What We Have and What We Want

DIGITALIZATION AND AI IN EUROPE

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**What We Have and What We Want –
Digitalization and AI in Europe**

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DIGITALIZATION AND AI IN EUROPE

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Executive Summary

In this study we discuss measurements of digitalisation and argue that:

→ comparing technology adoption rates across geographies is misleading and that we should first define sensible targets, given the peculiarities of the European Union. As such, since we do not have a clear vision of what European digitalisation ought to be, we do not have a clear picture of how we are performing.

→ the emergence of European platforms is made difficult in most instances by intrinsic fixed factors, not necessarily by a lack of political action.

→ existing legislation (GDPR and, likely, the future AI regulation) can be used as a way to nudge European companies into behaving "in the European way" as well as constraining transnational companies. There is evidence that, currently, the first role dominates.

→ the emergence of European platforms would be fostered mostly by educating the population in digital matters. Training citizens not only in the technical, but also the societal aspects of digitalisation, may incentivise them to favour local solutions. That is, if those solutions reflected their values better than the solutions offered by transnational companies (which the legislation in place makes more likely). As such, creating "a digitally skilled population" might in fact be the most important factor and the bottleneck of the whole European Commission's Digital Compass[1].

1 See European Commission (2021), https://digital-strategy.ec.europa.eu/en/policies/digital-compass

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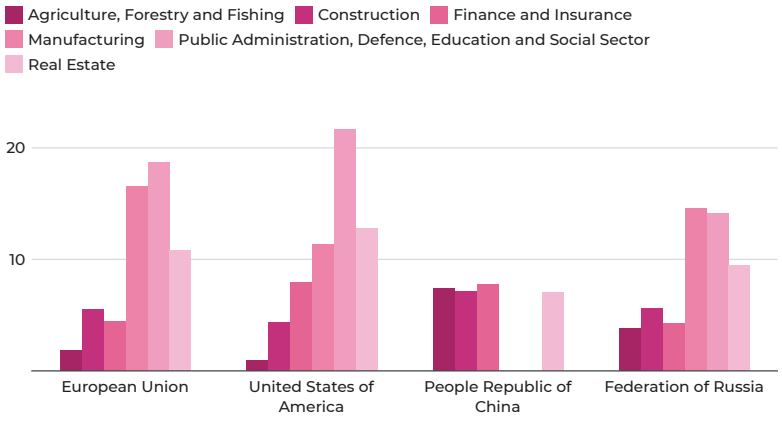
1 What do we have?

Comparisons are always tricky. Identifying the yardsticks that make sense is a matter of identifying why we want to compare two elements. In the case of digitalisation, due to the moving nature, pervasiveness and complexity of the topic, when trying to understand our position in comparison to other geographical and political entities it is a constant challenge to identify measures that are both available and relevant.

Availability of data is problematic[2] (collecting data on the potential needs, the diffusion and actual use of technologies across sectors is costly) but relevancy tends to be the major burden. This is because digitalisation remains a means to an end, or rather, a means to multiple ends, depending on the discipline that studies it. Economics, for instance, sees digitalisation, and by extension AI, as (mostly) a means to increase productivity.

FIGURE 1

Value Added by Activity in Large Economic Areas



Source: OECD - National Accounts - Value Added by Activity

Figure 1 shows the sectoral split of the value added in some activities. There exists quite some heterogeneity between the major geographic zones. This is, of course, no surprise, and yet, most of the comparisons between countries or zones are currently taken at face value: Europe is more or less “digital” than the USA, and above China in the take-up of some technology, and so forth. Seldom do we perform the analysis wondering what the optimal adoption rate of some technologies ought to be when considering the economic “mix” in the countries. Moreover, Figure 2, taken from a recent OECD report, illustrates the differences across sectors in need of digital tools (in this case, web technologies and advanced ICT functions).

This is less true of what is termed General Purpose Technologies (GPT). A GPT is broadly defined as a technology that enables the use of other technologies and leads to massive productivity growth. While there is broad consensus that computers and the internet are GPT’s (that helped fuel the third industrial revolution), the jury is still out on AI[3]. By their enabling nature, those technologies are supposed to be relevant for everyone. It is both easy to get accurate data on these technologies, and relevant for a broad scope of purposes. Consequently, we tend to commit two fallacies: identifying digitalisation to those sole aspects, and applying the same type of logic to other, non-GPT technologies.

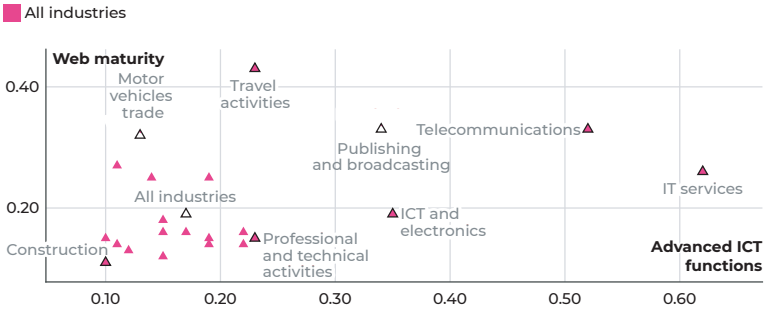
2 This is highlighted, for example in OECD (2019), https://www.oecd.org/publications/measuring-the-digital-transformation-9789264311992-en.htm

3 On the topic, see, for example, Goldfarb, Taska and Teodoridis (2019)

FIGURE 2

Different Industries Have Different Intensities of ICT Needs

Web Maturity and Advanced ICT Functions in European Companies



This graph comes from the OECD report "Measuring the Digital Transformation"

Source: OECD, based on Eurostat Data

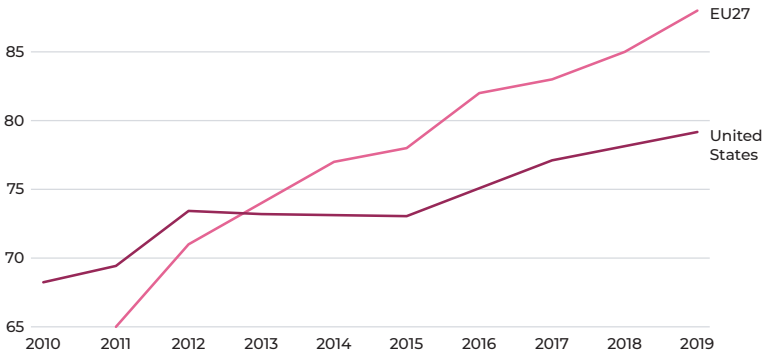
When we observe digitalisation under the sole prism of the GPT (the first fallacy), we find that the "gap" in terms of infrastructure between the EU and the USA[4] is not only strenuous, but sometimes inverted. The European population has wider access to the digital world than her American counterpart, and this equality or edge holds in most segments of the population. It is clear that Europe, as a political entity, has scope for improvement in terms of digital inclusion and that it should mostly strive to connect the remaining rural population. But this is a social effort and will not foster the competitiveness of its companies. Once this observation is done, it becomes tempting to measure the adoption rates of all other technologies with the same yardstick. And there comes the second fallacy.

We can safely operate under the assumption that having access to the digital world is beneficial for citizens and companies alike. It makes business transactions and knowledge acquisition faster and less burdensome, reduces the asymmetry of information between economic actors, and brings people together and closer to their institutions, which, if astutely done, is positive for democracy. This assumption is likely

FIGURE 3

Broadband Internet Connections of Households

in %



Missing data for the US where interpolated linearly

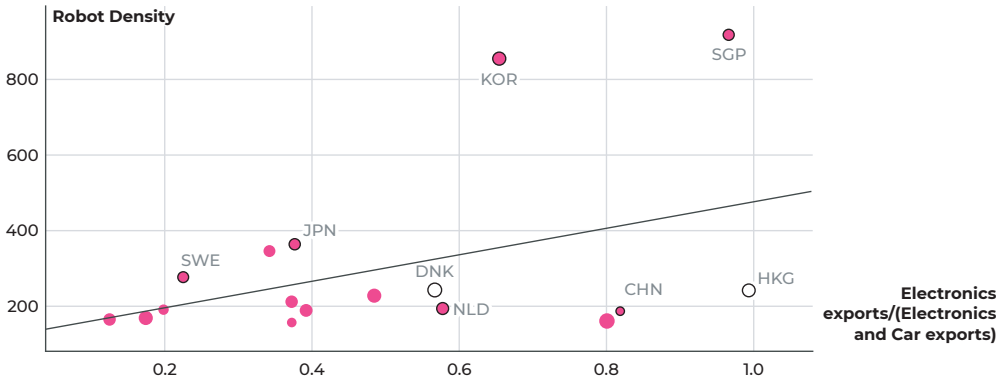
Source: EU: Eurostat, US: OECD

4 As one can see in Figure 1, the US is the closest match for the EU in terms of activity composition and is therefore the most sensible benchmark when one thinks in terms of general purpose technology.

less relevant for most other technologies. In terms of productivity, for example, it is doubtful that an individual baker has much to gain from implementing a blockchain-based inventory management system. It is therefore *natural* that an economy with more bakers will have a smaller blockchain adoption rate than an economy where bankers and insurers constitute a large part of the economy. This does not mean that the first economy is naturally more hostile to the blockchain. It just means that it has less use for it[5]. The problem is that we tend, once again due to the complexity of this matter, to accept adoption numbers as a "score".

FIGURE 4

Robot density and Manufacturing Sophistication Ratio



Sources: IFR Manufacturing Sophistication Ratio, GDP World Bank

Even relying on the national account is troublesome: it remains a blunt instrument. Take, for example, one of the most significant indicators of robot adoption: the industrial robot density, which consists of the number of robots installed, divided by the number of workers employed in the industry. While it may seem like a sensible way to look at the intensity of robot adoption in an economy, it crucially hinges not only on the number of workers, their wages and some sampling uncertainty, but also on the type of manufacturing performed in a determined geographical area. We know, for example, that the average robot density in the USA manufacturing sector was 228 robots per 10,000 employees, whereas the average for Europe was 114. But the actual industries are hard to compare. Robot density is much higher in Singapore and South Korea than anywhere else in the world, for example. While this might be interpreted as a sign of a highly digitalised economy, an alternative narrative highlights the fact that manufacturing in those countries mainly consists of electronics. Electronics manufacturing currently requires significantly more precision than, for example, car manufacturing. Robots have an edge on humans in this area and are sometimes a requirement to be able to produce some components. Figure 3 illustrates robot density as indicated in the most recent World Robotics report from the International Federation of Robotics. However, it is only an illustration, and there is no claim that the activity mix of those economies is the main driver for the choice of the number of robots. We argue, however, that in order to benchmark the adoption of certain non-GPT technologies, it would be best to have a model that provides a theoretical level for what is expected, rather than bluntly grouping different geographic areas which have multiple reasons for different levels of adoption. Designing such models requires time and effort, and is further complicated by our initial lack of understanding of the potential impact of new technologies. Cross-country comparisons, meanwhile, are fast, cheap and useful, but only to some extent. When reading these, however, one should always remember that they are, at best, a proxy for the real story behind those numbers.

5 As an aside, the debate about whether or not blockchain is a GPT, while existing, seems to be leaning towards the negative at the time of writing. See, for instance, Kane (2017)

This leaves us with a potentially worrying conclusion: we do not have a clear view of the state of the digitalisation of Europe, because we do not have a clear view of what it should be, given its unique characteristics. We are not the USA and we are not China. When looking at economic activity, we are somewhere in between in some regards, but not all. If we look at the access to information aspect, we are considered to be ahead of the USA. It is therefore not a matter of catching up with a supposedly optimal infrastructure, nor a question of improving on the existing ratios. It's about measuring things that make most sense in the situation that we are in. And this requires deciding what is important for us.

Therefore, the position that Europe is "lagging behind"[6] hinges on flawed data analysis due to our relative lack of understanding of those topics and the prohibitive costs of having better indicators. It nonetheless exists and seems to have more materiality than ever. This is likely due to the pervasiveness of large foreign brands in our daily lives. Our phones are increasingly Chinese and our social networks American. Europe is at the forefront in some digital technologies (mostly in the B2B sphere, as is the case of SAP, Celonis, UiPath, and for consumer-facing applications that benefit less from network effects[7] such as Spotify[8]) but it is generally agreed that there are still too few big European players in the digital hot markets.

6 As expressed, for example, in EIB (2019), https://www.eib.org/en/publications-research/economics/surveys-data/eibis-digitalisation-report.htm; FT (2018), https://www.ft.com/content/9b5c24fa-5df6-11e8-ab47-8fd33f423c09; MGI (2016), https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-europe-realizing-the-continents-potential

7 The phenomenon arising when the value of a solution depends on the number of other users already on board.

8 A review of European platforms is available in JRC (2017) – The reader will note, however, that most platforms shown in the report are relatively small in size. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC109190/jrc109190_jrc_mapping.pdf

2 Platform Economy and Structural Limitations

As citizens, much of our daily lives are lived on platforms. We have our social networks, our micro-blogging systems, our music listening and sharing apps… Most of our non-vital (and some vital) necessities are now provided through digital intermediaries, and few of them are run from inside the European Union.

Before delving into numbers, we should review the basics of the dynamics of platforms to understand the mechanisms at play. This has been a hot topic in economics, with most of the major thinkers of such phenomena tossing their hats into the ring[9]. Ultimately, much of the winner-takes-all aspect of platform business models in consumer markets stems from the idea that the value for an individual joining the platform is determined by the number of other people using the service. It is in everyone's best interest to join the most populous platform[10].

However, some platform models are naturally limited by physical conditions: it is unclear whether there is much to gain for a food-delivery platform rider if many new customers sign up from another city. These platforms are more likely to breed successful local competitors. But some platforms do not suffer such limitations, and even benefit from a wider geographical spread of its users. This is typically the case of social media. Indeed, a social network that would only allow you to connect with people you see daily would have less value than one that lets you share news with remote relatives and friends.

The combination of these two characteristics, the necessity to acquire as many users in as little time as possible and the comparative advantage of geographical reach, makes Europe a complicated ground to start such services. Indeed, if integration is in progress and the European people are increasingly connected, it is largely clustered at the national level, while the population graph across states in the US is likely more intertwined as a result of a common language and a longer history of economic integration.

Some of these limitations are to be overcome as the European project unfolds, but some, like the barrier of language, are fundamentally embedded in the European culture for the foreseeable generations to come. In the specific context of networks that connect individuals, Europe has fundamental limitations that will make it a complicated terrain for new ventures. In that scope, regulation of foreign actors makes sense.

A route to foster the emergence of European companies in the platform economy would be two-fold: firstly, by making it more costly for foreign companies operating under foreign business models to operate on European ground in their original way, and secondly, by making local solutions comparatively more attractive to European consumers in a way that offsets the limitations outlined above.

The first of these components is currently being put in place and entails the creation of rules and regulations aimed at compelling foreign companies to operate in a fashion consistent with European values. The General Data Protection Regulation (GDPR), and

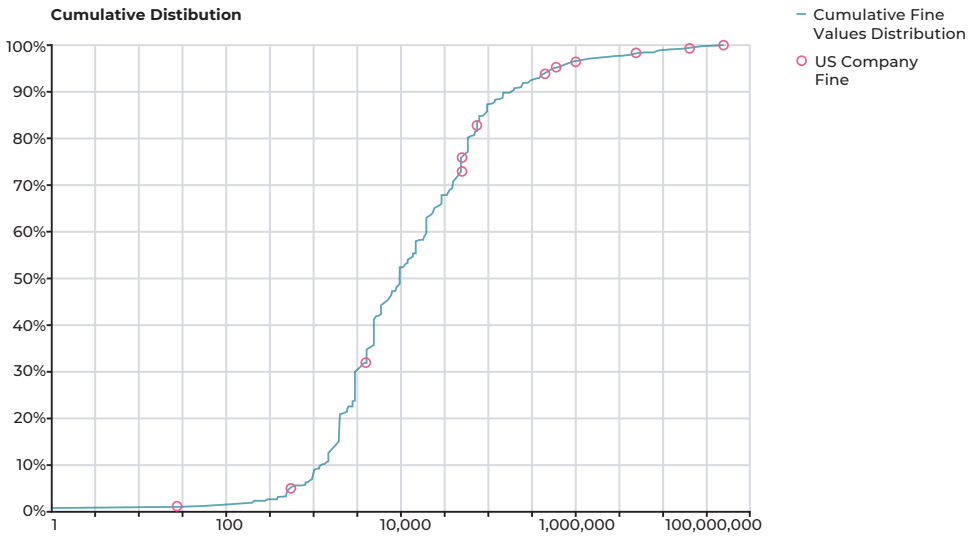
9 The interested reader may want to turn to the classic Tirole and Rochet (2003) for an early overview, or Armstrong (2006) for a competition view.

10 Except, obviously, for competitors of said platform.

the more recent regulation proposal on Artificial Intelligence, are perfect examples of such rules. Enforcement is a permanent challenge, and we are not yet able to accurately measure sensible effects from our available instruments.

FIGURE 5

Distribution of GDPR Fine Value and Position of US Companies



Source: GDPR Enforcement Tracker

A look at the value of the fines as highlighted in Figure 5 is interesting: while the large majority of companies that have been fined under GDPR were European (which would appear inconsistent with the goal of incentivising large foreign platform businesses to behave according to standards deemed compatible with European values), the prevalence of foreign companies among the large fines (the ones above 100,000 euros) is much higher than in the lower fine brackets.

While this is obviously to be read with the fact that transnational companies are more prevalent as a whole among companies with a high turnover (indeed, “crossing the pond” is still a large company’s game), this also means that, somehow, the GDPR, and, hopefully, the AI regulation that is to come, might be read using a double interpretation grid:

1. As a way to influence the actions of transnational companies on European soil.

2. As a way to “guide” smaller European companies to make them behave, from the onset, according to the norms in place across the Union and twisting their ways of operating to distinguish themselves from their foreign counterparts.

The media has largely emphasised the first role and somehow overlooked the second[11]. The numbers presented above, however, show clearly that those regulations, more than being primarily aimed at making foreign firms change their approach, are in fact much more frequently directed at European companies. As such, it is to be expected that, more than incentivising large data companies from overseas to change the way they operate, such regulations are, in the end, going to change the way we conceive the standards for doing business as Europeans.

11 See, for example, Politico (2018), https://www.politico.eu/article/the-gdpr-hit-list-who-stands-to-lose-from-europes-new-privacy-rules-facebook-google-data-protection/. In fact, some institutional documents frame the issue in this way, see for example the briefing in EPRS (2020), https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651992/EPRS_BRI(2020)651992_EN.pdf, on data sovereignty

The consumer also faces a choice whether they will join a platform that has merely adapted to their local situation in an ad hoc fashion and has a large array of users in another geographic zone, whether they are going to sign on to a local platform that has been built with local regulation in mind from the start, or whether they will stay out of the market. It is clear that the latter is not interesting, neither for the consumers nor the regulator. More interesting, and probably in line with this idea of having the European Facebook/Google/Twitter etc., is the switch that might be operated towards alternatives that have integrated the regulations in such a way that this became part of their core solution.

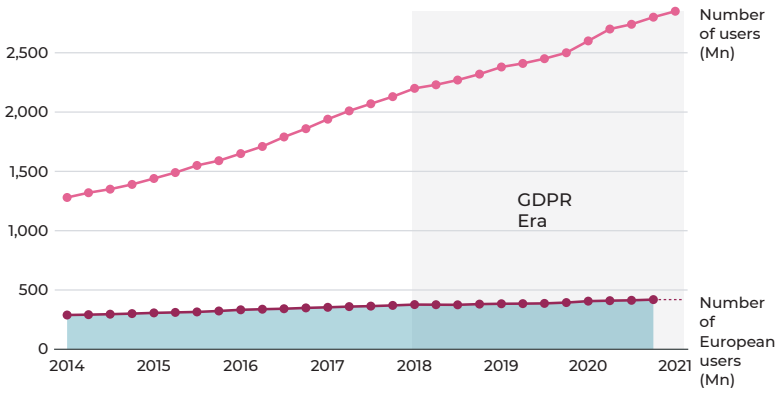
3 Ethics as a Business Model

It is undeniable that, as a consequence of recent regulations, not greedily collecting data on one's customers has become comparatively attractive. But then, why isn't Mastodon the new Facebook? There is still a gap to be bridged. This gap is the valorisation of ethics compared to convenience in online solutions. Figure 6 presents anecdotal evidence that the growth of Facebook users does not seem to have been specifically hindered by GDPR.

Circling back to the theory of platforms, the differential between a small and a large network, from a user perspective, is enormous. The inconvenience, or cost, of having one's data collected and sold to sometimes unidentified entities is simply not enough to compensate the value of being able to connect to one's friends[12] .

FIGURE 6

Number of monthly average Facebook users



Source: Facebook Press Releases

When using services that appear to be free, consumers often do not think explicitly about the price they put on their own participation. Their mere presence on these networks influences the value of those networks, not only for their peers, but also for the peers of their peers, etc.[13] If the presence of certain types of people on some platform makes a difference, so does a potential mass exodus. If somehow, critical users, in the sense in which those users would be both central in the network, or "very informative" in their behaviour, could be made to switch to other options, there might be an opportunity for a change in the competitive landscape and a potential place for local players to emerge.

12 One might wonder whether the possibility to connect with remote people is actually that valuable from the standpoint of the user. While probably discounted at the individual level, the value of remote users might go through indirect channels such as the presence of internationally connected local hubs. For example, academics are typically well connected locally while valuing international connection in their research communities, making them one channel through which exclusively locally connected citizens "benefit" from global social networks

13 A similar, yet weaker case may also be made for platforms that are not networks per se but derive their values from the behavioural profiling of other members.

This can be achieved through a change in the relative valuation of privacy and a fundamental effort in digital education. This is different, and complementary in nature, to building innovative capability inside the EU. This is not something that has to happen only in universities, or that aims at giving people technical skills. This is more closely related to the process of mass alphabetization in the wake of the first industrial revolution: although not directly related to the technology at the time, the switch to an industrial society became increasingly important, both for companies having to foster productivity and for society as a whole, to have a workforce that was able to read and write in order to ensure effective information communication. Per analogy, today's "literacy" might be conceived as the ability to read through ever more subtle processes of value capture.

Perhaps not entirely in line with the initial intent of the regulation, GDPR, for example, had a de facto educating effect on the population, as many people who had never heard of cookies or had never taken stock of how pervasive they were, now had the data laid out before their eyes as they opened a website. However, this data is often presented in a fashion that frames it as a technical rather than freedom-related problem. While the change in companies' behaviours is visible, we don't know whether users, previously unaware of the existence of cookies, are now conscious of the economic and legal consequences of them granting their approval or not. It is currently unclear if the burden imposed on European citizens when browsing the web to look at how their data is used and shared will eventually have an awakening effect or, on the contrary, make some of them long for times where they were happy not to know about the issue. In the latter case, this would give clear guidance that, besides the legal and enforcement aspects of the regulation, special care should be taken to the educational one, lest such measures be considered, on the long run, as counterproductive by the general public.

The emergence of European local players is therefore partially conditioned on an improvement of digital education. Unless extremely strong, costly and freedom-restricting laws are taken to regulate online activities (which, from a liberal standpoint, would probably be worrying), transnational platforms are here to stay while the general public does not see the value in more privacy respecting alternatives. It is hard to imagine a way for public institutions to directly influence the number of users of a new local solution, so the only channel left to influence is this question of personal valuation of privacy and, more generally, to make sure consumers have access to the all required information, both on the solutions and the underlying mechanisms at play, to make their choice.

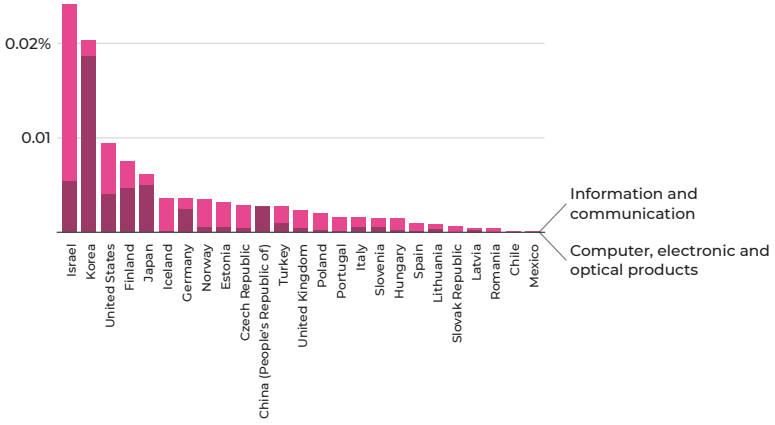
4 Time to think of what we don't know

What remains is to determine what every citizen should know before contracting with actors that will benefit from their buy-in. In an era of supposed "post-truth", the mere thought that a national or a supra-national entity might take interest in providing a common knowledge basis to its citizens may raise eyebrows and, yet, citizens' education is necessary. In a sense, in a world where we have business schools to teach how to sell products, it seems unfair not to have consumer schools to reduce information asymmetries on business-to-consumers markets.

This is where digital education comes into play. There are two prongs to the matter: ensuring that the education of digital specialists is consistent with the European way of doing business, and the guarantee that the consumers, no matter where or who they are, are aware of what they are getting into when using services ("free" or paid online).

FIGURE 7

Investment in ICT R&D per Country in 2018



Source: OECD - ANBERD

The first part of this challenge, referred to as "highly skilled digital professionals" in the Digital Compass program of the European Commission[14], goes further than a pure pursuit of excellence at university level. It is, rather, a matter of fostering innovation, both on the technical and business model side, an area where Figure 7 shows most European countries are behind, at least at the level of investments. It is a matter of "brain-washing"[15] our future engineers and entrepreneurs so that, once out and about, be it in Europe or elsewhere, they will be biased towards operating in a privacy- and individual-, public freedom-respecting and inclusive way. This is hard to measure and enforce, but might be a natural consequence of the recent legislation as European employers will look for professionals that will not only be able to come up with a technically advanced solution, but will avoid them getting fined by integrating ethics in the core of their solution.

14 For information about the Compass, see European Commission (2021).

15 Credits for this interesting allegory goes to Basanta Thapa who expressed this idea rather compellingly in a recent workshop.

At least as fundamental is the general improvement of the "basic" understanding of the digital and technological inner working by the general population. This concept is called "digitally skilled population" in the Digital Compass of the European Commission. This is where the challenge lies today. Official statistics give us a measure of the effort that remains to be done, as illustrated in Figure 8. We can expect, and observe, that most European citizens use a computer relatively frequently. But it seems most are content to use applications as they receive them and do not bother making them work more to their liking, let alone create new ones. While we cannot really compare this picture to the US (as the data is not published for this country), this gives a picture of the power that large software producers yield: by setting up defaults, they influence the way north of 70% of the European population is going to navigate the digital world and, de facto, the position most of the European (and, more generally, global) citizens on the economic chessboard. One could argue that the defaults are designed to correspond to the preferences of most users and, therefore, should rarely be changed. This argument is valid, but would warrant further exploration: users use myriads of apps and software, and thinking that most users have "standard preferences" across all the programs they use is akin to suggesting that, in their choice of transportation, most people actually prefer the same brand, make and colour of car.

Figure 8 illustrates the ratios and distributions of a selection of three indicators representing the digital sophistication on populations. If the EU average is never among the highest values, there are reasons to rejoice. Indeed, for each of those measures, some European countries are among the leaders. The Nordics (be them inside the EU or not), for example, are systematically on top.

In terms of digital citizenship, it therefore seems that the Union and its close neighbours have a head start, but the road ahead seems long. Again, there are two challenges: making sure that we, as consumers, are appropriately informed and therefore aware of the challenges of digitalisation, and that we are able to use the tools offered by new technologies to be both more productive and free.

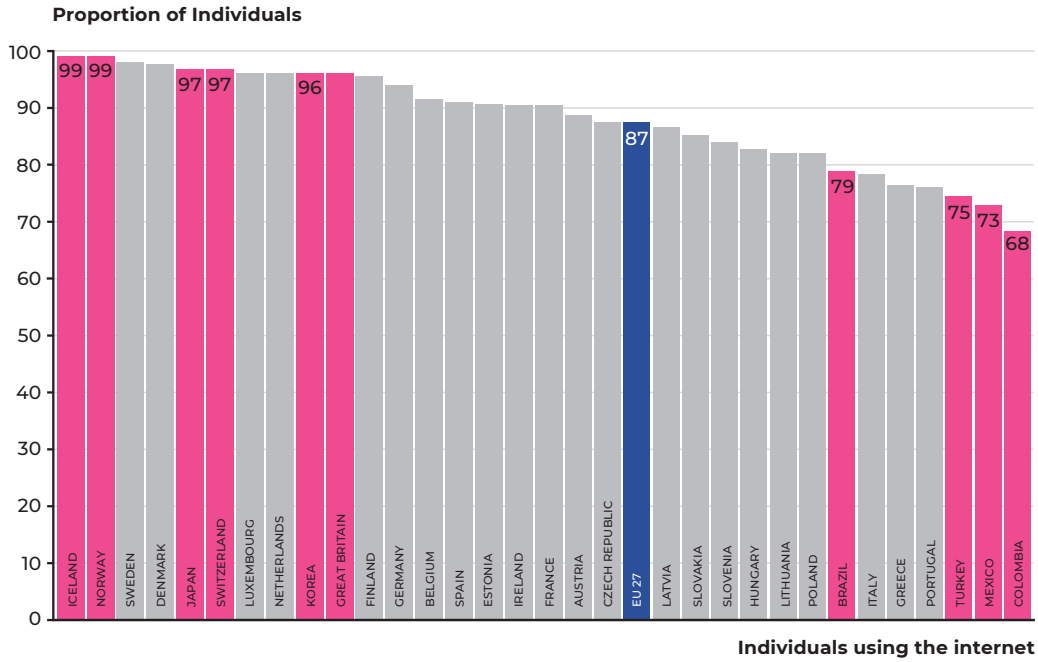
Computer and programming language literacy is becoming increasingly relevant, not only professionally, but in everyday life. We are assailed by information, and filtering it efficiently has now become a task that is impossible to perform on a case-by-case basis[16]. Think of the number of spams, advertisements and news we are exposed daily. Sifting through those and separating the wheat from the chaff is now impossible without the help of services provided by firms using artificial intelligence. The problem is that if you don't understand the economic model of a service, you are likely its product. Understanding even the basics of algorithmics and programming is both relatively easy and salutary in that respect. Teaching kids to program from an early age using Scratch or Minecraft blocks is fun and one of the most useful investments we can make to build a society where technology works for us. Teaching adults to configure their digital tools and, perhaps on a more basic level, to recognize and understand the business models in which they engage online, is paramount if we want them to invent new ones and put the existing ones to their best use.

In this situation where we are accustomed to see the situation as a race towards "digital supremacy", or something close to it, we are actually doing quite well compared to other parts of the world. But the winners will not be some parts of the world as opposed to others, but societies that will be ready and able to enjoy the great potential rewards of a digital economy, while avoiding the pitfalls in terms of freedom-restricting and rent-seeking.

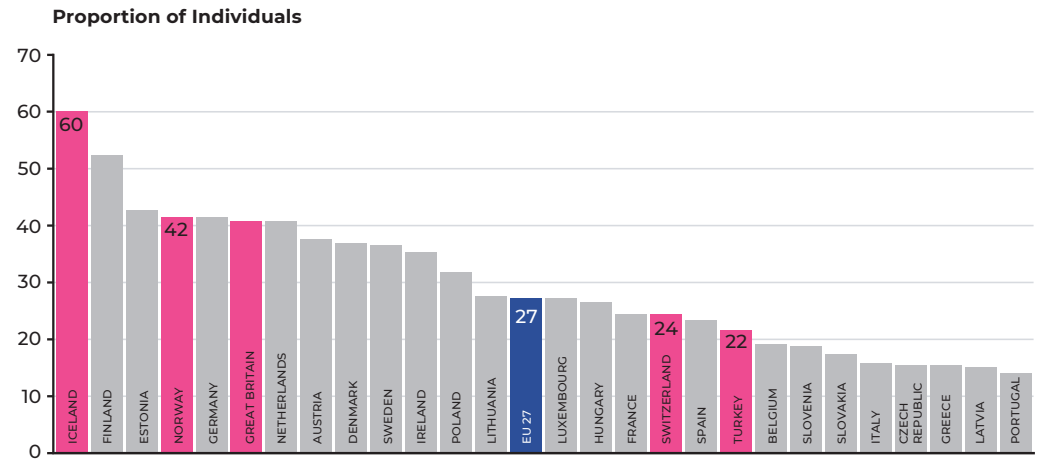
16 There is evidence that this happens in adults, but also among children. For a treatment at length of the question of filtering, the interested reader might want to consult the recent PISA report (OECD (2021). https://www.oecd.org/pisa/publications/21st-century-readers-a83d84cb-en.htm

FIGURE 8

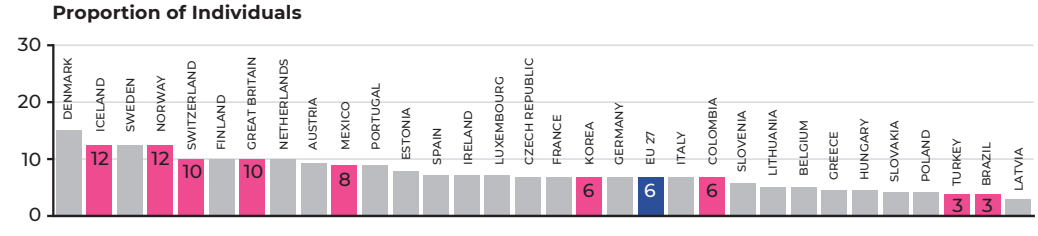
The funnel from Passive Consumer to Producer



Individuals using the internet



Individuals who have modified/verified the configuration of software application



Individuals who have written computer code

Source: OECD

5 What we have and what we want

Comparisons are always tricky. And sometimes, as in the matter of digitalisation, they are pointless. By all accounts, and contrary to what we sometimes might believe, the European Union is in balance, scoring relatively high on most indicators on the use of digital technologies[17]. Heterogeneity subsists inside the Union, but this is also the case in most large geographical areas, and this is a matter that seems to be on its way to be addressed by the Commission in the near future.

The real challenge is therefore not to operate a catch-up or leapfrog, but rather to determine a clear vision of where we want to be in the future, given our peculiarities as the largest economy in the world, but also as one of the most heterogeneous ones. Deciding how much we are ready to invest to have global players, despite adverse initial conditions for certain types of business, and how much of the sovereignty over their data and mass-media channels the European people are ready to relinquish in order to benefit from large networks and cheap services built through massive economies of scale that we cannot cheaply produce here, is paramount. Those choices must be discussed, but this discussion can only take place if people understand what is at stake and how much we stand to gain and lose from the alternatives.

Much in the same way as liberals were at the forefront of the movement that brought widespread alphabetisation in the wake of the first and second industrial revolution, making sure that people have the understanding required to choose what they believe is best for them is once again the challenge of the day. It is a complex challenge as it is difficult to operationalise, but it is also an area where Europe has competitive advantages: we have leading countries in the field, both inside the Union and next to it, and we already have a very well educated population and great talent. This, with some reforms towards fostering innovation and R&D in ICT and AI will surely strengthen the EU, well on the path that it is already trailing towards a fair, positive and profitable digitalisation.

17 The creation and appropriation aspects of these technologies, as well as the topic of innovation, are a different matter that would need to be treated elsewhere.

Literature

Armstrong, M. (2006). Competition in two–sided markets. *The RAND journal of economics, 37*(3), 668-691.

Bughin J., Hazan E., Labaye E, Manyika J., Dahlström P. Ramaswamy S, Cochin de Billy C. (June 29 2019) Digital Europe: Realizing the continent's potential, *McKinsey Global Institute,* https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-europe-realizing-the-continents-potential, retrieved June 9 2021

Cerulus L., Scott M. (May 23 2018) Who stands to lose most from Europe's new privacy rules, *Politico,* https://www.politico.eu/article/the-gdpr-hit-list-who-stands-to-lose-from-europes-new-privacy-rules-facebook-google-data-protection/ retrieved June 7 2021

CMS Law.Tax (2021) GDPR Enforcement Tracker, https://www.enforcementtracker.com/ retrieved May 29 2021

European Commission (2021) The Digital Compass. https://digital-strategy.ec.europa.eu/en/policies/digital-compass, retrieved June 8 2021.

European Investment Bank (April 20 2020), Who is prepared for the new digital age? – Evidence from the EIB Investment Survey, https://www.eib.org/en/publications/who-is-prepared-for-the-new-digital-age.htm retrieved June 8 2021

Fabo, B., Beblavý, M., Kilhoffer, Z. and Lenaerts, K., An overview of European Platforms: Scope and Business Models , Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77251-1, doi:10.2760/762447, JRC109190.

Facebook (2021) Press Releases of Quarterly Results, https://investor.fb.com/investor-news/default.aspx retrieved May 29 2021

Goldfarb, Avi and Taska, Bledi and Teodoridis, Florenta (May 8, 2021), Could machine learning be a general purpose technology? A comparison of emerging technologies using data from online job postings . Available at SSRN: https://ssrn.com/abstract=3468822

International Federation of Robotics (September 24, 2020), IFR Press Conference [presentation], https://ifr.org/downloads/press2018/Presentation_WR_2020.pdf retrieved June 8 2021.

Kane, Ethan (March 11, 2017), Is Blockchain a General Purpose Technology? Available at SSRN: https://ssrn.com/abstract=2932585 or http://dx.doi.org/10.2139/ssrn.2932585

Madiega T. (July 2020), Digital sovereignty for Europe, EPRS Idea Paper, European Parliament, https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651992/EPRS_BRI(2020)651992_EN.pdf retrieved June 9 2021

McGee P. (June 5 2018) Europe risks falling behind in digital transformation, *Financial Times,* https://www.ft.com/content/9b5c24fa-5df6-11e8-ab47-8fd33f423c09, retrieved June 9 2021

OECD (2019), *Measuring the Digital Transformation: A Roadmap for the Future,* OECD Publishing, Paris, https://doi.org/10.1787/9789264311992-en.

OECD (2021), *21st-Century Readers: Developing Literacy Skills in a Digital World,* PISA, OECD Publishing, Paris, https://doi.org/10.1787/a83d84cb-en.

OECD (March 30 2021), Analytical Business Enterprise Research and Development, https://www.oecd.org/innovation/inno/anberdanalyticalbusinessenterpriseresearchanddevelopmentdatabase.htm retrieved May 29 2021

OECD (2021), ICT Access and Usage by Households and Individuals, *OECD Telecommunications and Internet Statistics* (database), https://doi.org/10.1787/b9823565-en

OECD (2021), Value added by activity (indicator). doi: 10.1787/a8b2bd2b-en (Accessed on 8 June 2021)

Rochet, J. C., & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the european economic association,* 1(4), 990-1029.

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INSTITUTIONS

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