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A Digital Strategy for Europe

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INTRODUCTION - DID EUROPE "MISS THE TRAIN" ON ICT?

To understand why Europe "missed the train" of the ICT (Information and Communications Technology) productivity boom, it is useful to take a step back and briefly summarise developments in European labour productivity. In their insightful 2008 paper, Van Ark, O'Mahony and Timmer,[2] identify three distinct periods: (a) during 1950-73 European productivity grew at a rapid pace, reflecting in part a catching-up process to the US's higher levels of productivity and per capita incomes. Import and imitation of existing technology played an important role,

[1] The author would like to acknowledge the contributions of Diana Correia and Joana Costa Pereira in researching and writing this policy brief.
[2] Van Ark, Bart, Mary O'Mahony, and Marcel P. Timmer. "The productivity gap between Europe and the United States: trends and causes", The Journal of Economic Perspectives, 2008. Available at: http://www.indexmeasures.com/dc2008/papers/vanark_productivity.pdf.

EXECUTIVE SUMMARY

The industrial internet – the network of intelligent machines, software analytics and people – would address the European productivity slowdown by providing a foundation for new businesses, new jobs and higher productivity.

While the new Digital Single Market (DSM) strategy makes a number of valuable contributions, it is predominantly focused on the consumer side of the digital economy. But this paradigm has now been substantially exhausted. We need to fundamentally change internet growth from the consumer side to the widespread digitalisation of industry. On this, the new strategy falls short and may be in need of some future development and revision.

This is in some way a missed opportunity to further connect the DSM with the EU's agenda of structural reform, with a renewed emphasis on employment, growth and productivity. Such an ambitious digital strategy for Europe should encompass:

- A cybersecurity strategy, because maintaining a protected IT infrastructure is a vital requirement, particularly for the industrial internet.
- Investment in infrastructure, as the shift from 4G to 5G could give Europe an opportunity to regain global leadership.
- Starting with data privacy, a common regulatory framework for data with favourable rules for ownership, transfer and storage of data is necessary – for both, European and non-European market participants.
- The majority of all current laws and standards were drafted at a time when many digital technology applications were still inconceivable. This is why a proper industry regulation needs to be flexible and technology neutral.
- Reskilling people for the thousands of job openings in the digital economy, which remain to be filled in Europe. If nothing is done, the Commission predicts there could be up to 825,000 unfilled vacancies for ICT professionals by 2020.
- Digital trade and free flow of data – the Trans-Pacific Partnership, the Transatlantic Trade and Investment Partnership, the Trade in Services Agreement and the Information Technology Agreement together represent a critical opportunity to advance a modernisation effort.

similarly to that which is currently benefiting a number of emerging markets; (b) during 1973-95 productivity growth slowed down in both Europe and the US, but productivity growth in Europe outpaced that in the US, reflecting a European decline in both labour force participation and working hours; (c) during 1995-2006 European labour productivity plunged, at the same time as US productivity rebounded.

Structural rigidities in markets for labour, products and services appear to have played a very important role in hindering the rapid reallocation of resources that would have accelerated the adoption of new technologies and maximised the attendant productivity gains. According to Ark et al, the European productivity slowdown is due to the later emergence and smaller size of IT investment in European economies compared to the United States. There seem to be three main explanations contributing to this:

First, the combined contribution of the investments in information and communication technology, greater demand for skilled workers and the impact of intangible investments, such as organisational changes related to the use of information technology, declined from 1.6 percentage points in the period 1980–1995 to 1.1 percentage points in 1995–2004 in the EU. Conversely, in the US economy the contribution of these three knowledge economy components doubled from 1.3 percentage points in 1980–1995 to 2.6 percentage points in 1995–2004.

Second, whereas multifactor productivity growth (which can be viewed as a proxy for advances in technology and innovation) accelerated in the United States almost a full percentage point from 0.5 percent from 1980–1995 to 1.4 percent from 1995–2004, the same measure declined from 0.9 to 0.3 percent between these two periods in the EU.

Third, productivity growth rates in ICT technology–producing sectors are 0.4 percentage points higher in the US (0.9 percent) than in the EU (0.5 percent), which reflects somewhat the relatively bigger share of these sectors in the United States.

THE INDUSTRIAL INTERNET

The deceleration of productivity has given support to technology skeptics arguing that technology has exhausted its growth-enhancing potential, and that innovation is now mostly about social media, entertainment and games, with no ability to boost living standards. In the following paragraphs it is argued how this idea may be unfounded.

Firstly, by looking closer at selected industries, Annunziata and Evans,[3] suggest that the industrial internet – a network that binds together intelligent machines, software analytics and people – through accelerated adoption of sensors and software analytics will have a powerful impact on productivity and growth.[4] As Annunziata and Evans note, the declining cost of instrumentation is beginning to enable a much wider use of sensors in machines ranging from jet engines to power generation turbines to medical devices. For example, the industrial internet could unlock residual capacity of the European railway network through integration of systems, data and operations, thus becoming a decision making tool for network optimisation. Combining terminals, stations, ports, railway undertakings and infrastructure managers, it could increase the visibility and predictability of railway operations, as well as improve the railway path allocation process. This could

[3] Annunziata, Marco and Peter C. Evans, "Industrial Internet – Pushing the Boundaries of Minds and Machines, A European Perspective", General Electric, June 2013. Available at: http://www.ge.com/europe/downloads/IndustrialInternet_AEuropeanPerspective.pdf.

[4] The industrial internet is a term coined by General Electric and refers to the integration of complex physical machinery with networked sensors and software. The industrial internet draws together fields such as machine learning, big data, the internet of things, machine-to-machine communication and cyber-physical system to ingest data from machines, analyse it (often in real-time), and use it to adjust operations.

also lead to better resource allocation, prevention and quick reaction to delays, as well as improve safety and customer service.

In the health sector, the industrial internet can help hospitals optimise their work, whilst at the same time maintaining levels of care. It would provide a far better and more sophisticated analysis of our medical data and history, which would help doctors make more effective decisions on treatment, or alert them more effectively if there is a potential deterioration in a patient's condition. In principle, check-up and testing should be better done by sensors and data collection, while diagnosis and prescription can be better developed by complex data analytics. No human doctor could read and digest all of the latest few thousand articles on heart disease, even if we would always want to leave the final call up to the doctor, ensuring that nothing gets decided which he or she would not decide anyway, while presenting a full panoply of alternatives, many of which no human caregiver would think of.

Secondly, there is an increasing consensus on the need to expand digitalisation beyond traditional sectors to sectors such as mining, transportation and health. These sectors are the ones apparently with the highest potential to benefit from adopting the wave of internet industrialisation,[5] especially in terms of productivity gains, but happen to be those with the highest barriers to entry today - regulatory and others. Removing those barriers would help to expand production with fewer inputs or at least without increasing the cost structure of the business.

Thirdly, even social networks might have the capacity to boost companies' productivity. Social media may be instrumental in building brands and connecting with customers, as well as useful for internal communication. These tools help business owners to align corporate goals, drive employee engagement and streamline operations. Twitter, Facebook, LinkedIn and YouTube can help in centralising activities within a company and fostering collaboration among inter-departmental groups. Internal social networks may be used as a strategy to empower employees to be creative and to have a voice on the direction of the company. Moreover, some of those platforms also have a positive impact in the way they help businesses sell beyond borders with lower costs.

In practice however, the first phase of internet expansion in the EU hid a fatal contradiction: As the internet remained limited to human interaction and communication, it could not have a dramatic and sustained impact on economic growth. This growth was, as the intended result of the industrial revolutions, much more centrally pursued by mechanical power than direct human activity. The industrial internet brings these two together: the slowly accumulated results of the industrial revolutions with the more recent and more explosive innovations in computing, information and communications systems. There should be little doubt that such a transformation is now upon us. In fact, the case has been made that if you build a factory today that is not using digitalisation and advanced robotics, then there is a real risk that your capital investment will never be repaid.

In terms of economic benefits, the impact of the industrial internet can be tremendous. In the Annunziata and Evans report, the authors estimate that the industrial internet could add $2.8 trillion to Europe's GDP by 2030, close to one quarter of the current size of the Eurozone's economy. That estimation is based on the assumption that European productivity growth would be boosted by 0.75 percentage points over a baseline where the industrial internet has no impact.

Nonetheless, one point that raises special concern is whether a further wave of productivity-enhancing innovation will destroy jobs. In today's context of high unemployment, the claim that higher productivity will simply mean fewer jobs is especially acute. It is true that technologic innovation will make some jobs redundant but it will create new ones if the impact on global

[5] Richard, K. "Big Data Protection", Kemp IT Law, November 2014. Available at: http://www.kempitlaw.com/wp-content/uploads/2014/10/Big-Data-and-Data-Protection-White-Paper-v1_0-November-2014.pdf.

growth is as strong as one is predicting. As regards this point, the challenge might be singly addressed to our education systems, which will need to ensure that the supply of skills matches the evolving demand for specialised labour.

On May 6th, the European Commission published its Digital Single Market Strategy (DSM), an expected development after Jean-Claude Juncker made the achievement of a connected digital single market one of his priorities immediately upon taking over as president of the European Commission in November 2014. The DSM strategy makes a number of valuable contributions and treads new, difficult paths for the EU's digital economy. At the same time, it must be said that it is predominantly focused on the consumer side of the digital economy and even on enhancing consumer experience, either by building consumer trust and developing cross-border parcel delivery, or by tackling the free and easy access to websites in other member states. So far I have been arguing that this paradigm has now been substantially exhausted. We need to fundamentally change internet growth from the consumer side to the widespread digitalisation of industry. On this, the new strategy falls short and may be in need of some future development and revision. This is in some way a missed opportunity to further connect the DSM with the EU's agenda of structural reform, with a renewed emphasis on employment, growth and productivity. One obvious criticism is the lack of focus on industrial digitalisation and industrial processes such as 5G, machine-to-machine (M2M) communication, big data, smart cities, and so on.

As I will show below, there is a lot that the EU can do in terms of setting the right general framework for the industrial internet, and we have reason to fear that without such a framework its possibilities will be severely hampered. With the right combination of coordinated efforts from public policy and from the private sector, the industrial internet can help Europe secure a leadership position in an increasingly competitive global economy.

A NEW DIGITAL STRATEGY FOR EUROPE

No one expects national governments and much less the EU to make operational decisions and be an active shareholder in the myriad of innovative projects which will one day turn the industrial internet into the central plank of our economies. But governments, and especially the EU, need to be active in providing the right kind of framework for private economic agents. An economic policy framework made up of rules and institutions already exists today. It is always present in a market economy. The problem is that it is not the right kind of framework for a new digital age. An ambitious digital strategy for Europe should cover:

1. **A cybersecurity strategy** - Increasing confidence and trust is a prerequisite for a digital economy. Maintaining a protected IT infrastructure is a vital requirement, particularly for the industrial internet. Security processes and controls should be designed to have multiple layers of defence. According to Barry Hensley, Director of Counter Threat Unit/Research Group for Dell SecureWorks, "security processes and controls should include vulnerability lifecycle management, endpoint protection, intrusion detection/ prevention systems, firewalls, logging visibility, network visibility, and security training"[6]. If the industrial internet evolves for critical sectors such as transportation or healthcare, providing high standards of cybersecurity is a requirement for consumers, governments and law enforcement. Scenarios of cyber-attacks directed against energy grids, water supply systems or emergency hospital real-time transmission systems of course carry significantly higher risks than cyber-attacks aimed at email or bank accounts. In the former examples vulnerabilities are more acute, broader and more complex. Life and physical human protection may well be at stake.

[6] "Emerging [Cyber Threats] Report", presented by the Georgia Tech Information Security Center and the Georgia Tech Research Institute at the Georgia Tech Cyber Security Summit 2011. Available at https://www.gtisc.gatech.edu/pdf/Threats_Report_2012.pdf.

2. **Investment in infrastructure** – It all starts with infrastructure, of course. The leap to 5G networks will allow us to connect a greater and greater number of industrial processes and machines, reshaping entire industries and turning the internet into the infrastructure of all of our other infrastructures. 5G is the crucial moment when most communication processes become autonomous, taking place without our active engagement.

   The industrial internet starts with embedding sensors in an array of machines, making them increasingly capable of collecting information which can be used to increase performance. Complexity has now reached a point where the capabilities of human operators promise to bring about few or no additional efficiency gains. For example, a human operator may miss the correlation between certain weather conditions and poor unit performance. Embedded intelligent systems, themselves part of the industrial unit, will be able to detect these correlations, much like algorithms today are already capable of finding out all existing correlations between stocks or bonds.

   In its Digital Single Market plans, the European Commission bemoaned some member states' slow introduction of 4G. The Commission said that coordination at EU-level should prevent similar time lags with 5G networks. In 2013 the European Commission proposed legislation on electronic communications, which, among other measures, provided for greater coordination in spectrum management in the EU, but Member States pushed back against creating European laws.[7] The Digital Single Market package announced in May of this year addresses this issue again.

   The shift from 4G to 5G could give Europe an opportunity to regain global leadership. In the opinion of Massaro and Bohlin, Europe has been successful in deploying second and third generation mobile services, but it seems unable to move on towards next generation LTE networks, which are needed in order to support the extensive growth of mobile data traffic. A main factor, among others, which has contributed to the relatively insufficient EU performance in terms of LTE deployment is market structure. The fragmented structure of EU electronic communications market prevents us from exploiting the basic characteristics of dynamic markets such as economies of scale and scope and network effects, hampering investment and innovation in services and infrastructures.[8] New spectrum for 5G will need to be allocated and governments should work together to make the necessary frequencies available at the same time in all markets.

3. **A regulatory framework for data** – That means clear and favourable rules of ownership, transfer and data storage and a completely harmonised regulation in data protection rules both for European and non-European market participants. Data protection is where we should start.

   On 15 June 2015, the Council reached a general agreement on the general data protection regulation that establishes rules adapted to the digital era.[9] The aims of this regulation are to enhance the level of personal data protection for individuals, increase business opportunities in the Digital Single Market, create more and better tools to enforce compliance with the data protection rules and guarantees regarding transfers of personal data outside the EU.

[7] Proposal for a Regulation of the European Parliament and of the Council laying down measures concerning the European single market for electronic communications and to achieve a Connected Continent, and amending Directives 2002/20/EC, 2002/21/EC and 2002/22/EC and Regulations (EC) No 1211/2009 and (EU) No 531/2012. Available at: http://data.consilium.europa.eu/doc/document/ST-5071-2015-INIT/en/pdf.

[8] Massaro M. and E. Bohlin. "Is Europe Moving Towards a Strategic Development of Spectrum Policy? A Review of the Connected Continent Legislative Proposal", SSRN, March 2014. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2418661.

[9] Proposal for a Regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation). Available at:http://data.consilium.europa.eu/doc/document/ST-9565-2015-INIT/en/pdf.

The completion of the final negotiations on the data protection reform as well as its full and broad implementation is needed for a single and comprehensive set of data protection rules for the EU.

Almost twenty years after adopting Directive 95/46/EC,[10] the degree of harmonisation in implementation is insufficient. For example, the term 'data transfer' is defined differently in national laws; data protection authorities, jurisdiction and sanction practice offer a wide range of data protection practices. This lack of harmonisation constitutes a legal risk, meaning Europe remains at a disadvantage relative to its most direct competitors. The different national implementations of Directive 95/46/EC entail the risk of legal uncertainty for companies. It is a complex and difficult undertaking to work with personal data in different member states. If a company operates cross-border, different national requirements have to be fulfilled. A company which uses a digital preservation system situated in another member state must transfer data including personal data.

The use of Big Data by the top 100 EU manufacturers could lead to savings worth €425 billion. By 2020, some estimates say the value of European citizens' personal data has the potential to grow to nearly €1 trillion annually.[11] Companies will have easier access to the whole EU market, with the current 28 national legislations being replaced by one and a one-stop-shop for governance and enforcement. The rules will also apply to companies from across the world providing their services in the EU, meaning fair competition for businesses and a guaranteed right to protection of personal data for citizens.

But as said above, data protection is just the start. We will need a much broader framework for industrial data ownership and use. Many firms and businesses reluctant to embrace digitalisation are simply reacting to the existing uncertainty how benefits and profits from data use can be apportioned between those who provide it at the source and those digital platforms where data is ultimately aggregated. At present different firms along the value chain are claiming rights in the data produced. Only governments can be expected to address this fundamental issue.

4. **Proper industry regulation** – To exploit the full potential of the industrial internet one should review the laws that are of relevance to digital transformation. The majority of all current laws and standards were drafted at a time when many digital technology applications were still inconceivable. That explains why highly automated driving, for example, is incompatible with prevailing laws. The legislator must keep up with technological progress and review all valid laws to determine whether they are fit for their purpose. To foster digital growth, regulation needs to be flexible and technology neutral.

   The International Chamber of Commerce (ICC) advises regulators to avoid evermore detailed prescriptions of how to implement solutions which can needlessly constrain business models and innovation.[12] They encourage alternative approaches to constructively address concerns related to fundamental rights without stifling the benefits of innovation in emerging technologies and business models.

[10] Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31995L0046:en:HTML.
[11] "What will the EU Data Protection Reform bring for startup companies and Big Data?", European Commission, April 2015. Available at: http://ec.europa.eu/justice/newsroom/data-protection/news/150415_en.htm.
[12] "To foster digital growth, regulation needs be flexible and tech neutral, experts say", International Chamber of Commerce, 26 March 2015. Available at: http://www.iccwbo.org/News/Articles/2015/To-foster-digital-growth,-regulation-needs-be-flexible-and-tech-neutral,-experts-say/.

Policy recommendations from the first report from the Strategic Policy Forum on Digital Entrepreneurship,[13] a think tank set up by the European Commission, gathering leaders from business, academia, international organisations and politics, highlights the following priorities on better policies, rules and regulation:

i) Establish a permanent observatory to scan current and proposed EU and national legislation for anything that puts unnecessary barriers in the way of businesses using digital technologies.

ii) Attendance at digital boot camps should become part of the continuous professional development for all politicians, regulators and staff involved in designing policy and regulation. Digital boot camps will give politicians and policy makers a much better understanding of the digital transformation and help them make better policy.

iii) Examine new policy through digital impact assessment, which will give legislators a framework for assessing the extent to which a proposal has negative or positive impacts on digital transformation – by changing the way they operate, for example, or how competitive they are.

iv) The EU public sector buys more than €2.4 trillion worth of goods and services through public procurement.[14] By opening these tenders up to more businesses, and across EU borders, European companies – especially SMEs – would expand their client base and their business. Moreover, if public administrations consistently used e-procurement to buy goods and services, it would gradually encourage European companies to adopt and develop digital technologies.

5. **Reskilling** – Thousands of job openings in the digital economy remain to be filled in Europe while Europe's youth suffers from unprecedented high rates of unemployment. According to the European Commission,[15] by 2020 the number of jobs for highly-qualified people will rise by 16 million while the number of jobs held by low-skilled workers will decline by around 12 million. 50% of jobs today require technology skills and 77% of all jobs will require these skills within the next decade. If nothing is done, the Commission predicts there could be up to 825,000 unfilled vacancies for ICT professionals by 2020.

   It is also important to recognise that machines, however intelligent they might be, are just tools. Equipping Europe's workforce and citizens with e-Skills is fundamental for the success of the Digital Single Market. To maximise the potential of the industrial internet, the EU will need to nurture a new skills pool not only by training more people in sciences, engineering and data science, but also by developing a new set of skills that combines expertise in software with skills in different branches of engineering. It will also need a cross-border framework to facilitate greater mobility of skilled labour. Accordingly, in the medium term it requires a realignment of educational institutions more closely with industry to meet the realities of the industrial internet. Employees will need to perform more and more specialised tasks in their professions, which in turn will require them to regularly update skills.

[13] "Digital Transformation of European Industry and Enterprises", Strategic Policy Forum on Digital Entrepreneurship, March 2015. Available at: http://www.digitaleurope.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=967&PortalId=0&TabId=353.

[14] Final Report: Study on eGovernment and the Reduction of Administrative Burden (SMART 2012/0061), April 2014. Available at: http://ec.europa.eu/digital-agenda/en/news/final-report-study-egovernment-and-reduction-administrative-burden-smart-20120061.

[15] "Grand Coalition for Digital Jobs", European Commission, April 2015. Available at: http://ec.europa.eu/digital-agenda/en/digital-jobs-0.

6. **Digital trade and free flow of data** – Production is today mainly done in fragmented and geographically dispersed global value chains, given the ability to split it up by the fast spread of ICT and the internet. For this kind of globally integrated production chains to be effective large quantities of data must be moved, usually cross-border. The United Nations Conference on Trade and Development (UNCTAD) estimates that about 50 percent of all traded services are enabled by the technology sector, including by cross-border data flows.[16] According to the report "No Transfer, No Production"[17], there are five main reasons why manufacturers need to move data for production chains to work:

    i) For overarching control and coordination of the geographically spread-out production;

    ii) To conduct R&D and testing in the pre-production phase;

    iii) For efficient supply chain management and the smooth flow of goods, services and capital necessary for production;

    iv) To manage actual production and final assembly, including controlling robotics;

    v) In the post-sales phase, to run and monitor products sold, including moving data to be used as input in earlier stages of the production process.

    Negotiations underway for the Trans-Pacific Partnership, the Transatlantic Trade and Investment Partnership, the Trade in Services Agreement, and the Information Technology Agreement together represent a critical opportunity to advance such a modernisation effort. The BSA (Business Software Alliance) report outlines some characteristics that modern trade agreements should have in order to stop digital protectionism,[18] which we outline here:

    i) Trade agreements should ensure data can flow across borders with few restrictions.

    ii) Trade agreements should cover current and future innovative services.

    iii) Trade agreements should provide robust intellectual property protections.

    iv) Trade agreements should promote market-led, globally adopted technology standards and minimally burdensome technical regulations.

CONCLUSION

New sources of growth are strongly needed to help us recover from the economic crisis and strengthen long-term productivity growth. The industrial internet - which could prove a powerful engine of transformation – is a critical part of the response and provides the foundation for new businesses, new jobs and higher productivity. Throughout this paper we provided the draft of a new digital strategy to drive innovation and increase productivity in the future, based on the industrial internet approach.

[16] "Information Economy Report", United Nations Conference on Trade and Development, 2009. Available at: http://unctad.org/en/docs/ier2009_en.pdf and Lee Makiyama, H. "Digital Trade in the U.S. and Global Economies", European Centre for International Political Economy (ECIPE), February 2015.

[17] "No Transfer, No Production – A Report on Cross-border Data Transfers, Global Value Chains and the Production of Goods", Kommerskollegium, April 2015. Available at: https://ec.europa.eu/futurium/en/system/files/ged/publ-no-transfer-no-production.pdf.

[18] "Power the Digital Agenda – A Trade Agenda to Drive Growth", BSA, 2014. Available at: http://digitaltrade.bsa.org/pdfs/DTA_study_en.pdf.

The continued spread of the digital economy and the proliferation of massive volumes of data have the potential to transform many industries, including transport and health as it was outlined here. Successful deployment of new technologies and business models will require innovation-friendly regulation consistent with a data driven economy, as well as efforts to improve the quality of human capital.

The industrial internet is key to innovation as almost no business today is run without the help of ICT. To reap the full benefits from technology for future growth and to support job creation, policymakers will need to keep the internet open and provide a sound policy framework for its governance, namely related to access, privacy, and security as well as to investment in new infrastructure like 5G.