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Will the DSM Strategy Spur Innovation?

The European Commission identified the completion of the Digital Single Market (DSM) as one of its ten priorities in 2014. This vision was then sharpened with an ambitious and comprehensive strategy document in May 2015, and was later translated into several policy initiatives, covering every layer of the digital ecosystem and a plethora of economic sectors. All these actions will lead to a thorough overhaul of EU rules affecting the online economy, from the digital infrastructure to platforms, cybersecurity, e-commerce, copyright and media. Horizontal policies such as data protection, consumer protection and antitrust law are being reshaped to better fit the peculiarities of the online environment. The Commission has adopted as many as 35 legislative proposals dealing with the digital economy since May 2015, including a thoroughly revised e-communications package and new rules on parcel delivery, VAT for e-commerce and copyright. It has also outlined a vision for a European Gigabit society, an agenda for regulating online platforms, strategies for very high speed broadband and the Internet of Things (IoT), and an early framework for 5G wireless communications. Furthermore, in mid-2018, the Commission will publish a Communication on artificial intelligence (AI), which will also elaborate on the issue of employment, a topic which was already explored in a first concept paper in 2017.[1]

These initiatives are expected to deliver massive benefits in terms of growth and to stimulate innovation and entrepreneurship by providing economic operators with simpler and more predictable rules that are applicable throughout the territory of the EU. However, the DSM mosaic still seems to be lacking some important bits due to the inadequacy of some of the rules and because of the complex interplay between the EU and the member states in key issues such as education and skills. In addition, it must be recalled that political agreement still needs to be reached on most of the proposals with the European Parliament and the Council. This is why the Communication on the mid-term review of the DSM strategy recently adopted by the Commission showed only very cautious optimism on the potential of the strategy to achieve its ambitious goals. This short paper discusses the extent to which the current DSM strategy reflects the peculiar features and evolution of the digital economy, and it draws some resultant policy implications for the EU.

Understanding the digital mosaic: layers, platforms, users, norms

The digital economy is normally described as a layered ecosystem, in which the infrastructure layer (whether fixed or wireless) sustains and supports the working of higher layers, such as applications and services (see Figure 1). In this context, the quality and availability of applications and services also nurtures the demand for better infrastructure. In other words, in the DSM, very high-speed infrastructure is more and more essential to the application and service layer, as high-capacity networks critically affect what is feasible in the application and service layers. For example, the development of IPTV and Voice over IP services was not possible until the underlying infrastructure reached a sufficient level of speed, reliability, capacity and stability. This development was also aided by complementary innovations, such as the emergence of content delivery networks that can effectively convey and cache traffic that is then delivered to the end user with seamless quality, by advanced traffic management and compression techniques that made it possible to ship more traffic by using less bandwidth, and by the softwarisation of network functions, e.g. software-defined networking (SDN), which reduced the cost and improved the effectiveness of traffic routing across the Internet. All innovations that affect the function of one layer also determine changes in the working of other layers. For example, geo-location services, which are made possible by infrastructure developments, enable a plethora of new services and applications, from advertising nearby shopping opportunities to geo-fencing for self-driving cars and even location-based filters for social media. Similarly, new services that boost demand for traffic, such as Netflix, critically affect the incentives of Internet service providers (ISPs) to invest in new infrastructure to manage demand and safeguard the user experience.

Together with its underlying technologies, the architecture of the digital ecosystem is also constantly evolving and adapting to the growing complexity of the environment. The explosion of Internet traffic in the past decade, powered by parallel streams of evolving technologies (data storage, broadband communications, data compression, innovation

1 European Commission: A concept paper on digitisation, employability and inclusiveness – the role of Europe, DG Communications Networks, Content &Technology (CONNECT), May 2017, available at ec.europa.eu/newsroom/document.cfm?doc_id=44515.

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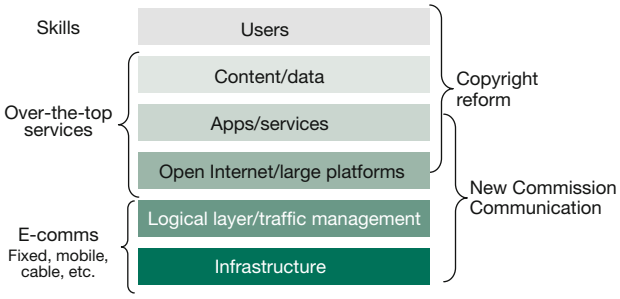
Figure 1
The layered architecture of the Internet



Source: Author's elaboration.

in traffic management), led to an emerging need for solutions that would reduce complexity. This solution was developed spontaneously by market forces, with the emergence of vertically integrated platforms that mediate between the application layer and end users and compete for a share of users' increasingly scarce attention. Platformisation, in other words, was a necessary solution in view of the ongoing complexity and richness of content and services available on the open Internet. Today, platforms are emerging in a myriad of sectors, with verticals increasingly being challenged by generalist giant platforms that exploit their grip on the end user's attention to offer a variety of services. These diverse players dynamically co-exist in the market, as they compete with one another for users' attention but also promote each other through positive externalities and traffic redirection.

Besides technological innovation and the evolution of user preferences and tastes, legal rules also affect the direction and speed of the evolving digital economy. For example, network neutrality rules may have both a distributional impact (e.g. redistributing revenues from the infrastructure layer to the application and content layers) and an absolute impact on ecosystem growth (with mandatory network neutrality often regarded as impacting incentives to deploy new infrastructure, and network diversity often regarded as hampering permissionless innovation at the higher layers). Rules constraining the free flow of data or text and data mining can have a direct impact on the expansion and speed of the Internet. And rules that mandate the interpretability of algorithms by end users can impinge on the development of AI-powered applications. In this respect, the "efficiency imperative" of the digital ecosystem often clashes with the ethical and policy constraints that reflect the preferences of given communities and legal systems. For example, while extensive user profiling may be acceptable in the United States or in China, it is much less welcome in Germany and other EU member states. This not only has legal and ethical implications but also economic consequences, as users will tend to use the Internet more if the services and architecture reflect their sensitivity towards privacy and data protection.

Against this background, sustainable digital innovation can be seen as the result of the simultaneous, harmonious development of various layers and platforms, which retain their peculiarities in terms of pace of evolution, actors involved, and modes of interaction between players. More specifically, Claffy and Clarke define the ICT ecosystem as a perfect setting for co-evolution.[2] They explore the natural rate of change of various components of the ICT ecosystem, in which some interdependent actors have a natural tendency to evolve faster than others (see Figure 2).[3] The *physical* (lowest) layer experiences a rate of change limited by labour and sources of capital, neither of which follow a Moore's Law cost function.[4] At the *network* layer (based on the Internet Protocol, or IP), the durability of the specifications of the core protocols provides a stable foundation for rapid innovation at other layers. At the *application* layer, the process of innovation is driven at almost frantic rates, which Clarke and Claffy estimate as holding a potential for ten improvements in underlying technology every five years.[5] At the *information* layer, the creation, storage, search and retrieval of essentially all forms of data – information, content, knowledge – is moving online. Finally, the *people* level displays a transformative empowerment from the deployment of technology in the hands of humans. But the growth of human capabilities is in no way consistent with a Moore's Law curve.[6]

These different paces of technology integration across the ecosystem also influence the stability and agility of firms. Companies that have invested in physical assets like fibre to the home, towers or data centres can sometimes earn a stable place in the ecosystem through that investment, although a bad technology bet can leave them disadvantaged by a stranded investment. Moreover, firms with extensive

2 K.C. Claffy, D. Clark: Platform Models for Sustainable Internet Regulation, in: Journal of Information Policy, Vol. 4, 2014, pp. 463-488; and D.D. Clark, K.C. Claffy: Anchoring policy development around stable points: An approach to regulating the co-evolving ICT ecosystem, in: Telecommunications Policy, Vol. 39, No. 10, 2015, pp. 848-860.

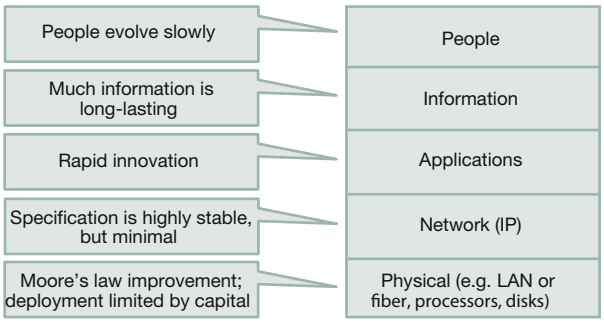
3 In particular, they observe that "the rapid pace of Moore's Law drives rapid innovation in the private sector, lending advantage to those who invent, discover, or adapt to new technologies sooner than others. But as technology is integrated into industry and society, different parts of the ecosystem exhibit different dynamics, subjecting each part of the ecosystem to evolutionary constraints."

4 The ongoing transition to optical fibre networks is expected to bring a quantum leap in capacity, which will pay dividends for several decades. Cloud computing is another example of the interplay of Moore's Law and capital investment. The large data centre infrastructures supporting cloud computing benefit from both rapidly advancing technology and ever increasing massive arrays of computers. The limit to the capacity of a data centre is not primarily Moore's Law, but construction and operational costs.

5 D.D. Clark, K.C. Claffy, op. cit.

6 As Clarke and Claffy observe, "We do not get twice as smart, or twice as capable of processing information, every 18 months. So we drown in information overload, and call for even more technology to control the flood, which makes us even more dependent on the technology." Ibid., p. 850.

Figure 2
Layered ICT ecosystem and pace of evolution



Source: D.D. Clark, K.C. Claffy: Anchoring policy development around stable points: An approach to regulating the co-evolving ICT ecosystem, in: Telecommunications Policy, Vol. 39, No. 10, 2015, pp. 848-860.

physical infrastructure investments also cannot easily move and typically remain domestic except through mergers and acquisitions of firms in other countries. In contrast, firms at higher layers in the ecosystem are more likely to be based on an idea (like Facebook) than on heavy capital investment. The ecosystem experiences constant pressure from application innovators who seek new capabilities from the physical layer (e.g. more capacity to the home), even if the investment in those capabilities must be made by a different set of firms. According to Clarke and Claffy,

> [t]his tension is a classic example of co-dependency and co-evolution within the industrial part of the ecosystem, where applications are limited in their ability to evolve by the rate at which the physical layer can evolve. Because the application layer depends on the physical layer, the application layer cannot simply out-evolve the physical layer, but is gated by it.[7]

Based on the above, Renda observes several features of innovation in the digital ecosystem:[8]

- *Diversity*: Innovation takes place in different ways across layers. More traditional, R&D-based innovation characterises the hardware layers, even if open, distributed innovation models are becoming more commonplace in those layers as well. Conversely, the application layer is typically characterised by new business models and organisational innovation rather than by new technological improvements. And while openness seems to be an increasingly defining feature of all layers of the ICT ecosystem, the degree of granularity reached by more virtualised layers such as cloud-based platforms and applications is unrivalled in the "physical layer".

- *Co-evolution*: The pace of innovation differs across layers. The higher the layer, the more intangible the investment behind new products and services and the faster the pace of innovation. This also applies to the competitive race for each layer: while the physical layer has shown a relative degree of stability over time, the higher layers feature a constant rise and fall of dominant players, and even when players manage to remain prominent for a significant period of time, they do so at the cost of massive investment in new products and services, new markets, and in the acquisition of smaller players.

- *Co-dependency*: The pace of innovation at each layer is dependent on the evolution of other layers. The existence of a robust, high-capacity network and the development of facilities such as Internet exchanges and data storage networks determine the evolution of the higher layers. For example, the app economy could develop only once the underlying mobile infrastructure and cloud platforms became well developed. And countries in which the infrastructure has greater capacity experience more developed and dynamic application and content layers. The video streaming market, for example, was able to develop earlier in the United States thanks to the existence of high-speed broadband networks such as cable operators using DOCSIS 3.0 and optical fibre networks built by ISPs.

- *Expansion*: The digital ecosystem is in constant expansion. This has to be fully taken into account in designing the DSM strategy. The peculiarities of the digital ecosystem are gradually permeating into the dynamics of innovation and the re-intermediation of many other sectors, and they are also creating entirely new sectors. This is one of the aspects that make this ecosystem most intractable for policymakers: as its peculiarities evolve, its specificity is declining, and its pervasiveness and sheer magnitude are rising.

All these features are important when it comes to assessing the prospective impact of the DSM strategy on sustainable innovation, and consequently on jobs and growth in Europe. Obviously, innovation does not happen "by law", but the right policy mix can positively affect its direction and speed.

The impact of the DSM strategy: towards sustainable innovation?

Based on the previous section, the impact of the DSM strategy can be gauged under a "layered" perspective, by looking at the extent to which EU rules are evolving towards the

7 Ibid., p. 850.
8 A. Renda: Selecting and Designing European ICT Innovation Policies, Report for the European Commission, Joint Research Centre Science for Policy Report, Luxembourg 2016, Publications Office of the European Union.

harmonious development of the digital environment. While a full analysis of the prospective impacts is beyond the scope of this short paper, several elements can be highlighted.

At the *infrastructure layer*, it is widely acknowledged that the EU regulatory framework, while promoting the massive entry of new players by mandating network sharing, has not been able to mobilise resources for sustainable infrastructure investment and competition, as has occurred in other legal systems. In this context, the most important recent policy initiatives include the new proposed e-communications code and soft law such as the 5G action plan and the vision for a Gigabit society. However, while many of the proposed changes appear meaningful, overall the proposal does not entirely reflect the lessons learned from the past two decades of e-communications policy in Europe. It ends up being at once too conservative (i.e. incremental with respect to legacy rules); fragile, since its effectiveness crucially depends on governance reform; and "retro", since it does not incorporate principles of flexible, adaptive regulation in its overarching framework. As a result, innovation might be hampered not only at the infrastructure layer due to scant incentives, but also at higher layers, especially where capacity, latency and speed are essential for the rapid flourishing of innovative services.

At the *logical layer*, it will be very important to monitor the impact of the rules on network neutrality, which entered into force on 30 April 2016 following the adoption of Regulation (EU) 2015/2120. So far, the new rules seem to have had limited impact on market behaviour, due in part to the fact that the past regulatory framework led e-communications operators to lose revenues and power to the over-the-top (OTT) players, some of whom have gained significantly greater bargaining power vis-à-vis network operators. Also, regulatory uncertainty surrounds the treatment of zero-rating offers, for which there are some clear prohibitions, but where much is also left to case-by-case analysis.

At the *application and content layers*, several new provisions can affect incentives to innovate and create jobs in Europe. In particular, while competition enforcement and neutrality rules seem to move in the direction of platform neutrality, the rest of the EU *acquis* seems to be shifting towards platform responsibility. While the need to preserve and, most importantly, enforce security and privacy rules would inevitably lead to more responsible cooperation between public authorities and large online intermediaries, the current regime appears to still be a mixture of incompatible principles. In this respect, regulatory coherence appears to be the most important goal to achieve in the years to come: a complete, REFIT-style review of all existing rules is needed to ensure that market players face a streamlined regulatory framework. For example, new proposals on e-commerce and the Audiovisual Media Services Directive encourage platforms to put in place measures to actively monitor their content, for reasons that range from protecting minors from harmful content to avoiding hate speech and curbing terrorist activity. The most difficult battle will probably be the review of the copyright *acquis* presented in September 2016. It contains changes to intermediary liability law that would require online services to monitor the uploading of user-generated content, and it unconvincingly addresses the issue of text and data mining, which is essential for future data-driven innovation.[9]

The *user layer* is probably the most complex for EU policymakers. On the one hand, consumer protection is becoming an obsolete, overly narrow concept, and it should be replaced by a set of rules that can achieve meaningful user empowerment. This implies that users would not simply be protected but would be given the possibility to safely exercise their right to choose various mixes of privacy, security and quality of service. A smart user empowerment policy should also make more use of behavioural instruments (e.g. default rules and other nudges) to ensure that end users do not end up in unwanted situations due to behavioural biases and rational ignorance. Even more importantly, education and skills are going to play a fundamental role, and school and university systems must foster widespread e-skills and digital literacy among both firms and citizens. Importantly, the skills needed are not a single set, but rather a combination of notions, capabilities and attitudes that can help fill all the gaps in the EU job market, at various layers of the digital ecosystem. The recommended skill set includes, inter alia, coding skills; creativity skills; science, technology, engineering, and math (STEM) education; cross-disciplinary skills; managerial skills; financial and accounting education; and leadership and teamwork skills.

Against this background, it is probably *horizontal policies* such as data protection, competition policy, and IP and technology transfer rules that exert the most important impact on the overall environment for investment and innovation. In this respect, the General Data Protection Regulation (GDPR) appears as a very structured and solid framework to ensure that innovation moves in a socially sustainable direction in the EU.[10] At the same time, some of its provisions will require abundant work and disruptive changes in existing business models, especially with regard to users'

9 A. Renda et al.: Ex-Post Impact Assessment on the Implementation, application and effects of Directive 2001/29/EC on the harmonisation of certain aspects of copyright and related rights in the information society (InfoSoc) and of its related instruments, Study for the European Parliamentary Research Service, 2015, available at http://www.europarl.europa.eu/RegData/etudes/STUD/2015/558762/EPRS_STU(2015)558762_EN.pdf.

10 European Parliament: Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), in: Official Journal of the European Union, L 119, 4 May 2016.

right to obtain an intelligible explanation of the functioning of algorithms that apply to them.[11] Concerning competition policy, the EU still seems to be adopting a structuralist approach, in which static competition seems to be preferred to dynamic, winner-take-all rivalry that is typical of some parts of the Internet. While this approach may have some merits, its current application seems to rely on relatively obsolete tools such as a traditional market definition and a notion of dominance that neglects the actual competitive dynamics emerging between online platforms.

Conclusions

All in all, the DSM strategy can exert a positive impact on innovation, but only under specific conditions. First, the rules in place have to be as predictable and streamlined as possible. Currently, there are too many areas of inconsistency and overlap, which potentially puzzle prospective investors and entrepreneurs. This is particularly visible in infrastructure policy (most acutely in spectrum policy), in copyright reform and in horizontal policies such as antitrust and consumer protection. Also in the case of artificial intelligence, the Commission seems to be adopting too many diffuse initiatives with no meaningful coordination.[12] Rules have to be consistent, clear and easy to comply with. Their stringency, when accompanied by good governance and design, may promote innovation rather than limiting it. This is the case, for example, with the new set of rules on privacy contained in the GDPR and in the e-Privacy regulation, which – if properly and not disproportionately enforced – can positively affect the direction of innovation and the services that are offered in the European market.

Second, the more pervasive the digital ecosystem becomes, the more sector-specific regulatory frameworks should be merged into general regimes. In this respect, the best digital agenda is the final one to be called "digital", as in the coming years, there will be less room for differentiating rules based on whether they apply on- or offline. This is the case for consumer protection policies: rather than extending the *lex specialis* currently applicable to e-communications operators to OTTs, modernised, horizontal consumer protection legislation should be adopted. Similarly, tort rules should be updated to clarify obscure aspects such as strict liability for damage caused by algorithms, or joint and several liability for cases of interaction between algorithms.

Third, it is important to gauge the impact that each policy initiative will have on the ecosystem as a whole. A more pragmatic approach is emerging in the area of infrastructure deployment, but EU institutions still seem to be partially aware of the huge opportunity cost of delaying deployment of fixed and wireless very high-capacity networks. Even more importantly, the digital ecosystem has undergone extensive platformisation and servicification, and while this has led to more concentration in some of the layers, it has also lowered barriers to entry at higher layers and created positive externalities for both higher and lower layers. The complexity of these impacts is often neglected by policymakers.

Fourth, the DSM strategy should be made more flexible, adaptive and co-regulatory. The growing use of algorithms and deep machine learning, the difficulty in enforcing rules that require the proactive cooperation of private players (e.g. privacy, cybersecurity, hate speech, fake news), and the breathtaking pace of technological evolution determine the need for public-private cooperation and a more flexible, deossified approach to policymaking. This might entail more technology-enabled regulation, as in the case of algorithm auditing, and algorithm-based differential privacy regimes.

Fifth, besides well-designed rules, the extent to which the DSM creates innovation and jobs rests on Europe's ability to promote the diffusion of innovative technologies and services. Rather than an innovation gap, the EU suffers from a diffusion gap, which is echoed in a number of widening divides: between cities and rural areas; between leading and lagging countries; between frontier, laggard and even "zombie" firms; between richer and poorer individuals; and between technology-savvy and less e-skilled end users and businesses. These gaps are so pronounced that they can be subsumed together as the main causes of a 21st century paradox, as recently observed by Soete et al.[13]

In summary, the DSM strategy appears laudable and overall very comprehensive. However, its impact will depend on whether the Commission manages to create a more suitable environment for innovation and entrepreneurship by upgrading skills, promoting more adaptive rulemaking, empowering end user choice, and avoiding rules that are hostile to innovation, such as excessive restrictions to text and data mining and the extension of obsolete rules to OTTs. On all these fronts, unfortunately, progress has been limited during the first years of the DSM strategy, and this might end up hampering Europe's long-awaited journey towards economic recovery and technology leadership.

11 B. Middlestadt et al.: The Ethics of Algorithms: Mapping the Debate, in: Big Data & Society, Vol. 3, No. 2, 2016, pp. 1-21.

12 For example, different units in DG CONNECT, DG R&I, DG JUST and DG FISMA are all launching their own initiatives.

13 L. Soete et al.: Europe's Future: Open Science, Open Innovation, Open to the World. Reflections of the RISE High Level Group, European Commission, Luxembourg 2017, Publications Office of the European Union.