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"Vertical Interoperability in Digital Markets: Insights from the *Google-Enel X* Case"

Prof. Giuseppe Colangelo

SUPERVISOR

Prof. Arnaudo Luca

CO-SUPERVISOR

Sabrina Ambrosanio 773591

CANDIDATE

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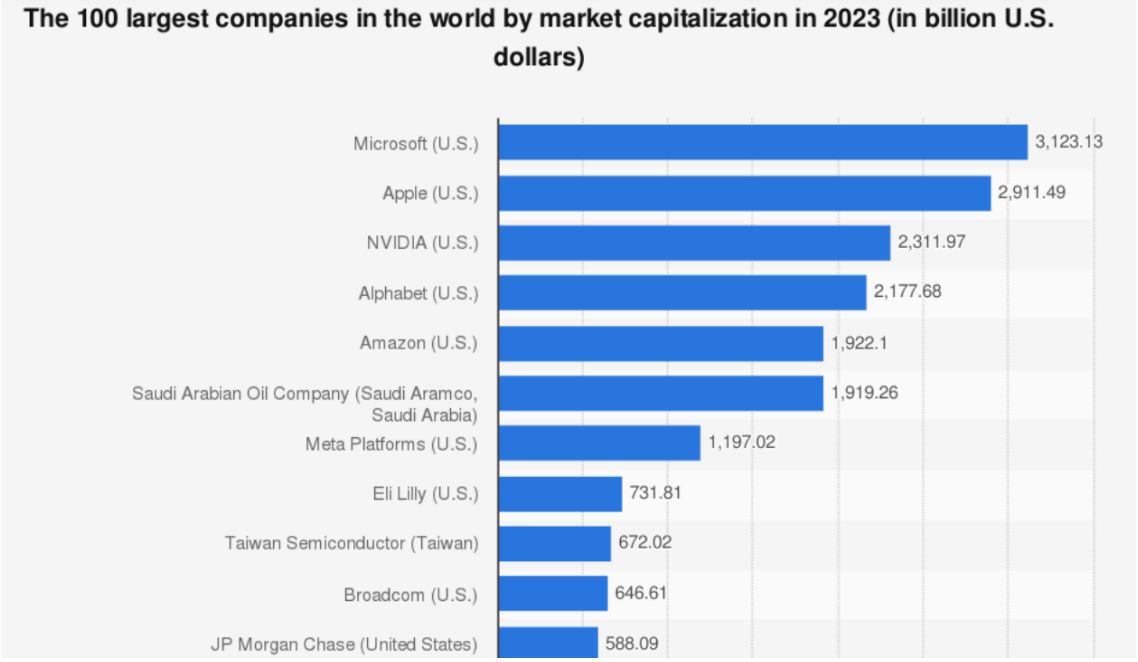
Introduction

In the ever-evolving landscape of digital economy, platforms and ecosystems have become dominant forces reshaping entire industries. The five tech titans Google, Amazon, Apple, Microsoft, and Meta (formerly known as Facebook Inc.), which were previously referred to as GAFAM– now known as GAMAM or GAMMA – have a combined market value of nearly seven trillion U.S. dollars and a user base in the billions, making them the largest internet companies in the world.[1] These companies have created extensive digital ecosystems that connect billions of users worldwide, offering a variety of services, including data storage, content distribution, mobile operating systems, and cloud computing. The interaction between businesses and consumers has been transformed by these ecosystems, which have also introduced unprecedented regulatory and competitive challenges.

Table 1. The 100 largest companies in the world by market capitalization in 2023



Source: Forbes. (2024). Biggest companies in the world by market value 2023.

The tech giants' oligopoly eliminates competition and reduces digital diversity by promoting their own products and services (on Google's search results) and acquiring successful companies and newcomers (in this case, Facebook acquired Instagram and WhatsApp). This concentrated power has frequently led to calls for antitrust action. A series of lawsuits have been submitted to democratize the digital infrastructure and regulate Big Tech's hold on the internet since Microsoft's early antitrust battle in the 1990s.[2]

[1] J. Clement (2024)
[2] *Ibid.*

To address the ever-increasing power of such tech companies, the European Union has decided to establish the Digital Market Act. (DMA). The European Parliament approved this regulation on digital markets on the 5th of June 2022, in conjunction with the Digital Services Act (DSA). Its goal is to monitor and regulate the conduct of substantial digital platforms, which are regarded as "gatekeepers."[3] Despite these regulations, some issues related to the ecosystems created by the so-called gatekeepers defined by the European Commission continue to persist.

One critical areas of concern within this ecosystem, which is extensively regulated by the DMA, is interoperability, specifically vertical interoperability — the ability of systems and services at different levels of the digital value chain to work together.[4] In the context of platform-driven markets, vertical interoperability plays a significant role in maintaining fair competition and impede innovation.

This thesis focuses on the Google - Enel X case, which illustrates the complexities of vertical interoperability and how dominant platforms can leverage their market position to limit competition. The Google - Enel X dispute centres on Google's refusal to permit JuicePass, an electric vehicle charging software developed by Enel X, to integrate with Android Auto, Google's in-vehicle infotainment system.
This case raises significant legal challenges concerning competition law, particularly under Article 102 TFEU and the Essential Facilities Doctrine. Moreover, this case allows us to shed light on the importance of the recently introduced application of the Digital Markets Act (DMA), as well as its shortcomings.

In order to further investigate the issue of vertical interoperability, this thesis also examines the Bosch - Blubrake case, which reveals comparable concerns in a hardware context. Bosch allegedly restricted Blubrake's ability to integrate its advanced anti-lock braking system (ABS) with Bosch's technology by restricting access to its e-kit systems.
Bosch - Blubrake and Google - Enel X are both scenarios of how dominant companies can restrict competition by regulating access to essential systems — hardware infrastructures or software platforms.
These examples underscore the more extensive consequences of denying interoperability between digital and physical ecosystems.

Therefore, as noted from the aforementioned cases, in the scenario where a dominant undertaking acts both as a trader and an intermediary on the same platform, it could have an incentive to discriminate against third-party undertakings in order to favour itself (self-preferencing). Although Article 102 TFEU addresses self-preferencing practices, it addresses it in an implicit manner. This practice is only considered in cases where a dominant company favours its own products or services, causing exclusionary or exploitative effects that harm competition. Conversely, the DMA introduces specific prohibitions against self-preferencing through Article 6, even in the absence of exclusionary effects. In the context of the DMA, it is imaginable that gatekeepers will persist in their efforts to maximize their profits by pushing the boundaries to the point of non-compliance with the rules, even if the practice itself does not result in market distortions or inequities.[5] Even though Article 102 TFEU addresses self-preferencing

[3] Lenoci and Spada (2024)
[4] DMA Art. 6.
[5] Adolfsson (2024)

practices, it does so in a non-explicit manner. This practice is only considered in cases where a dominant company favors its own products or services, causing exclusionary or exploitative effects that harm competition. Conversely, the DMA introduces specific prohibitions against self-preferencing through Article 6, even in the absence of exclusionary effects. In the context of the DMA, it is imaginable that gatekeepers will persist in their efforts to maximize their profits by pushing the boundaries to the point of non-compliance with the rules, even if the practice itself does not result in market distortions or inequities. This thesis endeavours to investigate this particular issue by analysing the above-mentioned cases that may be regarded as potential instances of self-preferencing.

This thesis opens with an examination of the regulatory framework of Article 102 TFEU, which pertains to the abuse of dominance. It also investigates the role of prominent digital ecosystems, particularly those developed by Apple and Google. Although these platforms are indispensable for both consumers and businesses, they pose substantial obstacles in terms of competition, data access, and interoperability. Through an examination of the Essential Facilities Doctrine and self-preferencing practices, the thesis investigates the potential for these dominant platforms to distort competition in their favour.

The primary analysis centres on the Google - Enel X case, which illustrates the impact of the refusal to grant interoperability on consumer choice and competition. The Bosch - Blubrake case provides a comparative perspective, demonstrating that these issues are industry-wide and impact both software and hardware ecosystems. Collectively, these cases underscore the necessity of more proactive regulatory instruments, such as the DMA, and emphasize the limitations of traditional competition law in rapidly evolving digital markets. The thesis concludes by analysing the legal and economic repercussions of interoperability challenges, as informed by a survey of companies that have encountered comparable situations.

The primary aim of this research is to conduct a critical evaluation of the impact of vertical interoperability on competition within digital ecosystems. This thesis seeks to comprehend the manner in which dominant platforms can deny interoperability by leveraging their market position, thereby restricting consumer choice and competition, through an examination of the Google - Enel X case.
In addition, the thesis integrates the Bosch - Blubrake case to offer additional insights into the potential restrictions on access to essential facilities that dominant firms in both digital and hardware markets may implement. This comparison enhances the thesis's examination of the challenges associated with vertical interoperability in various sectors. The research also evaluates the effectiveness of current legal frameworks, with a particular emphasis on the Essential Facilities Doctrine and Article 102 TFEU, in addressing these challenges. It also investigates the potential of new regulatory tools, such as the DMA, to reduce the risks associated with gatekeeper platforms and promote a more competitive and open digital marketplace.

In the final analysis, the objective of this research is to provide a deeper understanding of the ways in which regulatory and legal instruments can be enhanced to promote innovation, safeguard consumer welfare, and ensure fair competition in markets that are dominated by large platforms. The results will be a valuable addition to the ongoing discussion regarding the future of digital platform regulation and the delicate balance between market fairness and innovation.

Chapter 1: Interoperability in Digital Markets: Examining Article 102 TFEU and the Digital Markets Act

1.1 Overview of the European Union Competition Law – Article 102 TFEU

In order to best introduce the topic that will be covered throughout this thesis, it is important first to provide an overview of the regulatory aspect of the case and, in particular, of Article 102 TFEU, which prohibits «[a]ny abuse by one or more undertakings of a dominant position within the common market or in a substantial part of it … as incompatible with the common market insofar as it may affect trade between Member States».

In order to prove an infringement, Article 102 TFEU stipulates that the following requirements:

i. A dominant position on the relevant market must be held by one or more undertakings;

ii. The position must be held in the internal market or a substantial part of it;

iii. Abuse of the dominant position;

iv. Actual or potential effect on trade between Member States.

The status of dominant firm itself cannot be considered as an infringement, since the dominance of many global players is a direct consequence of their inventions and entrepreneurship. Although the Court of Justice (CJEU) has not issued definitive guidelines on dominance or market power, determining dominance is based on a case-specific approach that considers several factors. The assessment in each individual case requires a two-stage test to be completed. First there is the establishment of the relevant market, through the definition of the appropriate product, geographic, and temporal markets. This is done by a meticulous examination of the group of goods that customers view as alternatives due to their attributes, functions, and prices. The second step regards the investigation of the undertaking's dominant position, by considering: i) the evaluation of the market share of the undertaking to determine its market position; ii) the analysis of barriers to entry or expansion. This concept relates to the probability of an existing competitor or a prospective competitor expanding into the relevant product market; iii) the assessment of countervailing market power, i.e., determining if customers or competitors may offset the undertaking's strength.

A market share above 50% is considered to support a presumption of dominance under EU case law, which can be challenged in specific instances. Entry barriers can strengthen market dominance by making it harder for competitors to enter the market. Low entry barriers may lessen the importance of market share as competitors are more likely to enter the market if, for instance, a company with a large market share raises prices above what is considered competitive. Market share often confers market power, which can be lessened by countervailing buyer power.[6]

[6] Herz and Vedder (2017).

As highlighted earlier, Article 102 TFEU, in addition to the concept of dominant position, focuses primarily on the concept of abuse by the dominant undertaking. In the framework of EU competition law, the term "abuse" is nebulous and subject to various interpretations. However, the CJEU provided some guidance regarding the scope of Article 102 TFEU in the Hoffmann-La Roche case holding that «[t]he concept of abuse is an objective concept relating to the behaviour of an undertaking in a dominant position which is such as to influence the structure of a market where, as a result of the very presence of the undertaking in question, the degree of competition is weakened and which, through recourse to methods different from those which condition normal competition in products or services on the basis of the transactions of commercial operators, has the effect of hindering the maintenance of the degree of competition still existing in the market or the growth of that competition ».[7]

This approach appears to provide little room for the application of the *per se* rules under Article 102 TFEU, as it necessitates a thorough economic study of each situation.[8]

In line with this more "consumer-oriented" approach the Commission established, originally in 2009 and then updated in March 2023, the Article 102 Guidance Paper that states that: «[t]he aim of the Commission's enforcement activity in relation to exclusionary conduct is to ensure that dominant undertakings do not impair effective competition by foreclosing their competitors in an anti-competitive way, thus having an adverse impact on consumer welfare, whether in the form of higher price levels than would have otherwise prevailed or in some other form such as limiting quality or reducing consumer choice ». [9]

This interpretation of the term abuse suggests that the Article's goal is to safeguard both the advancement of consumer welfare and the survival of competitive market institutions. The European Commission has to demonstrate that abuse of a dominant position has a negative impact on both consumer welfare and the market structure. It is crucial to highlight that abuse does not always result from a dominating position; rather, Article 102 TFEU is violated when the dominant corporation takes actions that have a detrimental effect on consumer welfare and market structure.

Moreover, dominant undertakings have a special responsibility, i.e. to avoid any abusive behaviour that may reduce the already compromised competition in the relevant market. Therefore, once the dominance threshold passes, an undertaking can no longer carry out its usual business activities, that could be qualified as abuse.[10]

There are two main categories of abuse that fall under the jurisdiction of Article 102 TFEU: exclusionary abuses and exploitative abuses. These classifications aid in comprehending the ways in which dominant firms may distort competition at the expense of customer welfare and market efficiency.

Exclusionary abuses occur when a dominant company engages in activities aimed at preventing the entry, growth, or long-term survival in the market of other companies. These practices are directed against the smaller rivals of dominant undertakings.

[7] CJEU. (1979). Case 85/76 Hoffmann-La Roche & Co. AG v Commission of the European Communities
[8] Herz and Vedder (2017).
[9] European Commission. (2009, February 24). Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, Para. 19.
[10] Herz and Vedder (2017).

According to the special responsibility explained before, the dominant undertaking is obliged not to eliminate the remaining sources of competition.

The Commission's Article 102 Guidance Paper offers a thorough framework for evaluating exclusionary practices and their foreclosure impacts. Foreclosure implications are defined as «a situation where effective access of actual or potential competitors to supplies or markets is hampered or eliminated as a result of the conduct of the dominant undertaking whereby the dominant undertaking is likely to be in a position to profitably increase prices to the detriment of consumers».[11]

1.2 Definition and Importance of Digital Ecosystems

Technological revolutions and economic expansion are closely related. Nowadays we are experiencing the transition from an industrial economy to a digital one, dragged by the "digital revolution", which is fuelled by information and communications technologies (ICT). The industries that leverage ICT—AI, 5G, big data, and IoT—as a driver of productivity and structural optimization, contemporary information networks as hubs for activity, and digitalized information as vital production variables are together referred to as the "digital economy". ICT is developing quickly, transforming organizational relationships, corporate structures, and employee motivation. This transition has resulted in significant changes to the industrial structure, production factors, business models, and worldwide environment.[12]

As a result of the digital economy, we have seen the emergence of digital ecosystems and platforms, which have enhanced the efficiency of distribution networks and made products and services more accessible and convenient.

Organizations must interact with the so-called "digital ecosystem" (DE), which has emerged as a crucial source of innovation for them, in order to effectively address the challenges posed by the digital economy and provide added value.[13]

Through intense technological rivalry, these ecosystems foster ongoing innovation. Their growth has also posed a threat to market competition, underscoring the urgent need to reconsider competition legislation in order to handle emerging forms of market power and maintain fair competition in the digital era.

Because of the impact of digital ecosystems, laws must constantly evolve to guarantee that progress and technology go hand in hand with justice, security, and accountability.

Current literature does not provide a single and standard definition for defining DE.

According to Petrova, the best way to define and understand a DE is to analyse it from three perspectives (organizational, technological, and economic)[14].This allows a better understanding of the concept and overall functionality of such digital ecosystems. Starting from the organizational perspective, DE can be seen as «the digital counterparts of

[11] European Commission. (2009, February 24). Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, Para. 19.
[12] Rong (2022).
[13] Petrova et al. (2022)
[14] *Ibid.*

biological ecosystems, which are considered to be robust, self-organising and scalable architectures that can automatically solve complex, dynamic problems» [15].

Another interpretation defines DE as a digital environment composed of digital elements, such as software, apps, services, information, business procedures, models, and legislation. In order to improve economic outcomes, it enables stakeholders to employ digital technology for service access and interpersonal communication.[16]

Moving on to the definition from a technological perspective, DE is considered an infrastructure built on peer-to-peer distributed software technology. Using Internet connections, this technology locates, transports, and links services and information, enabling network transactions and the dissemination of all digital "objects" included within the infrastructure. All representations stated in formal or natural languages that are interpreted and processed by computer software and/or humans are considered digital objects. Examples of such representations include software programs, services, knowledge, training materials, legal frameworks, and laws. [17]

Finally, regarding the definition from an economic point of view, DE is defined as a self-organizing, sustainable and scalable system which is composed of heterogeneous and interconnected digital actors (enterprises, organizations, developers, customers). That system is cantered on site-to-site interactions to boost the system's usability, encourage and profit from information exchange, foster internal and external collaboration, and foster system innovation.[18]

Another interpretation defines DE as a loosely linked network of participants who interact and offer a variety of resources to create a digital service cantered around the platform.[19] With this definition we can introduce a new concept, closely linked to DE: digital platforms.

Most of the strategy literature takes the view that platforms, which facilitate interactions between ecosystem participants and potential end users, are frequently the foundation of ecosystems. However, platforms and ecosystems are not equivalent and need not to be confused. A platform can be described as a new infrastructure formation, a new social technology, a new economic model, or all three at once. If platforms are about technology, then ecosystems are about interorganizational linkages.[20]

The digital platform is a customized desktop or mobile application designed to serve internal users (workers) and/or external users (partners and consumers). Digital platforms serve as a means of facilitating communication between businesses and customers by connecting people, organizations, and resources. They also ensure that company administration is conducted more efficiently.[21]

Moreover, it is important to highlight that platforms are frequently (though not always) owned or managed by a single company, which is typically a business undertaking with a keen interest in creating an ecosystem. But some platforms—like Linux, which has a

[15] Briscoe (2009).
[16] Fu (2006).
[17] Nachira et al. (2007).
[18] Li et al. (2012).
[19] Ojala and Lyytinen (2018).
[20] Jacobides and Lianos (2021).
[21] Ruggieri et al. (2018).

foundation—are managed by different governance mechanisms. Android, on the other hand, is a separate company that is indirectly under Google's control and makes use of "Google Mobile Services," a formalized complementary platform.[22]

Beside the platform, the technological infrastructure of a digital ecosystem has also another component: application programming interfaces (APIs). APIs are tools that provide pre-implemented functionalities, enabling software reuse and reducing development time and effort. They act as common ground for different software systems to communicate and exchange information, facilitating value creation within and between organizations.[23]

The integration of digital platforms and APIs has empowered DEs to bolster collaboration at various business levels, driving innovation notably in service delivery, client interface, and delivery system technology.

Multi-channel access and adaptable pricing structures like subscriptions or transaction-based fees are examples of innovations in service delivery. Improvements to client interfaces are cantered on enhancing user authentication procedures and providing greater access for end users. Furthermore, the delivery systems are greatly enhanced by the integration of revenue sharing and product complementarity methods with the latest developments in security and stream connection technologies.

1.2.1 Mobile ecosystems: Google and Apple

Within the scenario of DEs, our analysis will focus on mobile ecosystems, which comprise various devices (mobile phones, tablets, and phablets) and software (operating systems, app stores, and development tools).

In mobile ecosystems, interconnectivity and interaction among components, whether produced by the parent company or third parties, are essential for an optimal use of all the ecosystem's functionalities. Nevertheless, within a mobile ecosystem, third-party services and device interoperability can be undermined by two practices: the ecosystem orchestrator abusing its regulatory role to pursue anticompetitive interests by limiting or deteriorating interoperability for third-party services and devices, thereby limiting their functionalities in comparison to its own, and restricting API access due to privacy, security, or technical concerns.[24]

Mobile ecosystems are currently dominated by two companies (Google and Apple). The way these two leading companies implement interoperability is crucial for market outcomes, as smartphones serve as entry points, guiding users through a sequence of related choices. Following a consumer's decision to select between an iPhone and an Android, behavioural biases reinforce the impact of that original choice. Because of this, embracing several services inside a single ecosystem makes moving to a different one extremely difficult.[25]

[22] Jacobides and Lianos (2021).
[23] Ofoeda et al. (2019).
[24] Colangelo and Martínez (2024).
[25] *Ibid.*

Google's mobile ecosystem is characterized for its openness and flexibility, and it revolves on the Android operating system. Through the operating system and Google's suite of mobile services, a wide range of actors, including users, developers, device manufacturers, service providers, and Google itself, are interconnected inside this ecosystem.

Interoperability is necessary for this ecosystem to function. Standardized protocols and APIs enable — or at least should enable — devices and applications inside the ecosystem to interact with each other effortlessly. This improves overall usability by enabling a seamless user experience across various platforms and devices. There's clear evidence of decentralized governance with some degree of stakeholder self-regulation. Manufacturers and developers are allowed to operate and innovate with some degree of autonomy, as long as the established criteria set by Google are adhered to. Regular security updates and the addition of Google Play Protect, which checks apps for malware and other security threats, are key components of Google's mobile ecosystem's security and privacy.[26] These steps, along with strict app permissions and data handling guidelines, help protect user information and preserve ecosystem trust .In addition to providing consumers with access to a wide range of services and content, the Google Play Store acts as a central platform for developers to distribute their apps, encouraging ongoing innovation and value creation of the entire ecosystem.

Device makers have the option to either license Google's version of Android or utilize the Android Open-Source Project (AOSP) code to develop their own operating system.[27]

Unlike Apple, Google allows third-party app stores and direct downloads from developer websites to be installed on devices. An example is F-Droid, an open-source app store and software repository for Android, with a similar functioning to the Google Play store. This adaptability gives developers additional channels for product distribution and customers access to a wider variety of apps. However, the Play Store remains the dominant platform, accounting for over 90% of app downloads on Android devices.[28]

APIs within the Google mobile ecosystem are crucial for Android app development, providing services like Google Play, Firebase, and the Android SDK. Apps may leverage the newest features without having to often upgrade their operating system thanks to Google Play Services' location, map, sign-in, and messaging APIs. App development is made easier with Firebase's real-time databases, cloud messaging, and authentication features. APIs for media processing, data storage, hardware access, and user interface design are all included in the Android SDK. These APIs emphasize security with OAuth 2.0 and optimize efficiency while ensuring smooth connection with other Google services like Drive, Calendar, and Gmail. APIs increase the value of the ecosystem by allowing third party developers Google to create apps that seamlessly interface with its key services. Moreover, tools like Android Studio, the official integrated development environment (IDE) for Android development, are extremely beneficial to inventors. When used in conjunction with Google's extensive documentation and support services, it accelerates the process of creating apps and guarantees a smooth integration with Google services like Calendar, Drive, and Gmail.[29] These tools, together with Google's

[26] Google Play Help. (2024)
[27] Cellan-Jones et al. (2022).
[28] *Ibid.*
[29] Google Developers. (2024)

extensive library of APIs, make it easier to develop complex, safe apps that improve user experience.

Another important feature of the ecosystem is its seamless experiences across various services and devices thanks to services like Google Assistant, Google Home, and Android Auto. This integration improves user experience overall by fostering a unified and connected digital world. For instance, users can control their smart home devices using Google Assistant on their Android phones or navigate using Android Auto in their cars. These functions are all synchronized through their Google accounts.

Moreover, The Google ecosystem, which supports a wide range of goods through open protocols for compatibility and unified control, integrates smoothly with wearables like smartwatches and wireless headphones as well as smart home devices from multiple manufacturers. Google Assistant is compatible with a wide range of third-party devices, allowing voice control and automation. Google Assistant may be used to operate smart speakers made by Sonos, Bose, and JBL. It allows users to play music, get weather reports, and control other smart devices using voice commands. In order to guarantee wide compatibility, Google works with partners to integrate protocols like Z-Wave and Zigbee, which are prevalent in many smart home products. By providing centralized control and interoperability for a range of smart devices, Google's Nest Hub is crucial for enhancing the user experience. This smart display serves as the primary control point for various smart home devices, allowing seamless management and integration within the Google ecosystem.

Google Chrome is the standard web browser on most Android smartphones. However, users are able to download and use alternative browsers including Firefox, Opera, or Samsung Internet. These browsers support any browser engine and offer a variety of performance and feature options. Nonetheless, Google Chrome has a browser share of 74%.[30] Google's mobile services are closely related to its advertising business, which constitutes the majority of its revenue, with notable contribution from the Google Network, YouTube advertisements, and Google Search. In addition, the Google Play Store generates a significant revenue stream via subscriptions and app purchases. Important contributions are also made by Google Cloud services, such as Google Workspace and Google Cloud Platform. Revenue is further supported by hardware sales of goods like Google Nest smart home appliances and Pixel smartphones. Finally, despite their smaller scale, Alphabet's experimental projects contribute to the broader financial scene.[31] These numerous streams of income illustrate how Google makes use of its open ecosystem to generate a stable income model though a variety of channels.

Apple's mobile environment differs considerably from Google's due to its closed and highly controlled structure. Apple is anticipated to be more impacted by the new regulations because to the distinctions in their business strategies and requirements for access to their mobile ecosystems.[32]

Apple mobile ecosystem revolves on the iOS operating system. Its so-called "closed" ecosystem is characterized by multiple features. Indeed Apple, unlike Google, does not license iOS to other device manufacturers, nor does it allow alternative operating systems on its devices. This implies that only iPhones and iPads can run iOS. Apple may then

[30] Cellan-Jones et al. (2022)
[31] Cuofano (2024)
[32] Colangelo and Martínez (2024).

utilize this position to control the pre-installed apps and services on Apple devices as well as the primary gateways (app stores and browsers) that allow users to access and receive web content. Moreover, native iOS apps can only be downloaded from its proprietary App Store. Users are unable to browse alternate app stores or download these programs directly from the creators' websites. Since these alternatives don't pose a threat to the App Store's competitiveness, Apple is free to establish the guidelines for app developers that want to release their products on iOS. Apple is able to set the terms and conditions for app developers because of its dominance over app distribution and the lack of competition from other options.[33] Apple's ecosystem is further defined by its great focus on security and privacy. By restricting how applications may track activity across other apps and websites, App Tracking Transparency (ATT) gives consumers more control over their data. Based on Apple's WebKit engine, Safari is the default web browser on all iOS devices. Although users have the option to download other browsers such as Chrome or Firefox, these browsers are limited in their ability to distinguish themselves from Safari in terms of performance and features as they too need to use the WebKit engine. Web apps, which are browser-based programs that may provide a user experience akin to native apps but are constrained by WebKit's features, are likewise impacted by this restriction.[34]

Beside the iOS operating system, other two components are crucial for the Apple ecosystem. The first one is Xcode, which is at the heart of iOS app development, serving as Apple's integrated development environment (IDE). It gives programmers strong tools for developing, testing, and debugging in Swift, the cutting-edge programming language from Apple. The Interface Builder in Xcode makes the process of creating user interfaces more efficient, and its full feature set of profiling tools helps to maximize the performance of apps.[35]

The other major component is the Apple's portfolio of services, that enhance customer experience and peruses a lock-in users approach characterized by a by a multi-layered strategy that fosters exclusivity, interoperability, and interdependencies while integrating software and hardware to differentiate its products and services.[36] As a unifying account, the Apple ID enables users to access and synchronize their data across all Apple platforms, making it possible for activities started on one device to be easily resumed on another. Services like iCloud, Apple Music, Apple Pay, and iMessage are clear examples of this integration; they offer a unified experience across Apple products like AirPods, Apple Watches, and Apple TVs. Within its ecosystem, Apple's maintenance of this degree of consistency enhances customer satisfaction and loyalty. The lock-in user strategy also includes the hardware integration into the Apple ecosystem. For instance, users may instantly switch from viewing a movie on their iPad, listening to music on their iPhone, or participating in a conference call on their Mac without having to pair their AirPods with each device that is linked to their Apple ID.

Other two indicative examples of the Apple's interoperability are the AirDrop and Handoff functions. The former allows rapid and simple file transfers between Apple devices without requiring internet connectivity. This secure and efficient local transfer

[33] Cellan-Jones et al. (2022).
[34] *Ibid.*
[35] Gorin (2024).
[36] Vijay (2021).

method enhances the user experience within the Apple ecosystem by enabling instant sharing. Handoff instead, enables users to begin tasks on one device and continue them on another, such as sending an email or visiting a webpage. This is a component of Apple's Continuity feature, which also lets Macs and iPads send and receive SMS/MMS messages and phone calls when an iPhone is close by. However, non-Apple devices are unable to support Apple's proprietary technologies and standards, which restricts file sharing and media streaming to the Apple ecosystem. Examples of these standards and technologies are those used in AirDrop or AirPlay, a proprietary protocol suite that allows wireless streaming of photos, video, audio, and device screens between devices. This deliberate restriction makes sure that utilizing Apple products and services in tandem is the only way to fully enjoy the advantages and convenience of the company's ecosystem.

Through limited third-party integration, Apple restricts interoperability with non-Apple devices.[37] Even though some third-party apps are supported, they are not able to achieve the same level of integration into the system as Apple's own apps, resulting in a less seamless experience. In order to achieve the lock-in user approach Apple ecosystem is designed to be less compatible with third-party products. This closeness ensures that users experience the full benefits and convenience only when using Apple devices and services together. This strategy keeps a significant competitive advantage in the market by strengthening brand loyalty and making it less desirable for consumers to switch to rival platforms.

1.2.2 Challenges in regulating digital ecosystems

The market capitalization landscape changed in the 2010s, with technology-based companies such as Google, Apple, Facebook, Amazon, and Microsoft (GAFAM) replacing industrial and banking titans. At first, the emergence of GAFAM was praised and attention was drawn to the ecosystems and platforms that contributed to its success. These ecosystems are formed up of clusters of specialized companies that rely on GAFAM and are very interested in their underlying business models.[38]

However, the dominance of these firms also raises concerns. Competition policy is challenged by the intricate multiproduct webs that GAFAM orchestrate, and which lead to client lock-in. Their ecosystems include a range of complimentary products, opening up new arenas of rivalry outside of niche industries. These companies use multiactor ecosystems and core digital platforms to exploit their influence; as a result, they are difficult to replace and vulnerable to lock-in and tipping because of cost structures and network externalities. With the help of financial markets, ecosystem orchestrators take advantage of industry bottlenecks and strive for total client lock-in. Their market-wide effect makes regulatory measures more difficult.

The emergence of dominant platforms with advantageous information about participants in the markets they control has drawn significant attention from regulators and economists. Such platforms are at the heart of online economic activity, connecting multi-sided markets of producers and consumers of various goods and services. Their privileged ecosystem position and market dominance give rise to worries that companies may

[37] Cellan-Jones et al. (2022).
[38] Jacobides and Lianos (2021).

engage in anti-competitive behaviour that stifles innovation and lowers consumer welfare.[39]

The reason why actors within the digital economy impact and are relevant in market competition and policy lies in their intrinsic characteristics:

i. *Multi-sidedness and network effects*: The interaction between two or multiple groups of users is facilitated through the platform, generating value for both the platform and the users. Both the number of users in one group and the number of participants in the other group raise the value of the service provided by the platform to that group (direct and indirect network effects).[40]

   The value can be symmetric between both sides (as in a marketplace where trading goods is the main goal) or it can be the case that one party gains more value from the other's interactions (as in an aggregator where users place more value on the platform's content and advertisers place more value on user interaction).[41]

   The unique economic traits of platforms lead to self-reinforcing effects that drive competition dynamics, often resulting in highly concentrated markets. As more users join a platform, its perceived value increases, enabling the collection of more data, which in turn improves the service. This cycle encourages user retention within the digital ecosystem and discourages switching to competitors.[42]
   For instance, in the Android ecosystem, the more users there are, the more attractive the platform for app developers and advertisers will be.

ii. *Economies of scale and economies of scope*: Those economies enhance the competitive advantage of digital players. Economies of scale and scope augment the competitive advantage of digital firms. Large datasets improve service quality and enable firms to diversify into new areas through advanced machine learning and AI, while once established, digital firms can expand rapidly at minimal cost due to significant fixed but low variable production costs.
   Moreover, once a digital ecosystem is established, it attracts a wide range of complementary services including hardware, devices, software, apps, and websites. This centralizing force promotes the creation of an ecosystem based on technical standards, which can lead to significant interoperability issues and increased switching costs, creating lock-in scenarios. The necessity for compatibility drives the ecosystem to develop around a dominant design, with its controller acting as an orchestrator. As platform providers aim to become the primary gateway to online content and services, the competition shifts from within the market to competition for control of the market.[43]

Because of these features, early adopters benefit greatly from increased service quality, reduced production costs, and a rapidly expanding user base. Second movers find it

[39] Parker et al. (2020).
[40] Borgogno and Colangelo (2022).
[41] Parker et al. (2020).
[42] Borgogno and Colangelo (2022).
[43] *Ibid.*

difficult to compete effectively in digital markets due to the high entrance costs, which strengthens the dominance of the first movers.

This dynamic inhibits investment in markets where a dominant company already exists but fosters innovation in uncharted territory. As a result of the market tipping phenomena, super-platforms have emerged, using their advantages in size and data to penetrate neighbouring markets. For example, Google grew from software to hardware, while Amazon changed from being an online marketplace to cover the food and entertainment industries.

Because of this disruption in traditional industries, incumbents are forced to incorporate digital technology in order to remain competitive. In the end, consumers stand to gain from this disruption as it spurs innovation and raises service standards. But the better data and well-established networks of digital platforms pose serious problems for conventional businesses, making it hard for them to successfully compete.

1.3 Digital Markets Act (DMA)

The Digital Markets Act (DMA) was introduced by the European Union in order to address the unique challenges posed by the dynamic and rapidly developing digital economy.[44] Additionally, this legislative measure has been adopted in order to address an alleged antitrust enforcement failure.[45]

Digital platforms have revolutionized economic activity in recent years by expanding into new sectors and changing those that already existed. These platforms show notable data-driven advantages, economies of scale, and network effects, which concentrate market power in the hands of a small number of dominant businesses. Online platforms do, in fact, create ranking algorithms, determine the prerequisites for business users to join the network, and establish the standards for suspending, delisting, dimming, or terminating their accounts as well as the related products and services that are sold through the platform. When a BigTech company acts as a trader and an intermediary on the same platform, these behaviours are seen as especially concerning since the company may be enticed to discriminate in favour of itself in these situations (self-preferencing).[46]

In this fast-paced world, traditional competition laws —which frequently call for drawn-out investigations and are implemented only after anti-competitive action has taken place— are considered insufficient. By this view, competition law alone is not enough to address systemic issues in the platform economy, so a regulatory intervention is implemented to impose *ex ante* obligations on digital gatekeepers and relieve enforcers of their duties. Unlike typical antitrust examinations —which involve defining relevant markets, establishing dominance, and evaluating concerns— this approach prevents gatekeepers from engaging in practices that harm competition and reduce efficiency, thereby ensuring better protection for the market and consumers.

The DMA is required in order to prevent dominant platforms from abusing their position and to maintain the open and competitive nature of digital markets. The DMA aims to

[44] Regulation (EU) 2022/1925 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act) [2022] OJ L 265/1 .
[45] Cappai and Colangelo (2021).
[46] *Ibid.*

create a regulatory framework that can more successfully encourage fairness and innovation since these platforms have the ability to swiftly solidify their market dominance and hinder competition.

As indicated by Article 1(1), DMA's purpose is to «contribute to the proper functioning of the internal market by laying down harmonised rules ensuring for all businesses, contestable and fair markets in the digital sector across the Union where gatekeepers are present, to the benefit of business users and end users.»

The DMA's first objective is to increase the digital market's contestability. The final version fills in some of the gaps, including defining the goals of the DMA proposal, which only states that it seeks to promote contestability and fairness without defining those concepts or explaining how each requirement placed on digital gatekeepers is supposed to contribute to the achievement of each goal.[47]

Contestability is defined as «the ability of undertakings to effectively overcome barriers to entry and expansion and challenge the gatekeeper on the merits of their products and services. »[48] In order to accomplish this goal, the DMA opens up current platforms to competition at different stages of the value chain (intra-platform competition) and encourages more direct rivalry across digital platforms (inter-platform competition). This is necessary because many digital markets have already tipped in favour of the largest platforms, and key players cannot sufficiently challenge each other in their home markets. The DMA aims to modify the business environment to promote more competition, especially when new digital services are introduced and subject to the DMA's behavioural regulations.[49]

Another objective of the DMA is to enhance fairness in commercial dealings, defining unfairness as «an imbalance between the rights and obligations of business users where the gatekeeper obtains a disproportionate advantage. »[50] The objective of fairness is issued by constraining large digital platforms' role as intermediaries between businesses and end users. This role, while providing benefits to end users, may disadvantage business providers. The DMA's regulatory intervention, driven by fairness notions, aims to address behavioural kinks in the marketplace that exacerbate the impact of network effects, thereby ensuring fair competition law and preventing potential anti-competitive conduct.[51]

The DMA does not make it apparent which requirements are meant to maintain fairness and which are meant to encourage contestability, therefore it is vital to emphasize that it views fairness and contestability as closely related. Confusion results from the text's inability to distinguish between the two policy aims of contestability and fairness, which is frequently mentioned combined.[52]

[47] Colangelo (2023).
[48] DMA, Recital 32. Also, see DMA, Art.12 (5b)
[49] De Streel and Alexiadis (2023).
[50] DMA, Recital 33. Also, Art.12(5a)
[51] De Streel and Alexiadis (2023).
[52] Colangelo (2023).

Finally, the DMA's ultimate objective is to strengthen the internal market. Consequently, its legal foundation is Article 114 TFEU[53] rather than Article 103 TFEU. [54] Member States can place obligations on digital platforms only if they align with EU competition laws or national competition legislation and serve legitimate public policy goals.

The DMA centralizes application and enforcement of antitrust laws at the EU level, in contrast to traditional antitrust enforcement, which is fragmented at the national level.

A digital platform that is designated as a gatekeeper for one or more Core Platform Services (CPS) is subject to up to 22 distinct requirements and restrictions.[55]

The duties are divided into three separate lists:

i. The black list under Article 5. A "quasi-automatic" list of nine items, primarily prohibitions, which ought to be self-executing and self-explanatory.[56] Article 5 includes the obligation to allow business users to offer their products or services to end users via third-party online intermediation services. It also forbids gatekeepers from requiring business users to utilize, offer, or integrate with the gatekeeper's identification service in the context of the business users' services provided through the gatekeeper's core platform services. Accelerating the adoption of remedies for anti-competitive behaviour by gatekeeper platforms is the main motivation behind the DMA policy agenda. Article 5 specifically does this by placing behavioural limitations or ex-ante duties on any sites that have been identified as gatekeeper platforms. These duties are applicable even in the absence of additional European Commission inquiry.[57]

ii. The black list provided under Article 6 including twelve restrictions and requirements[58] susceptible of further specification under Article 8.[59] Though those Article 6 obligations apply to the designated gatekeepers directly in theory, the Commission may specify them more precisely in the course of a regulatory discussion with the gatekeeper.[60] These obligations include making sure that comparable services work together, facilitating data portability, giving advertisers access to performance data, and not giving their own goods preferential treatment. In addition, gatekeepers must provide fair and transparent pricing and grant equitable access to the platform's essential services without requiring customers to use other services.[61]

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[53] Article 114 TFEU empowers the European Union to harmonize national laws to ensure the effective functioning of the internal market

[54] Colangelo (2022).

[55] The requirements only apply to the CPS for which a gatekeeper designation has been made; they do not extend to the other CPSs that the online platform offers.

[56] De Streel and Alexiadis (2023).

[57] Cabral et al. (2021).

[58] *Ibid.*

[59] DMA, Art.6

[60] DMA, Arts 8(2) and (3)

[61] A more accurate description of the obligations set out in Article 6, particularly of Recital 6.7 on vertical interoperability, which is useful for the thesis argument, will be provided subsequently.

iii. A horizontal compatibility requirement for fundamental features across number-independent interpersonal communication services is imposed by Article 7.

Table 2. Digital Markets Acts obligations

	Black list *(Article 5)*	Grey list *(Article 6)*
Transparency	– Price transparency for ads: Art.5 (9) and (10)	– Performance transparency for ads: Art.6 (8)
Prevention of unfair leverage	– No data fusion without user consent: Art.5(2) – No tying to business users from CPS to ID, search or payment services: Art.5(7) – No tying from CPS to other CPS: Art.5(8)	– No self-preferencing in rankings: Art.6 (5)
Facilitating user mobility	– No MFN/parity clauses: Art.5(3) – No anti-steering and anti-disintermediation clauses: Art.5 (4) and (5) – No bar to user complaints to public authorities: Art.5(6)	– Allow un-installing of apps, unless essential to OS/device: Art.6(3) – Device neutrality: No technical restriction of switching or multi-homing across apps using OS: Art. 6(6) – Provide real-time data portability for end-users: Art.6(9) – No disproportionate conditions or process for termination of service: Art.6(13)
Opening platforms and data		– Allow 'side loading' (interoperability) of third-party apps or app stores: Art. 6(4) – Access to and interoperability with OS for third parties on same terms as proprietary ancillary services: Art. 6(7) – FRAND access to app stores, search and social network: Art.6(12) – No use of data related to business users to compete against them: Art.6(2) – Data access for business-users: Art.6 (10) – Provide FRAND access to click and query data for search engines: Art. 6(11)

Source : De Streel, A., & Alexiadis, P. (2023). The European Way to regulate big tech: the EU's Digital Markets Act. In Law, governance and technology series.

1.4 Interoperability in Digital Markets

Before explaining in detail, the concept of interoperability, and particularly vertical interoperability, in the context of the digital market and the provisions set out by the DMA, it is useful to delve into the concept of interoperability and its pros and cons from an economic perspective, both for businesses and consumers.

The lack of a precise definition of interoperability is one of the challenges facing the interoperability debate. In general, interoperability refers to a system, product, or service's

capacity to interact and work with other (technically distinct) systems, goods, or services.[62]

In the digital economy, interoperability problems usually have to do with data and information exchange. Palfrey and Gasser describe interoperability in this context as the «ability to transfer and render useful data and other information across systems, applications, or components».[63] Finally, The International Standards Organisation (ISO), in its standard on cloud interoperability, defines the term as «the ability of two or more systems or applications to exchange information and to mutually use the information that has been exchanged».[64]

Different levels of interoperability can be significant. For instance, syntactic/technical interoperability describes the potential for systems to physically connect to one another and exchange data, whereas semantic interoperability describes the capacity of systems to comprehend the meaning of the information shared.[65]

Another classification of interoperability is provided in the European Commission's 2019 special advisers' report on digital competition, which identified three types of interoperability:

i. *Protocol interoperability*, allows different products or services to technically interact with one another, enabling complementing services instead of direct substitutes. Among the most notable instances are the rulings made by the European Commission against Microsoft in 2004 about Sun workgroup server compatibility and in 2009 on the integration of Internet Explorer with Windows.

ii. *Full protocol interoperability* permits competing services to collaborate, such as message systems, sharing the advantages of network effects.

iii. *Data interoperability*, similar to data portability, allows for continuous, real-time access to user data through privileged APIs; however, it requires fundamental protocol compatibility in order to control data transfers and requests.[66]

Further, particularly relevant is the distinction between horizontal and vertical interoperability. The latter allows consumers to freely select a mix of devices/operating systems, software/apps, and service providers (including search). For instance, a user might select a different search engine to use as the default for their Android web browser or a different default browser for their Windows PC, if the necessary software support was available (both options are allowed in Europe due to EU competition enforcement utilizing current regulations). Meanwhile horizontal interoperability allows consumers to use different products and service providers than those used by the people they are interacting with.[67]

By analysing interoperability from an economic perspective, it becomes evident that it is vital for innovation and has many positive economic effects. To enhance innovation,

[62] Kerber and Schweitzer (2017).
[63] Palfrey and Gasser (2012).
[64] International Organization for Standardization/International Electrotechnical Commission. (2017).
[65] Kerber and Schweitzer (2017).
[66] Brown (2020).
[67] *Ibid.*

consumer choice, usability, content availability, and diversity, interoperability should be regarded as a means rather than an end in societal development. The Internet, with its open and interoperable architecture that facilitates the convergence of different networks and systems, is one of the best illustrations of how interoperability promotes innovation (e.g. The Internet of Things). Better data exchange and cooperation are made possible by interoperability, which also encourages scientific and research innovation. As demonstrated by open APIs, it promotes user liberty by enabling users to combine different systems and apps for particular uses. Higher degrees of interoperability also make it easier to access material and conduct business, as seen by the European Commission's request for more interoperability to support online cross-border shopping inside the EU.

It is notable that, even if interoperability has many benefits, there might be risks and drawbacks. A single platform may become standard as a result of increased interoperability, which would limit innovation to what is feasible on that platform and reduce market variety. Increased homogeneity may result from this, stifling future innovation.

Reliability can also be decreased by excessive complexity in interoperable systems. Systems that are interconnected may have faults that spread throughout the network, making it challenging to find and address them. As demonstrated by the complexity of mobile payment systems, users may experience difficulties with issues involving several systems.

Furthermore, since complicated interactions between private players can obfuscate liability and responsibility, increasing interoperability may result in diminished accountability. This is particularly relevant in situations such as digital ID single sign-on systems, where third parties might exploit the system without explicit contractual obligations. Existing business models, particularly those that depend on lower degrees of interoperability to preserve client lock-in, may potentially be threatened by interoperability. For instance, in order to keep users in its marketplace, Amazon restricts interoperability within the Kindle ecosystem. Increased interoperability might upend traditional models, which could be counterproductive in the long term but may be supported by established companies.[68]

Given the advantages and, more crucially, their drawbacks of interoperability, it has become imperative to establish appropriate regulatory frameworks to manage its complexities, particularly within the digital landscape. This regulation is essential to handle he intricate challenges posed by interoperability and balancing its benefit and costs.

1.4.1 Vertical Interoperability

Vertical interoperability allows collaboration between services across various layers of the digital value chain, and through Article 6 of the DMA are established two main obligations regarding vertical interoperability.

[68] Gasser (2015).

The first requirement, set by Article 6(4) allows end users to sideload apps and app stores. Notably, the gatekeeper «shall allow and technically enable the installation and effective use of third-party software applications or software application stores using, or interoperating with, its operating system and allow those software applications or software application stores to be accessed by means other than the relevant core platform services of that gatekeeper.»

Additionally, Recital 50 states that it should be possible for the gatekeeper in question to implement strictly necessary and proportionate measures and settings, other than default settings, to achieve that goal, provided that these measures are duly justified by the gatekeeper. This will help to ensure that third-party software applications or software application stores do not jeopardize the integrity of the hardware or operating system provided by the gatekeeper as well as end users' security.

The second obligation imposed by the DMA regarding vertical interoperability is established by Article 6(7), according to which the gatekeeper «shall allow providers of services and providers of hardware, free of charge, effective interoperability with, and access for the purposes of interoperability to, the same hardware and software features accessed or controlled via the operating system or virtual assistant […] as are available to services or hardware provided by the gatekeeper.» Also in this case, the gatekeeper can take the appropriate and required steps to guarantee that interoperability will not compromise the integrity of its systems. These measures must, however, be justified as proportional and necessary.

As argued in Recital 54, by restricting user switching, gatekeepers' control over necessary hardware and operating system components might be detrimental to competition. This technological restriction hurts consumers by distorting the free market for internet access services. Further, Recital 55 notes that competing service or hardware providers such as providers of wearable devices, need equally effective access to the same hardware or software features to offer competitive services to end users. Therefore, through the implementation of vertical interoperability, it is possible to level the playing field between gatekeepers and potential rivals. Finally, because of their dual role, gatekeepers can use their power over fundamental OS or device features to restrict competition. Recitals 56 and 57 highlight that it can seriously impede innovation and narrow the options available to end users if gatekeepers abuse their dual positions to deny competing hardware and service providers access to the same features under identical circumstances.

A company operating in the downstream market that possesses an essential input may be incentivized to hinder its rivals. Denying access, margin squeeze, lowering the quality of input supplied to rivals, and disclosing information in a discriminating manner are some strategies. These strategies can successfully stifle rivalry and safeguard the gatekeeper's place in the market.[69]

Because of their considerable economic power, gatekeepers have an obligation to ensure interoperability by rigorous adherence to their commitments. This involves, as underlined in Recital 70, refraining from adopting discriminatory terms of service, unjustified technical protection measures, unlawfully claiming a copyright on APIs and misleading information. These measures ensure that gatekeepers are prevented from evading rules designed to preserve equitable competition and safeguard user autonomy.

[69] Bourreau and Krämer (2023).

DMA's vertical interoperability obligations have fuelled a lively debate regarding the handling of access requests, the definition of interfaces, security concerns, and the definition of appropriate economic conditions for access.[70]

In particular, handling access requests is a significant challenge because Article 6(7) requires gatekeepers to provide access to functionalities controlled via their operating systems or virtual assistants. This may result to numerous and wide access requests, necessitating efficient processes. According to Bourreau one possible approach is to allow gatekeepers to manage these requests under regulatory oversight.[71] To this end, access provision should adhere to the "equivalence of input" concept, which ensures that new entrants obtain the same functionality on the same conditions as the gatekeeper, maintaining proportionality, in order to reduce the danger of foreclosure. The equivalence of input principle is inspired by the telecommunications industry. In this industry, however, it is not difficult to implement because telecommunications networks are standardized. Meanwhile, due to the dynamic and varied nature of digital technologies this principle could be challenging to monitor and implement. Gatekeepers should initiate a self-reporting procedure and, if needed, conduct more thorough audits.

Another issue concerning the debate is who should define the interfaces. There are two possible approaches to solve this issue.

The first approach requires the gatekeeper to create the interface for interconnection access and make sure that access is distributed equitably. The first option is for the gatekeeper to design the interconnection access interface themselves and ensure access is granted fairly. Technically, this method is efficient because the platform, having developed the underlying hardware or software, is ideally suited to design the interface. Additionally, the platform can seamlessly update the interface to accommodate technical changes and implement measures to maintain integrity and security. However, this approach also allows the platform the opportunity to hinder access and potentially exclude competitors in the markets for complementary products and services. Monitoring such obstructive tactics can be challenging and time intensive. Alternatively, the second approach involves developing open interface standards, although this process is often lengthy and complex.

Security and integrity are also concerns, since the DMA does not specify whether access can be screened through licenses. While it mandates that gatekeepers provide equal access to their systems, it also allows them to take necessary actions to maintain system integrity. As in the context of horizontal interoperability, the gatekeeper possesses the authority to determine whether security measures to safeguard the system's integrity are "proportionate" and "duly justified." Since the gatekeeper is the one most knowledgeable with the technology, this decision-making process is seen to be efficient. The gatekeeper may, however, take actions that disadvantage rivals while also preserving security and integrity due to its vertical integration. As a result, constant regulatory inspection of such security measures is required, which may be difficult and time-consuming. Only entities that fulfil specified security or privacy criteria should be permitted access, maybe through access licenses, in order to protect the integrity and security of hardware and software systems. These licenses may be granted or denied in accordance with objective standards.

[70] *Ibid.*
[71] *Ibid.*

Finally, in an effort to promote competition and innovation, Article 6(7) requires that access to hardware and software features be provided free of charge. This zero-entry price, however, can draw inefficient entrants and lessen the incentive of gatekeepers to innovate, which could result in non-price discrimination. To address these issues, it is advised that access seekers pay a portion of the expenses associated with providing access.

Chapter 2: Navigating Competition Challenges: The Essential Facility Doctrine and Self-Preferencing in Digital Markets

2.1 Self-Preferencing – Analysis of the DMA's Provisions

As emerges from the analysis carried out in the previous chapter, due to the dual role of gatekeepers, who act both as direct sellers of goods and services and as intermediaries for third-party undertakings, they could have an incentive to give preferential treatment to their own goods and services compared to those offered by other companies, resulting in an exclusion of competitors.

The issue of self-preferencing is addressed by the DMA. According to the DMA, gatekeepers must not treat their products or services "more favourably" than their rivals, without a clear definition of the concept. Only "*better position*" (Recital 51 DMA) and "*prominence*" (Recitals 51 and 52 DMA) are mentioned. In this case as well, the text does not provide a clear explanation of these concepts. It only states that prominence encompasses the display, rating, linking or voice results and the communication of only one result to the end user. The rationale behind this lack of definition by the legislator likely lies in the fact that, without a clear definition, the Commission is allowed to detect self-preferencing in any context other than gatekeepers displaying and positioning their own offers at the top of search results.[72] Another reference to self-preferencing can be found in Article 6.5, which states that the gatekeeper is prohibited from giving preferential treatment to its own services and products over those of third parties in terms of ranking, indexing, and crawling. The gatekeeper must ensure that the conditions for such ranking are transparent, fair, and non-discriminatory.[73] Despite clear references that prohibit self-preferencing practices, implementing this prohibition, especially in the context of digital markets, appears difficult and complex. Firstly, favouring one's own offerings at the expense of competitors is intrinsic to the nature of competition within the market, and the dual role of gatekeepers incentivizes self-preferencing practices. Secondly, the DMA is inherently self-executing, requiring gatekeepers to demonstrate their compliance with its rules. This shifts the responsibility for proving adherence from the Commission to the gatekeepers themselves. The issue is that when gatekeepers are required to demonstrate compliance, they might interpret the rules to suit their own expectations, potentially manipulating the regulation to their advantage[74]. Finally, the identification and implementation of such a prohibition require a range of technical and specific knowledge that policymakers are not equipped to manage.

2.2 Essential facility doctrine (EFD)

The risk of self-preferencing appears even more evident in the context of vertical interoperability.

Two hypotheses of self-preferencing strategy can be distinguished in the landscape of

[72] Carugati (2022).
[73] DMA Art. 6(5).
[74] Carugati (2022).

vertical interoperability. The first involves interoperability degradation, which includes scenarios where interoperability is provided but is limited or undermined by technical and contractual restrictions. The second, which is the focus of our analysis, is that of pure denial of interoperability. This includes refusing to install apps or app stores, denying access to a device's hardware or software features, or refusing to develop or adapt features to meet interoperability requests. This could be examined under the essential facility doctrine (EFD).[75]

The EFD refers to the obligation of a dominant undertaking owning an indispensable facility to grant access to that facility to its competitors. Its legal framework has been used in several cases to assess refusal to deal under European Union competition law. However, these infringements are typically confined to exceptional circumstances occur when: (i) the access to the product or service is indispensable for a business to operate in the market; (ii) the refusal is unjustified; (iii) the refusal effectively eliminates competition in a secondary market; and (iv) if intellectual property rights are involved, the refusal hinders the emergence of a new product for which there is potential consumer demand. [76]

For the sake of our investigation, the first relevant case in the jurisprudential evolution of the EFD is *Microsoft*, as it addresses the issue of interoperability.[77] As a player in the workgroup server downstream market, Sun required access to interoperability data in order to integrate its services with Windows, the PC operating system from Microsoft. The General Court highlighted the indispensability of Microsoft's interoperability information, emphasizing that competitors must have equal access to interoperate with the Windows operating system on an equal footing. Further, the Court stated that the new product requirement is also satisfied when the access to the facility is necessary for competitors to create subsequent innovations, such as enhanced products with added value.

Previously, in *IMS*, the Court of Justice (CJEU) already watered down the third requirement arguing that the secondary market requirement is fulfilled even if the market is merely potential or hypothetical.[78]

As a result, the only requirement still standing in its original formulation is represented by the indispensability of the facility. According to *Bronner*, such a criterion is not met when alternatives (even if less convenient) are available.[79] Therefore, the access to an input is deemed indispensable if there are no technical, legal, or economic obstacles that render duplication impossible or unreasonably difficult. Additionally, to demonstrate the absence of a realistic alternative, it must be proved that creating the resource on a scale comparable to that of the enterprise controlling the existing product or service is not economically viable.[80]

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[75] Colangelo and Martínez (2024).
[76] Colangelo (2023a).
[77] Case T-201/04, Microsoft Corp. v. Commission of the European Communities, ECLI:EU:T:2007:289.
[78] Case C-418/01 IMS Health GmbH & Co. OHG v NDC Health GmbH & Co. GH ECLI:EU:C:2004:257
[79] CJEU, C-7/97, Oscar Bronner GmbH & Co. KG v. Mediaprint Zeitungs- und Zeitschriftenverlag GmbH & Co. KG, Mediaprint Zeitungsvertriebsgesellschaft mbH & Co. KG and Mediaprint Anzeigengesellschaft mbH & Co. KG., ECLI: EU:C:1998:569.
[80] Colangelo (2023a).

Nonetheless, the scope of the indispensability test has been progressively narrowed down by the recent case law. Notably, it is not required when the litigation involves a claim of margin squeeze, rather than a pure denial to grant access.[81] The same applies when a sector-specific regulatory obligation mandates to provide access.

Moreover, even when the EFD is applicable, its effective implementation may result challenging for antitrust enforcers, especially when it involves technical features. Indeed, interoperability problems are made more difficult by their intrinsic technological complexity. These issues frequently need in-depth understanding of hardware, software, or communication protocols. Further, the owner of the facility may present arguments based on the necessity to preserve the security and integrity of the system or to safeguard intellectual property.

In summary, drafting effective remedies may be particularly difficult under competition rules, while it usually belongs to the traditional task of regulators. Therefore, in principle, a regulation such as the DMA appears better suited to tackle problems regarding the lack of interoperability and deliver the proper remedies.

2.3 Economic Implications of Self-Preferencing and Interoperability

The idea that there might be an incentive for exclusion has been disputed by some commentators, who assert that a platform would have an economic interest in maintaining the interoperability of complementary apps or services because they are their main source of revenue, or that even in the event of exclusion, there would not be anti-competitive behaviour because, for instance, these markets are marked by zero prices for customers. On the other hand, it can be also argued that a dominant firm may be able to maintain its monopoly by denying interoperability to a new entrant.[82] This is crucial to comprehend the rationale behind the dominant platforms' behaviour, as it sheds light on the consequences that may be expected from such behaviour.

Both a short-term monopoly power approach and a long-term core market protection strategy, especially regarding data-driven externalities, can be used to analyse the dominant undertakings' strategic denial of interoperability. Preventing potential competitors from getting traction in the market is the main objective of the short-term strategy. A dominant undertaking maintains its monopoly by preventing new entrants from successfully competing through the denial of interoperability. In this case, the incumbent's benefit can be expressed mathematically as follows:

$$\Pi \text{ incumbent} = MAX\ no \text{ interoperability } [\pi - C]$$

where the profit of the incumbent is represented by Π incumbent, while the π represents the market profit and C is associated with the costs of maintaining market dominance, such as the costs of denying interoperability.

[81] Colangelo (2023a).
[82] Motta (2023).

In addition, the long-term strategy to safeguard the core market makes use of data-driven externalities. The value of a service rises with the number of consumers in marketplaces with strong network effects. According to the model presented by Motta, by restricting data flows and network advantages to its benefit, the incumbent may preserve its share of the core market by refusing interoperability:

$$\mathrm{Ui} = \mathrm{f}(\mathrm{N}, \mathrm{D})$$

The total number of users N and the data D within the company's control determine the utility U that a user receives from the service. A new competitor's attractiveness is diminished when they are unable to interoperate using the incumbent's data D. This includes the network effect in the incumbent's profit maximization problem:

$$\Pi\mathrm{incumbent} = MAX\ no\ \mathrm{interoperability}\ [\mathrm{p} \cdot \mathrm{f}(\mathrm{N}, \mathrm{D}) - \mathrm{C}]$$

where C is the costs of blocking interoperability and using other competitive actions, and p is the price the incumbent charges. The function f(N, D) represents the externalities, or network effects, and shows that the value of the service rises with an increase in N (number of users) and D (amount of data), hence supporting the incumbent's position in the market.

Motta's model demonstrates how the incumbent makes it far more difficult for any new entrant to compete by controlling interoperability, which guarantees that data-driven network effects solely act in its advantage. By utilizing the inherent benefits of acquired data and user base, this strategic denial preserves immediate market domination and protects the incumbent's core market from future competing threats. Thus, a dominant firm can maintain and strengthen its monopoly by refusing interoperability as a short- and long-term strategy. It prevents newcomers from effectively competing in the short term. By guaranteeing that network effects and data advantages stay exclusive, it uses data-driven externalities to strengthen the incumbent's position over time, excluding possible competitors and defending the core market.[83]

[83] *Ibid.*

Chapter 3: Examining the Refusal of Interoperability Between Android Auto and Third-Party Apps – A Deep Dive into Google v. Enel X Italia

The difficulties of adapting conventional competition law principes to digital markets are exemplifies by the Google-Enel X case. The Italian court's queries to the CJEU will offer crucial guidance on how to understand and implement EU competition law in the context of rapidly evolving digital economy. The outcome in this case will undoubtedly have major implications for the enforcement of competition law in the digital age, shaping the future landscape of platform regulation and market access.

3.1 Background

One of the biggest integrated energy businesses in the world, the Enel Group, is the parent company of Enel X Italia S.r.l. Enel X is committed to creating cutting-edge technologies for electric mobility, demand response, and energy management. Enel X is the company behind the JuicePass app (formerly known as Enel X Recharge) and oversees more than 60% [84] of Italy's EV charging infrastructure. Launched in May 2018, JuicePass provides EV drivers with a full suite of features, including Battery Electric Vehicles (BEV) and Plugin Hybrid Electric Vehicles (PHEV) and the possibility to find, reserve, and pay for charging stations. The JuicePass app has been available since May 2018 on Google's app store (Google Play).[85] To reach its target market, Enel X Italia considered publishing its app on Android Auto.

The second actor in the dispute is Google. Due in large part to its wide array of internet-based goods and services, as well as its significant influence over several market segments, including search engines, online advertising, and mobile operating systems, Google has grown to become a major force in the technology industry over time. Google made the decision to enter the in-vehicle application industry after seeing the growing need for car-specific applications as automobiles get more sophisticated infotainment and telemetry systems installed. Moreover, the creation of Android Auto in 2015 was undoubtedly inspired by the launch of CarPlay the previous year by Apple, Google's main competitor.[86]

The dispute revolves around Google's denial of approval to install the Juice Pass app on Android Auto. Enel X Italia field a complaint against Google of abusing its dominant position in violation of Article 102 TFEU in a complaint it filed with the Italian Competition Authority (ICA). By decree dated April 27, 2021, the ICA declared that Google's actions amounted to an abuse of a dominant position as defined by Article 102 TFEU since they prevented and postponed the release of Enel X's Juice Pass app on the Android Auto platform. In the following paragraphs, it will be analysed how the investigation was conducted by the ICA and the related findings.

[84] Council of State, 7 April 2023, Case No. 07412/2022, Google/Enel X, pp. 3
[85] Italian Competition Authority, 27 April 2021, Decision No. 29645, Google/Enel X.
[86] Koolen (2022).

3.2 The ICA's investigation

Starting from the relevant upstream market, the ICA emphasizes Google's unique position within the market for mobile communication. Indeed, the Android operating system dominates the market for licensable operating systems for smart mobile devices, with a market share of 96.4% in 2016.[87] The networked ecosystem of end users, app developers, and device manufacturers sustains this dominance. The market for Android app stores is similarly dominated by Google Play, which is the primary distribution platform for Android apps. Network effects within the Android ecosystem, which link device manufacturers, app developers, and end users, further solidify this dominance. Android's wide adoption attracts more apps, which in turn attract more users, creating a virtuous cycle. The ICA also considered a study by an independent consultant that emphasized how ecosystems with "impossible" levels of competitiveness are created by indirect network effects, such those involving app developers. By designating these ecosystems as "black ocean," they are distinguished from contestable "red ocean" marketplaces and potentially contestable "blue ocean."[88]

Table 3: Mobile app ecosystem oceans

Source: European Commission Decision on Case AT.40099 – Google Android

Even though Android is an open-source platform, Google exerts significant influence over its developments through investment, the governance structure it oversees, and choices regarding the timing of updates and new versions. Furthermore, Google maintains control over the Android trademark licensing and the compatibility testing of Android's deployment on smart mobile devices.

[87] Google/Enel X, *supra* note 80, para 30.
[88] *Ibid*., para 34.

Against this backdrop, the ICA provides a detailed description of Android Auto, which is considered to be an integral part of the Android ecosystem.[89]
In the ICA assessment Android Auto is defined as "smartphone projection app" that displays content from a mobile device's screen onto an infotainment system in a car.[90] The infotainment system then communicates inputs (such as buttons, touchscreens, etc.) back to the mobile device, which reacts appropriately. It facilitates communication between the infotainment system of the vehicle and compatible smartphone apps. Car manufacturers decide whether to make their infotainment systems compatible with Android Auto, and developers must program their apps to be compatible. Car manufacturers such as FCA, Volkswagen, PSA, Renault, and Mercedes-Benz have made their infotainment systems compatible with Android Auto and Apple CarPlay, as these platforms are considered as market standards that allow companies to reach a high audience of consumers. Furthermore, Android Auto improves the user experience by simplifying the functionalities and appearance of the applications in addition to connecting compatible apps with the car's entertainment system.

Regarding the definition of the downstream relevant market in its assessment, the ICA refers to it as the "competitive space." Applications designed for usage while driving are included in the downstream competitive space. In defining the competitive space, the ICA broadly includes all applications designed for use while driving, thereby encompassing apps that provide services for charging electric vehicles, such as Juice Pass. Consequently, the competition has been identified between Google's applications, Google Maps and Waze, and the app developed by Enel X.

The ICA also identified Google's crucial role in the development of applications within the Android Auto platform. Firstly, Google is the only source of the programming tools required for developers to create applications that work with the Android Auto platform. Secondly, these apps can only be distributed via the Google Play Store. Because of this two-way reliance, an app cannot work with Android Auto without Google's permission. This essentially puts Google in a strong gatekeeping role between developers and end users.

Moreover, Google retains the right to apply its interoperability policy to confirm an app's real compatibility with Android Auto, so deciding over which apps end consumers may use. This power enables Google to decide which apps are made available, demonstrating its significant market dominance. Google's actions highlight a significant concern with the DMA's vertical interoperability approach. Gatekeepers are permitted by the DMA to impose security measures in order to preserve system integrity, but when they do so in order to stifle competition, this discretion can become problematic. Actually, Google's control over app compatibility with Android Auto allows it to restrict consumer options and undermine competition under the guise of security. Regulatory authorities are faced with difficulties in determining if these actions are really meant to maintain the integrity of the system or to disadvantage competitors.

Google competes in the downstream market with its own apps, which further complicates this role. Google's prohibiting of Enel X Italia's Juice Pass app for Android Auto, despite

[89] *Ibid*., para 45.
[90] *Ibid*., para 47

the program's development using Google templates, serves as an illustration of this gatekeeping capability. Google used Juice Pass's exclusion from the media and message app categories as justification for the refusal. Enel X Italia pointed out that Android Auto already includes several applications that do not fall into these categories, such Google Maps and Waze, which are both maintained by Google, and Kakao, which was created for South Korean customers in partnership with other developers. Crucially, the fact that these apps weren't made with Google's openly accessible application templates highlights the company's selective gatekeeping role in regulating app availability on Android Auto.[91]

The examination conducted by the ICA brought to light two important aspects of Google's Android Auto policies.

First, Google's control is clear from the way that developers of apps have to comply with Google's policies about the compatibility of their products with Android Auto. The second aspect is to Google's abusive refusal to engage with third parties. This rejection took two different shapes: first, it was made clear that JuicePass would not be published on Android Auto; second, it was demonstrated by the fact that adequate interoperability solutions—like an application development template—were not put in place. In response to Enel X Italia's request, the ICA identified that Google could have either (a) developed a template that would have enabled features like searching, navigating, booking, and starting charging sessions, (b) collaborated with Enel X Italia to create a custom app, or (c) carried out the required actions on the Actions-on-Google platform in order to enable these features through the Juice Pass app. With the goal of reducing app complexity for safe driving usage, these development tools comply with Google's safety standards.[92]

Evidence suggests that in order to put one of these options into action, Google would have needed to assign it highest priority in its plans, which is a manageable step considering that Google controls the publication policy for Android Auto in its entirety. The ICA concluded that Google had taken discriminatory and obstructive measure. Given Google's special responsibility to guarantee effective competition, its refusal to permit interoperability, with the lack of objectively justifiable reasons, goes against the idea of preserving fair competition and threats the "*level playing field*" (principle of non-discrimination)".[93] This conduct involves discrimination as well as giving Google's proprietary applications an unfair edge, as demonstrated by the creation of a special app for Kakao but not for Enel X Italia. Consequently, it is correct in stating that Google's commercial decision directly led to the rejection.[94]
Due to Google's actions, the JuicePass app has been blocked from the Android Auto platform for more than two years. This ban has occurred at a period of notable increase in the sales of electric vehicles and the corresponding need for charging stations. Juice Pass' prospects of becoming a popular app has been harmed by continued blocking of Enel X Italia's app on Android Auto, considering the significance of Android Auto as a driving access point and the indirect network effects that are essential for the efficient functioning of digital apps.[95]

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[91] Koolen (2022).
[92] Google/Enel X, *supra* note 80, para. 354.
[93] *Ibid*., para. 375.
[94] *Ibid*., para. 370.
[95] *Ibid*., para. 266.

The indispensability criteria was also subject to the investigation. It is considered essential for Google to provide and define development tools for Android Auto-compatible apps to enable third-party developers to offer their applications to consumers. This necessity arises from the fact that approximately 75% of smartphones and 50% of tablets in Italy operate on the Android system. When compared to the full functionality of a smartphone, the customized and streamlined user experience of Android Auto is invaluable for drivers. Furthermore, no other technological solution for utilizing applications in car infotainment systems can serve as an adequate substitute.[96]

Google, in support of its argument regarding the non-essential nature of Android Auto, claimed that JuicePass received a large number of downloads through the Google Play Store despite not being available on Android Auto. Moreover, Google added that scheduling a charging station may be done when a vehicle is stopped for a brief period of time and that many drivers continue to use applications on their smartphones. None of the justifications appeared to be acceptable. In response to Google's defence, the ICA claimed that an app's usefulness is determined by the benefits users may obtain from it, which encompass both functional and safety features.[97] Google's assertion that using Juice Pass to make a quick stop and reserve a charging station is adequate is impractical and goes against the fundamental safety and usability tenets of Android Auto. This makes it a laborious process because it doesn't account for the time needed to look for charging stations or find a parking space. In conclusion, despite Google's justification it's evident how vital Android Auto is to the efficient use of driving-related applications, such as JuicePass from Enel X Italia. Google is the sole provider of programming tools for Android Auto, making its cooperation indispensable and aligning with the criteria for an abusive refusal to deal under EU law, as stipulated in Article 102 of the TFEU.[98]
The ICA appears to have deviated from the definition given by the CJEU in Bronner when addressing the indispensability criteria with relation to Android Auto. In fact, the ruling states that even while there are less advantageous options for reaching the same goal, the indispensability component of the test is satisfied since there are no alternatives that are as secure and easy as Android Auto.[99] The ICA's unusual approach for determining indispensability is exemplified by its conclusion that the construction of new development tools is problematic in order to gain access to the Android Auto platform, as access to an essential facility is the result of an omission. This case implies a subjective rather than an objective interpretation, since it evaluates indispensability from the viewpoint of a particular company rather than the market as a whole. This questions accepted theories from the Microsoft and Magill cases, presumably to get around obstacles in determining indispensability.[100]

The ICA investigation proceeded by examining two critical issues: the potential elimination of effective market competition and the obstruction to the emergence of new products for which there is significant consumer demand.

[96] *Ibid*., para. 376.
[97] *Ibid*., paras. 378–381.
[98] *Ibid*., paras. 376 -381.
[99] Colangelo and Martínez (2024).
[100] Koolen (2022).

In the following years, the electric vehicle (EV) industry is predicted to develop rapidly, most likely due to network effects and a *winner takes all* phenomenon in the downstream competitive environment. From this perspective, excluding Juice Pass from Android Auto for a two-year period has likely hindered Enel X Italia's efforts to establish itself in the market for EV charging services. As a result, Google's failure to produce these templates on time might lead to the end of meaningful competition in the market. Because of these factors, Google's actions are bound to have an impact on the market structure, resulting in the exclusion of Enel X Italia in addition to impeding and delaying its arrival. In this case, the omission by the dominant company fulfils the criteria of conduct capable of eliminating effective competition in the market, as required for establishing a refusal to deal under Article 102 of the TFEU.[101]

Furthermore, the ICA identified preferential treatment for apps owned by Google compared to the app developed by Enel X, which prevents consumers from accessing comprehensive services related to booking and paying for EV charging points. Indeed, the Google case is identified as a potential self-preferencing case because the refusal to ensure interoperability favours Google Maps at the expense of JuicePass, which offers more functions and services than the gatekeeper's app. Although Google Maps provide information about charging infrastructure, end users are unable to use Juice Pass's unique features, such as payment and reservation capabilities. The absence of interoperability limits the choices and welfare of the consumer by limiting access to some of the JuicePass services. Additionally, it strains Enel X Italia's business model by denying it access to user-generated data, which diminishes the value of the apps and services that are offered and undermines data-driven business models. This behaviour serves as a major obstacle to the introduction of a new product for which there is evident potential consumer demand, given the growing popularity of electric cars.[102]

The ICA investigation revealed that Google's refusal to publish Juice Pass on Android Auto was not due to technical issues but rather a business decision. This decision, according to the ICA could have been modified by Google to accommodate Enel X Italia's request. As highlighted in the previous paragraphs, the justifications presented by Google were found to be, according to the Authority, inconsistent and contradictory, demonstrating a lack of willingness for collaboration with Enel X Italia and grant its request.

By decree dated April 27, 2021, the AGCM declared that Google's actions amounted to an abuse of a dominant position as defined by Article 102 TFEU since they prevented and postponed the release of Enel X's Juice Pass app on the Android Auto platform. The AGCM prescribed Google to stop its anticompetitive actions and refrain from such behaviour in the future; release the final version of the template for creating electric charging apps; develop any features that Enel X deemed necessary but were missing from the template.[103]

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[101] Google/Enel X, *supra* note 80, paras. 383-386
[102] *Ibid*. paras. 387-392
[103] Court of Justice of the European Union, Summary of the request for a preliminary ruling: Case C-233/23, para. 11

In addition, Alphabet Inc., Google LLC, and Google Italy Srl were jointly fined EUR 102,084,433.91 by the AGCM.[104]

3.3 Google's appeal

Following the above-mentioned measures, Google filed an appeal with the Regional Administrative Court of Lazio, contesting the obligations imposed by the ICA and presenting seven objections, seeking the annulment of these obligations. However, in July 2022, the TAR rejected this appeal, deeming it unfounded.

The first objection asserts an error in identifying the relevant upstream markets and the failure of proving dominance. The appellant contends that the legislation falsely implies that Google, particularly through the Android operating system and Google Play, has a dominant position on licensing mobile operating systems and app stores for Android. The Android Auto app is the subject of the alleged abusive behaviour, which Google argues should be treated separately from the Android operating system and Google Play. The measure is considered invalid since it does not specify the particular market in which Android Auto operates, hence failing to establish Google's superiority with regard to Android Auto. Google emphasizes that Android Auto is not an extension of the Android operating system, but rather a "smartphone projection app" that is available to Android users.[105]

Second, the appeal draws attention to the inability to specify which downstream market was impacted by the asserted abuse. It faults the action for purportedly establishing a competitive space between navigation applications and apps for charging electric vehicles without accurately defining a relevant market affected by Google's actions. According to the measure, there is competition between navigation applications like Google Maps and electric car charging apps like JuicePass in a number of areas, including search and navigation features, prospective payment and charge management features, and user data. The appellant contends that the measure's results are invalid because this competitive space does not represent a properly defined market.[106]

Moreover, in the third complaint Google disputes the measure's claim of a competitive relationship between Google Maps and JuicePass, rejecting the ICA's assumptions regarding the three types of competition: actual, potential, and for users and data. Regarding the actual competition, it questions the interchangeability of the two apps in terms of finding charging stations. This implies that rather than being rival services, they are complimentary. JuicePass and Google Maps are not direct rivals since they fulfil different user demands and have distinct functions. Regarding the potential competition standpoint, Google contends that, in accordance with EU regulatory requirements, there has not been enough evidence to support the hypothetical future integration of Google Maps, on Android Auto, with capabilities for arranging charging sessions and payments. According to the appellant, there is insufficient evidence to support the speculative assumption of future competition. Lastly, Google emphasizes that Google Maps and Juice Pass are essentially two distinct software categories for user data

[104] Google/Enel X, *supra* note 80, para. 442
[105] TAR Lazio 2022, Case No. 10147/2022, pp. 7-8.
[106] *Ibid*, pp. 8-9.

collecting. This indicates that although while their methods of gathering data are comparable, they are not directly competing.[107]

Further, Google contested the obligation to supply, as stated in the appealed judgment and the Authority's order. It claimed that the requirements cumulatively listed in the ruling of the General Court in the Microsoft v. Commission case (T-201/04) were not satisfied. Such cumulative conditions concern: (i) the duty related to a necessary good or service for operations in a neighbouring market; (ii) the refusal of the supply eliminates all effective competition in that market; (iii) the denial stops the introduction of a new product. Google highlighted that no indispensability test was been out by the ICA. Moreover, the JuicePass app remained operational without access to Android Auto, as it could still be utilized on a smartphone installed in the vehicle. Further, the notable expansion of JuicePass and the existence of comparable applications in Italy show that this did not prevent effective competition in the market for electric car charging apps.[108]

The fifth complain regard the assessment of Google's objective justifications and specific circumstances of the dispute is considered by Google flawed, with violations and misapplications of Article 102 TFEU. As stated by the appellant, the assessment is devoid of an exhaustive investigation and ignores the particular case circumstances and factual background that give legitimacy to Google's actions. Google's first rejection was supported by the need to dedicate resources to applications with higher user interest, such media, messaging, and navigation apps, and by the necessary testing to verify that apps available on Android Auto did not distract drivers. Furthermore, Google released the electric car charging app template in October 2020 after developing it for a respectable length of time. The COVID-19 pandemic's exceptional circumstances made this delay inevitable. Once the template was made available, developers may use it to build Android Auto-compatible beta versions of their electric car charging applications. Many developers have already adopted this framework to create compatible versions of their apps, including Enel X's rivals.[109]

Finally, the last two complaints concern the sanctions and obligations imposed on Google. According to Google in defining the sanction calculation, the Authority wrongly included Android and Google Play in the assessment and miscalculated Google's revenues. The appellant questioned the additional amount imposed, the length of time and intensity of the claimed abuse, and the decision to disregard the accusations' novelty. Furthermore, Google claims the behavioural obligations are disproportionate and unnecessary since the refusal ended with the template's release in October 2020. Google also attacks the Authority for making judgments based only on Enel X's opinions without taking the larger market environment into account.[110]

[107] CJEU, *supra* note 100, para. 22.
[108] *Ibid*, para. 17.
[109] CJEU, *supra* note 102, pp. 11-12.
[110] *Ibid*, pp. 12-13.

3.4 Referral to the CJEU

In April 2023, after the Regional Administrative Court of Lazio denied Google's appeal, the Italian Council of State submitted many critical legal inquiries to the Court of Justice of the European Union (CJEU). This referral requested clarification on the meaning of Article 102 of the Treaty on the Functioning of the European Union (TFEU), concerning the abuse of a dominating market position. The refusal of Google to permit access to Enel X's JuicePass on Android Auto raised substantial concerns regarding the obligations of dominant companies and competition law, particularly in the context of the Essential Facility Doctrine. As previously mentioned, this doctrine has traditionally required companies that control key infrastructure toto provide access to competitors. However, this doctrine encounters substantial obstacles in the context of digital markets, particularly in light of the increasing significance of platforms like Android Auto as gateways to the market access. This raises the question of whether the refusal to supply such platforms constitutes an abuse of dominance.

The CJEU is tasked with the responsibility of resolving a number of intricate issues that will determine the application of competition law to digital platforms, particularly with regard to the notion of "essential facilities" and the definition of an abuse of dominance. These inquiries have substantial implications for the future of digital competition law in Europe, as the responses will contribute to the form of this legal field.

The initial question relates to the interpretation of indispensability under the essential facility doctrine. Traditionally, for a facility to be deemed 'essential', it must be indispensable for the interested company to compete in a neighbouring market, indicating the absence of competitive alternatives. However, the Council of State's referral inquires whether this rigorous definition should be reinterpreted in the context of digital markets, where market success is significantly influenced by convenience and simplicity of use. Specifically, it poses the question of whether a facility can be deemed essential if it merely makes a competitor's product more convenient to use, even if there are alternative solutions.[111]

The examination in question is probably one of the most controversial aspects of the decision, as it will define a new case law evolution in Europe regarding the Essential Facility Doctrine and the indispensability requirement applied in the context of digital markets. In this case, Enel X argued that while JuicePass could still operate without Android Auto (via a smartphone interface), integration with Android Auto would significantly improve convenience for users, particularly by allowing them to manage electric vehicle charging through the car's in-dash system. The key question is whether this convenience elevates the significance of Android Auto to the status of an essential facility. In digital markets, where smooth platform integration frequently shapes the user experience, the bar for what is deemed indispensable may be considerably lowered if the CJEU agrees with this interpretation. This would constitute a departure from traditional precedents, such as the Magill case law, which underscored the indispensability of a facility for a competitor to operate, rather than whether it was more convenient. The Enel

[111] Council of State, *supra* note 79, p. 18.

X Italia v. Google interpretation of the indispensability requirement moves the emphasis from an "essential facility" to a "convenient facility," reducing the threshold for determining a refusal to deal.[112] By broadening the scope of indispensability, the Court has the potential to establish a precedent in which platforms that improve convenience are considered essential facilities, making it necessary for dominant firms to provide access even when alternatives are available.

The second question concerns whether behaviour in a situation where, despite not having access to the requested product, (i) the requesting company was already operating in the market and had continued to expand during the alleged abuse, and (ii) other companies that were in competition with the company seeking access to the product continued to operate in the market could be deemed abusive under the framework of conduct classified as refusal to supply under Article 102 of the TFEU.[113] In this instance, the Enel X JuicePass application maintained its user base expansion despite being denied access to Android Auto. This poses the question of whether the assertion of abuse is undermined by market success in the absence of access. The primary concern is whether long-term exclusion from a dominant platform, despite short-term expansion, can still be considered a violation under Article 102 TFEU. This issue is of paramount importance in digital markets, where network effects and rapid innovation can result in a competitor's temporary success, but ultimately disadvantage them by being excluded from a dominant platform.

The following questions examine whether an abuse, under Article 102 TFEU, consisting in a refusal to grant access should be interpreted considering specific circumstances. More precisely the last three questions address the extent to which requiring interoperability might necessitate a redesign of the product.[114]

The third question posed by the Council of State pertains to the validity of the non-existence of a product or service at the time of the request for access as an objective justification for refusal under Article 102 TFEU. Specifically, it inquires whether Google's refusal to accommodate Enel X's JuicePass app could be justified by the fact that the technical remedy (such as a template for electric vehicle charging applications on Android Auto) had not yet been developed. Additionally, it inquires whether a competition authority is required to assess the time required for the dominant undertaking to develop the product applying objective criteria, or whether the dominant undertaking is required to disclose the development timeline to the requesting party in order to ensure transparency and accountability.

This inquiry addresses a critical issue in digital markets: the justification for withholding access when a product is not yet available, and the appropriate approach for dominant firms to take when managing development timelines. A decision in favour of Google could establish that the absence of a product is a valid justification for refusal, provided that the time required for development is reasonable. Alternatively, the CJEU may determine that dominant platforms are required to either accelerate development or

[112] Koolen (2022).
[113] Council of State, *supra* note 79, p. 18-19.
[114] Colangelo and Martínez (2024).

explicitly communicate the timeline for granting access, in light of their unique responsibilities in the market.

The ruling will have broader implications for the obligations of dominant platforms, particularly in relation to their obligation to facilitate access to essential products or services, even if these have not yet been completely developed. A ruling that prioritizes transparency and timeliness could impose supplementary obligations on platforms such as Google, guaranteeing that access cannot be denied due to development delays without explicit communication and objective justification.

The fourth question of the Council of State concerns whether a dominant company that controls a digital platform, such as Google with Android Auto, is obligated to modify existing products or develop new ones in order to grant access to third parties, as outlined in Article 102 TFEU. It expressly asks whether Google is required to redesign Android Auto to accommodate Enel X's JuicePass app, despite the fact that such functionality did not originally exist on the platform.

In addition, the inquiry seeks to ascertain whether Google is obligated to consider the general market requirements or the specific needs of individual businesses that are requesting access, if such an obligation exists. Additionally, the Council of State is questioning whether Google is obligated to establish objective criteria for evaluating and prioritizing requests from third parties seeking access, as a result of its special responsibility as a dominant undertaking.

This examination underlines a critical issue in digital markets, where dominant platforms frequently operate as gatekeepers, regulating access to essential services and influencing the competitive landscape. This could potentially change the way companies manage their ecosystems by imposing significant obligations on them, such as the requirement for dominant platforms like Google to modify or develop new products to ensure access, if the CJEU rules. This would ensure that third-party applications have access to critical platform features, thereby promoting increased competition, and would prevent platforms from restricting access based on the design of their products. Alternatively, a decision in favour of Google would establish that platforms are not obligated to modify their products in response to every access request, particularly if those requests are technically challenging or do not align with the general market requirements. This has the potential to result in exclusionary practices that restrict competition, but it would also grant dominant platforms greater control over their ecosystems.

Lastly, the fifth inquiry pertains to the question of whether Article 102 TFEU requires competition authorities to identify and define the relevant downstream market that is impacted by the alleged abuse in the context of a refusal to supply an indispensable product or service. The question also asks whether the pertinent market may encompass potential markets. Potential markets are those that are not yet established but have the potential to develop if access is granted. This is particularly critical in digital sectors that are experiencing rapid growth, as new competitors and market opportunities may emerge at a rapid pace.

Waiting for CJEU's decision, it is clear that the issues raised by Android Auto underscore the challenges associated with developing effective and efficient solutions for mandating interoperability in accordance with competition law.[115]

[115] *Ibid*.

3.5 Additional Case: Bosch - Blubrake

In order to conclude the analysis of the denial of interoperability, it is imperative to examine an additional significant case: Bosch v. Blubrake. This case highlights the obstacles associated with the refusal to facilitate interoperability, particularly in the context of hardware integration in the European e-bike market. Although both instances are distinct from the Google-Enel X case, they share the common theme of utilizing a dominant market position to restrict technological innovation and limit competition.

The research group of Professor Sergio Matteo Savaresi at Politecnico di Milano (Polimi) devised an innovative initiative that gave rise to Blubrake. Blubrake was established as a consequence of the research, which resulted in the development of a sophisticated e-bike brake control system. This partnership was established between Polimi and e-Novia, a company that specializes in technology spin-offs. Blubrake's anti-lock braking system (ABS)[116] was designed to seamlessly integrate into e-bike frames, thereby enhancing safety without compromising the vehicle's aesthetic.

Blubrake encountered substantial obstacles in the market introduction of its ABS, despite its innovative design and the attraction of investment. The primary obstacle encountered by the Italian startup was Bosch, a global leader in e-bike components, as it dominated the market for e-kits, the electronic systems that power e-bikes. Blubrake accused Bosch of impeding its efforts to integrate the ABS with Bosch's e-kits, prompting the Italian Competition Authority (ICA) to initiate an investigation into Bosch's conduct in 2023.

In 2023, the ICA launched an investigation into Bosch's conduct after Blubrake accused Bosch of blocking its attempts to integrate the ABS with Bosch's e-kits. Blubrake alleged that from 2018 to 2019, Bosch erected both technical and legal barriers to prevent its ABS from being compatible with Bosch's systems. Bosch's refusal to provide the necessary Y-cable—a critical connector for integrating Blubrake's ABS—was a key issue. This refusal effectively blocked interoperability between the two systems, forcing manufacturers to rely solely on Bosch's own ABS offerings. The situation worsened with Bosch's introduction of the BES3 e-kit in 2022, which removed the option for third-party ABS integration via the Y-cable altogether. Instead, Bosch restricted access to a 12V high-power port (HPP), which was incompatible with Blubrake's ABS, as it required 36V for proper operation.[117]

Bosch declined to develop a solution or grant access to the CAN protocol (Controller Area Network), a communication protocol that is essential for the management of e-bike safety features, despite Blubrake's repeated requests.[118]

The ICA's investigation demonstrated that Bosch's refusal to facilitate interoperability, particularly its refusal to share the CAN protocol and develop connection tools, was not supported by legitimate technical justification. Bosch asserted that the integration of Blubrake's ABS would necessitate an exorbitant amount of resources. Nevertheless, the

[116] ABS stands for Anti-lock Braking System. It prevents the vehicle's wheels from locking up during braking through improved control and less skidding.

[117] Italian Competition Authority, 2023, September 5, Decision No. 773, paras. 14-16.

[118] *Ibid*, para 68.

ICA found these arguments to be unconvincing, given Bosch's substantial technical capabilities and dominant market position. Bosch sought to consolidate its position in the ABS market by leveraging its dominance in the e-kit market, and the ICA concluded that Bosch's behaviour was a strategic decision intended at excluding competition.[119]

Bosch's refusal to collaborate had far-reaching consequences. The denial of interoperability not only hindered Blubrake, which experienced the cancellation of orders by numerous e-bike manufacturers due to compatibility concerns, but also limited consumer choice and impeded innovation. Bosch's exclusionary strategies effectively impeded Blubrake's ability to access a substantial portion of the market, despite the fact that Blubrake's ABS had been acknowledged for its exceptional safety features and integration. Bosch's e-kits were installed in approximately 41% of e-bikes worldwide by 2021, granting it a dominant position in the European premium e-bike market.[120]

The ICA described this as a classic case of exclusionary conduct under Article 102 TFEU, where Bosh, as a dominant firm used its control over a critical input (in this case, the e-kit) to block market access for competitors.

Despite the fact that this case involves distinct forms of technology, it shares significant similarities with the Google v. Enel X dispute. In a hardware context, Bosch restricted Blubrake's access to the e-kit system, mirroring Google's refusal to permit the integration of Enel X's JuicePass app with Android Auto. In both instances, dominant firms utilized their control over critical systems—whether software (Google) or hardware (Bosch)—to prevent interoperability and preserve their market dominance. Consequently, the market was deprived of lower, innovative firms, which resulted in a reduction in consumer choice and a reduction in competition.

In these instances, the strategic denial of interoperability not only stifles innovation but also reinforces the dominant firm's market position. Bosch's refusal to grant access to critical technical interfaces underscores the extent to which a company can regulate market outcomes by restricting third-party access. This results in a reduction in the number of product options and a stagnation of technological advancements within the industry. Despite the fact that Bosch's actions were taken in a more specialized market—the e-bike industry—its control over critical inputs, such as the e-kit system, has significant implications for the broader digitalization of hardware products.

The Bosch v. Blubrake case is a critical illustration of the substantial consequences that a refusal to cooperate in digital and hardware ecosystems may impose on competition. Bosch's actions serve as an example of how dominant firms can impede innovation and restrict market access for smaller competitors by employing technical barriers and a lack of interoperability. Bosch's dominance in the e-kit and ABS markets for e-bikes was further solidified by its refusal to share essential technical protocols or develop integration tools, which effectively excluded Blubrake from the market.

The Bosch case, similar to the Google v. Enel X case, emphasizes the necessity of regulatory supervision to address the strategic use of interoperability as a means of preserving dominance. Both instances underscore the increasing significance of interoperability in promoting innovation, ensuring equitable competition, and ultimately benefiting consumers by providing a broader selection of products and services. The

[119] *Ibid*, paras. 50-74
[120] *Ibid*, para 56.

ICA's findings in the Bosch case indicate that the refusal to interoperate is not merely a technical issue, but a deliberate strategy to obstruct competition. This underscores the need for more robust regulatory action to prevent similar behaviour in both digital and physical markets.

3.6 Economic Model Analysis of the Google-Enel X Case

The Google-Enel X case serves as a pivotal example of how digital platforms can leverage their dominant positions to undermine competition and innovation in the market through strategic denial of interoperability. This section explores Google's reasoning behind preventing Enel X's JuicePass app from operating on Android Auto, using economic models to clarify the relevant dynamics.

Analysing the case from a purely economic standpoint, it becomes clear that what lies behind Google's decision is not resource constraints or technical incompatibility, as claimed by the gatekeeper, but rather a purely commercial decision, as defined by the ICA, with the objective of protecting and enhancing its future competitive position in the market for electric vehicle (EV) services. In fact, as will be analysed, the conduct undertaken by Google is motivated by long-term strategic considerations that outweigh the immediate costs of exclusion. In this scenario, Google's conduct can be understood through the lens of a vertical foreclosure strategy.[121]

The idea of data-induced network effects, which are crucial in the digital economy, is at the centre of the strategic choice. Initial access to Android Auto would have given Enel X the opportunity to grow its user base significantly, collect useful user data, and improve the overall quality of its services. This would have provided Enel X competitive advantage, potentially allowing JuicePass to establish itself as a dominant player in the EV charging service market and compromising the position of the Google ecosystem's apps.

The following mathematical model formalize the strategic interplay between the relevant players of the dispute. The model considers a two-period framework in which Google, as the platform owner, face the decision whether to grant third-party apps like JuicePass compatibility during the first period.
In the first period if the app is available on Android Auto, Enel X generates a profit shown by $\pi_E^1(x)$, where $x = 1$ indicates the availability of the app.
The profits for the second period, $\pi_E^2(x;Y_E;Y_G)$ for Enel X and for Google $\pi_G^2(x;Y_E;Y_G)$, are dependent on the availability of both the third-party app and Google's first-party app, where Y_E and Y_G respectively, signify the presence of Enel X and Google's apps.

The trade-off between Google's short-term losses and long-term strategic gains is a crucial decision point. The parameter β, which represents Google's portion of third-party earnings, indicates the reduction of short-term profits of Google from revenue-sharing with Enel X when interoperability is denied during the first period. However, by denying

[121] Motta and Peitz (2024).

it, Google gains the opportunity to release its app during the second phase, when there will be less competitors and more market dominance. Mathematically, the Google decision criterion can be represented as follows:

$$\pi_G^2(0,1,1) - \pi_G^2(1,1,1) > \beta\ (\pi_E^1(1)\ + (\pi_E^2(1,1,1) -\ (\pi_E^2(0,1,1)))$$

The benefit of denial for Google, which guarantees a weaker competition plus greater future revenues, is represented on the left side of the inequality. The profit share lost by denying Enel X's app early market access is represented on the right side of the inequality as the cost of denial. Google determines that it is economically advantageous to refuse interoperability if the left side outweighs the right side as it maximizes future profits by limiting the competitive threat from Enel X.

Consumer welfare is heavily impacted by the denial strategy of Google. App availability and the resulting competition have a significant impact on the consumer surplus, which is represented by $CS^1(x)$in the first period and $CS^2(x)$in the second period. Enforcing mandatory compatibility allow to increase consumer surplus by guaranteeing the availability of both applications, enhancing competition and innovation.
In particular, the greater quality and choice that result from having both applications available throughout both periods increases the consumer surplus, as shown mathematically by:

$$CS^2(1,1,1) > CS^2(0,1,1)$$

This emphasizes how crucial regulatory action is in requiring interoperability and preventing anti-competitive behaviour. Google stifles innovation in the emerging EV sector, inhibits customer choice, and prevents access to better services by refusing compatibility.

Additionally, the analysis highlights the crucial role that entry costs, F_E for Enel X and F_G for Google, play in defining the strategic environment.
The expectation of profits over entrance expenses determines whether Enel X decides to enter or not the market. This decision can be represented by:

$$(1-\beta)(\pi_E^1(1) + \pi_E^2(1,1,1)) > F_E$$

If this condition is satisfied, Enel X enters the market, anticipating sufficient returns to justify the investment. Enel X enters the market if this need is satisfied since it expects strong enough returns to cover its costs. On the other hand, Google's choice of developing its own app is contingent upon whether the anticipated profits, after deducting entry expenses, justify the strategic investment:

$$\pi_G^2(x,1,1) + \beta\pi_E^2(x,1,1) - F_G\ > 0$$

The Google-Enel X case illustrate of the intricacies involved in the competition among digital platforms, wherein control over data and network effects can create significant barriers to entrance and advantages over competitors. The economic model

demonstrates the necessity for strict regulatory monitoring to maintain fair competition and consumer protection by showing how incumbents might use purposeful denial of interoperability as an instrument to reinforce their market dominance.

Chapter 4: Evaluating Interoperability Challenges in Digital Markets – Survey

In order to gain a more comprehensive understanding of the interoperability challenges that companies encounter when integrating their products and services with iOS and Android operating systems, a survey was administered to a diverse variety of businesses operating within the Connected Devices and Services Industry. For the effective operation of their products, this industry, which includes both wearable technology manufacturers and digital service providers, is heavily dependent on the seamless integration with these dominant platforms. The survey was designed to collect information regarding the technical challenges that these organizations face and the strategies they use to circumvent the constraints imposed by Apple's and Google's ecosystems.

The data obtained from this survey provides a fundamental foundation for the examination of the ways in which dominant platforms influence market dynamics by exerting control over platform functionalities, APIs, and operating systems. The survey offers valuable insights into the practical challenges that businesses encounter and emphasizes broader legal and competitive concerns by analysing the responses of key industry participants.

4.1 Survey Design and Methodology: Selection of Companies and Data Collection Procesee

The survey was conducted among 20 companies that operate within the consumer electronics and digital services sectors. The companies in question either manufacture connected devices, including smartwatches, fitness monitors, and headsets, or offer digital services, including cloud-based applications, media streaming platforms, and health monitoring services, that necessitate integration with iOS and Android operating systems. The participants were selected due to their substantial reliance on these platforms for the fundamental functionality of their products and services. The survey was administered to companies of different sizes in order to ensure a heterogeneous sample. The companies are a cross-section of the industry, encompassing both small and medium-sized enterprises (SMEs) and larger corporations that operate in the global market. Approximately 65% of the organizations are classified as device manufacturers, with a primary emphasis on hardware that must interact with mobile operating systems in order to provide services. The service providers, who comprise the remaining 35%, rely on platform features, including APIs for data sharing, Bluetooth connectivity, and cloud integration, to guarantee that their services operate optimally within the iOS and Android ecosystems.

The respondents were critical personnel, such as technical managers, product developers, and software engineers, who are directly engaged in the daily operations of integrating their company's products or services with Apple's and Google's platforms.

The survey was developed with four qualitative questions that were designed to disclose the specific technical challenges that companies encounter when integrating their products or services with iOS and Android operating systems. Respondents provided detailed descriptions of the issues and the solutions they have implemented in response to these questions.
The initial question examined the importance and relevance of the technical challenges that these companies encounter when integrating with Apple's iOS and Google's Android. This aimed to determine the platform that presents the most significant obstacles and to define the extent of the challenges.

The second question concentrated on the strategies that undertakings have implemented to overcome the obstacles imposed by gatekeepers in analysis. It investigated the specific strategies that companies use to navigate the limitations imposed by each operating system and maintain interoperability with their products or services.

The third question aimed to compare iOS and Android, requesting that respondents identify which operating system presents greater challenges in terms of interoperability and define the technical problems they encounter most frequently with each platform.

Lastly, the fourth question explored API access issues, inquiring whether respondents had encountered any challenges in accessing or utilizing the APIs provided by Apple or Google. The objective was to determine which APIs or functionalities have been controversial and how these challenges have impacted the integration of their products or services.

The survey was electronically distributed to the participating companies. The open-ended format of the queries facilitated the provision of comprehensive responses, enabling the participants to elaborate on their unique challenges and solutions. Subsequently, the responses were analysed and aggregated to identify recurring themes and patterns in the companies' experiences with interoperability on the iOS and Android platforms.

The collected data was subjected to a qualitative content analysis with the objective of identifying common themes that are associated with the technical challenges that companies encounter. The responses were categorized into specific areas, including hardware integration issues, API restrictions, platform fragmentation, and data-sharing challenges.

4.2 Survey Results: General Overview of Responses

The responses to the survey offered a comprehensive understanding of the obstacles encountered by both device manufacturers and service providers in the pursuit of seamless interoperability with iOS and Android. The examination disclosed numerous critical difficulties regarding the technical challenges encountered, the resolutions implemented, and the distinctions between the two platforms.

The survey indicated that 70% of respondents found iOS to be more complicated to interoperate with, particularly due to API restrictions and restrictions on accessing

essential functionalities. These companies, which are predominantly device manufacturers, emphasized that Apple's closed ecosystem made it challenging to fully make use of the features that are essential for the optimal functioning of their products, such as Bluetooth connectivity and biometric sensors. For instance, a respondent observed that its ability to access Apple's health-related APIs was "frustratingly limited," which hindered the provision of more advanced features to its users. Conversely, Android was perceived as more difficult by 30% of companies, although for dissimilar reasons. The predominant issue, according to these respondents, was fragmentation across various Android versions. The requirement to ensure compatibility with multiple operating system versions, each of which has variable degrees of support for various APIs, resulted in substantial resource requirements. A respondent stated, "While Android gives us more flexibility, ensuring our app works seamlessly across different device models and OS versions is a constant challenge".

4.3 Key Findings

This section presents a schematic summary of the major discoveries from the survey that was conducted. The responses emphasize critical issues, including fragmentation, system restrictions, and API access, providing companies with a better understanding of how to overcome these obstacles. The results provide a comparative analysis of iOS and Android, highlighting the operational and developmental complexities of each ecosystem by analysing both the challenges and the solutions implemented.

i. *Relevance of Technical Challenges*

85% of respondents reported that the technical challenges associated with integrating products and services with iOS were substantial. This group, which is primarily constituted of device manufacturers, emphasized that Apple's strict control over APIs and system functions frequently restricted their capacity to develop fully functional products. For instance, companies developing Bluetooth-enabled devices, noticed that Apple's limitations on Bluetooth protocols made it challenging to achieve the same level of functionality as Android, where such restrictions were not as stringent. According to a company, "iOS imposes restrictions that affect not only connectivity but also user experience, as we are compelled to reduce features that are otherwise fully operational on Android."

System fragmentation was identified as a significant technical challenge by 40% of companies for Android. Service providers, in particular, underscored the necessity of substantial investment in testing and development to guarantee compatibility with a variety of Android versions. "It is not sufficient to ensure that the application functions on the most recent version of Android; we must also provide support for users on older devices, which escalates our development expenses," stated one respondent.

ii. *Solutions Adopted*

50% of respondents reported developing internal software solutions to address the obstacles presented by iOS. These encompassed the development of customized software interfaces that could function within the constraints of Apple's APIs. As an instance, a respondant company was compelled to construct a proprietary software layer to manage data from biometric monitoring systems and motion sensors due to the fact that Apple's APIs did not offer direct access to these features.
Third-party solutions were mentioned by 30% of respondents on the Android side to resolve the fragmentation issue. These companies were able to manage the differences between various Android versions by collaborating with third-party developers to generate compatibility profiles. In addition, 20% of organizations reported that they collaborated closely with Google's support teams to address specific interoperability concerns, particularly those associated with cloud-based services.

iii. *Comparison Between iOS and Android*

70% of respondents identified iOS as the more difficult operating system to achieve interoperability when contrasting the two platforms. The primary reason for this, according to the companies, was Apple's isolated ecosystem and restricted access to essential system functionalities. According to one respondent, "iOS restricts our ability to customize our devices, which makes it difficult to compete with Apple's own products that do not face the same restrictions."
The primary concern for Android was not system restrictions, but rather the fragmentation that necessitated developers to support multiple versions of the operating system. According to 30% of organizations, this fragmentation necessitated the allocation of additional resources to testing and optimization, which was unnecessary for iOS.

iv. *API Access Issues*

In terms of API access, 65% of respondents reported issues with specific APIs on iOS. Their capacity to provide sophisticated functionalities that their products could otherwise support was restricted by these limitations. According to one participant, "Apple's ecosystem is stable; however, the closed nature of their APIs necessitates us to circumvent their limitations, which diminishes the overall functionality of our product."

On Android, 30% of respondents reported experiencing difficulties in sustaining API compatibility across various operating system versions and device models. The development process was made more complex by the necessity of frequent changes and continuous updates to keep up with new versions of the operating system, despite the fact that Android's APIs were generally more accessible.

4.4 Interoperability Challenges – Legal and Economic Implications

The survey results emphasize the profound interconnection between the broader legal and competitive landscape and technical challenges in the wearable devices and service providers industry. The technical impediments that companies encounter—including platform fragmentation and restricted access to APIs—are not isolated. Rather, they are indicative of the competitive dynamics that serve as the foundation for EU competition law, including the EFD under Article 102 TFEU and the DMA. The barriers to interoperability in the analysed industry are central to the broader discussion of market power, self-preferencing, and the regulation of gatekeepers when these legal principles are analysed in conjunction with the survey results.

The survey indicated that 70% of respondents encountered substantial challenges in fully incorporating their products and services with Apple's iOS ecosystem, predominantly as a result of API access limitations. The legal concept of self-preferencing is reflected in these limitations, which are not merely technical in nature. This concept is characterized by dominant platforms, prioritizing their own products and services by limiting access to essential functionalities for competitors. This is a clear example of vertical foreclosure, in which competitors are denied equal access to critical resources, thereby restricting their capacity to innovate and compete on a level playing field.

The Google-Enel X case serves as a direct legal example, in which Google's refusal to enable the JuicePass app to be installed on Android Auto was perceived as a form of self-preferencing, with the intention of favouring Google's own applications, such as Google Maps. Similarly, the survey participants' challenges with Apple's confined ecosystem are indicative of the ways in which platform owners can leverage their dominance to stifle competition. This underscores the very issue that the DMA's Article 6(5) aims to resolve by prohibiting gatekeepers from prioritizing their own services over those of third-party providers. The technical barriers identified in the survey are not merely obstacles for companies; they also pose substantial legal concerns regarding market openness and equal competition.

The EFD provides a more comprehensive understanding of the restrictive access to APIs that 85% of the surveyed companies have reported. Under the EFD, a dominant firm may be legally obligated to grant access to a resource that is essential for others to compete. The iOS and Android ecosystems, and their APIs in particular, are indispensable inputs. The Bosch vs. Blubrake case demonstrates how the denial of access to a critical technical input, such as the Y-cable required for the integration of Blubrake's ABS system with Bosch's e-kits, can be considered an anti-competitive refusal to deal under Article 102 TFEU. In the same vein, Apple's prohibition of API access can be interpreted as a denial of access to an essential facility. The companies assessed are unable to provide their consumers with the same level of functionality as Apple's own devices due to the lack of access to these APIs, thereby stifling competition and innovation in the sector. The broader competitive implications of such technical restrictions are underscored by the connection between the legal doctrine of essential facilities and the survey findings.

Although 30% of respondents found Android to be more difficult, the problem was not so much restricted access as the fragmentation across various versions of the operating system. This presents a distinctive obstacle, as firms are required to allocate substantial resources to guarantee compatibility with numerous Android versions, each of which offers variable degrees of support for critical APIs. Android's fragmentation results in higher entry costs, which can indirectly benefit larger companies that are better suited to address these challenges, despite the fact that its open nature allows for greater flexibility than iOS.

This complication resembles a form of foreclosure, in that it effectively excludes lesser competitors from the market by making access complex and expensive, rather than by outright denying them access. In this context, the Article 6(7) DMA on vertical interoperability is of the utmost importance, as it mandates that gatekeepers guarantee equal and unrestricted access to critical hardware and software features. This type of regulatory intervention is essential to prevent fragmentation from becoming a *de facto* barrier to competition, particularly for smaller, more innovative companies, as indicated by the survey's highlighted issues.

Many of the technical challenges that respondant companies encounter can be attributed to the gatekeeping authority of dominant platforms such as Apple and Google, as the survey results emphasize. The DMA was specifically designed to address these concerns by imposing *ex-ante* obligations on gatekeepers to prevent them from exploiting their market power. The DMA's requirements for free and effective access to APIs and platform features would alleviate many of the challenges that the wearable and services providers companies in the survey encounter. The DMA aims to guarantee that third-party companies can innovate and compete without artificial barriers by prohibiting gatekeepers from restricting access to essential functionalities, such as those required for biometric monitoring or Bluetooth connections. This proactive regulation, as demonstrated in the Google-Enel X and Bosch-Blubrake cases, is an essential complement to conventional competition law, which frequently responds only after competitive damage has occurred.

In principle, the barriers identified in the survey should be alleviated by provisions such as Article 6(7) DMA, which require gatekeepers to provide third-party hardware and service providers with access to the same software and hardware features as their own products. At the same time, the prohibition of self-preferencing should prevent companies from favouring their own offerings. However, the survey results suggest that platform's owners persist in crafting methods to circumvent the DMA's provisions, despite the existence of these regulatory frameworks. For instance, despite the fact that Apple and Google technically permit access to specific APIs or development tools, they still implement nuanced limitations, such as limiting functionality or establishing bureaucratic obstructions that impede the complete integration of their products by third-party competitors. This is comparable to the Google-Enel X case, in which Google's refusal to authorize the JuicePass app was not a result of technical limitations, but rather a deliberate business decision to preserve its ecosystem control.

Despite regulatory obligations, gatekeepers are still able to impose high costs and technical restrictions that unfairly burden competitors, as evidenced by the observation that 50% of respondents had to develop internal software solutions to overcome these barriers. This highlights a critical vulnerability in the current regulatory framework: despite the DMA's establishment of explicit regulations, administrators can exploit gray areas—such as asserting security or technical concerns—to maintain access restrictions. These practices have substantial implications for consumer welfare. Gatekeepers reduce consumer choice and prevent the market from offering innovative products that could enhance user experience by imposing technical barriers and limiting third-party access. These restrictions have a particularly significant impact on the wearable device and service provider's market. The Bosch-Blubrake and Google-Enel X cases demonstrate that the restriction of interoperability results in a negative impact on both consumer welfare and competition.

The survey results indicate that gatekeepers continue to exert significant influence over the market, despite the DMA's proactive approach, by devising methods to circumvent the principles of the law. The full potential of a competitive and open digital market has not yet been realized, despite the fact that the DMA has provided some relief. The subtle methods by which gatekeepers continue to impose technical and economic barriers suggest that additional regulatory supervision and potentially even more stringent enforcement mechanisms are required to guarantee compliance.

Concluding remarks

Big tech companies' great power prompted the EU to establish the DMA, which aims to control and restrict these companies for the protection of competition and consumers. The *ex-ante* application of the DMA appears to be more advantageous than the application of EU competition law, which is frequently perceived as evaluative and time-consuming in cases of abuse of dominance. This thesis demonstrates that gatekeepers can continue their anti-competitive practices by circumventing the DMA's prohibitions and obligations in a non-explicit manner. Consequently, can we be confident that the DMA will fulfil its intended purpose?

Although DMA may reduce anti-competitive behaviour by GAFAM-style enterprises, it is unlikely to resolve the competition law enforcement lack for digital services due to two primary factors. Initially, DMA is unable to promptly and effectively address new anti-competitive behaviour and measures implemented by regulated companies following the dispersal of prior instruments due to its ex-ante nature. Secondly, it only targets new gatekeepers when they distort competition and does not address their emergence. One concern is that the specification of strategies to reduce contestability may incite gatekeepers to employ alternative methods to empower their products and services.[122]

While the DMA is intended to serve as a novel regulatory intervention, it encounters numerous obstacles in its implementation, particularly in relation to the self-preferencing strategies implemented by gatekeepers. The findings of this thesis suggest that the rejection and technical challenges associated with vertical interoperability are not exclusively due to technical issues, but rather to mechanisms implemented by dominant companies to fortify their dominant position at the expense of third-party companies. Google's refusal to integrate JuicePass with Android Auto is a clear example of a refusal of vertical interoperability that is obscured by technical or security justifications. In the Bosh case, a comparable pattern has been identified in the hardware sector, with the exception of Blubrake. In this instance, technical systems are denied access under the guise of technical complexity, when the true objective is market foreclosure.

The cases analysed, particularly the one concerning the dispute between Google and Enel X, once concluded, will have very significant implications in the context of the DMA. In particular, from the five legal inquiries that the Italian Council of State submitted to the CJEU, a number of evident gaps have emerged, particularly concerning vertical interoperability and how it can be managed. Undoubtedly, the outcomes of this case will lay the groundwork for a more effective management of future cases and address the gaps regarding interoperability.

From an economic perspective, the strategic denial of interoperability represents an attempt put into action by gatekeeper in order to control competition without compromising their ecosystems, In these scenarios analysed trough this thesis, companies such as Google and Bosh, are able to shape the competitive landscape in a manner that benefits their own products while marginalizing competitors. This strategy, as analysed

[122] Hučková and Semanová (2023)

by the papers of Motta and Peitz, it is founded on the economic principle of maintaining long-term dominance by leveraging first-mover advantages, data control, and network effects.

The economic literature refers to these practices as walled gardens, in which gatekeepers monopolize essential digital or hardware infrastructures – essential to third party undertakings – ensuring that any new entrant encounters disproportionate barriers to entry. Innovation is impeded as smaller companies are denied access to the essential tools and resources to bring their products to market, consumer choice is restricted, and market power is increasingly concentrated in the hands of a few dominant firms. The economic impact is profound. The broader market is negatively impacted by diminished competition, as the incentives for innovation are diminished when gatekeepers employ interoperability as a gatekeeping instrument rather than a platform for collaborative development.

In terms of the Essential Facility Doctrine, the standard for determining the requirement of indispensability needed in digital markets should not consider the mere existence of alternatives, but it should consider whether those alternatives provide meaningful competitive parity. In digital markets, a company's capacity to contend effectively is reliant upon the seamless integration, simplicity of use, and access to data. The act of denying access to these elements can be just as exclusionary as denying tangible access to essential infrastructure. It appears that the current legal and regulatory frameworks are inadequate to address the complex nature of digital ecosystems. The DMA's provisions on vertical interoperability are a positive development; however, their enforcement will necessitate rigorous supervision to prevent gatekeepers from exploiting regulatory ambiguities. As illustrated in the case of Google, gatekeepers frequently assert that interoperability restrictions are essential for technical or security reasons; however, this thesis demonstrates that these assertions are frequently employed to hide anti-competitive and self-preferencing practices.

In conclusion, this thesis's research targets a wide range of stakeholders. First, the research has revealed, owing to findings of the survey addressed to companies operating in the wearable devices and service providers industry, that the issue of integration with dominant platforms involves a large number of companies. Companies operating in digital ecosystems, particularly small or third-party developers, will be able to gain a broader and more detailed understanding of the structural barriers they face.

Additionally, scholars of economics and competition law will benefit from the fragmentary examination of the ways in which traditional legal doctrines must be modified to accommodate the dynamics of the digital market. Lastly, this thesis is a contribution to the increasing number of studies that advocate for a more proactive and sophisticated approach to the regulation of digital markets. Vertical interoperability is not merely a technical issue; it is a battlefield where the future of consumer welfare, innovation, and competition will be determined. Monopolistic control, reduced innovation, and fewer consumer options will be the hallmarks of the market if gatekeepers persist in their control of essential infrastructures to impede competition. In order to prevent this result, regulators have to vigorously enforce regulatory tools such as the DMA and adapt legal systems to accommodate the constantly evolving needs of

digital ecosystems. This is the sole way to guarantee that digital markets remain competitive, open, and open to innovation for the benefit of all stakeholders.

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APPENDIX A: SURVEY QUESTIONS

TOPICS	QUESTIONS
INTEGRATION CHALLENGES WITH IOS AND ANDROID OPERATING SYSTEMS	1) To what extent does your company face technical challenges when integrating your devices (e.g., headsets, smartwatches, fitness trackers) with Apple's iOS or Google's Android systems?
OVERCOMING IOS/ANDROID INTEROPERABILITY ISSUES: SOLUTIONS IMPLEMENTED	2) What measures, if any, has your company had to implement to overcome challenges or restrictions imposed by iOS or Android in achieving full interoperability with your devices?
IOS VS. ANDROID: KEY COMPATIBILITY CHALLENGES	3) In your experience, which operating system (iOS or Android) presents more challenges in ensuring smooth compatibility with your devices and services? What are the most frequent technical issues that arise?
API ACCESS ISSUES WITH APPLE AND GOOGLE	4) Have you experienced any difficulties in accessing or using APIs provided by Apple or Google to enable seamless functionality between your devices/services and their operating systems? If yes, which specific APIs or functionalities were problematic?