight, and the appetite will only grow, both for entertainment and for education.'

For developed regions of the world, such as the European Union, the quality of digital literacy has already become a central focus of even the most conservative of educational systems. Given that access to information is by now something almost taken for granted, the main challenge will be to teach children a healthy balance between the virtual and the real world; and for adults, how to make use of the information which will continue to wash over them like the waves of a raging ocean. Dependence on the stimulation provided by electronic devices is by now as much of a recognised diagnosis as substance addiction and is almost as difficult to overcome, once established. Two- and three-year olds will scream more loudly if their iPad is taken away than they will ever scream at being parted from their teddy or their favourite doll. Adolescents as well as adults will have the opportunity to become veritable philosopher-kings with all the information available at their fingertips, but will they use this to broaden their minds or to dull them? While social contacts can become a window on the world to the old, the ailing or the handicapped, they can also become a tool for mobbing, slander and the murder of reputations, whether deserved or not. The Internet contains ready-made recipes for every conceivable manner of mischief, even as it allows one to look up the words of some half-remembered song or read up on the merits of some famous figure in history.

The medium is *not* the message, in spite of Marshall McLuhan's claim to the contrary. The medium is the medium and the message is the message. The task of education, tomorrow no less than yesterday, will be to form minds capable of telling the difference between these two and to know how to act in consequence. Having access to much of the accumulated knowledge of mankind is well and good, but skills in sifting, choosing and analysing information become more and more acutely needed. The accumulated information available should be there to serve us, rather than crushing us under its weight. More than that – education will need to form minds capable of shaping new content and to become generators of information as well as consumers of it. Knowing where a popular revolution is brewing may be liberating (but also life-threatening), but knowing what to put in place of the overthrown regime will be required, if a hopeful Spring is not to wilt into a leafless Autumn or even a frosty Winter of our discontent.

On the supply side, there is no doubt that the digitised world will form a continuously growing part of world economies. There will be keen competition for a share in this growth, but the rewards will be great and well worth competing for. On the demand side, no decrease is in sight, and the appetite will only grow, both for entertainment and for education. How much of this information will be distilled into knowledge – that still remains the question. Surely, it will be up to each new generation, for whom this brave new world will be as common and as trivial as electricity or modern plumbing had become only a few generations ago. Looking at the signs around us, the world is sure to become different. How much it will become better – that is a moot point. Since hope springs eternal, one may be permitted to hope that each new generation will be at least a little better than the one before, even if the world around us shows dire signs of retrogression as well as occasional progress. Standing in line for over 24 hours so as to be first in acquire the latest gadget is – alas – not a hopeful sign for the mental and emotional maturity of those whose only aim will be the empty claim that they were among the first to acquire something. Being the witness to some startling occurrence may bring anyone their much-coveted 10 minutes of fame, but will not usually be transformative for their lives. Posting a selfie of oneself brushing teeth may well place one's features on the same media as transmit every frown and smile of world celebrities, but it is not likely to cause one to go down in history. Hopefully, even posting atrocities on YouTube will not give more power to extremist groupings than their real weight and influence deserve.

The digital world is upon us and there is an enormous potential for it to offer us what previous generations could not even dream of. It has great treasures in store, as well us pitfalls and snares. Babies and centenarians alike will be transformed by it. It only remains to make sure that it will be transformed for the better.

Cloud computing in Europe: putting the power in the hands of the customer

By Werner Vogels

Werner Vogels is chief technology officer and vice-president of Amazon.com.

We are rapidly entering into an era where massive computing power, digital storage and global network connections can be deployed by anyone as quickly and easily as turning on the lights. This is the promise – and the reality – of cloud computing which is driving tremendous change in the technology industry and transforming how we do business in Europe and around the world.

Cloud computing unlocks innovation within organisations of all types and sizes. No longer do they need to spend valuable human and capital resources on maintaining and procuring expensive technology infrastructure and data centers, they can focus their most valuable resources on what they do best, building better products and services for their customers. Europe's fastest growing startups, like Spotify, SoundCloud, Hailo, JustEat, WeTransfer and Shazam, through to some of the region's largest, and oldest, enterprises, like Royal Dutch Shell, Schneider Electric, SAP, BP and Unilever, through to governments, education and research institutes, all are using cloud computing technologies to innovate faster and better serve their customers and the citizens of Europe.

According to a study from the Centre for Economics and Business Research, the expected cumulative economic effects of cloud computing between 2010 and 2015 in the five largest European economies alone is around €763 billion. Analyst firm IDC notes the cloud economy is growing by more than 20% and could generate nearly one trillion euros in gross domestic product and four million jobs by 2020. The change being driven by cloud computing has become so significant that many of Europe's policymakers are debating the best policy approaches to enable broad success with cloud computing across the continent.

The European Commission has taken a lead in this discussion and is recognising the benefit cloud has for the European economy and the role it can play in building a global competitive advantage, on-going prosperity, and world-leading innovation for Europe's commercial and public sectors. In 2012, the European Commission set up the European Cloud Partnership (ECP), an initiative that brings together technology leaders, cloud users, both private and public sector, and policymakers to recommend how to establish a digital single market with no walls for cloud computing in Europe. As a member of the steering board of the ECP, and someone who has been working with the European Commission on their cloud strategy for many years, I am privileged to help contribute to the collaboration on how to promote and shape cloud computing in the region.

> 'Cloud computing – done right – enables broad expression and realisation of these European values, especially when combined with a business model that puts customers first.'

As a Dutchman, I hold European values in close regard – values such as the right to a fair and democratic society, and a strong protection of privacy and freedom. Cloud computing – done right – enables broad expression and realisation of these European values, especially when combined with a business model that puts customers first. One of the key themes of the ECP's vision document is the call for a cloud computing framework that focuses on customers and empowers Europeans. As a senior member of the Amazon team, focusing on customers is something I know well.

When Amazon launched nearly 20 years ago, it was established with the mission to be the Earth's most customer-centric company. This means giving customers' choice – where they can find and discover anything they might want to buy online and offering the lowest possible prices – bringing products to everyone at an affordable price point. This customer focus permeates every part of the Amazon business where we will not do anything unless the customer is going to benefit directly. We also know that if we do not live up to this customer-first promise, and constantly strive to give the best service, they are free to walk away. This puts the power in their hands and constantly keeps us focused on delighting our customers.

For cloud computing to be successful in Europe, providers must hold exceeding customer needs as a core value. The easiest way to accomplish this is to put power in the hands of the customer with no minimum or long-term commitments. This means they have the freedom to walk away at any time if they don't get the service they expect. They also have the freedom to use as much or as little of the cloud services they want and only pay for the resources used. For too long customers have been locked in to long-term service contracts, costly capital outlays that require equipment upgrades every two to three years, and expensive software licensing fees from "old guard" technology vendors. Being customer focused means ridding European businesses and organisations of these handcuffs and democratising technology so that anyone has access to the same, world-class technology services on demand. This brings large amounts of the latest technology resources, something that was previously a privilege of the world's largest companies, into the hands of organisations of all sizes.

'Focusing on lowering prices for Europeans will boost the economy and prosperity of local businesses as more capital can be allocated to innovation.'

I have also seen some antiquated thinking attempting to undermine the important work that the ECP is doing in other ways. We have heard calls in some corners to develop a cloud computing framework in Europe to protect the interests of "old guard" technology vendors and the way that information and communications technology (ICT) "used to be" procured, leading to the same expensive contracts just disguised as cloud. I disagree and think this goes against the ethos of the ECP's focus which is that cloud computing should serve the customers and citizens of Europe, not shareholders of technology companies. Focusing on lowering prices for Europeans will boost the economy and prosperity of local businesses as more capital can be allocated to innovation – not activities that don't differentiate businesses, such as the overhead of managing the underlying ICT infrastructure. As a result of affordable cloud resources, we are already seeing centres of innovation and excellence – emerging in London, Berlin, Barcelona and Stockholm – that are beginning to rival Silicon Valley. If we continue to focus cloud computing on lowering the barrier of entry and cost of failure for customers we will see more companies experimenting and exploring things previously not possible. More experimentation drives more invention and ultimately more centres of innovation appear. This is vital to Europe's ongoing leadership in the world economy.

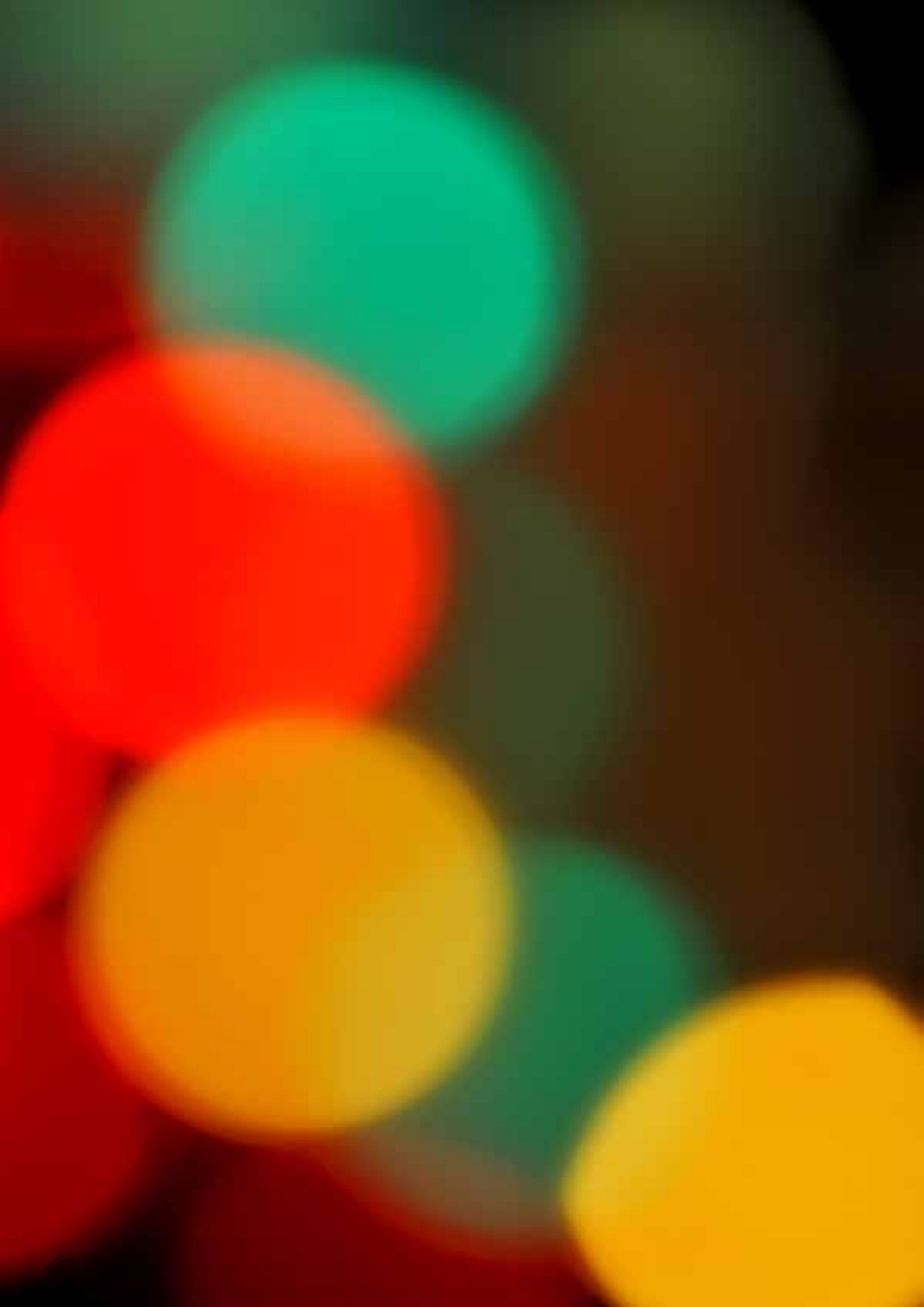
Finally, one of the core messages we have been taking to the ECP is the call to put data protection, ownership and control in the hands of cloud users. For cloud to succeed, and realise its potential, it is essential that customers own and control their data at all times. Recent news stories have brought this topic to the fore. Customers, governments and businesses, large and small alike, have concerns about the security, ownership and privacy of their data. If they are not addressed, these concerns have the potential to undermine the pervasive adoption of cloud computing and the resulting benefits to the European business community. At Amazon Web Services, we decided on day one to put this control in the hands of our customers. They own the data – they choose where

to store the data and their data would never be moved to optimise the network. This means that European customers using the AWS Cloud can choose to keep their data in Europe. We also give customers tools and techniques to encrypt their data, both at rest and in transit, and manage their secret keys in such a way that it is the customer who completely controls who can access their data, not Amazon Web Services or any other party. Content that has been encrypted is rendered useless without the applicable decryption keys.

For cloud technology to fulfil its potential to fundamentally change the European digital landscape, it must benefit the many, not the few. We have seen this with the rapid rise of the Internet and we will also see this with cloud computing if we put the power in the hands of the customer. We echo the ECP's call to focus a cloud computing framework on customers and remove barriers and restrictions to adoption in order to pave the way for increased prosperity of European businesses and provide access to high quality, secure and trustworthy cloud services across Europe.

Cloud computing is not a technology of the future; it is a technology of today. I commend the European Commission and the ECP in recognising the potential cloud computing has to be a job creator, a driver for the economy and a catalyst of innovation across Europe. The launch of the Trusted Cloud Europe vision is an important milestone as it will help accelerate cloud adoption in the region while helping to ensure customer-focused tenants at the core of cloud provider's strategies. European customers were among the first to adopt Amazon Web Services cloud technologies when we launched in 2006 and we look forward to continuing to work with the customers and policymakers, as we help more companies in Europe reach their potential through cloud computing.

'Cloud computing is not a technology of the future; it is a technology of today.'



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About the European Digital Forum

The **European Digital Forum** is a think tank dedicated to empowering web entrepreneurs and growing Europe's digital economy. The initiative is led by the Lisbon Council, a European think tank based in Brussels, and Nesta, the United Kingdom's innovation foundation, in collaboration with the European Commission's Startup Europe Initiative. Among the founding partners of the European Digital Forum are the European Investment Fund (EIF), Banco Bilbao Vizcaya Argentaria (BBVA), Orange and Telefónica. Its website is www.europeandigitalforum.eu.

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