Secondary Publication

Eckardt, Martina

EU digital law and the digital platform economy : an inquiry into the co-evolution of law and technology

Date of secondary publication: 12.05.2025

Version of Record (Published Version), Article

Persistent identifier: urn:nbn:de:bvb:473-irb-1082279

Primary publication

Eckardt, Martina (2025): EU digital law and the digital platform economy : an inquiry into the co-evolution of law and technology, in: Review of evolutionary political economy : REPE, Cham: Springer Nature Switzerland, Vol. 6, Nr. 1, pp. 183–213, doi: 10.1007/s43253-024-00135-z.

Legal Notice

This work is protected by copyright and/or the indication of a licence. You are free to use this work in any way permitted by the copyright and/or the licence that applies to your usage. For other uses, you must obtain permission from the rights-holders.

This document is made available under a Creative Commons license.

The license information is available online:
https://creativecommons.org/licenses/by/4.0/legalcode

Review of Evolutionary Political Economy (2025) 6:183–213
https://doi.org/10.1007/s43253-024-00135-z

ORIGINAL PAPER

EU digital law and the digital platform economy—an inquiry into the co-evolution of law and technology

Martina Eckardt[1,2]

Received: 24 July 2024 / Accepted: 2 October 2024 / Published online: 5 November 2024
© The Author(s) 2024

Abstract

EU digital policy is currently one of the most ambitious and far-reaching endeavors to regulate the digital economy. Online platforms in multisided markets with digital ecosystems lie at the heart of digital technologies and business models. Among others, they pose new challenges with regard to the abuse of a dominant market position, thus ultimately reducing competition and innovation. This paper outlines an evolutionary approach to the co-evolution of law and technology with collective cognitive constructs and wealth effects as essential drivers (Eckardt (2001, 2008). It is then applied to the evolution of EU law in this field. After an overview of the evolution from telecommunication monopolies to the current digital platform economy, a case study presents firstly the *Google Search (Shopping) case* (2010–2024). Based on traditional EU competition law, it resulted in gradual judge-made legal innovation. It also generated new knowledge about the shortcomings of the ex post approach of EU competition law when applying it to the digital platform economy. As a consequence, secondly, the introduction of the *Digital Markets Act* (DMA) (2020 onwards) as a radical statutory innovation is discussed. The DMA introduced a novel ex ante regulation for large online platforms to overcome the problems of traditional EU competition law. Finally, the paper reflects on the impact of wealth effects and the (co-evolving) cognitive constructs of the relevant players as drivers in this current example of the co-evolution of law and technology. The paper concludes with an outlook on further areas of empirical and conceptual research that can provide a better understanding of the co-evolution of law and technology and allow for better policies in regard to disruptive technological innovation.

Keywords Big tech · Digital platforms · EU Digital Markets Act · Market power · Legal evolution · Technological change · Co-evolution

JEL Classification K21 · K24 · K4 · L86 · O31 · O33 · O38

✉ Martina Eckardt
martina.eckardt@uni-bamberg.de

[1] University of Bamberg, Bamberg, Germany

[2] Andrássy University Budapest, Budapest, Hungary

1 Introduction

EU digital policy is currently one of the most ambitious and far-reaching endeavors to regulate the digital economy. Digital transformation not only creates huge benefits, but poses also a number of far-reaching challenges to society due to its disruptive impact on economic structures (Kerber 2023). Online platforms in multisided markets and their digital ecosystems lie at the heart of the digital platform economy (Acs et al. 2021). Digital data has become an essential and valuable economic resource in the digital world. Since online platforms in multisided markets and digital data are of more recent historical date, legal regulation of the digital economy is still in its infancy.

Nevertheless, in the EU, a number of regulations have been put into force or are awaiting enactment to cope with some of the resulting challenges. The *General Data Protection Regulation* which is concerned with privacy issues regarding personal data was enacted in 2016 and put into force in 2018. It stimulated a number of similar regulations in other countries (Bradford 2020, 131–156; Petrova 2019). The *Digital Markets Act* (DMA) regulates big online platforms ("gatekeepers"), it was implemented in 2022 and is applicable since March 2023. The *Data Services Act* deals with the digital content of online platforms. The *Data Governance Act*, which also entered into force in 2023, is aimed at increasing data availability and facilitating voluntary data sharing. The *Data Act* was enacted at the end of 2023. Among other things, it deals with non-personal data and introduces new mandatory rights for users to access, use, and share data generated by IoT devices. Most recently, the *Artificial Intelligence (AI) Act* was passed in 2024 which deals with the risks of using AI technologies.

Digitalization is a disruptive technology that brings enormous benefits, but also poses previously unknown problems. Therefore, the current EU regulation of the digital economy is more characterized by experimenting than by knowing what the best rules are to solve emerging, sometimes novel, problems. From an evolutionary economics point of view, EU digital policy can be conceptualized as a trial-and-error process where novel legal regulation is enacted to cope with the challenges posed by the disruptive new digital technologies although it is still far from clear whether the rules enacted could solve the regulatory problems (Kerber 2023).

While innovation and change are at the core of evolutionary economics, there is still a lack of understanding of the co-evolution of technological innovation and legal change. There is a broad literature that deals with technological innovation and market evolution, both theoretically and empirically, however, with an often implicit optimistic notion that technological innovation is mainly welfare enhancing (Borrás & Edquist 2019; Robert & Yoguel 2022). In this literature, the law—which is part of the institutional framework ("rules of the game," North 1990)—is mostly treated as exogenous or given while its impact on innovation is analyzed. This holds not only for approaches that use a rather linear innovation model, but also for approaches with a more holistic perspective. The literature on technological innovation systems, for example, analyzes

institutions and thus also legal regulation primarily in relation to the innovative capacity of technological innovation systems (Borrás & Edquist 2019, 34f.). Thus, the interdependence of technological and legal change is still underexplored. This results in a lack of our understanding of the impact of (radical) technological innovation on legal change and vice versa. This holds in particular for the novel problems technical innovation might pose and for which legal regulation could provide an adequate socio-technological problem–solution (Nelson & Sampat 2001). But it also refers to the mechanisms through which the co-evolution of law and technology takes place. As a consequence, we still have only limited knowledge of the co-evolution of law and technology. Consequently, there is also a lack for giving adequate policy advice regarding the timing and content of novel legal regulations in light of the current problems posed by digital transformation.

This paper therefore makes two contributions to the literature. Firstly, it contributes to the conceptual analysis of this co-evolution of law and technology with a particular focus on legal evolution in relation to technological innovation. Following Deakin and Markou (2021, 695), the "dynamic, processual and experimental character of legal change" is emphasized. Based on the approach by Eckardt (2001; 2008), wealth effects and collective cognitive constructs are explored as essential drivers in the co-evolution of law and technology. Secondly, this approach is applied to the current evolution of EU digital regulation regarding dominant market positions of online platforms of the major US tech firms and the associated digital ecosystems. Fair market competition plays an important role in innovation systems since "a level playing field for market interactions reduces uncertainty and manages conflict/cooperation in cross-firm innovation interactions" (Borrás & Edquist 2019, 173). Because the ex post approach of traditional EU competition law is no longer seen as sufficient to ensure competition and limit market power, the DMA was introduced in 2022. It is a genuine legal innovation that is intended to restrict the economic power of large online platforms and guarantee competition and innovation in the digital platform economy. Based on a case study on the evolution of EU competition law, this paper applies the outlined evolutionary approach to the co-evolution of law and digital technology and thus also contributes to our understanding of the co-evolution of institutions and technology in general.

The paper is structured as follows. Section 2 outlines the theoretical framework for analyzing the complex interrelationship in the co-evolution of law and technology to guide the following analysis. Section 3 looks at the evolution from telecommunication monopolies in the 1980s to the current digital platform economy and the challenges it poses. Section 4 then presents the case study on how the EU attempts to regulate the market power of the major online platforms. It shows the evolution from traditional ex post–oriented competition law (Sect. 4.1) to the novel ex ante approach of the DMA (Sect. 4.2) and finally discusses the case study with respect to the underlying co-evolutionary processes of law and technology (Sect. 4.3). Section 5 concludes and provides an outlook for further research.

2 The co-evolution of law and technology—a theoretical framework

Co-evolution takes place when "two (or more) evolving domains (…) causally influence each other in such a way that this multidirectional influence shapes the innovation, replication or selection processes that are specific to each domain. In this way, the multiple evolving realms linked by coevolution are dynamically codetermined" (Almudi & Fatas-Villafranca 2021, 9). In the following the mechanisms that account for such a co-evolution of law and technology are outlined based on Eckardt (2001; 2008), starting with technological evolution followed by legal evolution and ending with a discussion of two main drivers of their co-evolution (see Fig. 1). These are based on a variation-selection-retention approach as part of a general theory of economic evolution that is not limited to an analogy with the theories used in biology (Nelson 1995, 54; 2018; Deakin & Markou 2021, 695 fn71).

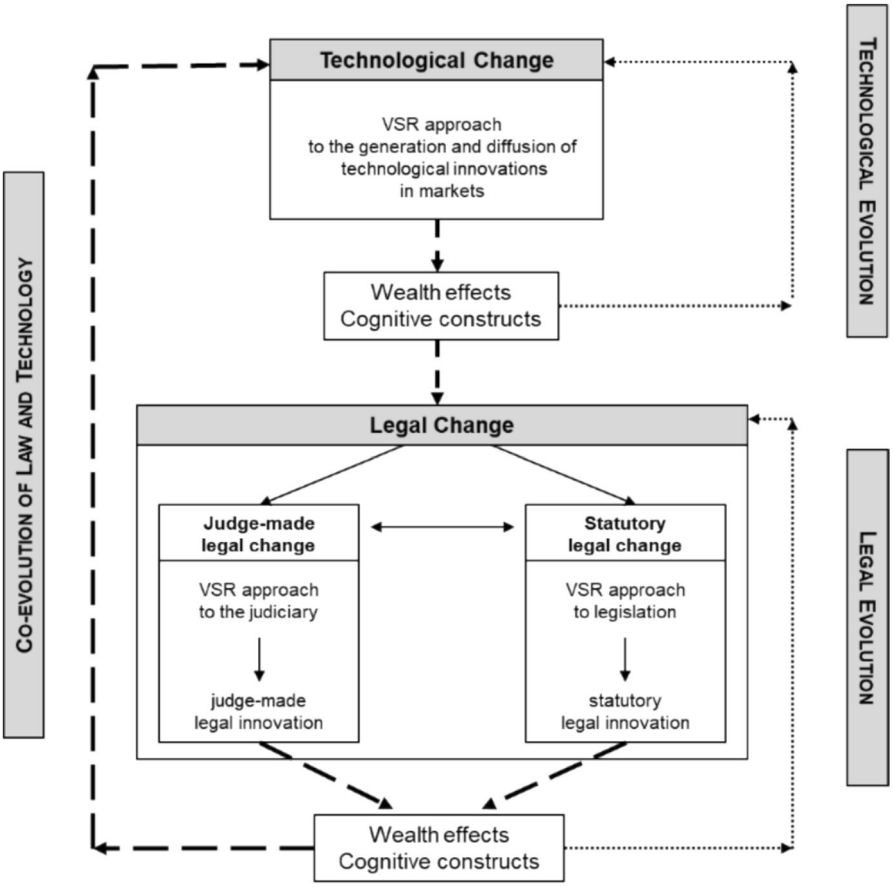

Fig. 1 Co-evolution of law and technology Source: Own composition based on Eckardt (2008) p. 458, Fig.2

In modern market economies, *technological change* is usually not an end in itself, but an integral part of economic activities on the markets (Saviotti 2023). Based on Hayek's idea of "competition as a discovery process" (Hayek 1968/2002) and Schumpeter's notion of competition as a process of innovation and imitation (Schumpeter 1934), economic activities on markets can be characterized as trial-and-error processes (Kerber & Saam 2001; Kerber 2006; Podszun 2024a). Firms test hypotheses as to which novel products and services might be positively valuated by consumers and generate the necessary sales and profits for the firms to stay in the market. In this respect, competition is a decentralized process of parallel testing hypotheses on the viability of novel products and services. It is the competitive mechanism that provides the knowledge about which innovations are accepted by consumers. While variations of products and services are generated by the innovation activities of firms, markets serve as the economic selection environment where consumers decide which innovations will be retained over time. In this evolutionary market process, ongoing technological change plays an important role since successful technological innovations give firms a competitive advantage setting incentives to invest in research and development and in generating or adopting innovations. Therefore, due to its success, a novel technology diffuses in the market over time (Dosi & Nelson 2018; Helfat 2018; Hummel 2023; Pyka & Nelson 2018).

However, the pace and direction of technological change depends also on the institutional selection environment of the market. The law is an essential part of this formal institutional framework (Eckardt 2008). If sufficiently enforced, the law influences the actions of firms in the markets via its impact on their opportunity costs. Thus, while the law does not causally determine which technologies will be invented and become commercially successful, it influences technological evolution by making some activities and thus also some forms of technological change more (or less) costly than others. The legal environment in market economies is usually set to promote technological change by subsidizing R&D and providing intellectual property rights to internalize potential positive technological externalities. But there are a number of factors that impede competition and thus markets to perform well, like positive or negative technological externalities, information imperfections, or market power. Depending on their economic effects, these factors also result in positive or negative wealth effects for the actors affected by them, thus changing their opportunity costs and incentives. What role they play is always specific to a particular industry. With technological evolution and the emergence of new industries, such market imperfections also change since with novel technologies new problems emerge, too. In case of problems caused by novel technologies, it is on the one hand institutional actors, like public agencies and regulators that decide whether given legal regulations that have co-evolved with previous technologies' potential market failures are to be applied to a technological innovation. On the other hand, actors negatively affected by the new technology can also try to take action against it on the basis of existing law by going to the courts. Thus, a process of legal evolution is set in motion by the wealth effects of new technologies. It can be again seen as an experimental trial-and-error process where hypotheses are tested on what legal regulation should be applied to cope with the problems resulting from new technologies (Kerber 2006; 2023).

Legal evolution is generated by two distinct, but interrelated mechanisms—judge-made and statutory legal change (Eckardt 2001; 2008).[12] In the following, legal innovation is understood as a (linguistic) construct of a legal rule consisting of several components that can represent different aspects: (1) the facts to which it is applied, (2) a legal norm that states what is allowed or prohibited, and (3) the distribution of the burden of proof to the parties involved (Eckardt 2008, 440, fn.9). Together, the specific features of each component determine the costs for specific activities and thus set incentives for the actors involved. Thus, a legal innovation does not only refer to the introduction of novel legal norms. Applying a given legal norm to a new technology without changing the burden of proof also implies a legal innovation, although an incremental one. This concept of legal innovation makes it possible to capture the changing incentives for the actors that result from new combinations of existing and novel elements in a legal innovation.

Judge-made legal change can itself be conceptualized as an ongoing trial-and-error process in which novel hypotheses as to the working of legal rules for specific activities are continuously tested and selected in the court system (Deakin & Markou 2021; Eckardt 2008, 446–453; Hayek 1967; 1969; 1973). In this strand of literature, it is assumed that variation in legal rules results mainly from judges interpreting legal rules by chance in different ways. Since the training of judges is aimed at creating stability and coherence in applying the law over time, judges are socialized so as to acquire a preference for interpreting cases in accordance with the given legal tradition.[3] Nevertheless, modifications in interpreting the case at hand are possible. This holds in particular regarding novel conflicts brought to the courts which result from the adoption of new technologies. Since for these no precedents exist, judges have to decide whether a given legal rule should apply to solve them—which in itself constitutes a judge-made legal innovation although an incremental one. However, such judge-made legal innovation at the lower court level becomes binding only for the respective parties and only as far as the respective court sticks to this decision in the future in similar cases. For such a legal innovation to diffuse through the whole jurisdiction, a party must appeal to a higher court which, in turn, confirms the novel judgement of the lower court so that it becomes binding also for other lower courts.[4] In addition, an appellate court can replace a lower court's ruling regarding a novel problem, thus itself generating a judge-made legal innovation.[5]

The probability that problems posed by technological innovation are decided by higher courts and thus result in a judge-made legal innovation that is binding for

[1] Law is part of the formal institutions of society ("the rules of the game," North 1990, 3). This means that not only enforcing legal rules, but also generating new legal rules or modifying existing ones is formally regulated, usually at the constitutional level of society.

[2] This holds also in civil law jurisdictions like the European Union and its member states.

[3] For different views on what motivates judges, see for example Posner (1993), Dothan (2023), and Epstein and Knight (2023) with additional references.

[4] A higher court's ruling becomes binding only in case it has the competence to set precedent or that judges of lower courts have incentives to not be overturned by the—anticipated—ruling of appellate courts (in case a party decides to appeal) (Aronson 2023 with additional references).

[5] In contrast, a statutory innovation is binding for the whole jurisdiction once enacted, although it only has an effect if it is actually enforced by the competent authorities and/or the courts.

the whole jurisdiction depends on the frequency of litigating such cases at the lower courts and/or on the incentives set by a lower court's ruling that is not in the interest of one of the parties.[6] The more such cases there are that are decided by lower courts, the higher the chance that for whatever reason some plaintiff appeals to the ruling of a lower court. In addition, the more there is at stake for a party when losing because of a lower court's decision, again, the higher the chance this party appeals. Due to these mechanisms, a "dominant" type of legal adjudication might evolve over time from the first rather heterogeneous judgements of the lower courts regarding technological innovation. In this trial-and-error process, it is the lower courts that together with appellate courts generate variety and enable learning about the adequacy of different legal problem-solutions within the hierarchical court system (Aronson 2023). This is the institutional selection environment for judge-made legal innovations with litigation as the main selection mechanism (von Wangenheim 2011).[7]

Statutory legal change may result if traditional law is no longer seen as adequate to cope with the problems posed by new technologies so that statutory legal innovations are sought. To account for such statutory legal change a multi-level variation-selection-retention concept can be applied using a cognitive evolutionary approach (Eckardt 2008, 442–446 based on Slembeck 1997). A statutory innovation is generated when for a problem, a novel statutory solution has successfully passed the different stages of the legislative process: mobilization, collective problem definition and agenda setting, legislative decision-making, and implementation of a new statute (see Fig. 2). At each of these stages, variation may occur and selection takes place. Individual actors and their cognitive capacities and limitations are nevertheless the starting point. It is only when some individual actor is successful in convincing others and mobilizing resources that a firstly individually perceived problem enters the collective decision-making process. The initiative can come either from the demand or supply side of statutory legal change. On the *demand side*, politically influential interest groups must be formed to be successful in the collective decision-making process. For this, free-rider problems of interest-group formation must be overcome. This is the easier, the fewer the participants, the more homogenous the interests, and the stronger the intensity of interests are, because then the costs of aligning the interests of the potential members of an interest group are lower. Therefore, entrants in new industries and incumbents from old industries have advantages in interest group formation because of the number of actors and the homogeneousness of their interests. In contrast, it is much more difficult for consumers to assert their interests.[8] If lobbying by such interest groups is successful in the political

[6] See Eckardt (1999/2004; 2001; 2008) for a detailed theoretical analysis of how the frequency to litigate in case of negative technological externalities can be related to the industry life cycle with an empirical application to the evolution of the German tort law.

[7] While a large part of the previous literature assumed that judge-made legal change leads to economically efficient legal rules, this supposition can no longer be upheld due to chance in variation and path dependencies in applying given law, see Deakin and Markou (2021, 688) and von Wangenheim (2011, 743–749) with additional references.

[8] This argument is quite in line with the Stigler-Peltzman approach of regulatory capture, see Stigler (1971), Peltzman (1976), Becker (1983), and Zingales et al. (2022) with a non-technical compilation of various current views on this approach.

process, statutory legal innovations might be generated in relatively early market stages. They might amend given legal provisions or introduce legal innovations in order to adapt to the new technology and to reap the potential benefits or cut the resulting losses. In addition, there might also be *supply-side initiatives* of statutory legal change since the search for and design and implementation of collective solutions to problems in the form of new statutes is at the center of governmental policy-making. In democracies, such initiatives by the government for new statutes must also go through the legislative process and find a majority in parliament before they are enacted. However, a new statute must also be enforced so that it has an impact as a new element in the selection environment of technological evolution. In this regard, both public administration and the courts have discretionary power to decide how to interpret the new statutory rules and thus to also influence whether and how they are finally applied.

There are *two main drivers of the coevolution of law and technology* in this framework: wealth effects and cognitive constructs. *Wealth effects* might be pecuniary or non-pecuniary, depending on the objective function the actors have. Innovation is the—sometimes unintended—outcome of the intentional behavior of actors that respond to incentives provided in the socio-economic system they are part of. For example, technological innovations diffuse over time in the economy because firms adopt them. This leads to both actual and potential benefits for some actors,

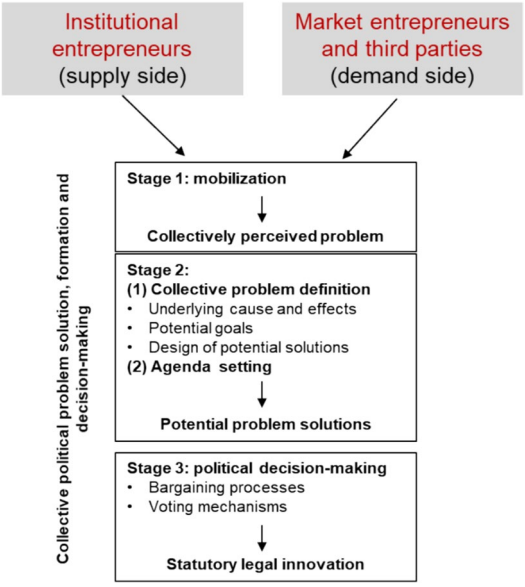

Fig. 2 The variation-selection-retention process of statutory legal change. Source: Own composition according to Eckardt (2008) p. 444, Fig. 1

while it generates actual and potential losses for others.[9] How well an actor can appropriate the benefits resp. defend itself against the negative effects of technological innovations depends in part on the given institutional framework—with the law being part of the formal institutions under which technological innovation takes place. Such wealth effects influence the opportunity costs for technological as well as legal change (Eckardt 2008, 456–462). They are therefore one of the main drivers of the coevolution of law and technology since they set incentives for the actors to actively engage in the generation and dissemination of technological and legal innovations.[10] Since innovations always show more or less genuine uncertainty, their contribution to overall welfare can only be assessed ex post given certain conditions (McCaffrey 2018). This is in line with the proposition by Baumol according to which "entrepreneurs … [are, M.E.] persons who are ingenious and creative in finding ways that add to their own wealth, power, and prestige" independent of whether this also "adds much or little to the social product or, for that matter, even whether it is an actual impediment to production" (Baumol 1990, 6). Thus, innovative activities can be "productive, unproductive, and destructive" (Baumol 1990) from a social point of view (Sussan & Acs 2017, 61).

The *cognitive constructs* about both the benefits and the problems emerging for example from a technological innovation and the possible technological and legal solutions to them are another important factor driving the co-evolution of law and technology. Cognitive constructs frame how the problems posed by a new technology are perceived and what solutions are considered appropriate. For example, there is no automatic application of legal rules to new problems caused by technological innovations; instead, an explicit, conscious decision is always required. The cognitive constructs on the appropriate legal solutions to novel problems also evolve over time. Both are the subject of academic and political public debates which may eventually lead to judge-made or statutory legal innovations. But this again implies a trial-and-error process "since the judge (and the same applies to the law-maker) will never be able to foresee all the consequences of the rule he lays down, and will often fail in his endeavour to reduce the sources of conflicts of expectations. Any new rule intended to settle one conflict may well prove to give rise to new conflicts at another point, because the establishment of a new rule always acts on an order of actions that the law alone does not wholly determine" (Hayek 1973, 102). In turn, a legal innovation might itself lead to modifications of the new technology. Since it is part of the formal institutional framework, it influences the opportunity costs and thus the incentives for technological and economic change. In this way, a process of co-evolution of law and technology is set in motion.

To summarize then, technological change creates incentives for legal change. The latter in turn again sets incentives for further technological change as it leads

[9] Pecuniary externalities as well as market imperfections like technological externalities, information asymmetries and market power are main factors that determine these wealth effects.

[10] Based on the industry life cycle more detailed insights as to the potential direction of legal change over time can be derived (Klepper 1997): If there are systematic changes in the wealth effects experienced by different actors over the life cycle of an industry, then these in turn lead to systematic changes in the opportunity costs of seeking legal changes that affect both judge-made and statutory innovations. For more on this, see Eckardt (2001, 2008).

to changes in the formal institutional framework that influences economic development which in turn leads again to technological change keeping the co-evolutionary processes in motion (see dashed lines in Fig. 1).[11] However, this process is driven by the incentives set by the potential wealth effects of innovation as perceived by the individual players (entrepreneurs), with their cognitive constructs also changing over time. It thus leads to "positive feedback between the interacting components of an SES [=socio-economic system, M.E.] in which each component reinforced the other, thus potentially accelerating processes of change and leading to the emergence of a new structure" (Saviotti 2023, 188). However, such processes are not chaotic or random, but due to path dependencies, the resulting technological and legal trajectories will each exhibit some form of regularity regarding its direction—with more radical innovations in the early stages of new technology giving way to more gradual modifications later on (Eckardt 2001, 176–200; 2008, 453–456).[12]

3 From telecommunication monopolies to the digital platform economy

The digital platform economy as we know it today is the result of year-long co-evolutionary processes based on legal change and technological innovations as well as the development of new business models (see Fig. 3). It relies on information and communication technologies which evolved out of the telecommunication and information technology sectors. In the following, it is analyzed how changes in the legal environment of telecommunication markets and the collective cognitive framing of the newly emerging digital economy shaped the evolution of the digital platform economy, although of course it did in no way causally determine it.

In the 1980s and 1990s, the liberalization of the telecommunication markets in the US and in Western Europe opened the way for competition in these markets, leading to new business and increased innovation. Before that, the telecommunication sector was fully integrated with—mainly—state monopolies providing both the network infrastructure, the communication devices, and the content and application services. Since the end of the 1990s, these are split up into three different sectors (Øverby & Audestad 2021, 61–72). However, the intricacies of the telecommunications network market did not lead to complete de-regulation, but to a series of trial-and-error processes of re-regulation to ensure broad coverage and access to high-speed Internet connections at competitive prices (Crettenand & Finger 2013; Finger et al. 2015). While previously there had been different specialized networks, currently integration of internet services over only "a cellular mobile Internet and a fixed Internet" takes place (Øverby & Audestad 2021, 38). In the EU, the telecommunication market that provides the necessary infrastructure for the Internet relies both on ex ante regulation and ex post competition policy (Mariniello 2022, 79–87).

[11] Independent of and parallel to this co-evolutionary process, processes of technological and legal change are taking place, each of which takes the state of the other as given, as indicated in Fig. 1 by the dotted lines.

[12] In a similar vein, see also Morena-Casas (2024), Muñoz (2024), and Novak (2024).

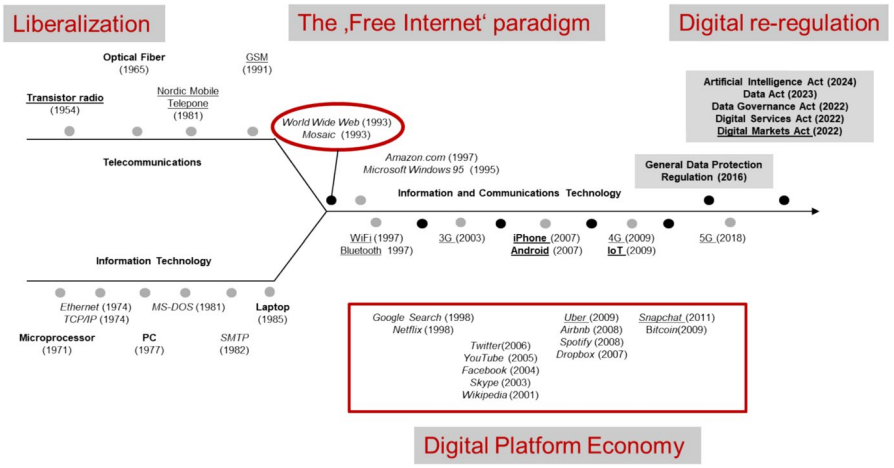

Fig. 3 The evolution of the digital platform economy and EU digital regulation (selection). Notation: Terms in bold mean Hardware; terms underlined mean Mobile and wireless; terms in italic mean Software and services; terms in bold with grey background mean EU digital regulations (selection). Source: Own composition based on Table 2 and Øverby and Audestad (2021) p. 20, Fig. 2.1

In the 1990s, the Internet emerged as a global digital network that was only minimally regulated by law. This was in line with the collective cognitive framework of libertarian market policies. It resulted from decisions of the US administration which aimed at promoting the global commercialization of the Internet by private businesses to reap the envisaged growth effects (Grosse 2020). Following a market-oriented economic paradigm, President Clinton opted for self-regulation of Internet users and firms and the application of technological solutions to potential problems such as privacy, with the optimistic notion that such technological solutions would eventually be found, even if they were not yet available (The White House 1997; Abbate 1999; Greenstein 2015). The underlying "The Free Internet" paradigm that informed the US regulation of Internet services is all about the potential welfare-enhancing effects of free and unregulated markets and the economic opportunities that the Internet would offer (Bradford 2023, 33–52).

Policy-makers in the EU and its member states also seem to have shared this paradigm. Until around 2015, the directives and regulations that were implemented were mainly directed at eliminating barriers between member states that would hinder the use of the Internet for information, communication, and transaction services (Mariniello 2022, 198f.). In this respect, the E-Commerce Directive of 2000 (Directive 2000/31/EC) was very important. Besides facilitating cross-border operations in the EU, it granted providers of digital intermediary services a liability and responsibility privilege "for the content they transmit, cache or store" in Art. 12–15 (Mariniello 2022, 186).[13] This gave them a competitive advantage over traditional providers

[13] The US Congress ensured already in 1996 that online platforms could not be held liable by third parties for content generated by the users of its services by Sect. 230 of the Communications Decency Act. The courts confirmed this; see Bradford (2023, 42–47).

of such services (Spindler 2023, 6f.) and has "played a crucial role in allowing the emergence of the platform economy" (Mariniello 2022, 223).[14]

Compared to traditional analogous platforms, digital platforms facilitate communication and allow us to immensely economize on information, search, and transaction costs and increase matching efficiency while providing a current stream of innovations. For one, the success of digital platforms depends crucially on the realization of (in-) direct network effects. When establishing a digital platform, it is therefore a priority to create quickly a large user base even if this can come at the expense of profit. To achieve this, one market side might get services at zero price, while other users are charged for these services by the platform—which is quite in contrast to traditional business models. Already early in the discussion, it has been understood that it is the large direct and indirect network effects of platforms, which lead to increasing concentration with often quasi-monopolistic platforms (problem of "tipping" into monopolies). This "winner-take-all or winner-take-most market outcome" (Cusumano et al. 2019, 41–61) in the digital platform economy results from the novel opportunities digitalization generated in regard to "the strength of network effects, the difficulty of multi-homing, lack of opportunities for competitor differentiation and niche competition, and the strength of entry barriers" (ibid, 49).[15]

Particularly important in this respect was the innovation of targeted advertising as a business model. For this, the digital platforms use the huge amounts of personal data that they collect as "payments" for their "free" services to the users (search, social media). This, in turn, has led to new problems for privacy and competition in advertising markets because it favors already well-established digital platforms against new market entrants (Belleflemme & Peitz 2021; Evans 2003; Varian & Shapiro 1999).

Another decisive innovation that increased the market dominance of already established platforms was the creation of digital ecosystems around a digital platform. These digital ecosystems are characterized by the operators of digital platforms allowing third parties to use their platform infrastructure for offering innovative content or application services (Evans & Gawer 2016). The business models based on digital ecosystems by an online platform "that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through service via the Internet" (OECD 2019, 23) have become a dominant new economic form since the mid-2000s (Evans et al. 2006). Figure 4 presents its most relevant members.[16]

[14] Net neutrality might prevent Internet service providers to discriminate against application services, thus giving the latter also a potential competitive advantage. For an overview of the discussion, see Øverby and Audestad (2021, 329–331); Stocker and Knieps (2019); and Wu (2003). It is implemented in the EU by Art. 3 of Regulation (EU) 2015/2120.

[15] Note, however, that network effects may also work the other way round and lead to an increasing loss of platform members and thus business once a platform is no longer seen as competitive compared to others. Therefore, there is a lot of advice in the business strategy literature, such as Cusumano et al. (2019, 173–210), on how platform operators should limit competition by making it difficult for users to multi-home on different platforms and creating barriers to entry for new market players while at the same time warning against overdoing.

[16] For detailed figures, see the data provided by Acs et al. (2021, 1639–1644).

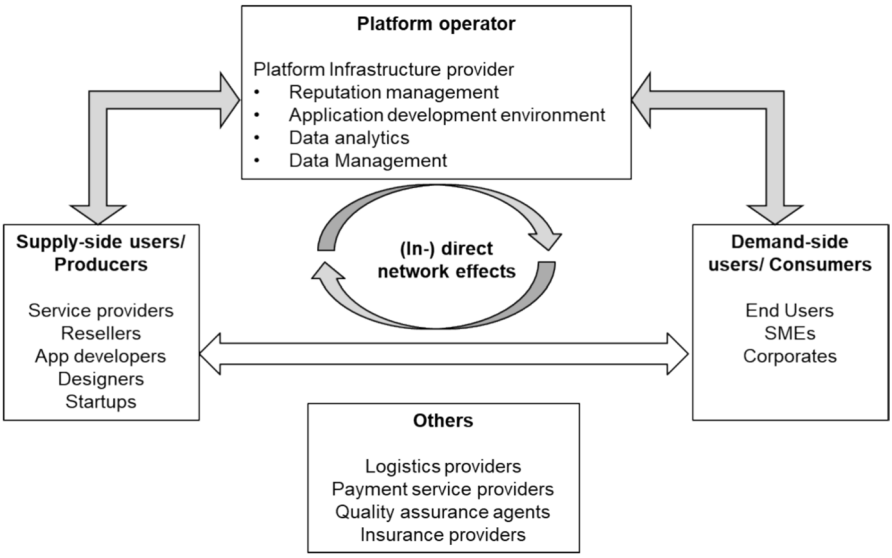

Fig. 4 The multi-sided digital platform with its ecosystem. Source: Own composition based on Zutshi and Grilo (2019) p. 3, Fig. 1

Critical for the success of digital ecosystems is their governance since the digital platform ecosystem business model is characterized by common value creation of its *inter*dependent but *in*dependent members which provide complementary services in a modular way (Cusumano et al. 2019, 63–138; Hornung 2023, 3–6 with additional references). Thus an adequate governance structure must be in place which is actively created and managed by the core platform provider. This then allows the digital platform ecosystem to come up with a current stream of innovations that are valued by consumers. However, it also brings platform operators into a superior strategic position compared to the other ecosystem members as well as to incumbents or new entrants. The firm that provides the core platform services and governs its relevant ecosystems can design the platform architecture and the governance structure in such a way that it restricts competition from other ecosystem members for its own benefit (Hornung 2023, 13–16). In addition, it can benefit from asymmetric access to the data that can then be used to enter successfully also other up- or downstream markets.As a consequence, disruptive effects on whole industries can be created (Acs et al. 2021, 1631; Evans et al. 2006; Montero & Finger 2017, 221f.).[17] Moreover, such digital ecosystems that evolve over time are hard to copy by new market entrants, again giving established online platforms an advantage and further allowing them to reap the benefits of a dominant market position (Cusumano et al. 2019).

[17] For a detailed account of the co-evolution of cooperation and competition in digital platform-based ecosystems, see Cozzolino et al. (2021).

Table 1 The "Big 5" tech companies, worldwide ranking (26/09/2024)

	Market capitalization		Earnings	
	Ranking	In trillion Euros	Ranking	In billion Euros
Apple	1	3.105	2	121.62
Microsoft	2	2.898	3	107.78
Amazon	4	1.823	10	56.85
Alphabet (Google)	5	1.801	4	101.82
Meta (Facebook)	7	1.297	8	60.64

Source: Own compilation based on https://companiesmarketcap.com/eur (last accessed: 26/09/2024)

Over the past 20 years, the major US tech firms Apple, Alphabet (Google), Amazon, Meta (Facebook), and Microsoft have become very successful and dominant in important online platform markets (Table 1).[18] This is partly due to their innovativeness in technology and its commercialization, partly due to the positive network effects associated with successful platform business (OECD 2019). Regarding the EU, "(t)he US platform companies (…) enjoyed first-mover advantages in the European Union, which is now a fully saturated market" (Acs et al. 2021, 1643).[19] This development has led to serious concerns about their economic power. Although the European Commission refrained from regulating the digital platform economy more strictly for a long time, this has changed recently.[20] While in a Communication published in 2016 the Commission still favored self-regulation of online platforms and their ecosystems (European Commission 2016), in 2019, the so-called "P2B regulation" introduced for the first time some rules to increase transparency and thus to reduce power asymmetries between online platforms and their business users (Regulation (EU) 2019/1150). This regulation, however, was not specifically designed to deal with the economic power of the large online platforms. This changed with the Commission's proposal for the *Digital Markets Act* in December 2020, which led to its enactment in 2022 (European Commission 2020; Mariniello 2022, 198–205; Savin 2020; Podszun 2024b).

Since then, a number of legislation has been introduced in the EU to address some of the so far unresolved problems of the digital platform economy (Table 2).[21] These legislative acts can be understood as attempts to address the perceived challenges posed by the digital platforms dominated by large US tech firms and the ecosystems they control: data privacy and data protection regarding personal data (*General Data Protection Regulation*), economic power and its effect on competition and innovation by large digital platforms (*Digital Markets Act*), illegal online content and online disinformation (*Digital Services Act*), lack of trust for sharing data with

[18] For Facebook's development from a social media platform to an infrastructure platform, see the detailed analysis by Helmond et al. (2019).

[19] With a detailed discussion and figures on the economic consequences, see Brühl (2023).

[20] Note that the discourse also changed in the US; see Bradford (2023, 50–57).

[21] For an overview of EU digital policy and the resulting regulations, see Eger and Scheufen (2024); Mariniello (2022); Savin (2020); Spindler (2023); Streinz (2021).

Table 2 EU digital regulations (selection, 2016–2024)

Year	Legal innovation	Source
2016	General Data Protection Regulation (GDPR)	Regulation (EU) 2016/679
2019	"P2B regulation"	Regulation (EU) 2019/1150
2022	Digital Markets Act (DMA)	Regulation (EU) 2022/1925
2022	Digital Services Act (DSA)	Regulation (EU) 2022/2065
2022	Data Governance Act (DGA)	Regulation (EU) 2022/868
2023	Data Act (DA)	Regulation (EU) 2023/2854
2024	Artificial Intelligence Act (AI Act)	Regulation (EU) 2024/1689

Source: Own composition

the introduction of trustworthy data intermediaries (*Data Governance Act*), access and use of non-personal IoT generated data by consumers and third parties (*Data Act*), and risks posed by the use of artificial intelligence (*Artificial Intelligence Act*).

It is not yet clear whether these regulations will be effective, as most of them entered new legal ground. The case study on the *Digital Markets Act* presented in the next section focuses on how competition policy has evolved to cope with the market power that the large US tech companies have gained in the digital platform economy.[22] It constitutes a change away from traditional EU competition law with its ex post regulation to ex ante regulation for large online platforms.

4 From ex post regulation by competition law to the ex ante approach of the DMA

In this section, the main developments of how EU (competition) law evolved to deal with the market power and the resulting behavior of large online platforms are presented from traditional ex post oriented competition law (Sect. 4.1) to the novel ex ante approach of the DMA (Sect. 4.2), while a short discussion on the co-evolutionary processes (Sect. 4.3) concludes.

4.1 A judge-made legal innovation: the application of traditional EU competition law in the Google Search (Shopping) case

In the EU, traditional competition law that deals with market power in the common market is laid down in Art. 101 and 102 TFEU. It allows for ex post investigation and remedies if a firm abuses its dominant market position to the detriment of consumers and competitors. The burden of evidence lies with the European Commission as the competent competition authority. Up to now, *Google Search (Shopping)* (AT.39740) is the most important case when it comes to the evolution

[22] Also in an evolutionary perspective to technological innovation, a level playing field is seen as a prerequisite for market competition and future innovations (Borrás & Edquist 2019, 173).

of competition law triggered by the digital platform economy.[23] The Commission started in 2010 an investigation based upon Art. 102 TFEU whether Google abuses its dominant market position in the search engine market via self-preferencing. It first tried to reach a settlement with Google, but after several proposals made by Google were rejected as insufficient,[24] the Commission issued a decision prohibiting the behavior of Google in June 2017. It claimed that Google has abused its dominant position in the search engine market via self-preferencing its own service Google Shopping and imposed a fine of €2.4 billion (Commission 2017). Google appealed against this decision first to the General Court of the EU and, after the latter largely confirmed the Commission's decision in 2021 (Court of Justice 2021), again to the European Court of Justice (ECJ). In September 2024, the ECJ again confirmed the decision of the Commission (ECJ 2024).

The *Google Search (Shopping)* case is a pioneering case. It was the first time that the Commission opened an investigation based on Art. 102 TFEU against the behavior of a large tech firm's online platform and prohibited self-preferencing behavior as abusive. Since finally the ECJ confirmed this decision, it has been a *gradual legal innovation* because existing statutory law is applied to a novel problem generated by technological innovation (see Sect. 2). Thus, from now on, Art. 102 TFEU is expected to be applied to such behavior of dominant online platforms in line with this decision/ ruling.

At the same time, however, this case also showed the problems of traditional EU competition law when dealing with digital online platforms and their ecosystems. For one, there are a number of challenges when applying the basic concepts of competition law to the digital platform economy, such as market delineation by globally accessible online platforms, the meaning of a dominant position or abusive behavior, esp. in zero-price markets.[25] More importantly, the lengthy duration of the antitrust proceedings is very problematic as technological change and market evolution do not stop during such proceedings. The objective of maintaining competition in markets with dominant companies may therefore no longer be achieved if it takes years until a decision is finally confirmed by the courts. In addition, it became doubtful whether the remedies of traditional competition law were sufficient to achieve the objectives of enabling competition and innovation in markets dominated by large online platforms.[26]

[23] Based on Art. 102 TFEU, 20 investigations against Alphabet/Google, Amazon, Apple, Meta, and Microsoft took place between 2000 and 2024; see European Commission (2024b). Most led to a commitment, only in four cases the Commission prohibited certain behavior as abusive and also imposed a fine: Google Search (Shopping) (AT.39740), Google Search (AdSense) (AT.40411), Google Android (AT.40099), Google – Adtech, and Data-related practices (AT.40670).

[24] In 2014, the political debate on this case led even to the adoption of a non-binding resolution by 384 votes to 174 with 56 abstentions by the European Parliament which called for a breaking-up of Google; see European Parliament (2014).

[25] For example, a dominant market position alone does not constitute a breach of competition law. Therefore, the competent authorities must provide court-proof evidence that such a market position also includes abusive behavior—evidence that is not easy to obtain even for the European Commission and therefore ties up time and resources.

[26] With a detailed legal and economic discussion of large digital online platforms, see Hornung (2023) in regard to EU competition law and Hovenkamp (2024) in regard to US antitrust law, each with additional references.

4.2 A genuine statutory legal innovation: the EU Digital Markets Act

All in all, with the *Google Search (Shopping)* case, learning took place as to the effects of applying traditional competition law to the large online digital platform operators leading to a change of the underlying cognitive framework. At the time of the Commission's decision in 2017, there was already growing skepticism as to whether traditional competition law with its ex post approach would be sufficient to overcome the new challenges of the digital platform economy. A process of searching for new legal solutions therefore began, which ultimately led to the adoption of the DMA in 2022 (Table 3).

The European Commission as well as other governments commissioned a number of expert reports to assess whether reforms of competition law are necessary and if so, which ones (Schweitzer et al. 2018; Australian Competition and Consumer Commission 2019; Furman et al. 2019; Montjoye et al. 2019; Stigler Committee on Digital Platforms 2019).[27] All reports agreed that current competition law provides no adequate response to the economic power of large online platforms, although they differed with respect to potential solutions (Kerber 2019). While all other reports are mainly based on modifications of the existing competition law that rests on ex post regulation, the "Furman" report presented the most innovative proposal because it suggested introducing an ex ante regulation of platforms for firms with "strategic market status" (meaning primarily the small group of large tech firms) additionally to traditional competition law. This is a clear deviation from traditional competition law's approach of ex post control of abusive behavior of dominant firms. This Furman proposal seems to have inspired both the DMA and the new Sect. 19a in German competition law (see below).

After extensive discussions both with experts and the public,[28] the Commission published its *Proposal for the Digital Markets Act* in December 2020. Compared to the traditional competition law based on Art. 101 and 102 TFEU as applied in the *Google Shopping* case, the Commission's 2020 proposal is a radical break and reflects a fundamentally changed perception of the problems posed to competition by the economic power of large tech firms that operate digital platforms. This proposal set in motion a process of statutory legal innovation that—within less than 2 years—led to the adoption of the *Digital Markets Act* in September 2022 by the European Parliament and the Council.

The *DMA* focuses on large online platforms in multisided markets (called "gatekeepers") to ensure fair competition and contestable markets in the EU (Art. 1 DMA). Instead of an ex post control of potentially abusive behavior of these firms, it introduces a set of obligations for these gatekeepers which they have to directly comply with, without the need for evidence being provided by the Commission why this behavior is abusive. Since the legislator directly decided on this set of behavioral obligations, it is an innovative form of ex ante regulation for a small group of gatekeeper firms which is far away from traditional competition law.

[27] For an overview of further reports, see Stigler Centre (2019).

[28] For a detailed description of the impact of expert advice from a policy science literature point of view, see Cini and Czulno 2022, 47–49.

Table 3 The enactment and implementation of the *Digital Markets Act*—timeline

Year	Event
2010	*Google Search (Shopping)*: Commission starts investigation based on Art.102 TFEU
2017	*Google Search (Shopping)*: Commission decides against Google; Google appeals to General Court and ECJ
Dec 2020	*DMA:* Commission makes *Proposal for the Digital Markets Act*
Sept 2022	*DMA:* European Parliament / EU Council enact the *Digital Markets Act*
Sept 2023	*DMA:* Commission designates first gatekeepers according to the *DMA*
March 2024	*DMA:* Commission starts first investigations on potential non-compliance of designated gatekeepers following the *DMA*
Sept 2024	*Google Search (Shopping)*: ECJ ultimately confirms Commission's decision

Source: Own compilation

Digital platforms are designated as gatekeepers if they have (a) a significant impact on the market,[29] (b) provide a so-called core platform service[30] which is an important gateway for business users to reach end users,[31] and (c) have an entrenched and durable position in its operations[32] (Art. 3. (1) DMA). Such gatekeepers to certain core platform services have directly to comply with all obligations, i.e., the DMA does not differentiate between different digital platforms, different business models, or core platform services ("one-size-fits-all" solution). These obligations either prohibit or require certain behaviors (Art. 5–7 DMA)[33] in order to prevent anticompetitive and unfair behavior by gatekeepers and reduce barriers to entry (for a detailed discussion, see Hornung 2023, 17–28). The Commission, who is in charge of the enforcement, only needs to control the compliance of the firms. It is the latter who have to provide evidence that they are complying (burden of proof). In case of non-compliance, the Commission can fine the gatekeeper up to 10% of its total worldwide turnover (Art. 30 (1) DMA).

The DMA is the outcome of the standard EU legislative procedures according to Art. 249 TFEU in which it was the European Commission that proposed the new regulation. The European Parliament and the Council then decided on its adoption[34] following a multi-stage procedure which entailed also public consultations where modifications to the proposal were made.[35] Thus the Commission as an institutional

[29] This is given if the following benchmarks are reached: an annual Union turnover equal to or above €7.5 billion in each of the last three financial years, or where its average market capitalisation or its equivalent fair market value amounted to at least €75 billion in the last financial year, and it provides the same core platform service in at least three Member States (Art. 3 (2a) DMA).

[30] For the 10 listed core platform services according to Art. 2 (2) DMA, see Table 4.

[31] This is the case if a platform in the last financial year has at least 45 million monthly active end users established or located in the Union and at least 10,000 yearly active business users established in the Union (Art. 3 (2b) DMA).

[32] This is the case if they were met in each of the last 3 financial years (Art. 3 (2c) DMA).

[33] Examples of such obligations are the prohibition of the combination of personal data from different sources and of no self-preferencing, as well as enabling data portability or interoperability.

[34] The European Parliament adopted the DMA by 588 votes to 11, with 31 abstentions in the first reading (European Parliament, n.d.).

[35] For details on the legislative procedure, the key actors involved and the discussions on the proposed regulation, see European Parliament (n.d.) and European Union (n.d.).

entrepreneur has a prominent role in introducing statutory innovations in the multi-stage variation-selection-retention (VSR) process of statutory legal change at the EU level (see Fig. 2). While the Commission defended the traditional ex post approach of competition law as adequate even shortly before it published the 2020 proposal on the DMA, this proposal entails a radical departure by introducing an ex ante regulation to large online platforms and their ecosystems. According to Cini and Czulno (2022), this policy change resulted from learning by the Commission in regard to the sub-optimal working of traditional competition law in digital online platform markets. To this contributed its extensive reflections and discussions on alternative legal solutions with a broad array of expert advice. Following the VSR process in Fig. 2, this led to a change in the collective perception of the problem and possible solutions by the Commission as the relevant institutional player (Cini & Czulno 2022, 47–49). In contrast, the influence of the demand-side players in this VSR process of statutory legal change was rather limited. Although the DMA proposal was clearly directed against the interests of the large US tech firms, as it was explicitly aimed at such large online platforms as "gatekeepers," they did not succeed in significantly influencing the DMA despite increased lobbying of the Commission.[36] There may even have been a "counter"-lobbying activity by other business users that were in favor of stricter regulation of the market power of the targeted platform operators (Cini & Czulno 2022, 51f.).[37] In the case of the DMA, therefore, regulatory capture by interest groups does not appear to have played a role.[38]

In addition to such *intra*jurisdictional competition among supply- and demand-side players of the statutory change, there may have been also some *inter*jurisdictional regulatory competition at work, incentivizing the Commission to take action. In the EU, there is always some rivalry between member states and the supranational EU level as to who defines and controls what policy fields. In this respect, the Commission always shows a strong tendency to strengthen its position. Activities by member states therefore tend to put into question the Commission's central role. From the mid-2010s on, discussions on regulating the economic power of digital platforms and their ecosystems also led to legislative reforms at the national level in the EU, especially in Germany.[39] Since 2016, there have been three amendments to the German competition law (GWB, Gesetz gegen Wettbewerbsbeschränkungen) with regard to these challenges. The 9th Amendment of the GWB, which entered into force in 2017, introduced a number of provisions for facilitating the assessment

[36] For more details and figures on these lobbying activities, see Cini & Czulno (2022, 49f).

[37] The European Parliament adopted the DMA by 588 votes to 11, with 31 abstentions in the first reading (European Parliament, n.d.).

[38] Note, however, that this does not generally hold for the recent statutory digital innovations in the EU. In regard to the Data Act, not only the discussion on how to regulate access to digital data was much more heterogeneous, in addition, there was also more influence by interest groups. For an overview with additional references, see Eckardt & Kerber (2024a; 2024b).

[39] Competition authorities in the member states are independent from the Commission. Although EU competition law applies to them, they are not bound by instructions from the Commission. In addition, member states are free to regulate markets by national competition law as long as it does not concern the internal market and does not contradict EU competition law. Therefore, there is scope for statutory innovations at the member states' level.

of the market dominance of large digital platforms. It clarified that also markets on which services are provided for "free" fall under competition law, and the legal texts explicitly state multi-sided markets, direct and indirect network effects, economies of scale, and access to data as important criteria for assessing market dominance on digital platform markets (Sect. 18 (3a) and (3b) GWB) (Jarman & Karaman Örsal 2020; Li 2019; Petit 2020).

More important, however, is the much more far-reaching statutory innovation of the new Sect. 19a GWB which was introduced in the 10th Amendment in 2020, whereby the draft bill was already published in October 2019 (Bundesministerium 2019). Like in the Furman proposal, it addresses the economic power of large tech firms by introducing legally a new group of firms with "paramount significance for competition across markets" (PSCAM). In this way, the ecosystem of digital platforms is also taken into account. After the Bundeskartellamt makes a decision that a firm is fulfilling the criteria of *PSCAM*, it can now prohibit certain types of behaviors as abusive—without the need to provide much evidence due to strong presumptions. The *PSCAM* criterion (like the 'strategic market status' in the Furman report) is not based upon the traditional concept of market dominance, which always has to be defined on a specific market, thus giving the competition authority more discretion. Compared to the DMA, the German competition law reform follows a different approach although it also applies an ex ante approach (Hornung 2023, 28–41). While the focus of the DMA is on large online platforms ('gatekeepers'), Sect. 19a GWB refers to entire firms with their platforms and ecosystems that have power beyond and across markets. In addition, it gives the competition authority more discretionary scope when investigating potential abusive behavior. In contrast to that, the DMA follows a "one-size-fits-all" approach where certain behavior is prohibited without discretion once a firm is designated as a "gatekeeper." Directly after entering into force in 2021, the *Bundeskartellamt* started proceedings against Alphabet/Google, Amazon, Meta, Apple, and, in the meantime, also Microsoft. It has made designation decisions against some of these firms and partly has also challenged already certain business practices based upon Sect. 19a GWB.[40] At this stage, it is not possible to assess whether the legal innovation of the DMA or Sect. 19a GWB will be the more successful approach. Nevertheless, the reforms of the German competition law since 2017 could have been a relevant factor in the unexpected change of attitude towards an ex ante solution in competition law by the Commission by questioning the Commission's powers on this urgent and important issue (Cini & Czulno 2022, 52).

At the moment, the DMA is in its initial implementation phase. Since September 2023, the Commission already designated seven gatekeepers (with 24 core platform services) (Table 4). These have to comply after 6 months with the obligations. Already in March 2024, the Commission launched its first investigations about possible non-compliance against Alphabet/Google, Apple, and Meta, based on their compliance reports. In June 2024, further non-compliance investigations against Apple were opened.

[40] For a current overview about these proceedings of the Bundeskartellamt against large digital companies, see Bundeskartellamt (n.d.).

Table 4 DMA implementation: designation of gatekeepers with regard to core platform services (CPS) and non-compliance investigations

CPS	Designated gatekeeper	Not designated as gatekeeper
Intermediation	Google Maps/Alphabet (05.09.2023) Google Play/Alphabet (05.09.2023)** Google Shopping/Alphabet (05.09.2023) Amazon Marketplace/Amazon (05.09.2023)** iOSApp Store/Apple (05.09.2023)** Meta Marketplace/Meta (05.09.2023)	
Social networks	Facebook/Meta (05.09.2023)** Instagram/Meta (05.09.2023)** LinkedIn/Microsoft (05.09.2023)	
Ads	Online advertising services/Alphabet (05.09.2023) Amazon Advertising/Amazon (05.09.2023) Meta Ads/Meta (05.09.2023) Booking (13.05.2024)	Online advertising services/Microsoft (12.02.2024) X Ads (13.05.2024) Tiktok/ByteDance (13.05.2024)
Browser	Chrome/Alphabet (05.09.2023) Safari/Apple (05.09.2023)**	SIB/Samsung (05.09.2023) Edge/Microsoft (12.02.2024)
Search	Google Search/Alphabet (05.09.2023)**	Bing/Microsoft (12.02.2024)
Operating system	Google Android/Alphabet (05.09.2023) iOS/Apple (05.09.2023)** Windows PC OS/Microsoft (05.09.2023) iPadOS/Apple (29.04.2024)	
Video sharing	YouTube/Alphabet (05.09.2023)	
N-IICS*	WhatsApp/Meta (05.09.2023) Messenger/Meta (05.09.2023)	Gmail/Alphabet (05.09.2023) Outlook.com/Microsoft (05.09.2023) iMessage/Apple (12.02.2024)
Virtual assistance	./.	
Cloud computing services	./.	

Source: Own compilation based on Commission (2024a)

*N_IICS = number-independent interpersonal communication service

**Non-compliance investigations opened by the Commission, see https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1689; https://ec.europa.eu/commission/presscorner/detail/en/ip_24_3433. Accessed 20 June 2024

The DMA intends to remedy the failure of traditional competition law (Art. 101 and 102 TFEU), in particular its lengthy procedures and ineffective remedies. It is expected that the introduction of its set of behavioral obligations by the legislator without the need for assessing the gatekeeper's behavior by the Commission might lead to much faster compliance, especially through the change of the burden of proof. But its "one-size-fits-all" approach regarding specific behaviors (with only a few exceptions) might also lead to a very inflexible application as well as enforcement gaps in the case of new problematic behaviors of gatekeepers (Budzinski & Mendelsohn 2022; Hornung 2023, 17–28; Wambach 2023; Boscheck 2024; Zimmer & Göhls 2024). Therefore, it remains to be seen whether this new legal instrument of ex ante regulation will achieve the objectives regarding shorter legal procedures as well as substantially improving competition and fairness in the digital platform economy. Whether and to what extent this legal change will have a feedback effect on the technologies and business models underlying the digital platforms will therefore also depend on the enforceability of these regulations.

4.3 Cognitive constructs and wealth effects as drivers of the co-evolution of EU competition law and the digital platform economy in the EU

The co-evolution of EU competition law and the digital platform economy as presented above is analyzed in the following with a focus on wealth effects and cognitive constructs as the underlying drivers (Fig. 5). The 1980s and 1990s saw the legal liberalization in telecommunications markets. This was based on a strong collective cognitive construct that perceived deregulation as a prerequisite for creating incentives for innovation, and thus ultimately for enabling overall wealth effects (Sect. 3). In the 1990s, the paradigm of the "free Internet," which is in line with this previous collective cognitive construct, also saw non-regulated markets as a guarantee for general wealth effects by not interfering in the digital economy.

Within this legal framework, the digital platform economy evolved based on innovations in information and communication technologies. From around 2000 onwards, multisided online platforms with digital ecosystems developed as a new and dominant business model. Some companies, like the "Big 5" US tech firms Apple, Alphabet (Google), Amazon, Meta (Facebook), and Microsoft, that were particularly successful in generating and commercializing innovations, reached strong market positions in many countries, for example in the EU. However, the strong positive network effects on which multi-sided digital platforms are based pose novel challenges for competition and innovation in such digital platform markets. Such "winner-takes-it-all" or "-most" markets set incentives for the platform operators to engage in anticompetitive behavior in order to maintain their dominant market position and reap the resulting monopolistic rents. If such behavior is possible, this leads to negative wealth effects for competitors, innovation, and finally overall wealth. Usually, traditional competition law deals with such problems as this legally may constitute abuse of a dominant market position.

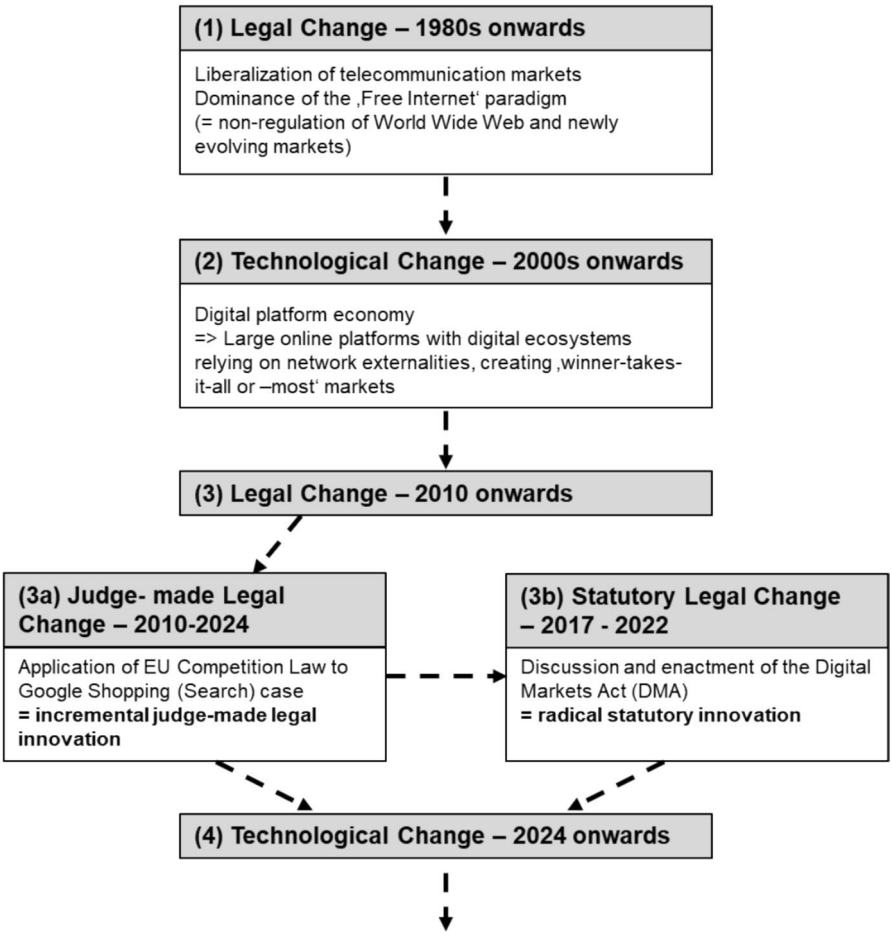

Fig. 5 The co-evolution of the digital platform economy and EU competition law. Source: Own composition

However, grounded in the prevailing cognitive construct of the "free internet," it took time until the European Commission, as the competent competition authority in the EU, took action and started the first investigation against potential abuse of a dominant market behavior of a large online platform with the *Google Search (Shopping) case* in 2010. The Commission applied traditional competition law to a novel behavior (self-preferencing) by a platform operator (Google) with a strong market position in the search engine segment. The Commission's decision to apply given EU competition law in 2017 and its confirmation by the European Court of Justice in 2024 constitutes an incremental judge-made legal innovation. This legal innovation was driven by the—perceived—negative wealth effects of the underlying behavior. In turn, Google's strong market position and its ability to abuse this position was the result of the preceding processes of technological innovation.

The *Google Search (Shopping) case* also involved learning for the actors. It led to novel knowledge on the limited effectiveness of applying traditional EU competition law to digital platforms and their ecosystems. As a consequence, a process of enacting a novel statute to deal with the perceived problems was started in 2020 by the Commission. It led to the enactment of the Digital Markets Act in 2022 which introduces and ex ante regulation for large digital platforms. It thus is a radical statutory legal innovation. So far, it is not at all clear whether and if so how effective the DMA will be in dealing with guaranteeing competition and allowing for more innovation in the digital platform economy. There can also be no statements currently about the effects of the DMA on the future technological evolution in the digital platform economy. However, these developments indicate that the collective cognitive construct has again changed—from the "free internet" paradigm to the collective cognitive frame according to which re-regulation of digital markets should result in positive wealth effects.

Several other countries also discuss reforms of their competition law by critically taking into consideration the approach of the DMA, like the UK, Brazil, India, Japan, South Africa, South Korea, and Turkey (Echikson & Hadjicosta 2024). Since currently it is not known which is the most effective legal solution to the new challenges posed by large online platforms and their digital ecosystems, the more statutory variants are introduced the better for learning across jurisdictions about their effectiveness in a decentralized way (Kerber & Eckardt 2007).

5 Summary and outlook

The digital platform economy poses new challenges for competition law as it favors the emergence of big tech firms with potentially dominant market positions due to the network effects and economies of size and scope associated with multi-sided platform markets and their digital ecosystems. Based on an evolutionary approach, wealth effects and collective cognitive constructs were identified as drivers of the co-evolution of law and technology in Sect. 2. Section 3 outlined how these shaped the evolution of the current digital platform economy, while the case study in Sect. 4 applied the theoretical framework to discuss how competition law evolved in the EU to cope with these novel problems. It described how both judge-made legal innovation (application of given competition law according to Art. 102 TFEU) and statutory legal innovation (introduction of the Digital Markets Act) took place over the last years with a short reflection of these findings with regard to the underlying co-evolutionary processes.

This paper makes two contributions to the literature, a conceptual and a more empirical one. It shows that the co-evolution of law and (digital) technologies can be analyzed by applying the suggested approach where co-evolution is driven by collective cognitive constructs and wealth effects. In addition, the evolutionary approach taken is a fruitful framework to also explain the experimental process of EU competition law evolution as a reaction to new challenges posed by the digital platform economy. Both wealth effects resulting from the dominant position of key platform operators and the collective cognitive models that frame the problem

perception of the key actors are decisive factors in this process of co-evolution of law and technology. However, additional research is necessary, both conceptually and empirically to refine the suggested approach. In addition, to make policy prescriptions for legal change, a number of further research gaps become clear. For our understanding and for policy-making, it seems to be most important to improve our so far limited understanding of the components, working, and evolution of the legal innovation system.

Thus, a more detailed empirical in-depth analysis of the actual judicial and legislative processes of the current evolution of EU competition law would allow us to further substantiate the findings made and to further develop the theory of the co-evolution of law and technology. In addition, the effectiveness of the DMA could be evaluated where the results could contribute to a theory of legal path dependencies over time. Additional case studies on the GDPR (2016), the DSA (2022), the DGA (2022), the DA (2023), and the only recently enacted AI Act (2024) would also allow us to further refine the theoretical framework by finding similarities and differences among these regulations that deal with additional problems posed by the digital platform economy. Comparative case studies would also provide valuable additional insights into the co-evolution of law and technology.[41] In particular, when it comes to a relatively homogeneous technology that is applied in different jurisdictions, as is the case with online platforms and their ecosystems, the question of whether there are functional equivalents in jurisdictions with different legal origins for certain challenges that the technology entails could be discussed. By analyzing the imitation of the DMA by other countries when updating their own competition law, one can gain further insights into the trial-and-error process of legal change and how legal innovations are imitated and diffused across jurisdictions. Furthermore, it could shed additional light on the "Brussel's effect" (Bradford 2020) by asking whether there is something like a first-mover-advantage also in regulatory competition among jurisdictions.

There are also other conceptual issues regarding our understanding of the co-evolution of law and technology. For example, the case study presented showed that there is judge-made innovation, but that it takes a long time to do so whereas legislation leads much quicker to statutory innovation. But apart from this observation, we have no benchmarks to assess whether a particular legal system works well in creating legal innovation, neither with respect to quality nor quantity. We cannot foresee what the content of a legal innovation would be. But an evolutionary approach allows us to derive statements on how a legal innovation system should be structured to improve the trial-and-error-process of legal innovation with its feedback effects on technological evolution. In addition, the current technological changes also impact the legal system. This holds for their still unclear effects in individual fields of law, like in labor law for gig workers or regulations for taxi licenses which merit further research. In addition, technological change and artificial intelligence could also influence the "division of labor" between law and technology by offering new technological alternatives for coordination and cooperation problems that were previously solved by legal instruments (Brownsword 2024).

[41] For a detailed comparison regarding the US, the EU and China, see Bradford (2023).

Acknowledgements For valuable feedback on an earlier version of this paper the author thanks Georg von Wangenheim, Michael Peneder and two anonymous reviewers as well as Wolfgang Kerber for his comments and for sharing his extensive knowledge of EU competition law and policy.

Author contribution M.E. wrote the manuscript text and prepared the figures and tables.

Funding Open Access funding enabled and organized by Projekt DEAL.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The author declares no competing interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Abbate J (1999) Inventing the Internet. MIT Press, Cambridge, MA, London

Acs Z et al (2021) The evolution of the global digital platform economy: 1971–2021. Small Bus Econ. https://doi.org/10.1007/s11187-021-00561-x

Almudi I, Fatas-Villafranca F (2021) Coevolution in economic systems. Cambridge University Press, Cambridge UK

Aronson O (2023) Hierarchies of justice. In: Epstein L et al (eds). The Oxford handbook of comparative judicial behavior, online edn. Oxford Academic: Oxford. https://doi.org/10.1093/oxfordhb/9780192898579.013.34

Australian Competition and Consumer Commission (2019) Digital platforms inquiry, final report. https://www.accc.gov.au/publications/digital-platforms-inquiry-final-report. Accessed: 19 June 2024

Baumol WJ (1990) Entrepreneurship: productive, unproductive, and destructive. J Bus Ventur 11:3–22

Becker GS (1983) A theory of competition among pressure groups for political influence. Q J Econ 98:371–400

Belleflamme P, Peitz M (2021) The economics of platforms: concepts and strategy. Cambridge Univ Press, Cambridge UK. https://doi.org/10.1017/9781108696913

Borrás S, Edquist Ch (2019) Holistic innovation policy: theoretical foundations, policy problems, and instrument choices. Oxford Academic, Oxford. https://doi.org/10.1093/oso/9780198809807.001.0001

Boscheck R (2024) The EU's Digital Markets Act: regulatory reform, relapse or reversal? Intereconomics. https://doi.org/10.2478/ie-2024-0032

Bradford A (2020) The Brussels effect: how the European Union rules the world. Oxford Univ Press, New York. https://doi.org/10.1093/oso/9780190088583.001.0001

Bradford A (2023) Digital empires: the global battle to regulate technology. Oxford Univ Press, New York. https://doi.org/10.1093/oso/9780197649268.001.0001

Brownsword R (2024) Technology, humans, and discontent with law. The quest for better governance. Routledge: Oxon, New York

Brühl V (2023) Big Tech, the platform economy and the European digital markets. Intereconomics 58:274–282. https://doi.org/10.2478/ie-2023-0056

Budzinski O, Mendelsohn J (2022) Regulating Big Tech: from competition policy to sector regulation? (Updated October 2022 with the Final DMA), Ilmenau Economics Discussion Papers 27, No. 168. https://doi.org/10.2139/ssrn.3938167

Bundeskartellamt (nd) Proceedings against large digital companies. https://www.bundeskartellamt.de/EN/Digital_economy/proceedings_against_large_digital_companies/proceedings_against_large_digital_companies_node.html. Accessed 23 July 2024

Bundesministerium für Wirtschaft und Energie (2019) Referentenentwurf GWB-Digitalisierungsgesetz. 7.10.2019. https://www.d-kart.de/wp-content/uploads/2019/10/GWB-Digitalisierungsgesetz-Fassung-Ressortabstimmung.pdf. Accessed: 28 September 2024

Cini M, Czulno P (2022) Digital Single Market and the EU competition regime: an explanation of policy change. J Eur Integr 44:41–57. https://doi.org/10.1080/07036337.2021.2011260

Cozzolino A, Corbo L, Averso P (2021) Digital platform-based ecosystems: the evolution of collaboration and competition between incumbent producers and entrant platforms. J Bus Res. https://doi.org/10.1016/j.jbusres.2020.12.058

Crettenand N, Finger M (2013) The alignment between institutions and technology in network industries. Compet Regul Netw Ind 14:106–129

Cusumano MA, Gawer A, Yoffie DB (2019) The business of platforms. Strategy in the age of digital competition, innovation and power. Harper Collins Publishers: New York

Deakin S, Markou Chr (2021) Evolutionary law and economics: theory and method. Legal Quarterly. https://doi.org/10.53386/nilq.v72i4.939

Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market ('Directive on electronic commerce'), OJ 2000 L 178, pp 1–16. http://data.europa.eu/eli/dir/2000/31/oj

Dosi G, Nelson RR (2018) Technological advance as an evolutionary process. In: Nelson RR et al (eds). Modern evolutionary economics. An overview, Cambridge University Press, Cambridge, pp 35–84. https://doi.org/10.1017/9781108661928.002

Dothan S (2023) Strategic analysis. In: Epstein L et al (eds). The Oxford handbook of comparative judicial behavior, online edn. Oxford Academic: Oxford. https://doi.org/10.1093/oxfordhb/9780192898579.013.9

Echikson B, Hadjicosta M (2024) Europe's DMA goes global, CEPA, insights, & analysis, article, bandwith, 4 March 2024, https://cepa.org/article/europes-dma-goes-global. Accessed. 18 July 2024

Eckardt M (2001) Technischer Wandel und Rechtsevolution. Mohr, Tübingen

Eckardt M (2008) Explaining legal change from an evolutionary economics perspective. German Law Journal 9:438–463

Eckardt M, Kerber W (2024a) Property rights theory, bundles of rights on IoT data, and the EU Data Act. Eur J Law Econ 57:113–143. https://doi.org/10.1007/s10657-023-09791-8

Eckardt M, Kerber W (2024b) Designing the bundle of rights on IoT data: the EU Data Act. In: Sattler A, Zech H (eds.) The Data Act: first assessments, digital recht 19: 3–22. https://doi.org/10.25353/ubtr-04b0-0969-2b7a

Eckardt M (2004) The evolution of the German tort law in the 19th century – an economic analysis of the evolution of law. Homo Oeconomicus 21: 83–116 (see also Eckardt M (1999) Thuenen Working Paper No.23. https://www.econstor.eu/bitstream/10419/78268/1/wp023thuenen.pdf. Accessed 10 July 2024

Eger Th, Scheufen M (2024) The law and economics of the data economy: introduction to the special issue. Eur J Law Econ. https://doi.org/10.1007/s10657-024-09796-x

Epstein L, Knight J (2023) How personal motivations affect judges' decisions. In: Epstein L et al (eds.) The Oxford handbook of comparative judicial behavior, online edn. Oxford Academic: Oxford. https://doi.org/10.1093/oxfordhb/9780192898579.013.10

European Commission (2020) Proposal for a regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), COM/2020/842 final, 2020/0374 (COD)

European Commission (2015) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - a digital single market strategy for Europe COM/2015/0192. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC0192. Accessed: 23 July 2024

European Commission (2017) Commission decision of 27.6.2017 relating to proceedings under Article 102 of the Treaty on the Functioning of the European Union and Article 54 of the Agreement on the European Economic Area [2017] C(2017) 4444 final (AT.39740— Google Search (Shopping))
European Commission (2024a) Competition policy. Search criteria: Digital Markets Act. https://competition-cases.ec.europa.eu/search. Accessed 09 July 2024
European Commission (2024b) Commission opens non-compliance investigations against Alphabet, Apple and Meta under the Digital Markets Act, Press release, 25 March 2024, Brussels. https://ec.europa.eu/commission/presscorner/detail/en/IP_24_1689. Accessed 09 July 2024
European Commission (2016) Communication on online platforms and the digital single market opportunities and challenges for Europe. [Online] Available at: https://ec.europa.eu/digital-single-market/en/news/communication-online-platforms-and-digitalsingle-market-opportunities-and-challenges-europe. Accessed: 21 July 2024
European Court of Justice (2024) Judgement 10.09.2024 Google and Alphabet v Commission (Google Shopping). Case C-48/22 P. ECLI:EU:C:2024:726
European Parliament (nd) Procedure File, 2020/0374(COD), Digital Markets Act, legislative observatory. https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?lang=en&reference=2020/0374(OLP). Accessed 17 July 2024
European Parliament (2014) Resolution on supporting consumer rights in the digital single market, Procedure file 2014/2973(RSP), Legislative Observatory
European Union (nd) Procedure 2020/0374/COD, COM (2020) 842: proposal for a regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), https://eur-lex.europa.eu/procedure/EN/2020_374. Accessed 21 July 2024
Evans D (2003) The antitrust economics of multi-sided platform markets. Yale J Regul 20:325–381
Evans D, Hagiu A, Schmalensee R (2006) Invisible engines: how software platforms drive innovation and transform industries. MIT Press, Cambridge, Mass
Evans P, Gawer A (2016) The rise of the platform enterprise: a global survey. The Emerging Platform Economy Series, 1–29. https://www.thecge.net/wp-content/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf. Accessed 23 July 2024
Finger M, Crettenand N, Lemstra W (2015) The alignment framework. Comp Regul Network Industries 16:89–105
Furman J et al (2019) Unlocking digital competition, Report of the Digital Competition Expert Panel. https://assets.publishing.service.gov.uk/media/5c88150ee5274a230219c35f/unlocking_digital_competition_furman_review_web.pdf. Accessed 19 June 2024
General Court (2021) Judgement, 10.11.2021 Google and Alphabet v Commission (Google Shopping). Case T-612/17. ECLI:EU:T:2021:763
Greenhalgh Ch, Rogers M (2010) Innovation, intellectual property and economic growth. Princeton University Press, Princeton, Oxford
Greenstein SM (2015) How the Internet became commercial: innovation, privatization, and the birth of a new network. Princeton University Press, Princeton and Oxford
Grosse M (2020) Laying the foundation for a commercialized Internet: international Internet governance in the 1990s. Internet Histories. https://doi.org/10.1080/24701475.2020.1769890
GWB = Gesetz gegen Wettbewerbsbeschränkungen, English translation includes the amendments to the Act by Article 1 of the Act of 25 October 2023 (Federal Law Gazette I, p 294). https://www.gesetze-im-internet.de/englisch_gwb/. Accessed 30 June 2024
Hayek FA (1968/2002) Competition as a discovery procedure. The Quarterly Journal of Austrian Economics 5: 9–23
Hayek FA (1973) Law, legislation and liberty, Vol.I, Rules and order. London, Henley
Helfat CB (2018) The behavior and capabilities of firms. In Nelson RR et al (eds) Modern evolutionary economics. An overview. Cambridge University Press, Cambridge, pp 85–103. https://doi.org/10.1017/9781108661928.003
Helmond A, Nieborg DB, van der Vlist FN (2019) Facebook's evolution: development of a platform-as-infrastructure. Internet Histories. https://doi.org/10.1080/24701475.2019.1593667
Ph Hornung 2023 The ecosystem concept, the DMA, and Section 19a GWB J Antitrust Enforcement https://doi.org/10.1093/jaenfo/jnad049
Hovenkamp H (2024) Tech monopoly. The MIT Press, Cambridge, Massachusetts/ London, England
Hummel LMF (2023) Innovation as a competitive constraint on online platforms in European competition law: the industry life cycle and dominant designs in digital markets. In: Mathis K, Tor A

(eds) Law and economics of the digital transformation, Springer, Cham/ Switzerland, pp 281–304. https://doi.org/10.1007/978-3-031-25059-0_11
Kerber W (2006) Competition, knowledge, and institutions. J Econ Issues 40:457–463
Kerber W, Eckardt M (2007) Policy learning in Europe: the open method of co-ordination and laboratory federalism. J Eur Publ Policy. https://doi.org/10.1080/13501760601122480
Kerber W, Saam N (2001) Competition as a test of hypotheses: simulation of knowledge-generating market processes. Journal of Artificial Societies and Social Simulation 4–2. https://www.jasss.org/4/3/2.html. Accessed 10 July 2024
Kerber W (2019) Updating competition policy for the digital economy? An analysis of recent reports in Germany, UK, EU, and Australia (September 14, 2019). https://doi.org/10.2139/ssrn.3469624
Kerber W (2023) Digital revolution, institutional coevolution, and legal innovations. European Business Law Review. https://doi.org/10.54648/eulr2023047
Klepper S (1997) Industry life cycle. Ind Corp Chang 6:145–181
Li L (2019) Data and market definition of Internet-based businesses. Compet Regul Netw Ind. https://doi.org/10.1177/1783591719840132
Mariniello M (2022) Digital economic policy. Oxford University Press, Oxford, The economics of digital markets from a European Union perspective. https://doi.org/10.1093/oso/9780198831471.001.0001
McCaffrey M (2018) William Baumol's "Entrepreneurship: productive, unproductive, and destructive. In: Javadian G et al (eds) Foundational research in entrepreneurship studies. Palgrave Macmillan, Cham. pp 179- 201. https://doi.org/10.1007/978-3-319-73528-3_9
Montero JJ, Finger M (2017) Platformed! Network industries and the new digital paradigm. Competition and Regulation in Network Industries. https://doi.org/10.1177/1783591718782310
Montjoye Y, Schweitzer H, Crémer J (2019) Competition policy for the digital era, Publications Office, Luxembourg. https://data.europa.eu/doi/https://doi.org/10.2763/407537. Accessed: 29 July 2024
Moore JF (1993) Predators and prey: a new ecology of competition. Harv Bus Rev 71:75–83
Moreno-Casas V (2024) A coevolutionary approach to institutional lock-in. Review of Evolutionary Political Economy 5. https://doi.org/10.1007/s43253-024-00132-2
Muñoz FF (2024) The coevolution of technology, markets, and culture: the challenging case of AI. Review of Evolutionary Political Economy 5. https://doi.org/10.1007/s43253-024-00126-0
Naudé W (2023) Destructive digital entrepreneurship, IZA Discussion Papers, No. 16483. Institute of Labor Economics (IZA), Bonn. https://doi.org/10.2139/ssrn.4587419
Nelson RR (1995) Recent evolutionary theorizing about economic change. Journal of Economic Literature 33:48–90
Nelson RR, Sampat BN (2001) Making sense of institutions as a factor shaping economic performance. J Econ Behav Organ 44:31–54. https://doi.org/10.1016/S0167-2681(00)00152-9
Nelson RR (2018) Economics from an evolutionary perspective. In: Nelson RR et al (eds) Modern evolutionary economics. An overview. Cambridge University Press, Cambridge. pp 1–34. https://doi.org/10.1017/9781108661928.001
North DC (1990) Institutions, institutional change and economic performance. Cambridge University Press, Cambridge
Novak M (2024) Sociologically influenced coevolutionary dynamics. Review of Evolutionary Political Economy 5. https://doi.org/10.1007/s43253-024-00119-z
OECD (2019) An introduction to online platforms and their role in the digital transformation. OECD, Paris. https://doi.org/10.1787/53e5f593-en
Øverby H, Audestad JA (2021) Introduction to digital economics. Foundations, business models and case studies, 2nd edn. Springer, Cham/ Switzerland. https://doi.org/10.1007/978-3-030-78237-5
Peltzman S (1976) Toward a more general theory of regulation. The Journal of Law and Economics 19:211–240
Petit N (2020) Big Tech and the digital economy: the moligopoly scenario. Oxford University Press, Oxford. https://doi.org/10.1093/oso/9780198837701.001.0001
Petrova A (2019) The impact of the GDPR outside the EU. https://www.lexology.com/library/detail.aspx?g=872b3db5-45d3-4ba3-bda4-3166a075d02f. Accessed 30 June 2024
Podszun R (2024a) Was ist das Problem bei der Zähmung von Big Tech? In: Heine K, Budzinski O (eds) Wettbewerb, Recht und Wirtschaftspolitik, Festschrift für Wolfgang Kerber. Nomos: Baden-Baden, pp 191–206
Podszun R (2024b) Introduction. In: Podszun R (ed) Digital Markets Act. Article-by-article commentary. Nomos: Baden-Baden, pp 1–16

Posner RA (1993) What do judges and justices maximize? (The same thing everybody else does). Supreme Court Economic Review 3:1–41

Pyka A, Nelson RR (2018) Schumpeterian Competition and Industrial Dynamics. In: Nelson RR et al. (eds) Modern evolutionary economics. An overview. Cambridge University Press, Cambridge, pp 104–142. https://doi.org/10.1017/9781108661928.004

Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union, OJ L 310, 26.11.2015, pp 1–18. ELI: http://data.europa.eu/eli/reg/2015/2120/oj

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) (Text with EEA relevance), OJ L 119, 4.5.2016, pp 1–88. ELI: http://data.europa.eu/eli/reg/2016/679/2016-05-04

Regulation (EU) 2019/1150 of the European Parliament and of the Council of 20 June 2019 on promoting fairness and transparency for business users of online intermediation services (Text with EEA relevance), PE/56/2019/REV/1, OJ L 186, 11.7.2019, pp 57–79. ELI: http://data.europa.eu/eli/reg/2019/1150/oj. ('P2B' regulation)

Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act) (Text with EEA relevance), PE/85/2021/REV/1, OJ L 152, 3.6.2022, pp 1–44. ELI: http://data.europa.eu/eli/reg/2022/868/oj

Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act) (Text with EEA relevance), PE/17/2022/REV/1, OJ L 265, 12.10.2022, pp 1–66. ELI: http://data.europa.eu/eli/reg/2022/1925/oj

Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a single market for digital services and amending Directive 2000/31/EC (Digital Services Act) (Text with EEA relevance), PE/30/2022/REV/1, OJ L 277, 27.10.2022, pp 1–102. ELI: http://data.europa.eu/eli/reg/2022/2065/oj

Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data and amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828 (Data Act), PE/49/2023/REV/1, OJ L, 2023/2854, 22.12.2023. ELI: http://data.europa.eu/eli/reg/2023/2854/oj

Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) Text with EEA relevance, PE/24/2024/REV/1, OJ L, 2024/1689, 12.7.2024. ELI: http://data.europa.eu/eli/reg/2024/1689/oj

Robert V, Yoguel G (2022) Exploration of trending concepts in innovation policy. Review of Evolutionary Political Economy 3:259–292. https://doi.org/10.1007/s43253-022-00064-9

Sanchez-Cartas JM, Leon G (2021) Multisided platforms and markets: a survey of the theoretical literature. Journal of Economic Surveys. https://doi.org/10.1111/joes.12409

Savin A (2020) New directions in EU digital regulation post-2015: regulating disruption. Pravni Zapisi. https://doi.org/10.5937/pravzap0-26241

Saviotti PP (2023) Innovation, complexity and economic evolution. From theory to policy, Routledge, London, New York

Schumpeter JA (1934) The theory of economic development. An inquiry into profits, capital, credit, interest, and the business cycle, Cambridge

Schweitzer H et al (2018) Modernisierung der Missbrauchsaufsicht für marktmächtige Unternehmen, Endbericht. https://www.bmwk.de/Redaktion/DE/Publikationen/Wirtschaft/modernisierung-der-missbrauchsaufsicht-fuer-marktmaechtige-unternehmen.pdf?__blob=publicationFile&v=12. Accessed: 19 June 2024

Section 230 of the Communications Decency Act. 47 U.S.C. § 230 (2018)

Slembeck T (1997) The formation of economic policy: a cognitive-evolutionary approach to policy-making. Const Polit Econ 8:225–254

Spindler G (2023) EU Internet policy in the 2020s. In: Savin A, Trzaskowski J (eds) Research handbook on EU Internet law, Edward Elgar, Cheltenham, Northampton, pp 2–45. https://doi.org/10.4337/9781803920887.00007

St J, Karaman Örsal DD (2020) The regulation of zero price markets by the competition authorities in the USA and the EU. Compet Regul Network Ind. https://doi.org/10.1177/1783591720943756

Stigler G (1971) The theory of economic regulation. Bell J= Econom Manage Sci 2:3–21. https://doi.org/10.2307/3003160

Stigler Committee on Digital Platforms (2019) Final report, September 2019. https://research.chicagobooth.edu/stigler/media/news/committee-on-digitalplatforms-final-report. Accessed 20 July 2024)

Stigler Centre (2019) World reports on digital markets, 15 May 2019. https://www.chicagobooth.edu/research/stigler/events/antitrust-competition-conference/world-reports-on-digital-markets. Accessed 20 July 2024

Stocker V, Knieps G (2019) Network neutrality through the lens of network economics. Rev Netw Econ. https://doi.org/10.1515/rne-2019-0025

Streinz Th (2021) The evolution of European data law. In: Craig P, de Búrca G. (eds) The evolution of EU law. Oxford University Press, Oxford, pp 902–936. https://doi.org/10.1093/oso/9780192846556.003.0029

Sussan F, Acs ZJ (2017) The digital entrepreneurial ecosystem. Small Bus Econ 49:55–73. https://doi.org/10.1007/s11187-017-9867-5

TFEU = Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union - consolidated version of the Treaty on the Functioning of the European Union - protocols - annexes - declarations annexed to the Final Act of the Intergovernmental Conference which adopted the Treaty of Lisbon, signed on 13 December 2007 - Tables of equivalences, Official Journal C 326, 26/10/2012 P. 0001 – 0390

The White House (1997) Read the framework [Framework for global electronic commerce], https://clintonwhitehouse4.archives.gov/WH/New/Commerce/read.html. Accessed 11 July 2024

Varian HR, Shapiro C (1999) Information rules: a strategic guide to the network economy. Harvard Business Review Press, Boston

Von Wangenheim G (2011) Evolutionary theories in Law and Economics and their use for comparative legal theory. Rev Law Econ. https://doi.org/10.2202/1555-5879.1571

Wambach A (2023) Wettbewerb in der digitalen Ökonomie. List Forum Für Wirtschafts- und Finanzpolitik. https://doi.org/10.1007/s41025-022-00242-x

Wu T (2003) Network neutrality, broadband discrimination. J Telecommun High Technol Law 2:141–179

Zimmer D, Göhls J-F (2024) Enforcement of the Digital Markets Act: The European Commission takes action. VerfBlog, 10 April 2024. https://doi.org/10.59704/b8a9c4f390103f3b

Zingales L et al (eds) (2022) George Stigler 50 years later. Stigler Center. https://www.promarket.org/wp-content/uploads/2022/06/CBP2121-Stigler-50-Year-singlepages-061422.pdf. Accessed 17 September 2024

Zutshi A, Grilo A (2019) The emergence of digital platforms: a conceptual platform architecture and impact on industrial engineering, editorial. Comput Ind Eng. https://doi.org/10.1016/j.cie.2019.07.027