Promoting European Growth, Productivity, and Competitiveness by Taking Advantage of the Next Digital Technology Wave

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The EU has an opportunity to make major strides in the next wave of digital transformation. But it will need to adopt a forward-looking policy perspective that focuses on the benefits of connectivity, automation, and smart systems for Europe's economy and society.

A new suite of digital technologies is reshaping advanced economies and promising increased rates of innovation, productivity, and economic growth, along with improvements in quality of life. However, the EU will not gain the full benefits of this next innovation wave without the right policies.

This report begins by discussing the emerging digital technology transformation, what is required for success, and where Europe stands vis-à-vis progress on digital development and adoption. It then compares Europe with China, Japan, and the United States in terms of indicators of both digital economy development and adoption as well as key policies and factors related to digital economy success. It then lays out six key strategic issues for the EU as it seeks competitive advantage and growth from the next technology wave. Finally, the report presents a series of policy recommendations for the EU, organized into five sections: regulatory framework conditions, trade policy, resources for firms (including data, R&D, skills and digital infrastructure), technology/sector/firm policies, and culture and institutions.

The Task Ahead: Transforming Europe Through Connectivity, Automation, and Smart Systems (CAS)

Europe faces a set of important new challenges and opportunities as the next wave of ICT-based innovations emerges. Advanced nations and regions are in the beginning stages of a major technology wave; a transformation to a more sophisticated, powerful, and wide-ranging digital system. This system will be much more connected (a massive number of "things" will be connected through more advanced networks), automated (devices and systems will enable more work to be done by "machines"), and smart (algorithms will play important roles in making sense of and acting on all this information). As a shorthand, we call this system connected, automated, and smart (CAS).

Successful development and adoption in the EU will likely lead to significant benefits, not the least of which includes the potential return to the kinds of robust rates of productivity growth EU nations enjoyed from 1980 to 1995. Indeed, this next innovation wave holds the potential to reverse the 20-year productivity growth lag suffered by the EU. Moreover, CAS adoption will help address pressing EU challenges, including in the areas of education, environment, health, and transportation. And CAS development could boost EU global competitiveness.

Because of the nature of this next wave, especially its potential transformation of "atom-based" industries, the EU is better positioned to succeed than it was in the last ICT wave, as Europe has many strengths it can leverage for success, including strong research universities, a highly skilled workforce, a large market, world-leading firms, and. importantly, core engineering strengths and a willingness to engage in public-private digital transformation projects. However, the EU also faces challenges, including lower ICT industry investment in R&D than in the United States and Japan, lower rates of ICT patenting, lower levels of entrepreneurial risk taking and a weaker ecosystem (e.g., venture capital) that accompanies it. The EU also has a much larger share of small firms than the United States, which limits innovation, investment, and productivity. Firms in the EU also invest less in ICT and spend less on digital services (including cloud computing and other information services).

Key Strategic Issues for the EU

As the EU considers how it wants to fully support and capitalize on the innovations emerging from the coming CAS transformation, it needs to consider several strategic factors.

1. Focus on the Future, Not the Past

The EU missed many of the opportunities from the last two ICT waves, including in personal computers, smartphones, cloud computing, Internet search, and social media. Because of the enormous economies of scale and scope, and first-mover advantages global leading firms have in these areas, it will be extremely difficult for the EU to break into these industries in a serious way. This implies the EU should focus on the industries and technologies of the future, and not on gaining market share in the current wave of ICT industries. The business and national winners in the CAS system (e.g., robotics, autonomous systems, blockchain, quantum computing, artificial intelligence, 5G, Internet of Things, etc.) are not preordained, and any current competitive advantage by no means assures future advantage. As such, the EU should focus on winning global market share in the emerging CAS technology areas.

2. Focus on Areas of Competitive Advantage

The EU should focus on the industries and technologies of the future, not the recent past, and build on existing core competencies.

The EU also needs to focus on areas of existing competitive advantage. Previous digital technology waves were largely about "bits"; in other words, purely digital technologies. The next wave will be increasingly about "bits and atoms," or, the emerging technology system increasingly combining digital technologies with physical things and activities (e.g., smart agriculture, smart cities, smart grids, smart manufacturing, autonomous vehicles, etc.). This plays well to the EU's considerable strengths in engineering, provided, however, the EU improves and expands its software capabilities. However, this means conceiving of "Industry 4.0" broadly, and not just on manufacturing. The digital transformation of "atom-based" industries is much broader than just manufacturing. All physical systems, including agriculture, buildings, infrastructure, logistics, and transportation, are being digitized—all areas wherein the EU has real strengths.

Another area of strength for the EU is technology-enabled business services, including in accounting and finance, engineering services, supply chain and logistics, environmental compliance, consulting, graphics design, and biometrics. Moreover, this is an area wherein East Asian capabilities are much less developed. The EU can build on both its own and national government policy efforts in areas such as health IT and genetic records, e-government services, digital IDs, fintech, blockchain-enabled logistics, and others. In particular, global liberalization of the services trade provides a core opportunity for Europe, especially as more services are being digitized and able to be more easily traded across borders, and the free flow of data across borders is enabled.

3. Address Unequal Adoption of Digital Tools Between Firms, Industries, and Nations

If the EU is to fully succeed in the CAS era, it needs to successfully address three key gaps. The first is too many EU organizations lag in their adoption of past and current waves of ICT. There is a considerable gap between leading firms and "zombie firms" (firms with low productivity growth and limited ICT adoption). And the EU has a significantly larger share of employment in small, relatively low-productivity, low-ICT-using firms protected by public policies that provide incentives to not get big, as getting big brings with it a host of regulatory and tax obligations.

Second, the gaps are not just between firms, but industries. ICT adoption is less even between European industries than it is in the United States. This is a major reason the gap between the most-productive and least-productive firms in any particular EU industry is higher than in the United States.

The third gap is between nations. Some EU nations, such as the Nordic nations, are on par with, or even ahead of, the United States. But many other EU nations, including the EU-10 and southern EU nations, lag significantly behind EU leaders in ICT development and adoption.

4. Shift the Strategic Focus of the EU's Digital Policies

There are three principal types of digital economy policies: foundational, field clearing, and proactive. Foundational policy activities are focused on addressing potential harms from ICT or ICT companies. Field-clearing policies are focused on clearing barriers and limiting future barriers to digital innovation. Proactive policies seek not just to open markets and enable digital entrants to compete, but to actively support EU-wide digital transformation. While EU member states and the European Union have taken steps in all three areas, much of the focus has been on foundational policies, and relatively less on field-clearing and proactive policies.

Yet, proactive digital policies represent the next big opportunity for EU digital policy. These include policies to expand and improve the resources firms rely on for success, including ICT R&D, data, broadband networks, and digital skills. The latter is particularly important, as Europe lags behind the United States in the share of the workforce with software skills, which is arguably the key ingredient for digital economy success. But proactive policies, often implemented through public-private partnerships, also support digital innovation and adoption in key technology areas, such as AI, digital IDs, high-performance computing, and robotics, and key application areas such as health IT, smart grids, and smart cities.

5. Build on the EU's Unique Advantages

While the EU lags behind the United States and China in several areas related to the digital economy, it has several unique advantages, particularly over the United States. To win in the next CAS wave, the EU needs to double down on these advantages. There are two that deserve particular focus. First, compared with the United States, the EU is much more open to supporting proactive policies to help drive digital transformation in particular areas, such as the smart grid, smart cities, health IT, E-IDs, etc. Taking advantage of this can not only produce needed transformation, but also give EU firms a leg up in global competition.

Second, the EU can take advantage of policy innovation going on in all EU nations, particularly in many of the smaller nations. National digital advantage in many technology and application areas depends both on coordination of multiple actors (a task that can be extremely difficult in large nations such as the United States) and policy innovation. But the EU has numerous nations that have shown a willingness and ability to be more innovative and flexible. The Commission should take advantage of these innovations, seeking to spur more bottom-up policy innovation and then bring those innovations fully to market, diffusing them throughout all of the EU. As such, a key challenge for the EU going forward will be to identify its many strengths and build on them while at the same time identifying weaknesses and taking steps to overcome them.

6. Win Through Out-Investing the United States

One reason for America's lead in the last two ICT waves is significant public investment from the 1960s to the 1980s, especially in R&D, including through the Department of Defense, NASA, and the National Science Foundation. But years of budget neglect have resulted in the United States now ranking eighth among Organization for Economic Cooperation and Development (OECD) nations in the ratio of government-funded R&D to GDP. And current budget challenges in the United States suggest this will only get worse. This provides the EU with a real opportunity to gain

ground on the United States through more robust public investment, particularly in R&D focused on CAS technologies. However, the EU will also need more effective technology transfer and commercialization —an area in which the United States does quite well—if it is to get the most out of increased investments in R&D.

Policy Recommendations

The report makes a number of recommendations in five main areas: regulation, trade policy, resources for firms (including data, R&D, skills and digital infrastructure), technology/sector/firm policies, and culture and institutions. These are not intended to be set in stone, but rather as suggestions of the kinds of steps the EU may want to consider.

Regulatory Framework Conditions

- In efforts to "level the playing field" between industries and firms, the EU should be focused more on equivalent protection, not equivalent regulation. In other words, the goal should not be to subject new digitally-based business models to the same regulation as incumbents—which often limits innovation.
- The Commission should actively support national efforts to reform and improve regulation. In particular, this will mean a greater embrace of the "innovation principle" when considering government response to new technologies.
- In order to enable digital single market, the Commission should be given political-level support to preempt digital economy regulations individual member states adopt.
- The Commission should create within the Regulatory Scrutiny Board an Office of Innovation Review whose mission would be to serve as an "innovation advocate" in the regulatory process.
- The Commission and member states should continue developing "regulatory sandboxes"—frameworks that enable firms to work with regulators to test their innovative products, services, and business models with real consumers in a controlled environment on a trial basis.

Trade Policy

- The Commission should be given the authority to review and approve or reject acquisitions of EU firms from nations practicing state capitalism.
- The EU should—within the text of its trade agreements, not outside of them—develop provisions to protect the role data flows play in digital trade in order to ensure other nations do not use privacy as a cover for digital protectionism, as it would make these measures subject to a trade dispute.
- The EU's digital trade agreement provisions should emphasize that firms will be held accountable for ensuring a country's data protection rules flow with the data.
- To better establish an EU single market for services, the EU needs to develop a more robust process to identify barriers to entry and operation in service markets, and reporting and transparency mechanisms to publicize relevant rules and regulations alongside a parallel effort to ensure regulatory agencies have the capability to enforce relevant rules and laws.

- The EU should take a leading role in reviving negotiations over an ambitious Trade in Services Agreement within the World Trade Organization.

Resources for Firms: Data, Research, Skills, and Infrastructure

- Every EU member state should appoint a chief digital officer to not only champion data innovation domestically, but also to serve on an EU-wide advisory panel charged with counseling the European Commission on development of a cohesive vision and strategy for capturing the full benefits of data-driven innovation.
- The Commission should adopt an ICT R&D funding system that gives EU industry much more say in determining the technology areas the EU funds. In contrast, for individual academic researchers and academic research centers, the Commission should identify areas of importance for ICT research and devote funds to projects in these areas.
- The Commission should reduce its role as a direct funder of large numbers of individual research projects and instead fund many more industry-funded university R&D centers on multiyear contracts.
- The Commission should establish an ICT-based Industry-University Cooperative Research Center program, wherein the research areas are determined by universities and industry working collaboratively.
- The Commission should establish a program to make awards of €1 million per year for 5 years to the top 100 or so individual academic researchers doing work in advanced ICT areas, such as AI, that industry values. This will help the best academic talent not only stay and develop in Europe, but also stay in academia rather than being lured to industry.
- The current proposal for the Directorate General for Research and Innovation for funding for R&D in robotics and artificial intelligence should be supported.
- The Commission should provide matching grants to member states to establish teacher-certification programs in computer science (CS) as the EU lags behind the United States in the production and employment of CS workers.
- The EU should build on public-private partnerships for computer science education and digital skills development. Many leading companies making or using digital technologies would likely be active participants in such programs.
- The Commission should fund a pilot program that would establish more maker spaces in European high schools, in order to boost digital manufacturing and engineering skills.
- The EU should consider the U.S. experience in creating a continent-wide telecom service market, including in spectrum, and assess its applicability in the EU.
- Wherever there are at least two competing broadband providers (e.g., wireline telecommunications, cable providers, or 5G wireless) in a market, the Commission should allow national governments to remove price regulations and wholesale network unbundling requirements.
- The EU should lower costs of deployment for 5G infrastructure by encouraging local authorities to streamline their infrastructure siting requirements.

- EU policymakers should continue to evaluate the benefits of differentiated network services, and whether existing net neutrality regulations impede innovative new broadband network applications.

Technology/Sector/Firm Policies

- The Commission should chart out steps articulating how it can help member states drive CAS applications through public-private partnerships. This should include heading an effort to help member states become lead adopters of emerging CAS technologies.
- The EU should focus on using existing programs and policies that affect particular industries to drive CAS transformation (e.g., agriculture and DG AGRI; financial and DG ECFIN; transportation and DG MOVE; etc.).
- Each major Directorate General should establish a position of chief technology officer to ensure Directorates' policies are aligned with CAS sector transformation.
- The EU should fund the establishment of an EU-wide version of America's Digital Manufacturing and Design Innovation Institute.
- The EU should fund a network of "manufacturing universities" focused on skills and R&D relevant to manufacturers in the EU.
- The EU should develop an "EU Smart City App Store"—a common repository of approved commercial applications and open-source code—other EU cities can adapt and reuse.
- The Commission should establish competitive programs to support member states that establish innovative CAS-related projects and initiatives.

Culture and Institutions

- The Commission should lead a dialogue that explores adopting the innovation principle, rather than the precautionary principle, when it comes to CAS.
- The EU should expand support for EU universities and colleges to create entrepreneurship education programs.
- The EU should provide challenge grants to universities to reform university engineering curricula toward more project-based learning and entrepreneurship.
- The EU should support innovative new organizational models in areas such as health care, transportation, and education.
- The EU should establish an EU-wide productivity agency to identify specific policies to spur faster technology-based productivity, and to act as a champion of stronger productivity policies. While the Commission encourages the establishment of National Productivity Boards, many key issues can only be addressed at the EU level. Moreover, many of the national productivity boards focus on macroeconomic and regulatory framework issues, rather than the more critical industry-, technology-, and firm-specific issues related to productivity and policy.

The EU has a significant opportunity to make major strides in the next wave of digital transformation, but it will need to adopt a forward-looking policy perspective that focuses foremost on the benefits the next generation of digital technologies can bring to Europe's economy and

society. In particular, Europe should leverage its distinct strengths in areas such as collaborative public-private partnerships and advanced industrial engineering to position itself to be a global leader in the coming CAS transformation. While the EU should be attuned to potential digital harms, it should also remember that, in total, these are well-outweighed by digital benefits, and manage its digital policymaking framework accordingly.