

Hard facts. Clear stories.

Copenhagen
Economics

CE

THE ECONOMIC RATIONALE FOR VERTICAL INTEGRATION IN THE TECH SECTOR

Hardware devices to software to services:
strategic risk-taking, innovation and investments in
the pursuit of efficiency and consumer value

CLIENT: APPLE
NOVEMBER 2020

AUTHORS

Dr Adina Claiici, Director
Dr Bruno Basalisco, Director
Dr Federico De Michiel, Economist
Dr Henrik Okholm, Partner
Dr Norbert Maier, Managing economist

EXECUTIVE SUMMARY

The long-established economic literature on the rationale for and benefits of vertical integration – demonstrated in practice in the tech sector – is a reminder to consider regulation on a case by case basis: throwing out the baby with the bathwater would harm efficiency and consumers.

Top-line summary

Based on the review of the economic literature, as well as the appraisal of major business developments in tech and the wider economy, of key case studies and of competition authority practice, this study finds:

On efficiencies

- Vertical integration is not necessarily a black-or-white, make-or-buy decision; it can involve a range of intermediate (hybrid) arrangements involving various degrees of integration, including platform / ecosystem strategies
- Vertical integration is a demonstrated driver of economic efficiencies
- Key efficiency mechanisms include the fostering of greater quality across the value chain (compared to what firms provide without vertical integration), the reduction of transaction costs, tapping into synergies and developing emerging markets

On incentives

- Vertically integrated firms have incentives to realise these efficiencies without intervention because they have a stake in the end-to-end customer experience: their success depends on the ability to satisfy better end customers' preferences compared to the alternatives
- The value chain related to digital businesses can extend significantly and exhibit different types of competitive constraints at every layer
- Managing the complementarities between hardware, software and services over integrated system design is a key manner by which vertical integration in tech can deliver economic efficiencies and consumer value

On regulation

- Digital/tech businesses differ significantly from one another, hence any generalisation upon designing regulation can lead to unintended consequences and/or an unlevel playing field
- There are material risks from imposing disproportionate interventions such as blanket rules, which could curtail the efficiencies identified in this study
- Caution is advised on possible one-size-fits-all regulatory interventions, including in the case of dual role platforms – the regulatory treatment of practices concerning pre-installing apps, access and interoperability can undermine the efficiencies and consumer value driven by vertical integration
- Policy makers would benefit from taking, as a starting point, the well-established economic evidence on benefits and drivers of vertical integration, while taking a case-by-case approach to regulatory design, balancing demonstrable efficiencies and concerns.

Background

Current regulatory initiatives, in particular linked to the emerging Digital Markets/Services Act Package,¹ appear to be based on the premise that digital markets are unbalanced due to a few large online platforms that act as gatekeepers. The policy conversation on digital platforms is often revolving around the concern of gatekeeping platforms being vertically integrated and acting as “referee and player”. Policymakers are scrutinising the incentives and conduct associated with platforms operating across a vertical value chain in competition with less vertically integrated firms, which purchase an input (e.g. intermediation service) from the platform.

Vertical integration is a relatively widespread practice across the economy – both in “digital” and “traditional” sectors. With the advent of digital transformation, many firms across industries, irrespective of their size or market prominence, attempt to add software and/or services to their products or develop partnerships to ensure a coordinated approach to deliver the best end user experience. When a firm chooses to invest and enter a market served by its suppliers (upward, i.e. backward integration) or in its output/customers’ markets (downward i.e. forward integration), it is delivering additional competition to the economy, a clear pro-competitive effect.

Different companies and value chains have different implications for competition analysis. As is demonstrated in the theory and practice of competition economics, vertical integration strategies are associated not just with harm to competition but also with efficiency and consumer benefits. In fact, these positive aspects are routinely considered and evaluated by competition and regulatory authorities in cases involving markets and regulatory design. Ex-post evaluations have found a degree of support for vertical mergers and acquisitions to be favourable in terms of their market and consumer outcomes due to these efficiencies. Nevertheless, in competition enforcement, the merits of the facts and effects of conduct have to be considered in a case by case assessment.

In summary, vertical integration cannot be reduced to select catchwords or theoretical concerns – it is valuable to study it in practice. It is a broader phenomenon of significant importance to value creation and consumer welfare outcomes in present-day free-market economies. The aim of this study is to shed light on the economic rationale of vertical integration. This is a key aspect defining the business models of some digital players. In turn, this is relevant to important policy conversations on the case for and effects of regulation of various aspects associated with the operation of vertically integrated businesses.

Vertical integration is a source of efficiencies

Firms may vertically integrate in different directions of their value chain, i.e. backward and/or forward. They may do so by building new own assets (organically) or through acquisitions, spanning different lengths across value chains. We observe a heterogeneous mix of vertical strategies undertaken by firms active in the digital sector. Both integrated as well as non-integrated players coexist and compete fiercely at every level of the value chain. Vertical integration is not a mere black and white decision, since it can involve a host of intermediate arrangements involving various degrees of integration, such as hybrid forms of vertical integration, including platform / ecosystem strategies.

A long-established line of economic theory has found that firms can pursue vertical integration; in doing so, they promote multiple economic efficiencies and consumer benefits, such as price reductions and more features / quality of product and experience for the same price. We have then

¹ Note: this study has been designed and conducted in summer/autumn 2020.

studied key patterns of business development across the tech sector and identified whether there are efficiencies in vertical integration in this sector and which efficiency is most relevantly displayed in this sector. We have also considered the broader picture and case studies of vertical integration both in tech and across the economy. We find at least five types of efficiencies linked to vertical integration investment strategies in tech.

VERTICAL INTEGRATION: EFFICIENCIES PARTICULARLY RELEVANT TO DIGITAL MARKETS	
EFFICIENCIES	DESCRIPTION
Quality externalities	Vertical integration allows firms to benefit from the positive effects that investing in a part of the value chain generates for other parts of the chain (i.e. externalities). As a result, vertically integrated firms have greater incentives to invest in product development in each step of the chain – compared to suboptimal investment and quality without integration.
Support emerging markets	Vertical integration enables firms to develop new and innovative products that may require inputs and components for which a functioning market has yet to be developed.
Transaction costs and hold-up problems	Vertical integration allows firms to overcome market failures when transaction costs (e.g. search, monitoring and contract enforcement costs) are too high or when moral hazard may discourage firms from making dedicated investments that lead one firm to become dependent on its transacting party (supplier/buyer).
Economies of scope (synergies)	Vertical integration allows a firm to benefit from economies of scope derived from the use of its inputs across the value chain and the reduction of redundant processes. It facilitates synergies across the value chain, e.g. efficiencies from the sharing of indivisible assets and the elimination of redundant processes.
Firm's capabilities	Vertical integration allows a firm to tap into its unique mix of resources and capabilities, which may not be easily transferrable across firm boundaries. These resources and knowledge capabilities can generate value via activities across the value chain.

Vertical integration unlocks multiple efficiencies. These and other **efficiencies ultimately benefit consumers** via lower prices and higher quality. According to economic literature, there are some specific conditions in the nature / features of a value chain that results in the highest benefits from vertical integration.

Based on business and case study analysis, we find that **digital/tech sector value chains hold key features that make vertical integration efficiencies particularly relevant for firms' and consumer value**, such as:

- High complementarity between product components e.g. hardware and software;
- Highly specific assets;
- High quality externalities: quality at every stage of the value chain impacts the whole chain;
- High economies of scope: large potential synergies that can be reaped across the value chain;
- High technological uncertainty; and
- Crucial role of intangible assets and knowledge capabilities.

Researchers and competition and regulatory authorities have identified potential competitive harms that may arise under vertical integration, specifically when dominant firms abuse their position via (i) foreclosure of actual/potential competitors, (ii) creation of barriers to entry or (iii) enhanced horizontal collusion. By statute, competition authorities assess vertical integration cases balancing its benefits and risks on a case by case analysis. Based on authorities' decisions and market outcomes, research finds that, generally, vertical mergers and acquisitions – by enhancing vertical

integration – deliver the expected efficiencies, while the ability and incentives to lead to competitive harm occur only under specific circumstances.

Vertically integrated companies have incentives to realise these efficiencies without intervention

There is not a one-size-fits-all to vertical integration or to the coordination approach in related platform models. This leads to a range of vertical integration strategies which can enable efficiencies and consumers' and firms' value generation. Vertically integrated firms can add a platform layer to their operations where 3rd party players can create new services to complement the products offered by the firm – a strategy known to **foster network effects that generate consumer value and thus ultimately value for the ecosystem orchestrated by the vertically integrated firm**. This can be seen as a hybrid form of vertical integration and involve a dual-role platform where the latter provides services that may compete with those of 3rd party players on the platform. The vertically integrated firm has incentives to ensure the consumer appeal and success of its entire ecosystem. Thus, in this form of integration, **managing the balance between openness and control over the platform is critical for the vertically integrated firm** due to quality spillovers that impact its entire value chain.

Depending on the combination of industry, market and firm specific characteristics, and the very nature of the business model they pursue, tech companies are disciplined by consumers to deliver the most efficient outcome. The platforms business model and the network effects are an illustration of this – and especially so in the context of vertical integration, given multiple sources of efficiency and consumer value that are key to ensure the success of a vertically integrated ecosystem.

A topical competition policy question is whether a vertically integrated platform will foreclose the 3rd party players on the platform (can a firm be the referee and a player at once?). Under competition law and economics, foreclosure concerns hold only when both ability and incentives back up the envisaged harmful practice. Irrespective of the question of ability, the evidence on the efficiencies of vertical integration is a basis to consider carefully the role of incentives in these types of business models. A key incentive is that these platforms benefit from a rich ecosystem due to the presence of 3rd parties on the platform, in particular through network effects – thus they may not hold incentives to foreclose those 3rd parties.

Ultimately, the success of any vertically integrated firm depends on the ability to satisfy the needs and preferences of the customers located at the end of the value chain covered – and to do so better than alternatives, at least for a sufficient set of customers. The goal to generate efficiencies valued by customers provides a key driver and constraint of firms' approaches to vertical integration.

Therefore, there are material risks from imposing disproportionate interventions such as blanket rules, which could curb these efficiencies

This study confirms, conceptually and in practice, the importance of vertical integration business strategy as a driver of economic efficiency and generation of value for firms and consumers – both generally across the economy and in particular in tech sector value chains. Based on these findings, we have considered the risks of policies targeting vertical integration in the tech sector. While policy evaluation is a case by case exercise and can only be done relative to specific, concrete rules identified, we can identify factors that can significantly affect the outcomes of regulations. By way of

example, let us consider the case of vertically integrated device manufacturers and rules tackling (i) app pre-installation, (ii) access of 3rd parties; and (iii) interoperability management.

EXAMPLES OF PRACTICES: ECONOMIC EFFICIENCIES IN A VERTICALLY INTEGRATED SYSTEM		
Key question	What does it mean in a vertically integrated system?	Benefits / Efficiencies identified
Pre-installation apps	<ul style="list-style-type: none"> The integrated firm makes and pre-installs own applications to ensure sufficient functionalities to consumers from the device start-up moment. Including key apps with core functionalities that affects the performance of the device Operating System. Removing the need (not the possibility to do so at any time) for users to incur search costs to find other functionalities. 	<ul style="list-style-type: none"> Consumers (and the vertically integrated firm) are less exposed to defects and flaws on 3rd parties' products – i.e. the hold-up inefficiency. Raising competitive responses, promote high quality by 3rd parties' developers, thus enhancing consumers' choice and quality experience. Reducing search costs, thus meeting consumer preferences for convenience.
3 rd parties' access	<ul style="list-style-type: none"> The integrated firm exercises control over the terms of access to its platform by 3rd parties' developers 	<ul style="list-style-type: none"> The integrated firm has consumer value-enhancing economic incentives to maximise quality and synergies over the entire integrated system.
Interoperability management	<ul style="list-style-type: none"> The integrated firm manages interoperability and interconnection of system services and technical features with 3rd parties' services. 3rd parties interconnecting to the integrated platform generally have less at stake than the platform owner and thus different views of functionality risks. Full compatibility with all services may come at the expense of lower product performance and lower quality. 	<ul style="list-style-type: none"> The integrated firm is better positioned and has stronger incentives to assess real risk of granting interoperability. Managed interoperability safeguards against low product performance and quality. Balancing of risk and hardware / software / service performance from the viewpoint of the entire end-to-end consumer experience.

In summary, when vertical integration strategies include platform models, 3rd parties will not only play a role in their layers (e.g. software) but they will also affect the extent of synergies between layers and their management, thus the end-to-end consumer experience. Any blanket prohibition of the above practices could risk to

- reduce the efficiencies generated by investment in quality improvement (quality externalities);
- increase search, monitoring and contract enforcement costs e.g. over quality aspects (transaction costs);
- discourage firms to make dedicated investments (hold up); and
- reduce the synergies from use of firms' inputs across the value chain e.g. efficiencies from the sharing of indivisible assets over complementary product components (economies of scope).

Via the above effects, inappropriate regulation would curtail some of the key benefits expected from vertical integration. The above efficiency limitations would hamper the ability of vertically integrated firms to yield consumer value via tightly designed systems. In the case of tech this includes the complementarities between hardware, software and services over integrated system design. Ultimately, blanket prohibition of the above practices could undermine incentives of vertically integrated firms to innovate and invest on downstream services that enhance the final products' and thus consumer welfare – including via privacy and safety levels that respond to users' preferences.

Thus, any policies curtailing the vertically integrated firms' extent of control of those hardware / software / services interdependencies risk impairing the overall quality of the user experience and thus undermining a major driver of economic efficiency via vertical integration. While blanket rules risk harm to economic efficiency, a case by case analysis can shed light towards balanced policies.

This leads to a clear policy recommendation: a case by case analysis is needed before the necessity and effects of any specific regulation is established

Vertical integration business strategies have made possible a considerable part of the present-day consumer experience in digital markets and services – to a level that would not have been recognisable even just a few years back. We have identified the benefits of vertical integration, through various case studies both in long-established industries as well as in newer digital markets. Successful policies furthering digital transformation potentials in the economy and in society must thus pay special care to the role of vertical integration models in driving competition and consumer value.

Digital businesses are, in the first place, very different from one another, hence any generalisation upon designing regulation is bound to lead to unintended consequences and/or an unlevel playing field via excessive regulatory burdens placed in some areas. Digital businesses' value chains are complex, with different types of competitive constraints at every layer. Thus, tackling one aspect of the value chain may create unexpected effects and alter the competitive dynamics in other parts. The economic literature findings and the evidence of the size and type of efficiencies and value generation by vertical integration across the tech sector are clear.

Based on this evidence, this study calls for policy evaluation to consider carefully the various type of platform-based businesses, including dual role platforms, since they reflect different incentives and consumer outcomes. One-size-fits-all regulation risks harming efficient consumer value-enhancing vertical integration practices by precluding or reducing incentives for firms to invest and both to tap into synergies across the value chain and to ensure a high standard of quality in their products. This harm to economic efficiency is to the detriment of consumers today as well as tomorrow, since any loss in dynamic efficiencies risks future innovation and consumer value stemming from vertical integration strategies, including the creation of emerging markets and layers in the value chain.

Just like competition authorities do when considering vertical integration cases (balancing efficiencies and concerns in mergers), regulatory decisions gain from taking as starting point the well-established economic evidence on the benefits of vertical integration. Our key conclusion is to avoid weakening the economic rationale of vertical integration and its industry and consumer benefits when trying to pursue policy aims – in other words avoid throwing the baby out with the bathwater.

A brief note on consultancy research: As is standard in our field of professional services, research is designed so that (i) the client chooses the research question; (ii) we analyse and address the question to the best of our knowledge; (iii) the findings and conclusions are our own. Professional services independence is ensured via a diversified portfolio of business, spanning across public sector and private clients across industries. For further information, see www.copenhageneconomics.com. We remain available for and appreciate any questions or comments.

TABLE OF CONTENTS

Executive summary	3
Introduction	15
1 Vertical integration in digital markets	17
1.1 Overview of vertical integration strategies	17
1.2 A framework to study vertical integration in digital industries	19
1.3 Different vertical integration strategies among tech firms	21
2 Economic and strategic management research on vertical integration	25
2.1 Economic efficiencies and consumer value from vertical integration	25
2.2 Foreclosure as potential anticompetitive effect	33
2.3 Empirical research supports efficiencies from vertical integration	35
3 Efficiencies from vertical integration in digital markets	42
3.1 Digital markets characteristics linked with vertical integration efficiencies	42
3.2 Vertical integration with platform business models	47

4	Case studies	58
4.1	Car manufacturing: OEMs as systems integrators	59
4.2	Apple's investment to design own processors	62
4.3	Marketplace governance: Apple's App Store	65
5	Concluding remarks	70
	References	74

LIST OF TABLES

Table 1 Overview of efficiencies from vertical integration.....	26
Table 2 Types of assets specificity.....	30
Table 3 Overview of main theories on firm's capabilities	32
Table 4 Potential foreclosure by type of asset	34
Table 5 Empirical evidence of the effect of vertical integration on consumer welfare	38
Table 6 Overview of vertical efficiencies in digital markets	43
Table 7 Vertical efficiencies from car manufacturers as systems integrators	62
Table 8 Vertical efficiencies from vertical integration of processors	65
Table 9 Vertical efficiencies from vertical integration of App Store.....	69

LIST OF FIGURES

Figure 1 General types of vertical integration.....	18
Figure 2 Digital sector's value chain	20
Figure 3 Examples of vertical integration pattern in digital sector	21
Figure 4 Overview of dual-role platform	52
Figure 5 60	
Figure 6 Apple's most important mobile chip devices until 2018	64

LIST OF BOXES

Box 1 Apple – a case study of a vertically integrated business model	23
Box 2 The death of Flash Player and the hold-up problem	45
Box 3 Manufacturing and service firms are developing integrating app stores in the value chain	50

INTRODUCTION

During the past few decades, we have seen an unprecedented development of our economies in multiple directions. The interconnection between the traditional industries and digital markets has increased. Firms expand more and more beyond their core activities, in an attempt to meet a sophisticated demand. Traditional industries adopt new technologies and tech firms develop into new markets and create new business models. In this environment, the borders between markets are becoming more blurred and so are the different levels of the supply value chain.

Many firms are constrained more and more by fierce competition arising from different directions and, in order to survive they have to be creative and reinvent themselves to different degrees. They may strive to expand beyond their original markets into new territories or combine assets in an unprecedented way in order to meet or, if possible, surprise demanding consumers that search for new ways to simplify their lives. One way for firms to do this is to seek efficiencies by integrating both vertically, upstream or downstream the value chain, as well as into adjacent markets that can complement their core products or services.

For economists, the above business reality should not be a surprise. For a long time, theoretical and empirical economic research has identified and appraised the benefits of integration, including vertically across value chains. Indeed, economies of scale and scope, as well as other types of efficiencies can be easily recognised in many sectors.

Vertical integration can be achieved in various forms (including hybrid forms of integration) and firms can pursue it to a different extent and via different arrangements and forms of governance. Some firms choose to grow organically and others through mergers and acquisitions. The economic rationales in both variants are very similar. By combining or developing complementary assets, firms can serve consumers more efficiently. The advantages of a one-stop-shop are well-known. Knowledge-based economies strive for sustained innovation which enables the organic development of innovative firms into new markets. The benefits of these expansions are well understood, for example, in the context of vertical or conglomerate mergers. Most non-horizontal mergers and acquisitions have been found to be unproblematic by competition authorities². The European Commission Guidelines themselves clearly explain the efficiencies stemming from such types of mergers and therefore represent a good reference for studying integration more broadly.

Paragraphs 13-14 of the EC Guidelines state that “*vertical and conglomerate mergers provide substantial scope for efficiencies. A characteristic of vertical mergers and certain conglomerate mergers is that the activities and/or the products of the companies involved are complementary to each other. The integration of complementary activities or products within a single firm may produce significant efficiencies and be pro-competitive. In vertical relationships for instance, as a result of the complementarity, a decrease in mark-ups downstream will lead to higher demand also upstream. [...] Vertical integration may thus provide an increased incentive to seek to decrease prices and increase output because the integrated firm can capture a larger fraction of the benefits. [...] Similarly, other efforts to increase sales at one level (e.g. improve service or stepping up innovation) may provide a greater reward for an integrated firm that will take into account the*

² OECD (2019) *Vertical Mergers in the Technology, Media and Telecom Sector*, p. 38.

benefits accruing at other levels. [...] Integration may also decrease transaction costs and allow for a better co-ordination in terms of product design, the organisation of the production process, and the way in which the products are sold [as well as] customer benefits such as one-stop-shopping.” Beyond the specific case of mergers & acquisition, the above points – borne out in the economic literature – apply a fortiori in situations where firms invest to develop new assets and expand into adjacent vertical activities.

This report is structured as follows.

- Chapter 1 provides an overview of vertical integration strategies, as relevant in digital markets, as a way to set the scene and summarise, at a high level, key vertical integration trends.
- Chapter 2 identifies and interprets key results of the last decades of economic and strategic management research on the rationale and effects of vertical integration, including theoretical considerations, potential competition concerns, as well as empirical findings on the efficiencies due to vertical integration and open questions.
- Chapter 3 tests the applicability of the above literature in present-day digital markets, by appraising features of digital markets conducive to generating efficiencies under vertical integration strategies, including via platform business models and the related governance to enable and sustain those efficiencies.
- Chapter 4 double clicks on three case studies spanning “traditional” sectors, as well as digital activities – presenting business strategies in light of the literature on vertical integration and testing to what extent these diverse business realities reflect the predictions of the literature findings.
- Chapter 5 provides concluding remarks relevant to optimal policy design in light of the theoretical and empirical findings of the diverse approaches to vertical integration throughout our economy and the efficiencies and consumer benefits associated with these business strategies and investments, including in digital value chains.

CHAPTER 1

**VERTICAL INTEGRATION IN DIGITAL
MARKETS**

- Firms may vertically integrate in different directions of their value chain, i.e. backward and/or forward, organically by building new own assets or through acquisitions, with different depth / spanning different lengths across value chains.
- In digital sectors the value chain can be stylised into three key levels: hardware (devices), software (Operating System), and digital services.
- Tech companies (such as Apple) that develop and design their own hardware and software and also offer digital services are vertically integrated.
- We observe a heterogenous mix of vertical strategies undertaken by firms active in the digital sector. Both integrated as well as non-integrated players coexist and compete fiercely at every level of the value chain.

In the following chapter we introduce the concept of vertical integration and we apply it to the digital sector. The chapter is divided into three sections:

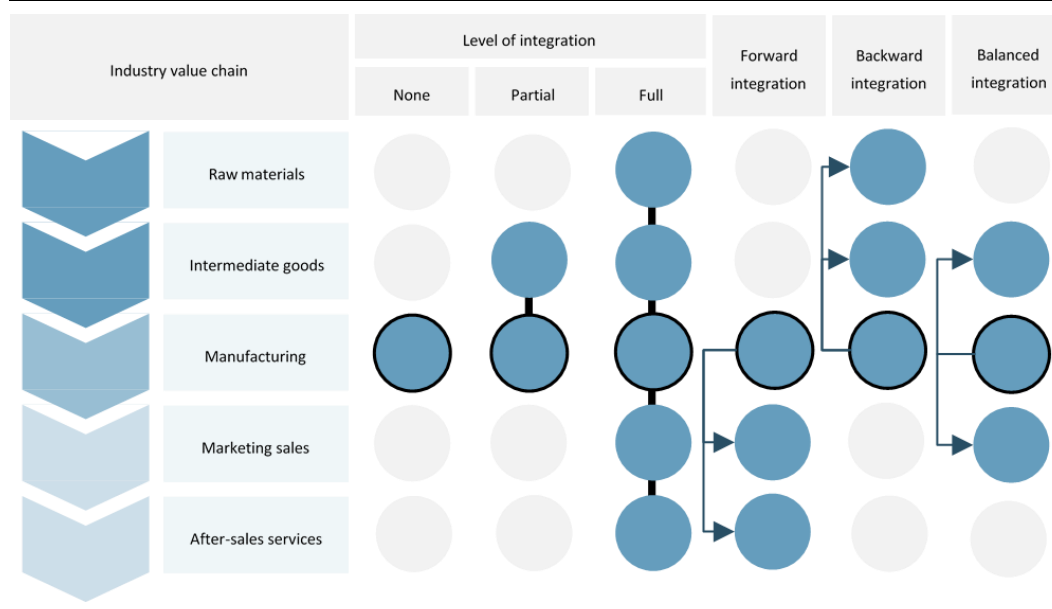
- 1.1 explains the traditional vertical integration strategies;
- 1.2 introduces a conceptual framework to analyse vertical integration in the digital sector;
- 1.3 applies this framework to digital players to highlight different degrees of vertical integration encountered in the digital sector.

1.1 OVERVIEW OF VERTICAL INTEGRATION STRATEGIES

Vertical integration allows firms to acquire control over parts or the entirety of the value chain in their sector. The typical value chain includes (i) the production and acquisition of inputs (raw materials and intermediate goods), usually defined as upstream markets, (ii) the manufacturing process and (iii) distribution and sales activities, defined as downstream markets.

The degree and direction of the vertical integration is a fundamental strategic choice which defines firms' boundaries. Firms may decide to be fully integrated and control their entire value chain or to be only partially integrated and only integrate backwards (upstream) or forward (downstream), see Figure 1. For example, firms can choose to design and produce their own products or only engage in retailing. Firms may participate in external transactions with other economic agents in markets where they are not integrated to acquire inputs and sell their products and services. This is a general definition of vertical integration; in the next section we will provide a more specific framework for digital industries.

Figure 1
General types of vertical integration



Source: Strategic Management Insights³

Firms can achieve vertical integration either organically (from within the company) by reallocating resources and introducing new products and processes or by acquiring existing firms operating in other parts of the value chain.

We note that there is an extensive range of *quasi-integration* strategies⁴ available, such as long-term contracts, licencing and franchising agreements and strategic alliances (e.g. joint ventures), which offer both more complexity and more possibilities to the spectrum of make-or-buy decision outcomes. While the merits of each of these options is beyond the scope of the current study, they may mitigate transaction costs and contractual risks in governance arrangements, while reducing the bureaucratic costs and resource intensive burden of internalizing the transaction within the firm. They may increase a firm's flexibility to mobilise tangible and intangible resources across the value chain at lower costs.

³ Strategic Management Insights, April 2013. Vertical Integration. Available at: <https://strategicmanagementinsight.com/topics/vertical-integration.html>

⁴ Stuckey, J. and White, D., 1993. When and when not to vertically integrate. *MIT Sloan Management Review*, 34(3), pp.71-83.

In this study we also explore vertical integration in those cases where part of the value chain is a platform. Platform business models have become increasingly relevant in the digital sector thanks to improvements in information technology, process and the storage of data. Multi-sided platforms create value by organizing and facilitating interaction between different groups of users, e.g. suppliers and content/service providers on one side and customers on the other side. Vertically integrated firms may implement platform business models in one (or more) layers of their value chain to broaden the offer of complementary services to their final customers via independent players (third parties) that contribute to the platform.⁵ This presents a sort of hybrid vertical integration strategy which allows a certain degree of openness in the system.

1.2 A FRAMEWORK TO STUDY VERTICAL INTEGRATION IN DIGITAL INDUSTRIES

In the digital sector context, we could think of the value chain as having three levels, see Figure 2:

- hardware (devices such as laptop, smartphones, smartwatches and e-book readers)
- software (the operating system that makes the hardware operable)
- and services/content (all complementary digital services and general content such as mobile apps and subscription services that consumers can access via their devices)

⁵ The business model choice of operating as a platform is separate from the choice of extent to which to be vertically integrated.

Figure 2
Digital sector's value chain



Note: Most services and products, e.g. mobile applications, are themselves software products. Here the software lawyer is intended to comprise operating systems that enable the functioning of the hardware devices.

Source: Copenhagen Economics

A firm is (fully) vertically integrated if it *a*) designs and sells its own hardware devices *b*) develops its software operating system(s) (OS) and *c*) offers additional services⁶ that can be accessed on the device. We consider the hardware and services as the upstream and downstream levels of the value chain respectively. For the purpose of this study we focus on the digital value chain depicted above, ignoring the part of the supply chain at the level of manufacturing plants. With this framework, for instance, Apple will be defined as a vertical integrated firm since it produces and designs its own devices, operating systems and provides complementary services for its device users⁷, even though the actual manufacturing of almost all its devices is outsourced to manufacturing companies such as Foxconn.

We note that the service category includes both platform services, such as mobile app stores and marketplaces, as well as the mobile applications and product services that are distributed through

⁶ We consider only operating systems in the software level, but we note that digital services are also essentially software.

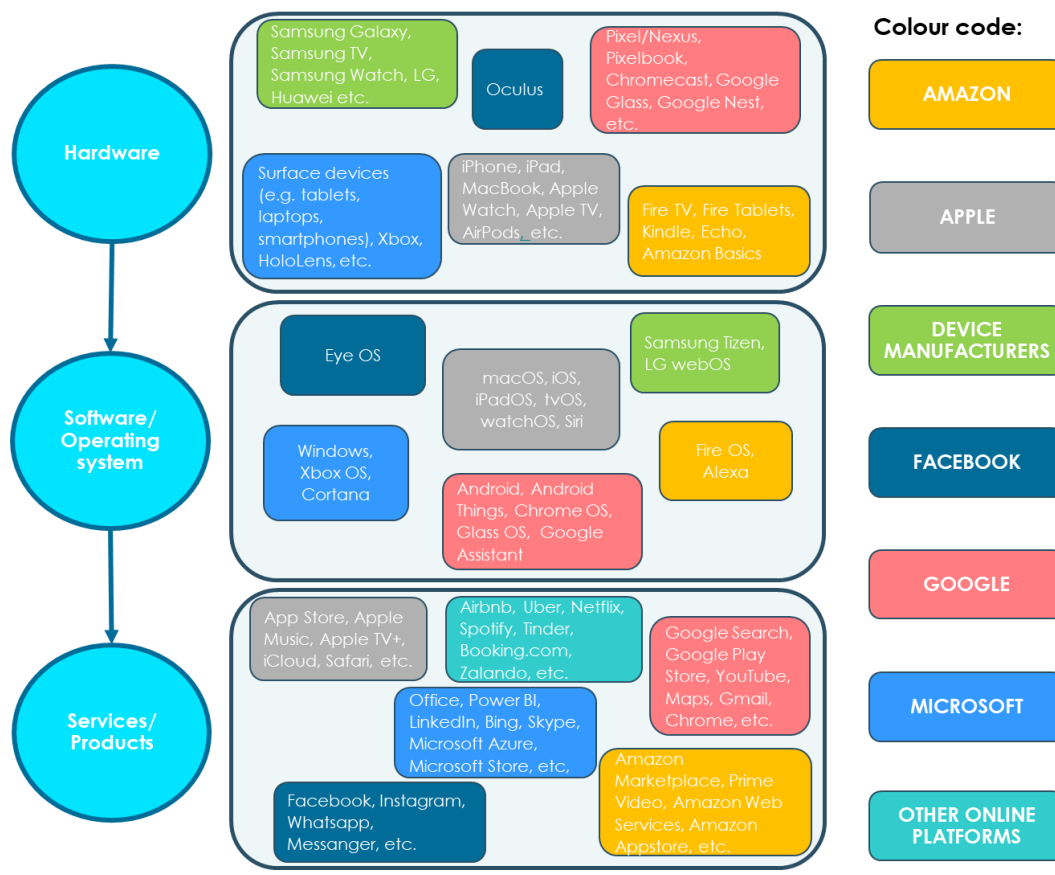
⁷ While they are integrated, they do give (controlled) access to other providers, both on the hardware, software and service side, e.g. third party app developers on the iOS.

them. A specific form of vertical integration within the service category is represented by the case when both the platform and (some of) the products/services offered are owned by the same firm. The economic rationale and competitive incentive of this vertical strategy will be examined in Section 3.2.

1.3 DIFFERENT VERTICAL INTEGRATION STRATEGIES AMONG TECH FIRMS

A broad set of tech and manufacturing companies are active and compete with each other along digital value chains. We observe a heterogeneous mix of vertical strategies, see examples in Figure 3.

Figure 3
Examples of vertical integration pattern in digital sector



Note: The list is by no means exhaustive and focus mainly on consumer facing companies
Source: Copenhagen Economics

As the figure shows, some of these firms focus their business models mostly on the development of hardware, such as Samsung, Huawei, etc. Nevertheless, those smartphone producers are now actively starting to enter the software and service layers of the value chain. Samsung, for instance,

developed its own OS (Tizen) and app store, which it uses as an alternative to other OS software such as Google's Android.⁸

Other well-known digital platforms are concentrated mostly on services: sharing-economy apps, such as Airbnb and Uber, content streaming services, such as Netflix and Spotify, booking and dating apps such as Booking.com and Tinder, online retailers such as Allegro, eBay and Zalando.

Even within one layer/category of the value chain, e.g. services, many firms pursue strategies involving forms of vertical integration. For example, Netflix is investing a large amount of resources to produce its own content and reduce its reliance on content owned by entertainment and production companies such as Disney and Warner. In turn, content owners have also launched their own streaming services and sought to reduce their reliance on Netflix and other online distribution platforms. We have also seen that Uber is integrating into ride sharing and food delivery. Likewise, Spotify is expanding into podcast production to offer original content on its platforms. Furthermore, online retailers including Allegro and Zalando have business lines that operate a marketplace, while also selling their own products as we will discuss more in detailed in section 3.2. These examples can all be interpreted as vertical integration strategies within the service category.

New digital (and traditional) players are continuously entering the market to challenge or complement existing business models. For instance, emerging trends such as the Internet of Things (IoT) – cross-industry enabling technologies connecting devices to each other and the internet - may create opportunities for integration. Telecom firms with strong experience and capabilities in the hardware and technologies relevant for IoT (e.g. connectivity and access technology) are well positioned to integrate into software and services. In this regard, Vodafone, among other telecom players, has invested in developing integrated IoT solutions for business customers in the automotive sector and is also exploring applications in healthcare, retails and insurance⁹.

Digital players such as the highly mentioned GAFAM (Google, Amazon, Facebook, Apple and Microsoft) have expanded in multiple markets covering full value chains. However, each of these firms initially specialised in one (or two) part(s) of the value chain, i.e. hardware, software (OS) and/or services, and adopted different paths and degrees of vertical integration over time. This decision influences their economic incentives and sources of revenues.

Apple can be seen as one of the most vertically integrated digital conglomerates. As part of its business model, Apple has always tightly designed and integrated both the hardware and software components of its devices and has differentiated its brand via their unique approach to product design applied to hardware, software and now also to the services supported (almost solely) on its devices, see Box 1.

⁸ Evans and Gawer, 2016. The Rise of the Platform Enterprise: A Global Survey, available at https://www.thecge.net/app/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf

⁹ TelecomTV, December 2016. Vodafone's strategy for IoT in key vertical markets. Available at: <https://www.telecomtv.com/content/iot/vodafone-s-strategy-for-iot-in-key-vertical-markets-14232/>

Box 1 Apple – a case study of a vertically integrated business model

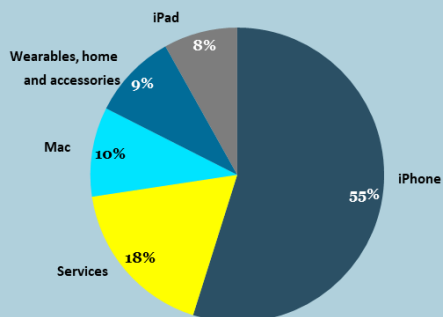
Since its launch in 1978, Apple has always centred its business strategy in developing its own integrated hardware and software, even at times when alternative approaches, i.e. Windows OS open to all hardware, were so successful. Presently, Apple produces and designs most of the components of their products in-house. It does not open its hardware to other OSs and does not licence its iOS to other device manufacturers.

This strategy – even at higher costs – allowed Apple to apply its unique approach to product design and consumer experience on hardware, software and also services. By doing so, Apple has been able to differentiate itself on the brand perspective as a business centred on product quality, user friendliness, security and privacy. Apple has historically attracted high-spec customers, early adopters of advanced technologies, solutions and designs which have over time become increasingly mainstream. In other words, the “Apple cult” has explicitly or implicitly converted many of the users of digital devices and solutions.

With the launch of the iPhone in 2007 (still its flagship product) and the creation of the App Store, Apple has also established itself as service provider. Third party developers can develop their own application using the available iOS Application Programming Interfaces (APIs) and distribute them through the App Store to end device users. Apple has maintained strict, “end-to-end” control over the value chain that has emerged around its devices in order to ensure a high-quality standard, spanning both their hardware and software, as well as services and content for end consumers. Apple also provides and distributes, on its App Store, its own complementary services – mobile apps offering media content, gaming, cloud service, photo sharing & editing, web browsing etc. (e.g. iCloud, Safari, Apple Podcasts, Apple TV+, Apple Music). Apple has a line of hardware products from tablets to wearable devices (e.g. iWatch) and smart appliances. Most of them have their own dedicated operating systems developed in-house. Furthermore, Apple has integrated its voice assistant, Siri, with its new smart speaker, the HomePod (complemented by HomeKit products e.g. smart lamps and cameras.) It is foreseen that networks of third-party developers will also emerge around the digital voice assistants, such as Siri, as they did around smartphone application platforms.

Apple’s main source of revenue is still derived, by a substantial margin, from iPhone sales. The financial report of 2019 shows that the iPhone and other devices accounted for around 80% of total sales, while services (revenues from app store and subscription services) represented only 18% of total sales. Therefore, Apple remains a product company (combination of hardware and software).

By adding complementary services to its product offer, Apple enhances the consumer value of its products and protects its main source of revenue: the hardware.



Finally, Apple has pursued vertical integration in the offline product distribution as well. Through its flagship Apple Stores in the world’s major cities, Apple secures a uniform high-value brand to consumers across online and offline sales channels.

Apple’s revenue streams based on product category, 2019

Source: <https://www.investopedia.com/apple-s-5-most-profitable-lines-of-business-4684130>

The business model of other GAFAM players generally tends to be integrated over a less deep span of activities and is often more specialised in one or two parts of the value chain. Google, for example, is more closely associated with services, (e.g. YouTube, Google maps, Google Chrome) oriented around its search engine which remains at the core of its business together with wider adtech services.¹⁰ Google has also entered the mobile OS market with the development of Android, which it made accessible to all smartphone manufacturers as a strategy to reach the greatest number of users with its services.¹¹ This strategy is similar to the one taken by Microsoft, originally a software company, which historically focused on making its OS Windows compatible with hardware produced by independent manufactures. Since then, Microsoft has expanded in several directions, yet most of its business remains anchored to its software and services for consumers and businesses, including a renewed effort in cloud services.¹² While Amazon started as online bookstore retailer, throughout the years it has expanded its product offer in several directions including the launch of its own digital services (e.g. Prime Video) and devices (e.g. Kindle and Amazon Echo) for which it has developed its Fire OS based on Android. Amazon also offers services to 3rd party merchants, such as through the Amazon marketplace and fulfilment / logistic, which recombines and coordinates inputs/services procured together with their own assets. Another major service area is its AWS cloud operations. Finally, Facebook operates predominantly as a service company geared around its social networks and messaging apps family (Facebook, Messenger, Instagram, Whatsapp).¹³ While the company also invests in hardware with Oculus (a virtual reality headset developer) and is starting to develop also its own OS (for example, for the headset)¹⁴ a considerable thrust of its expansion is horizontal in digital services such as online commerce.

Before turning to review the broader theories of vertical integration, we note that these firms have been successful in expanding across diverse businesses by adopting new technologies and creating / expanding markets with increasingly blurred boundaries. This multi-dimensional expansion, e.g. the horizontal diversification into cloud computing, embraced by several of these firms may be a testament to key efficiencies achieved via vertical integration, such as economies of scope and firm capabilities. While this report analyses below the economic theories of vertical integration, a discussion of drivers and economic effects of horizontal expansions is beyond the scope of the current report.

¹⁰ Google derives 84% of its revenues from the advertising on its platforms, i.e. Google Search, YouTube etc. Source: [United States Securities and Exchange Commission, 2019, Google Form 10-K](https://www.sec.gov/Archives/edgar/data/1013017/000101301719000001/google-2019-google-form-10-k.htm), available at https://abc.xyz/investor/static/pdf/20200204_alphabet_10K.pdf?cache=cdd6dbf

¹¹ Google started to develop its own smartphones (hardware), i.e. Pixel/Nexus, though they account for a small share of all Android devices. Google has also entered the smart appliances segment with acquisition of Nest Labs and wearables via the pursuit of Fitbit.

¹² Microsoft expanded also through important acquisitions such as LinkedIn and GitHub and started to develop its own devices (e.g. Surface, Xbox).

¹³ Statista, 2020. Facebook's annual revenue from 2009 to 2019, available at: <https://www.statista.com/statistics/268604/annual-revenue-of-facebook/#:~:text=In%202019%2C%20Facebook's%20revenue%20amounted,of%20income%20is%20digital%20advertising>

¹⁴ Tech Crunch, December 2019. Facebook is building an operating system so it can ditch Android, available at <https://techcrunch.com/2019/12/19/facebook-operating-system/#:~:text=Facebook%20doesn't%20want%20its,on%20its%20Android%20operating%20system>.

CHAPTER 2

**ECONOMIC AND STRATEGIC MANAGEMENT
RESEARCH ON VERTICAL INTEGRATION**

- Scholars found that vertical integration can reduce inefficiencies caused by market power at one or more steps of vertical value chains: elimination of double mark-ups, internalisation of quality externalities, efficient composition of inputs and downstream prices.
- These findings apply even more so in complex environments (e.g. markets with high transaction costs and assets specificities), where vertical integration can overcome market failures.
- Firms opt for vertical integration to achieve economies of scope and create efficiencies from the sharing of indivisible assets and the elimination of redundant processes.
- Firms can invest in vertical integration strategies so as to tap into their unique mix of resources and capabilities, when these are not easily transferrable across firm boundaries.
- Researchers have identified potential competitive harms that arise under vertical integration when dominant firms abuse their position via e.g. foreclosure of actual/potential competitors, creation of barriers to entry, or enhanced horizontal collusion.
- Policymakers in competition agencies routinely balance potential competitive harms from increased vertical integration (due to M&A) with the related efficiencies and consumer value – concluding in many cases that efficiencies outweigh the potential risks of foreclosure.
- Based on existing evidence, the scientific conversation finds qualified support in the evidence that vertical M&A deliver the expected efficiencies. At the same time, it cannot be concluded that vertical integration (by M&A) leads in general to competitive harm.
- Remarks (1) While the debate is open, a case by case approach to policy should be taken. (2) Besides M&A (which join existing assets), firms often pursue vertical integration by investing in new own assets, thus creating / expanding capacity and choice.

In this chapter we draw upon existing theoretical and empirical literature in the fields of economics and strategic management to explain the motives and effects of firms' decisions to vertically integrate and gain control over their value chain. The chapter is divided in three main sections:

- 2.1 provides an overview of the literature that studied the efficiency reasons behind a firm's decision to vertically integrate;
- 2.2 describes the theoretical arguments behind possible anticompetitive behaviours;
- 2.3 assesses the empirical studies that corroborate the theoretical rationales for vertical integration.

**2.1 ECONOMIC EFFICIENCIES AND CONSUMER VALUE
FROM VERTICAL INTEGRATION**

The economic and strategic management literature identifies various efficiencies and benefits for consumer value related to vertical integration. We divide them in 8 groups, see Table 1.

Table 1
Overview of efficiencies from vertical integration

TYPE OF EFFICIENCIES	DESCRIPTION
Elimination of double mark-ups	Insofar as market power can exist at different layers (i.e. absent perfect competition), a vertically integrated industry – by reducing the number of mark-ups (margins) along the value chain – yields a lower consumer price and is more profitable than the equivalent but non-integrated industry.
Quality externalities	Vertical integration allows firms to internalise the positive externality that an investment in one part of the value chain generates on other parts of the chain. As a result, vertically integrated firms have greater incentives to invest in product development in each step of the value chain.
Elimination of inefficient input substitution	Vertical integration allows downstream firms to gain access to the most efficient combination of inputs even when the price of one input is too high because the market of that input is monopolised upstream. This shifts the mix of inputs to a combination that enhances the productive efficiency.
Support emerging markets	Vertical integration enables firms to develop new and innovative products that may require inputs and components for which a functioning market has yet to develop.
Price discrimination	Vertical integration may allow upstream suppliers to more efficiently price their inputs to downstream producers.
Transaction costs and hold-up problems	Vertical integration allows firms to overcome market failures when transaction costs (e.g. search, monitoring and enforcement costs) are too high or when moral hazard may discourage firms from making dedicated investments that lead to one firm becoming dependent on its transacting party (supplier/buyer).
Economies of scope	Vertical integration allows a firm to benefit from economies of scope derived from the use of its inputs in excess across the value chain and the reduction of redundant processes.
Firm's capabilities	Vertical integration allows a firm to leverage its bundle of non-transferable resources and knowledge capabilities on other activities across the value chain.

Source: Copenhagen Economics

2.1.1 Market structure and market power

This research frames vertical integration as a way to mitigate inefficiencies caused by market power at one or more steps of vertical value chains. This stream of research assumes that *i*) firms can internalise activities (integrate) without incurring any additional bureaucratic and organizational costs; *ii*) economic agents are able to design complete contracts.

Elimination of double mark-up

Double marginalisation occurs when both upstream and downstream firms enjoy some level of market power which allows them to charge high mark-ups (margins), i.e. prices above marginal costs¹⁵, in each step of the vertical structure.

¹⁵ Tirole, J. and Jean, T., 1988. *The theory of industrial organization*. MIT press, p. 179-180.

Vertical integration in this case may lead to lower downstream prices for end consumers. The main intuition behind this result is the following: Consider the most extreme case where there are two monopolies, one in the upstream manufacturing market and one in the downstream retail market. The upstream firm will sell its manufactured product to the downstream firm and charge a monopoly price for it. Likewise, the downstream firm will also charge a monopoly price for its product when selling to final consumers. Hence, monopoly prices will be charged twice, resulting in double-marginalisation. By integrating, the two firms would align incentives and charge a lower price to the final consumer, increasing consumer welfare, because the downstream firm will acquire the inputs at marginal cost from the integrated supplier. Moreover, as lower prices increase the demand for the final product, integration leads to higher joint profits than in the case of a chain of monopolies.

Quality externalities

Similar to the problem of double-marginalisation, both upstream and downstream firms have the incentive of free-riding on the efforts made by other firms to improve the quality of their product.¹⁶ This is because neither firm can solely capture the positive externality stemming from such product improvements, instead all firms benefit from them. Since firms share the benefits, each firm is less interested in investing time and resources in product development compared to the situation where they can reap the rewards of such efforts solely for themselves. For example, a downstream firm introduces a quality improvement to its product at a certain cost (e.g. R&D investments) which increases consumer demand. The increase in demand downstream translates to an increased demand for inputs sourced by the downstream innovator from the upstream firm. By consequence, the upstream firm benefits from higher profits without having incurred any cost. This lowers the incentives for the downstream firms to invest in the quality upgrade in the first place since it is not able to appropriate all of the benefits derived from this innovation. Vertical integration offers a solution to this problem by internalising the positive externality between the two firms and thereby removing the incentive to free-ride. As a result, the vertically integrated firm now has greater incentives to invest in product development in each step of the value chain, something which benefits not only the firm but also the consumers in the form of a better and possibly cheaper product.

In relation to this point, Teece (1986) provides a framework for firms to profit from their innovations by integrating.¹⁷ The author suggests that a firm with innovation in some segment of the value chain characterised by weak intellectual property rights (e.g. poor patent protection) may find it efficient to integrate in other parts of the value chain where the market structure allows it to appropriate the benefits from the innovation¹⁸. The framework also considers the case where the innovation requires specific complementary assets (possibly upstream or downstream) to be commercially successful. The innovative firm should integrate into the complementary assets' market if that market presents competitors and/or imitators and the appropriability of innovation benefit is difficult.

¹⁶ OECD, 2019, *Vertical Mergers in the Technology, Media and Telecom Sector*, p. 27.

¹⁷ Teece, D.J., 1986. Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy, *Research Policy*, 15, pp.285-305.

¹⁸ This is just one simple intuition from the framework which also considers other elements and strategies such as licensing.

Elimination of inefficient input substitution

When a downstream firm uses different inputs to produce a final good, input substitutability may exist, namely when the firm can change the proportion of each input in the production process. More precisely, input substitutability may exist when the downstream firm substitutes one input for another and seeks to do so in the most efficient way. However, the problem arises when one of the input markets is characterised by a monopoly, leading the downstream firm to be charged monopoly prices for that input. As a consequence, the downstream firm will substitute away from the more expensive monopoly priced input.¹⁹ This in turn may lead to an inefficient combination of inputs that is not reflective of the actual upstream costs of production.

Vertical integration offers a solution to this problem. By vertically integrating with the upstream monopoly, the downstream firm may now access the monopolised input at their marginal costs of production. This enables the downstream firm to combine the two different inputs in the most efficient way. Put differently, vertical integration eliminates the inefficient input substitution that is caused by the monopoly pricing in one of the input markets. Ultimately, this benefits not only the downstream firm but also society in general by increasing consumer welfare since most efficient production lowers the price of the final product.

Support emerging markets

In newly emerging industries it might occur that the availability of the necessary inputs upstream may be very limited. Pioneer downstream firms that develop novel products may require highly specialised expertise and inputs for which there is little existing demand and a clear standard has not yet emerged. This may be aggravated by the presence of scale economies as the little emerging demand downstream may not be enough to achieve sufficient scale to cover high initial fixed costs for a potential entrant upstream. As a consequence, downstream firms may not be able to rely on a functioning market for their inputs.²⁰ By vertically integrating upstream, the downstream firm ensures a reliable supply of the necessary input to develop and distribute its new products.²¹ Another factor that also determines the need for vertical integration in emerging industries, is the level of financial development of the country or region where the firm is active. If financial markets do not work properly and credit is not easily accessible, then vertical integration is needed in order to sustain the development costs in emerging industries, especially in the high-tech sectors with continuous systemic innovations and short product life cycles.²²

Price discrimination

Price discrimination is the practice of charging different prices to different buyers of the same product. This is possible because buyers have different demand elasticities, i.e. they are more or less sensitive to price changes. Those who would consume the good at any price, i.e. price-insensitive, will normally be priced higher. Price discrimination can be welfare enhancing in those circumstances where it may lead to a demand expansion, by enabling those with a low ability to pay to consume the product or service.²³

¹⁹ OECD, 2019, *Vertical Mergers in the Technology, Media and Telecom Sector*, p. 28.

²⁰ Stigler, 1951. *The Division of Labor is Limited by the Extent of the Market*, The Journal of Political Economy, p. 188.

²¹ Bresnahan, T. F. & Levin, J. D., 2012. *Vertical Integration and Market Structure*, Stanford Institute for Economic Policy Research, p. 29-30.

²² Acemoglu et al, 2005, *Determinants of vertical integration: Finance, contracts, and regulation*, National Bureau of Economic Research, p. 3.

²³ OECD, 2016, *Price Discrimination*, p. 9.

Vertical integration may facilitate a certain form of efficient price discrimination²⁴. For instance, an upstream producer faces two downstream firms with different price sensitivities. The upstream firm is not able to charge different prices to each firm because the price sensitive firm, which would obtain the input at a lower price, would find it profitable to sell part of the input to the other price insensitive downstream firm willing to pay higher prices (arbitrage). By vertically integrating with the price sensitive firm, the upstream firm can charge different prices to the two players and prevent this re-selling opportunity. As the price sensitive firm will access the input at lower cost than absent integration, this may lead to lower prices for consumers, improving their welfare.

2.1.2 Transaction costs and hold-up problems

Transaction costs economics focuses on the trade-off between organizing processes internally within a firm and outsourcing some of the processes to the market, i.e. buying the necessary products or services from an outside third party. According to this stream of literature, this would depend primarily on the costs of conducting transactions, e.g. cost of searching, negotiating, enforcing contracts and coordinating. Moral hazard and difficulties in interacting with a third party in the market (higher transaction costs), are factors working in favour of organizing processes internally within a firm, i.e. vertically integrating.²⁵ Conversely, increased administrative costs is a major reason as to why firms do not organise all processes internally.²⁶

In an environment that is bound to change, disagreements among the transacting parties with differing objectives are likely to arise in the future. With high uncertainty on how the environment will evolve in the future and how the counterparty will ex post react to those changes, the parties usually want ex ante to specify the contracts in a manner as detailed as possible. However, writing *complete contracts* that provide for all possible contingencies and states of the world is almost impossible and certainly difficult and impractical in uncertain environments.²⁷ Therefore, the *incomplete* nature of contracting places a burden on the efficiency of bilateral negotiation.

These contracting costs are even more exacerbated for recurring transactions and long-term relationships. Since they last long into the future, considering all possible future developments and capturing them in a contractual agreement is difficult. Therefore, in complex environments, markets will typically have a higher risk of failure and the benefits of vertical integration will likely increase.

Furthermore, as contracts are inherently incomplete and often difficult to enforce, they may carry a moral hazard component, i.e. that one of the two parties has an incentive to not fully commit to the contract. This, in turn, may give rise to a hold-up problem, discouraging either firm to invest in assets which are part of the joint production out of fear that they will lose the sunk cost in the case

²⁴ Perry, Martin K. 1989. Vertical Integration, *Handbook of Industrial Organization*. Ed. Richard Schmalensee and Robert Willig, Amsterdam: North Holland.

²⁵ Kaplan, S., Schenkel, A., von Krogh, G. & Weber, C. *Knowledge-Based Theories of the Firm in Strategic Management: A Review and Extension*, Academy of Management Review, p. 13.

²⁶ Osterloh, M. & Frey B. S., 2000. *Motivation, Knowledge Transfer, and Organizational Forms*, Organization Science, p. 546-547.

²⁷ Hart and Moore (1988). Incomplete Contracts and Renegotiation, *Econometrica*, 56(4), 755-785. Ketokivi and Mahoney (2017), Transaction Cost Economics as a Theory of the Firm, Management, and Governance, Oxford Research Encyclopedia of Business and Management, p.7

that the other firm stops honouring their agreement.²⁸ Examples of such investments could be physical or human capital which is specialised solely for the joint production and is therefore not usable in any other context. More concretely, such investments could be a production plant that cannot be moved once built or highly skilled workers whose training cannot be applied elsewhere, see Table 2.

Table 2
Types of assets specificity

ASSETS' SPECIFICITY	HOLD-UP PROBLEM
Physical asset	Investments in machinery and equipment made by one or both transacting parties that is specific to the transaction, i.e. no alternative use, e.g. tools to produce parts used in specific downstream manufacturer products
Human assets	Accumulated relationship specific human capital as a consequence of learning by doing, e.g. design engineers with special skills in designing a specific part of an automotive or aircraft
Dedicated assets	Upfront investments made by a supplier only with the prospect of selling a large amount of product to a specific party, e.g. large natural resources deposit only to serve a large user
Intangible assets	Brand and name loyalty, e.g. McDonalds must transmit those attributes to its franchisees
(Plant) Site	Highly immovable assets where buyers and sellers are located side by side to minimise inventory and transportation expenses, e.g. Coal mines and power plants.

Source: Copenhagen Economics based on Joskow²⁹.

Postponing or eliminating investments due to the abovementioned problems, eventually has a negative impact both on the firms themselves and their consumers, thereby reducing social welfare.³⁰ Vertical integration offers a solution to this problem by removing the contractual relationship altogether and internalising any investment benefits.

2.1.3 Economies of scope

Economies of scope essentially means that it is less costly to produce two or more products by a single firm than it is to have the same products produced by several more specialised firms. That is, a firm can lower its production costs by using the same inputs to produce a wide range of different outputs. This way, the firm is able to use its inputs more efficiently and by doing so lower the marginal cost of producing one extra unit of output of both products.³¹

²⁸ Joskow, P. L., 2006. *Vertical Integration*. Issues in Competition Law and Policy , p. 20

²⁹ Ibid, 28

³⁰ Ibid, 28

³¹ OECD, 2019, *Vertical Mergers in the Technology, Media and Telecom Sector*, p. 31.

The two main channels through which vertical integration may help a firm to achieve economies of scope and enjoy efficiency gains are the sharing of indivisible assets and the elimination of redundant processes.³² Examples of indivisible assets used in the production can be physical, such as infrastructure and machinery as well as intangible ones, like marketing and human capital. Splitting the fixed and sunk costs of the physical infrastructure (or training) across the value chain also helps drive down the average cost of production.

We note that vertical integration is justified by economies of scope only if the markets for the shara-ble assets do not function efficiently, otherwise the firm would be able to trade the excessive in-puts³³. As we can see, this efficiency argument for vertical integration relies on the combination of industrial organization theory of market structure (e.g. optimal use of inputs in production) and transaction cost theory described previously³⁴.

Production processes that can be eliminated through vertical integration range from packaging and transportation to encryption of personalised data. In general, vertical integration may provide effi- ciencies by aligning the manufacturing process improvements with product design improve- ments³⁵. The importance of the economies of scope can change with time and technological devel- opments as we can see in certain industries, such as the integrated circuit industry and the pharma- ceutical industry³⁷ which experienced, to some extent, a disintegration process of their value chain³⁸. This is also related with the theory on emerging markets discussed in section 2.1.1.

2.1.4 Firm's capabilities

Firms may decide to expand into new markets and vertically integrate, organically or via acquisi- tions, to leverage their superior internal capabilities and management competences. In this context, strategic management literature provides theories that look at firms as bundles of resources and ca- pabilities to explain firm ability to succeed in different areas of business, see Table 2.

³² Ibid 31.

³³ Teece, D.J., 1980. Economies of scope and the scope of the enterprise. *Journal of economic behavior & organization*, 1(3), pp.223-247.

³⁴ Transaction costs theory identifies difficulties in transferring intangible assets across firms as a motive for vertical integra- tion.

³⁵ Also in this case, transaction costs theory can be used to explain the economies of scope derived from the better coordina- tion of manufacturing and design processes.

³⁶ Bresnahan, T. F. & Levin, J. D., 2012. *Vertical Integration and Market Structure*, Stanford Institute for Economic Policy Research.

³⁷ In the circuit industries, certain players started to specialize only in the design of chips, while in the pharmaceutical sector large pharma companies started to outsource breakthrough innovation from small bio-tech companies and focus on the drug development, clinical trials and distribution processes.

³⁸ This also holds for economies of scale.

Table 3
Overview of main theories on firm's capabilities

THEORY OF THE FIRM	AUTHORS	FIRM'S CAPABILITIES
Resource based view of the firm	Penrose (1959), Barney (1991), etc.	Physical and intangible resources that are unique, valuable, rare and inimitable
Knowledge based view of the firm	Grant (1996), etc.	Knowledge capabilities: shared routines, technical skills, common language, firm's culture, etc.
Firm's absorptive capacity	Cohen and Levinthal (1990)	Ability to assimilate, process and integrate external knowledge

Source: Copenhagen Economics

The first theoretical contribution in this sense was the Resource Based View (RBV) of the firm³⁹. The RBV explains a firm's success by the firm's possession of a set of resources that are unique, valuable, rare and inimitable. The presence of these resources is the underlying factor driving a firm's competitive advantages. Consistent with this view, competitive advantages in one stage of the value chain can be built on capabilities and resources developed in other parts of the value chain.

A similar stream of literature, i.e. Knowledge Based View (KBV) of the firm⁴⁰, considers the firm as a knowledge system and links firms' competitive advantages to the capabilities generated from shared routines, technical skills, common language and firm culture. These knowledge capabilities are embodied by managers and employees and shared within the organization. They facilitate coordination within the firm and help firms to face a variety of challenges and uncertainties. The superior know-how makes the firm that possesses it more productive than other players in the market, thus justifying the choice to internalise certain operations in the value chain.

These theories rest on the assumption that this bundle of resources and capabilities are not easily tradable and transferrable across firm boundaries. This aspect shares some similarities with integration arguments derived from incomplete contracts and assets specificity described above. However, there are some nuances: this type of capabilities may not be transferable as they are the result of shared body knowledge accumulated through regular interaction among employees. Looking from a different angle, specific managerial capabilities might not be transferable since the management authority itself defines the very boundaries of the firm⁴¹.

Finally, another important and related organizational capability defined in strategic management is the concept of 'knowledge absorptive capacity'⁴²: firms that are able to better assimilate, process and integrate external knowledge might find it to be economically profitable to integrate in upstream and downstream markets.

³⁹ Penrose, E. T., 1959. *The Theory of the Growth of the Firm*. New York: John Wiley; Barney, J.B., 1991. The resource based view of strategy: Origins, implications, and prospects. *Journal of management*, 17(1), pp.97-211.

⁴⁰ Grant, R.M., 1996. Toward a knowledge-based theory of the firm. *Strategic management journal*, 17(S2), pp.109-122.

⁴¹ Bresnahan, T. F. & Levin, J. D., 2012. *Vertical Integration and Market Structure*, Stanford Institute for Economic Policy Research.

⁴² Cohen, W.M. and Levinthal, D.A., 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative science quarterly*, pp.128-152.

2.2 FORECLOSURE AS POTENTIAL ANTICOMPETITIVE EFFECT

Competition authorities have also been concerned with the ability of vertically integrated firms with market power to harm competition in downstream or upstream markets. Competitive harm may be caused by the foreclosure of competitors, elimination of potential competition, creation of barriers to entry, and enhanced horizontal collusion⁴³.

The potential foreclosure of efficient competitors is certainly the most common among the theories of harm considered by competition authorities in vertical integration cases. There are several underlying assets that can be used to foreclose competitors, see Table 4. Vertically integrated firms can deny access to valuable assets, i.e. complete foreclosure, or grant access under unfavourable terms, i.e. partial foreclosure or raising rival costs.

⁴³ Salop, S.C. and Culley, D.P., 2016. Revising the US vertical merger guidelines: policy issues and an interim guide for practitioners. *Journal of Antitrust Enforcement*, 4(1), pp.1-41.

Table 4
Potential foreclosure by type of asset

UNDERLYING ASSET	TYPE OF FORECLOSURE
Input	<p>Input foreclosure occurs when an upstream supplier refuses to supply to a downstream competitor or worsens the conditions under which the input is supplied (e.g. by increasing price or lowering quality).</p> <p>Important questions to answer in the assessment of input foreclosure are whether there are any alternatives to the input and how important the input is to the firm being foreclosed. Other factors that may be considered are upstream economies of scale and the pass-through of input price increases.</p>
Customer base	<p>Customer foreclosure can occur when a vertically integrated firm denies an upstream competitor access to its customer base or worsens the conditions under which access is provided. This type of foreclosure may, for example, be a concern if an e-commerce platform denies unintegrated sellers from accessing its users on the other side of the platform.</p>
Complementary good	<p>Vertically integrated firms often produce complementary components or products. This may enable them to foreclose competitors through tying or bundling, i.e. by making a customer's purchase of one good conditional on the purchase of another good.</p>
Commercially sensitive information	<p>Vertical integration may enable a firm to get access to, and misuse, commercially sensitive data about competitors. By using privileged access to data to react aggressively to competitors' price cuts or innovations, a firm may preclude its competitors from such actions or even force them to leave the market.</p>

Source: OECD 2019, Vertical Mergers in the Technology, Media and Telecom Sector

The incentives for firms to vertically integrate for anti-competitive reasons, however, are not always clear. On one side, the well-known Chicago school's "single monopoly profit theory" argues that a firm with a monopoly in the upstream market typically has no incentive to engage in vertical foreclosure by vertically integrating downstream. In a situation with a vertically integrated upstream monopolist that competes with a more efficient firm downstream (the downstream competitor can produce the final good at lower costs), the vertically integrated monopolist benefits from selling its input to the competitor as long as it can extract the extra profit generated by the higher efficiency of the downstream firm. As there is only one monopoly profit to extract, the upstream firm does not gain any extra profits by integrating and foreclosing rivals. According to this reasoning, vertical mergers observed in the market must be motivated by other reasons, i.e. efficiencies.

On the other side, modern industrial economics literature based on game-theory (post-Chicago school), has challenged this theory because it is based on strong assumptions that might not always apply in the real world. An upstream monopolist may have an incentive to foreclose if there are restrictions on wholesale prices (e.g. regulated markets) which do not allow the upstream firm to charge monopoly prices and to extract the full surplus from the downstream firm⁴⁴. Additionally, anticompetitive foreclosure can arise when, the upstream monopolist cannot credibly commit with the downstream rival to restrict the output of its downstream unit. The upstream firm is then incentivised to foreclose the downstream rival since as it cannot extract from the downstream rival first-best monopoly profits⁴⁵. Other recent theories also explore “dynamic vertical foreclosure” where the upstream monopolist may forego short-term profits by foreclosing downstream rivals that present a future threat to their monopoly position upstream⁴⁶. Research has shown that there may be anticompetitive foreclosure incentives if there is competition upstream⁴⁷. An integrated firm may relax competition upstream by reducing its supply to downstream competitors, benefitting from higher profits upstream and downstream.

Overall, incentives to harm competition through vertical integration depend on specific assumptions. A case-by-case approach, carefully assessing the vertically integrated firm’s ability and incentive to harm competition by foreclosing competitors, is therefore warranted.

2.3 EMPIRICAL RESEARCH SUPPORTS EFFICIENCIES FROM VERTICAL INTEGRATION

Our overview of the theoretical literature presented both efficiency rationales as well as anticompetitive foreclosure motivations for a firm’s vertical integration. Existing empirical research seems to provide substantial support for the efficiency motivations while less is available for the foreclosure arguments⁴⁸. However, this remains an open debate among academics and policy makers as seen, for example, in the different rounds of comments and contributions around the update of the Vertical Merger Guidelines by the FTC in US over the last few years.⁴⁹

⁴⁴ Armstrong, M., 2002, “The Theory of Access Pricing and Interconnection”, *Handbook of Telecommunication Economics*, Vol. 1, pp. 297-386, North-Holland, Amsterdam

⁴⁵ Rey, P. and J. Tirole (2007), “A Primer on Foreclosure”, *Handbook of Industrial Organization Vol. 3*, Chapter 33, pp. 2145-2220

⁴⁶ These theories were used to explain the Microsoft case of tying in internet browser market. See for example Carlton, D W and M Waldman, 2002. The strategic use of tying to preserve and create market power in evolving industries. *The RAND Journal of Economics* 33(2): 194.; Choi, J P and C Stefanadis, 2001. Tying, investment, and the dynamic leverage theory. *The RAND Journal of Economics*, 52-71.

⁴⁷ Ordovery, J.A., Saloner, G. and Salop, S.C., 1990. Equilibrium vertical foreclosure. *The American Economic Review*, pp.127-142.

⁴⁸ Joskow, P. L., 2006. *Vertical Integration*. Issues in Competition Law and Policy, p. 29.

⁴⁹ U.S. Department of Justice Press Release, 30 June 2020. “Department of Justice And Federal Trade Commission Issue New Vertical Merger Guidelines”. Available at: <https://www.justice.gov/opa/pr/departments-justice-and-federal-trade-commission-issue-new-vertical-merger-guidelines#:~:text=A%20primary%20goal%20of%20the,competitive%20impact%20on%20the%20marketplace>.

Competition authorities have generally found fewer vertical issues compared to horizontal issues in their merger control activities. In 2018, only 9% of deals subject to antitrust intervention around the world raised vertical concerns, while 13% raised conglomerate concerns – the remaining 78% of deals required intervention due only to horizontal concerns.⁵⁰ A recent survey conducted by the International Competition Network (ICN) and the CMA (the UK Competition Authority) on 39 National Authorities also found that: “[...] overall vertical concern are less likely to result in non-clearance than are horizontal concerns, [...] vertical concerns accounted for around 1 in 10 of the mergers that were not cleared without remedies or conditions.”⁵¹

Nevertheless, authorities do sometimes find credible concerns in the case of vertical mergers, which are usually resolved via behavioural remedies. The ICN and CMA survey showed behavioural remedies were used in 62% of the vertical mergers that were not unconditionally cleared. These commitments may take different forms. In the technology sector, for example, the 2017 high profile international deal between networking product supplier, Brocade, and its purchaser, semiconductor manufacturer, Broadcom, was cleared by the European Commission subject to conditions on interoperability with competing suppliers and protection of third-party confidential information.⁵² In the telecommunication and media sector, behavioural remedies on vertical deals sometimes took the form of access remedies, i.e. granting access of inputs and/or services to other (competing) players. For instance, in 2015 the European Commission conditionally cleared Liberty Global’s acquisition of a controlling stake in Belgium media company, De Vijver, after the parties agreed to license De Vijver’s channels to rival TV distributors on fair, reasonable and non-discriminatory terms (FRAND).⁵³ Other examples are the acquisition of Bonnier Broadcasting by Telia in the wholesale supply and distribution of TV channels in Finland and Sweden in 2019⁵⁴, and the Comcast-NBCU transaction in US in 2011.⁵⁵

A similar picture is provided by Salop and Culley (2018)⁵⁶ in the US. They tracked all vertical merger actions in US between 1994 and 2018 and found that the authorities conducted only 58 in-depth reviews of deals involving vertical integration. Out of these, 52 mergers were approved primarily with only behavioural remedies (36), while six of the mergers were abandoned prior the imposition of remedies. Among the deals considered by Salop and Culley, we note that the famous AT&T/Time Warner merger was approved with no conditions after a trial court ruled against the previous decision of the Department of Justice (DOJ) which did find concerns related to the merger.

⁵⁰ The figures are based on data from 26 Jurisdictions including the European Union. Source: Allen & Overy, 2019. Global Trends in Merger Control Enforcement. Available at: <https://www.allenoverly.com/en-gb/global/news-and-insights/global-trends-in-merger-control-enforcement>

⁵¹ ICN & CMA, 2018. ICN Vertical Mergers Survey Result, para 60. Available at: https://www.internationalcompetitionnetwork.org/wp-content/uploads/2018/10/MWG_SurveyreportVerticalMergers2018.pdf

⁵² European Commission’s Press release, 12 May 2017. Mergers: Commission clears acquisition of Brocade by Broadcom, subject to conditions. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_17_1309

⁵³ European Commission’s Press release, 24 February 2015. Mergers: Commission clears Liberty Global’s acquisition of controlling stake in De Vijver Media, subject to commitments. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_15_4481

⁵⁴ European Commission’s Press release, 12 November 2019. Mergers: Commission clears Telia’s acquisition of Bonnier Broadcasting, subject to conditions. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_19_6271

⁵⁵ FCC’s news, 18 January 2011. FCC GRANTS APPROVAL OF COMCAST-NBCU TRANSACTION. Available at: <https://www.fcc.gov/document/fcc-grants-approval-comcast-nbcu-transaction>

⁵⁶ Salop, S.C. and Culley, D.P., 2018. Vertical Merger Enforcement Actions: 1994-July 2018. Available at SSRN 2684107.

More generally, the precedent of competition enforcement is that competition authorities have analysed mergers presenting non-horizontal concerns on a case by case basis, recognising that vertical mergers often bring efficiencies (a factor even more prominent in vertical than in horizontal mergers).

In regard to the academic literature, a recent OECD report⁵⁷ summarises the conclusion of two literature surveys, Lafontaine and Slade (2007)⁵⁸ and Global Antitrust Institute (2018).⁵⁹ The two survey articles reviewed 34 empirical studies primarily focused on the effect of vertical mergers, see Table 5. According to the reviews, most of the studies (27) found that vertical integration had an overall positive consumer welfare effect or that the ultimate impact was neutral. The remaining seven studies did not establish a clear welfare effect. Additionally, according to the surveys, no study appeared to find any strong indication of consumer welfare loss resulting from vertical mergers. The authors also found that, even when studies did find evidence of vertical foreclosure, the negative effects were likely (more than) compensated by efficiency gains,⁶⁰ derived from lower prices and/or higher quality, leaving consumers either in an equal situation or better off. Based on similar empirical evidence, Wong-Ervin (2019)⁶¹ and other commentators⁶² conclude that vertical mergers are generally pro-competitive or neutral.

⁵⁷ OECD, 2019, *Vertical Mergers in the Technology, Media and Telecom Sector*

⁵⁸ Lafontaine, F. and M. Slade 2007. Vertical Integration and Firm Boundaries: The Evidence. *Journal of Economic Literature*, Vol. 45/3, pp. 629-685,

⁵⁹ Global Antitrust Institute, 2018. Vertical Mergers, available at: <https://gai.gmu.edu/wp-content/uploads/sites/27/2018/09/GAI-Comment-on-Vertical-Mergers.pdf>

⁶⁰ Chipy, T., 2001. *Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry*, *The American Economic Review*, p. 428, 450.

⁶¹ Wong-Ervin, K. 2019. Antitrust Analysis of Vertical Mergers: Recent Developments and Economic Teachings, *ABA Antitrust Source*.

⁶² O'Brien, D., 2008. The Antitrust Treatment of Vertical Restraints: Beyond the Possibility Theorems, in *THE PROS AND CONS OF VERTICAL RESTRAINTS* 40, 76 (2008); Wright, J. D., Ginsburg, D. H., Lipsky, T. & Yun, J. M., 2020. Connecting Vertical Merger Guidelines to Sound Economics, *Truth on the Market Blog*. <https://truthonthemarket.com/2020/02/06/wright-vmg-symposium/>

Table 5
Empirical evidence of the effect of vertical integration on consumer welfare

AUTHOR	YEAR	INDUSTRY	METHODOLOGY	FINDINGS	ΔW
Levin	1981	Crude oil and refining	Panel regressions	<ul style="list-style-type: none"> Decrease in profits Fall in profit stability 	+
McBride	1983	Cement and concrete	Panel regressions	<ul style="list-style-type: none"> Fall in delivered price 	+
Spiller	1985	Various	Cross-section regressions	<ul style="list-style-type: none"> Increase in financial gains Decrease in systemic risk 	+
Helfat and Teece	1987	Various	Difference in differences	<ul style="list-style-type: none"> Decrease in systemic risk 	+
Anderson	1988	Electronic component sales	Cross-section regressions	<ul style="list-style-type: none"> Fall in index of opportunism 	+
Reiffen and Kleit	1990	Railroads and terminals	Descriptive	<ul style="list-style-type: none"> No evidence of foreclosure of access to railroad terminals 	0/+
Kerkvliet	1991	Coal and electricity	Panel regressions	<ul style="list-style-type: none"> Increase in cost efficiency Fall in monopsony power 	+
Muris, Scheffman and Spiller	1992	Soft drinks and bottlers	Panel regressions	<ul style="list-style-type: none"> Decrease in retail price 	+
Shepard	1993	Gasoline refining and sales	Cross-section regressions	<ul style="list-style-type: none"> Decrease in retail price 	+
Rosengren and Meehan	1994	Various	Event study	<ul style="list-style-type: none"> No foreclosure of unintegrated rivals 	0/+
Waterman and Weiss	1996	Cable TV programming and distribution	Cross-section regressions	<ul style="list-style-type: none"> Evidence of foreclosure (fewer rival programs carried) 	?
Snyder	1996	Crude oil and refining	Event study	<ul style="list-style-type: none"> Evidence of foreclosure 	?
Ford and Jackson	1997	Cable TV programming and distribution	Cross-section regressions	<ul style="list-style-type: none"> Evidence of foreclosure Decrease in program cost 	0
Mullin and Mullin	1997	Iron ore and steel	Event study	<ul style="list-style-type: none"> No evidence of foreclosure Efficiency gains 	+
Corts	2001	Film production and distribution	Cross-section tobit regressions	<ul style="list-style-type: none"> Fall in release date clustering 	+
Mullainathan and Scharfstein	2001	Chemical	Panel regressions	<ul style="list-style-type: none"> Decrease in investment responsiveness 	?

Chipty	2001	Cable TV programming and distribution	Cross-section and IV regressions	<ul style="list-style-type: none"> Evidence of foreclosure (fewer rival programs carried) Efficiency gains 	+
Ciliberto	2005	Physicians and hospitals	Panel regressions	<ul style="list-style-type: none"> Increase in investment in health care services 	+
Jin and Leslie	2005	Restaurant chains	Panel regressions	<ul style="list-style-type: none"> Increase in quality (health scores) 	+
Hastings and Gilbert	2005	Gasoline refining and sales	Difference in differences	<ul style="list-style-type: none"> Evidence of foreclosure of unintegrated rivals 	?
Gil	2006	Movie distribution	Cross-section regressions	<ul style="list-style-type: none"> Increase in movie run length 	+
Hortacsu and Syverson	2007	Cement and concrete	Difference in differences	<ul style="list-style-type: none"> No evidence of foreclosure Efficiency gains 	+
Suzuki	2009	Multichannel television	Difference in differences	<ul style="list-style-type: none"> Evidence of foreclosure Decrease in cost 	?
Hanssen	2010	Motion pictures	Cross-section regressions	<ul style="list-style-type: none"> Increase in film run adjustments No evidence of foreclosure 	+
Taylor et al.	2010	Retail gasoline	Difference in differences	<ul style="list-style-type: none"> No significant change in price 	0
Forman and Gron	2011	Insurance	Panel regressions	<ul style="list-style-type: none"> Increase in adoption of information technology 	+
Malik	2011	Pharmaceutical	Panel regressions	<ul style="list-style-type: none"> Development of new product 	+
Ataley et al.	2014	Various	Panel regressions	<ul style="list-style-type: none"> Increase in productivity 	+
Baker et al.	2014	Hospitals	Panel regressions	<ul style="list-style-type: none"> Increase in price and spending Decrease in hospital admissions No analysis of quality effects 	?
Ashenfelter et al.	2015	Beer	Panel regressions and event study	<ul style="list-style-type: none"> No price change 	0
Austin	2015	Retail gasoline	Panel regressions	<ul style="list-style-type: none"> Decrease in price 	+
Gil and Warzynski	2015	Video Games	Panel regressions	<ul style="list-style-type: none"> Increase in price Increase in quality Increase in output 	+
Koch et al.	2017	Hospitals	Difference in differences	<ul style="list-style-type: none"> Increase in physician hospital utilization 	?

Crawford et al.	2018	Multichannel television	Panel regressions	•	Decrease in price	+
-----------------	------	-------------------------	-------------------	---	-------------------	---

Note: ΔW is the variation in consumer welfare. For studies that find no evidence of foreclosure, the variation in consumer welfare is assumed zero or positive due to potential efficiency effects.

Source: OECD (2019) *Vertical Mergers in the Technology, Media and Telecom Sector* based on Lafontaine and Slade (2007) and Global Antitrust Institute (2018)

However, other experts tend to be more cautious. Recently, Beck and Scott Morton (2019)⁶³ critically assessed the two review studies mentioned above and reached different conclusions. They concluded that the evidence brought forward in those empirical studies was quite mixed⁶⁴. According to the authors view: “[...] *the economic literature demonstrates a variety of effects of vertical integration, including foreclosure and efficiencies, that justify examining vertical transactions on their merits rather than making general assumptions about their competitive effects*”⁶⁵. This reinforces our conclusion that policy evaluation of vertical structures have to rely on a focused, case by case review.

One important point made by Beck and Scott Morton, and, in a separate study, Slade (2020)⁶⁶, is that some empirical studies fail to provide estimates of the real net effect of vertical mergers on welfare. Some studies cannot separate efficiencies from foreclosure incentives. For instance, a study that found that vertically integrated firms favour their own integrated products, may also interpret this as evidence of foreclosure⁶⁷. However, those favoured integrated products might have simply become better/more efficient exactly because of efficiencies derived from vertical integration (e.g. elimination of double mark-up, etc.), regardless of the position of their rivals. Furthermore, Slade notes that foreclosure can be a double-edged sword as vertical mergers could actually serve to overcome pre-existing foreclosure practices by other players.

Among the studies reviewed in the surveys, Crawford et al.⁶⁸ (2018) is notable in its estimation of the net welfare effect of vertical integration in the U.S. multichannel television markets by building a fully-fledged structural model⁶⁹. The study indicated that the overall welfare effects were on average positive although with some variation. It showed that vertically integrating regional sports networks with the large TV channel distributors, often led to lower consumer prices and an increase in the number of people watching the regional sports network.⁷⁰ However, according to the study, the anticompetitive aspects of vertical integration could vary depending on the regulation on program access for non-integrated networks.

⁶³ Beck, M. and Scott Morton, F.M., 2020. Evaluating the Evidence on Vertical Mergers. Available at SSRN 3554073.

⁶⁴ They also point out that the industries analyzed in the empirical studies surveyed by Lafontaine and Slade were generally competitive industries which may reduce antitrust concerns. Further, earlier studies sometimes did not use state of the art econometric techniques.

⁶⁵ Ibid 63, p.2

⁶⁶ Slade, M.E., 2020. Vertical Mergers: A Survey of Ex Post Evidence and Ex Ante Evaluation Methods. Working Paper.

⁶⁷ Suzuki, A., 2009. Market foreclosure and vertical merger: A case study of the vertical merger between Turner Broadcasting and Time Warner, *International Journal of Industrial Organization*, p. 533.

⁶⁸ Crawford G. S. et al, 2018. *The Welfare Effects of Vertical Integration in Multichannel Television Markets. Econometrica*, p. 893-894, 938.

⁶⁹ Their model accommodated several aspects, for example, they allow less than full coordination across divisions of the integrated firm; such a situation that might occur when divisions of the integrated firms price independently.

⁷⁰ Crawford G. S. et al, 2018. *The Welfare Effects of Vertical Integration in Multichannel Television Markets. Econometrica*, p. 893-894, 938.

Besides acquiring other companies, firms may expand vertically by investing in their own assets (organic vertical integration). This is also a key channel that results in vertical integration and does not result in the loss of competition due to removing an independent firm from the market – on the contrary, it adds one more producer at the level of value chain where the expansion takes place. The empirical literature on firm productivity may shed some light on the effects of vertical integration in general – not limited to integration via mergers and acquisitions. For instance, Atalay et al.⁷¹ (2014) used firm level data across industries to show the positive correlation between integration and a firm’s productivity. Interestingly, they looked at data on the shipping of commodity goods and found little intra-firm trade in goods between integrated units. This additional finding does not seem to support the idea that vertical ownership is used to increase coordination and reduce transaction costs in the transfer of goods along the value chain. The authors, however, suggested, as an alternative explanation, that the higher efficiency of integrated firms may come from sharing intangible assets. This supports the theory of firm’s capabilities explained in section 2.1.4.

Finally, this debate extends to a wider discussion on vertical relations, i.e. on what agreements firms can take, as seen in the recent Staff Working Document published by the European Commission DG COMP on the revision of the Vertical Block Exemption Regulations (VBER)⁷². There, the Commission presents a comprehensive set of arguments on both sides – against and in favour of various forms of vertical control over the value chain.

⁷¹ Atalay, E. et al, 2014. *Vertical Integration and Input Flows*, American Economic Review, p. 1121.

⁷² European Commission, 2020. Evaluation of the Vertical Block Exemption Regulation. SWD(2020) 173, available at: https://ec.europa.eu/competition/consultations/2018_vber/staff_working_document.pdf

CHAPTER 3

**EFFICIENCIES FROM VERTICAL
INTEGRATION IN DIGITAL MARKETS**

- Key efficiency drivers of vertical integration include a) high complementarity between product components e.g. hardware and software, b) highly specific assets c) quality externalities across the value chain, d) economies of scope e) high technological uncertainty, f) the crucial role of intangible assets and knowledge capabilities.
- Vertical integration is not a mere black/white decision (*make own inputs vs buy services from others*) but includes a host of intermediate arrangements involving varying degrees of integration.
- Vertically integrated firms can add a platform layer to their operations where other independent players can create new services to complement the core product offered by the firm. This can be seen as a hybrid form of vertical integration.
- Managing the balance between openness and control over the platform is critical for vertically integrated firms because of quality externalities that impact their entire value chain.
- Vertically integrated, dual-role platforms provide services competing with those of 3rd party players on the platform. Irrespective of ability, these platforms may not hold incentives to foreclose given that they benefit from a rich ecosystem of 3rd party players – network effects.
- Emerging literature calls for caution on possible one-size-fits-all regulatory interventions against dual role platforms. It is important to understand the various types of business models since they reflect different firm incentives and consumer outcomes.

The chapter is divided into two main sections:

- 3.1 discusses the efficiencies presented in the previous chapter in the context of digital sectors, zooming in on the most prominent efficiencies based on the specific characteristics of the sector;
- 3.2 investigates how firms may pursue integrated platform business models in one (or more) layers of their value chain and explores the governance challenges in balancing various degrees of openness (including the case of dual-role platforms offering services competing downstream with third party players active on the platform).

**3.1 DIGITAL MARKETS CHARACTERISTICS LINKED WITH
VERTICAL INTEGRATION EFFICIENCIES**

In this section we identify various types of efficiencies that digital players may obtain by adopting vertically integrated structures based on distinctive elements of digital markets. In doing so we follow the economic theories explained in the previous chapter. We argue that digital markets possess intrinsic elements that make them particularly prone to efficient integrations across the value chain. In this context, we consider that the ‘digital value chain’ is composed of the three main elements presented in section 1.2: hardware, software (operating system) and complementary services.

While all efficiencies discussed in chapter 2 are present to a certain extent, we will discuss only five efficiencies that we believe are particularly prominent in the case of digital markets, see Table 6.

Table 6
Overview of vertical efficiencies in digital markets

TYPE OF EFFICIENCIES	PARTICULARLY RELEVANT IN DIGITAL MARKETS	CHARACTERISTICS OF DIGITAL MARKETS
Elimination of double mark-ups		
Quality externalities	√	High investments in intangible assets and high complementarity/spillover effects across products and services. Intellectual Property Rights and related negotiation complexity and appropriability challenges.
Elimination of inefficient input substitution		
Support emerging markets	√	High technological uncertainty with short product life cycles and frequent (disruptive) innovation. The expansion of digital firms' boundaries in different technological fields across the value chain, allows them to prepare and act quickly regarding the introduction of new technologies.
Price discrimination		
Transaction costs and hold-up problems	√	Highly specific and large investments in research and development and design of components.
Economies of scope	√	Complementarity in the product design, technologies and use of data both upstream, at the level of hardware, and downstream, at the level of software.
Firm's capabilities	√	Successful digital players possess strong brand and knowledge capabilities that tend to be valuable, rare, inimitable, and non-substitutable.

Source: Copenhagen Economics

In the sections that follow we present in more detail the efficiency arguments most prominent in digital markets.

3.1.1 Quality externalities in digital markets

Vertical integration allows firms to reduce negative quality externalities in digital markets characterised by high investments in intangible assets and with high complementarity effects across products and services. Improving the quality of a product has a positive effect on vertically related firms and sometimes on direct competitors benefitting from higher demand.

An integrated smartphone producer has all the of the incentives to develop and offer high quality applications (services) and software functionalities as they will positively affect the demand for its smartphones.

After one year from the launch of the first iPhone, Apple decided to stop using Samsung processors and started to design its own processors for the iPhone. Apple realised that remaining dependent on external suppliers, such as Samsung or Intel, would limit Apple's ability to control the quality of its product and would reduce the appropriability of the returns derived from the expected success of its future generations of products⁷³.

3.1.2 Support of digital emerging markets

The expansion of digital firms' boundaries in different technological fields across the value chain, allows them to prepare and act quickly in relation to the introduction of new technologies. Digital markets are highly dynamic and subject to waves of disruptive innovation and technological uncertainty. Most of the time, new products have no markets and their functionalities are based on frontier technologies which are not widely available in the industry. For this reason, innovative digital firms must sometimes design and create the inputs necessary for the development and production of their new products downstream.

3.1.3 Transaction costs and hold-up problems in digital markets

Vertical integration in digital markets may reduce or eliminate the hold-up problem that is likely to arise for highly specific and large investments in research and development. Digital markets are fuelled by continuous innovation with relevant shares of resources dedicated to research and development activities.⁷⁴

Technologies developed through the innovative process may have multiple applications across different products and steps of the value chain that cannot be foreseen *ex ante* and that may create appropriability problems. For instance, as mentioned above, there are efficiencies from integrating hardware and software products. The development of a new piece of hardware by one firm upstream that may improve the performance of a software designed downstream by another firm may require highly specific investments in machines and human capital in the long run. The upstream firm may not be willing to take the investment risk associated with the potential failure to recover the costs of the investment in the case that the downstream firm pulls back from the deal⁷⁵. Therefore, in the presence of transaction costs and inability to negotiate complete contracts, the investment level of the upstream firm may be inefficiently reduced. Integration overcomes this hold-up problem as the vertically integrated digital firms would be able to tailor the investment in R&D upstream so as to maximise all efficiencies with its products downstream.

The hold-up problem is particularly severe in the IT sector when IT companies build their product on proprietary software owned by others. If the software is licenced in binary form (without the

⁷³ Teece, D.J., 2018. Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy*, 47(8).

⁷⁴ Hernández, H., Grassano, N., Tübke, A., Amoroso, S., Csefalvay, Z., and Gkotsis, P.: The 2019 EU Industrial R&D Investment Scoreboard

⁷⁵ Or the downstream firm can also try to appropriate the knowledge and enter upstream in competition with the other firm.

source code), the buyers are forced to cooperate with the original software vendor (at her condition) for any future changes. Therefore, open source alternatives, even though less performant than proprietary software, are widespread. The disappearance of the Flash software platform can serve as an example to explain the concept of hold-up in the IT sector, see Box 2.

Box 2 The death of Flash Player and the hold-up problem

Flash was once a ubiquitous multimedia software platform used to develop and play animations and video content on the web. Without a Flash extension it was almost impossible to browse interactive websites, load videos etc. Because of its success it was acquired by Adobe in 2005. Now Adobe, has announced the definitive stop to Flash updates by end of 2020⁷⁶.

The decline of Flash started back in 2010 when Steve Jobs announced, with some noise, that iOS would not support Flash. Android followed in 2012. The main reasons for this decision were severe security fallacies and malfunctioning suffered by Flash Player. For example, at the time, if you had an old website running on Flash, your activities were compromised.

A possible hold-up problem could be seen from the point of view of Apple, which at that time, was investing in developing its iPad ecosystem. If developers started to use Flash to write software for the iPad, Apple would have been forced to collaborate and would therefore depend on Adobe in the future, to some extent being held-up by Adobe. Banning Flash from iOS avoided this risk.

Source: <https://gigaom.com/2010/08/08/open-source-and-economics-how-the-hold-up-problem-explains-the-flash-wars/>

As an additional example, showing the impact of transaction costs in integration decision, Apple has recently announced that it will gradually stop buying chips from Intel for its Macs⁷⁷. The announcement was concomitant with Intel reporting a delay in the production of its new 7-nanometer processors by approximately six months and a delivery expected only by 2022 or 2023. Apple would have had to wait until that time for a hypothetical launch of a new, faster, model of Macs if it were to rely on Intel. By vertically integrating Apple will avoid being exposed to the poor behaviour of the transacting party. Again, this example shows Apple's intent to avoid a hold-up problem by investing in designing its own chips in order to integrate them in the most efficient, timely and secure way with its software operating system.

3.1.4 Economies of scope

Digital markets are characterised by a strong presence of economies of scope. Digital players may find it efficient to expand in other segments to reap the benefit of those economies. One type of economies of scope is derived by the complementarity in the product design and technologies

⁷⁶ Barret, B., July 2017. Adobe Finally Kills Flash Dead, available at <https://www.wired.com/story/adobe-finally-kills-flash-dead/>

⁷⁷ Intel had another delay in the manufacturing of 10-nanometer chips in 2018. Source: Haselton T., July 2020. Intel's latest delay shows exactly why Apple was right to ditch the company and make its own chips, available at <https://www.cnbc.com/2020/07/24/intel-chip-delay-shows-exactly-why-apple-is-right-to-move-to-arm.html>

applied both upstream, at the level of hardware, and downstream, at the level of software. For instance, business, middleware and database software and service vendor, Oracle, acquired Sun Microsystems, producers of servers, storage and networking equipment, in 2010. Normally, Sun Microsystems would not be a usual target for a company such as Oracle, but the merger had the declared incentive to create synergies between software and hardware solutions⁷⁸.

Specifically, the modularity design of software inputs can be used with different combinations of hardware, further contributing to greater economies of scope.⁷⁹ One example of this is the economies of scope derived by Apple from using the same range of processors for all its iPads and iPhones.⁸⁰

Another important source of economies of scope is derived from the collection and processing of data and artificial intelligence developments. Players in digital markets may be able to leverage the data and its insights, due to machine learning, that they receive in one part of the value chain to improve the quality of their services and products in another part of the value chain. For example, data generated by devices such as smart appliances may inform the development of new software and applications (services) downstream. In another example, the large amount of data generated by connected vehicles can support car manufacturers to improve the hardware (the car) as well as provide new or better services related with infotainment.

3.1.5 Firm's capabilities

Successful digital players possess a bundle of resources and capabilities that tend to be valuable, rare, inimitable, and non-substitutable. Integration into adjacent markets may be an efficient way to leverage and exploit their firm specific capabilities. These unique resources allow them to maintain their competitive advantage in the industry. With the increasing relevance of the knowledge-based economies, most of these resources take the form of intangible assets, technology expertise, human capital and firm culture. These resources reflect the ability of firms to perform well and are, to some extent, transferrable across products and processes. This supports the market decision of these firms to expand their boundaries.

A classic example is the success of Apple in product design: the ability to develop intuitive, easy-to-use and aesthetically appealing devices.⁸¹ This type of capability is very specific to the firm. It is formed by shared knowledge, routines and skills and it is rooted in the company culture. This particular commercially successful approach to product design and consumer experience has been applied by Apple on hardware devices, software, service and even to physical Apple stores around the world.⁸² This unique capability represents a strong competitive advantage which can be applied along the value chain and it is not easily transferable across firm boundaries. A similar point can in-ter alia be made for Google and its creative and experimental approach to business challenges.

⁷⁸ Oracle website, available at: <https://www.oracle.com/sun/>

⁷⁹ Sanchez, R. & Mahoney, J. T., 1996. *Modularity, Flexibility and Knowledge Management in Product and Organization Design*, Strategic Management Journal, p. 67.

⁸⁰ Bourreau, M. & de Streel, A., 2019, *Digital conglomerates and EU competition policy*, p. 10.

⁸¹ Luenendonk M., February 2018. The Apple product design, available at : <https://www.cleverism.com/apple-product-design/>

⁸² This also contributed to the development of the strong Apple brand.

3.2 VERTICAL INTEGRATION WITH PLATFORM BUSINESS MODELS

In this section we explore the increased adoption of platform business models in the digital sector and its organizational and competitive implications on vertically integrated firms. Vertically integrated firms can open their structure in a controlled manner and develop innovation and transaction platforms where independent players compete and cooperate to create complementary products and/or services that increase the value to consumers of the vertically integrated firm.

3.2.1 Types of platforms among tech firms

The recent developments and wide adoption of Information and Communication Technologies (ICT) have reduced coordination and matching problems by decreasing the transaction costs, i.e. search, contracting, monitoring and enforcement costs⁸³. This has fostered the creation of platform-type business models⁸⁴ where platform providers create value by facilitating interactions between different groups of users (i.e. multi-sided markets platforms). Examples of these digital platforms are online marketplaces, social networks, and mobile application stores. While platforms are not per se a digital product (hardcopy newspapers, credit cards and shopping malls are examples of physical platforms), the relevance of digital platforms has increased dramatically thanks to developments in ICT, which allows for highly efficient matching and processing of large-scale transactions across long distances.

A fundamental characteristic of platforms is the presence of network effects, whereby the utility that one user derives from the platform increases with the number of other users present on the platform.⁸⁵ Network effects can be direct, when utility is derived by additional users on the same side of the platform, and indirect, when utility is derived by additional users on the other side of the platform.

In the report “The Rise of the Platform Enterprise: A Global Survey”,⁸⁶ Evans and Gawer (2016) define four types of platforms:⁸⁷

- *Transaction platforms* that facilitate (intermediate) the exchange or transactions between different groups of users, e.g. buyers and sellers. Uber and Airbnb are two examples.⁸⁸

⁸³ Ciborra, Claudio, 1993. *Teams, Markets and Systems*, Cambridge University Press.

⁸⁴ OECD, 2014. *The digital economy, new business models and key features. Addressing the Tax Challenges of the Digital Economy*. OECD Publishing, Paris, available at <https://doi.org/10.1787/9789264218789-7-en>.

⁸⁵ Rochet and Tirole, 2003. Platform Competition in Two-Sided Markets, *Journal of the European Economic Association* 1, no. 4, 2003, pp. 990-1029

⁸⁶ Evans, P.C., and Gawer, A., 2016. The Rise of the Platform Enterprise: A Global Survey, available at https://www.thecge.net/app/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf

⁸⁷ We note that this is just one classification. There are many others, for example advertising funded and non-advertising funded.

⁸⁸ Evans and Gawer include Amazon among the integrated platforms as they consider all services provided by Amazon, e.g. Amazon Web Services, which orchestrate a large network of third-party developers.

- *Innovation platforms* that provide the base on top of which other independent players are able to develop complementary technologies, products or services⁸⁹. Microsoft Windows and Microsoft Azure (cloud business) ⁹⁰ are examples as they maintain a large network of third-party developers.
- *Integrated platforms* that combine transaction and innovation platforms. Apple's app ecosystem⁹¹ is one example: it enables third-party developers to innovate and create new apps by providing specific APIs and software developer kits (SDK), and provides the intermediation between developer and end users via its App store.
- *Investment platforms* that have developed a platform portfolio strategy and act as either a holding company, an active platform investor or both. This type is less relevant for the current study.

Evans and Gawer's study identified six firms as integrated platforms (which in this literature means the combined function of transactional and innovation platform): Apple, Google, Amazon, Facebook, Alibaba and XiaoMI. They observe that companies in this category are active in multiple markets, they may have multiple platforms, (e.g. Google's Search and Google Play Store) possess sizable assets and may have control over the supply chain. However, we note that within this group there can be found a degree of diversity in business models.

3.2.2 Integration of platform layers in the value chain

In this context, a vertically integrated firm can add a platform layer to its operations where other independent players (complementors) create and develop new services and features that complement the core product offered by the firm. This can be seen as a hybrid form of vertical integration. The incentive for independent players to participate on the platform is represented by the possibility to offer their complementary services to the end consumers of the firm operating the platform. The inputs from independent players allow the firm to expand the choice of services available to the end consumers of its core products far beyond what it could have achieved only in-house. The increased availability of complementary services and additional features will attract more end consumers, making the platform even more attractive to other independent players. This self-reinforcing mechanism is reflected in the presence of positive indirect network effects between firms offering complementary services and final consumers.

⁸⁹ This is more in line with the concept of platform used in Cusumano and Gawer (2002); Cusumano, M.A. and Gawer, A., 2002. The elements of platform leadership. *MIT Sloan management review*, 43(3), p.51.

⁹⁰ Other examples of innovation platforms identified by Evans and Gawer are Oracle, SAP and Salesforce.

⁹¹ Other examples of integrated platforms identified by Evans and Gawer are Google, Facebook, Alibaba, Amazon and XiaoMI.

A classic example of this type of hybrid form of vertical integration is the Apple's app ecosystem mentioned above⁹². By opening up its closed system to third party developers shortly after the iPhone was launched, Apple has provided an innovation platform and a distribution system (the App Store) whereby other firms could contribute with their own innovations, making the system as a whole more valuable.⁹³ This approach is not just valuable for the platforms and consumers but also for the third parties participating in the platform. A recent study from Analysis Group estimated that in 2019 alone, the Apple App Store facilitated more than 500 billion dollars in billings⁹⁴ and sales worldwide. More than 85% of that went solely to third parties present in the platform.⁹⁵

We note that other digital companies and device manufactures are starting to integrate app stores/operating systems in their value chain, see Box 3.

⁹² We consider the app store platform as a service, although it is powered by the underlying hardware (data centers etc.) and software.

⁹³ Amazon, Microsoft, Google and Facebook have also created rich ecosystems around their platforms.

⁹⁴ The authors include paid downloads of apps and in-app purchases including subscriptions in this category.

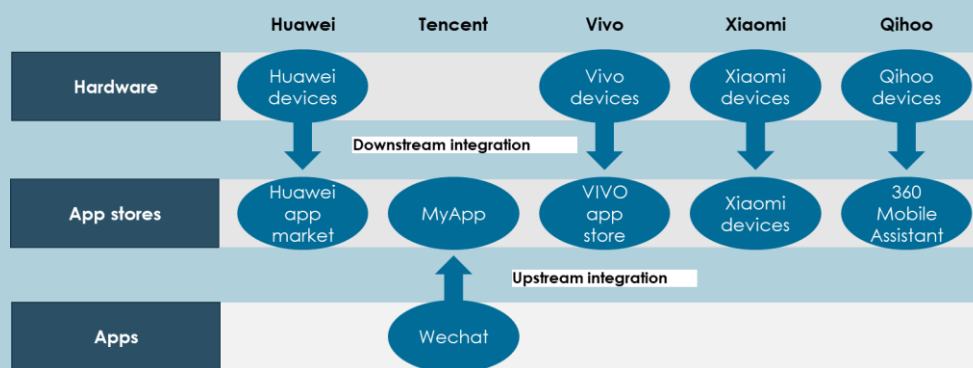
⁹⁵ Analysis Group, 2019. How Large Is the Apple App Store Ecosystem? – a global perspective in 2019. Available at: <https://www.apple.com/newsroom/pdfs/app-store-study-2019.pdf>

Box 3 Manufacturing and service firms are developing integrating app stores in the value chain

A range of smartphone manufactures and service firms (incl. app development) are starting to integrate their business models by developing their own platforms to distribute first and third-party applications. The choice of other firms to integrate downstream (device manufactures) and upwards (large app developers) by launching their own app stores is a clear indication that market players see efficiencies and value in creating this type of hybrid form. This also shows that players active in other parts of the value chain are better placed to manage the platform compared to a potential specialised firm, possibly because of the strong complementarities between these components.

Samsung has its own app store that is supported by Samsung OS Tizen. The Tizen OS is mostly for smart TV and Samsung wearable products. Furthermore, existing device manufacturers and app developers (e.g. in China) have started to introduce their own App stores by vertically integrating, as a Google Play alternative is not present in that geographic market.

Vertical integration of app stores by manufacturing or service firms



Source: [Text]

This type of governance structure may be complex to manage. In his framework on how to profit from innovation in the digital economy, Teece defines a platform⁹⁶ as:

“A platform is any combination of hardware and software that provides standards, interfaces, and rules that enable and allow providers of complements to add value and interact with each other and/or users. Collectively, the platform innovator(s) and the complementors constitute an ecosystem, the viability of which depends on continued innovation and maintenance of the platform by its owner(s) and a delicate balance of cooperation and competition among the providers of complements.” (Underlining is our)⁹⁷.

⁹⁶ We note that the Teece’s framework does not refer specifically to two-sided platforms but generally on innovation platforms.

⁹⁷ Teece, D.J., 2018. Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy*, 47(8), p.1375.

Platform governance is organizationally challenging. The platform firm needs to strike the right degree of openness that allows new services and innovation to be created and offered on the platform (by attracting the best independent players in the highest number), while securing the well-functioning and quality of its products. This requires platform firms to take the leadership role in setting the rules and monitoring mechanisms that establish who has access to the platform, how to distribute the value generated by the platform and how to handle conflicts generated on the platform⁹⁸.

The control over the access to the platform, is particularly important for the well-functioning of the system. In a recent study by Zhang and Tong (2018)⁹⁹, the authors looked at the iOS 7 jailbreak event: a hacking process that exploits loopholes in the system to remove iOS built-in restriction. During the hacking, Apple lost the ability to control the access to its ecosystem with the consequence of a spread of copycat apps. The authors found that the breach had the effect of reducing knowledge sharing activity among app developers on online fora. Therefore, the definition and implementation of well-balanced platform access policies influences the contribution of independent players to the platform and eventually the value of the platform to consumers. As integrated players internalise the value generated by the platform over their value chain, e.g. by increasing sales of the devices that support the platform, they have strong incentives to invest and maintain the control over the platform to maximise its quality. These incentives are aligned with the ones of consumers on the other side of the platform which benefit from a better service.

Nevertheless, the platform firm is essentially orchestrating¹⁰⁰ independent players rather than exerting command and control over these players in a way it does for the fully integrated operations of its value chain. Consequently, the right incentive schemes should be put in place to boost participation in the system by independent agents. This may require the platform owners to restrain from extracting all the value from its complementors.

3.2.3 Vertically integrated firms as dual-role platforms

Independent players active on the platform may present divergent incentives: some may cooperate while others may compete with each other (and the platform) depending on whether their services are complements or substitutes. There are specific cases where the platform firm offers services similar to the ones offered by other independent players present on the platform¹⁰¹, see Figure 2. Hence, the platform firm has a “dual role” in the sense that is at the same time a ‘collaborator’ and a ‘competitor’. In other terms, this can be seen also as having at the same time the role of an “umpire” (referee), as it sets the rules of the platform, and a “player”. This may create foreclosure risks which were discussed in section 2.2.

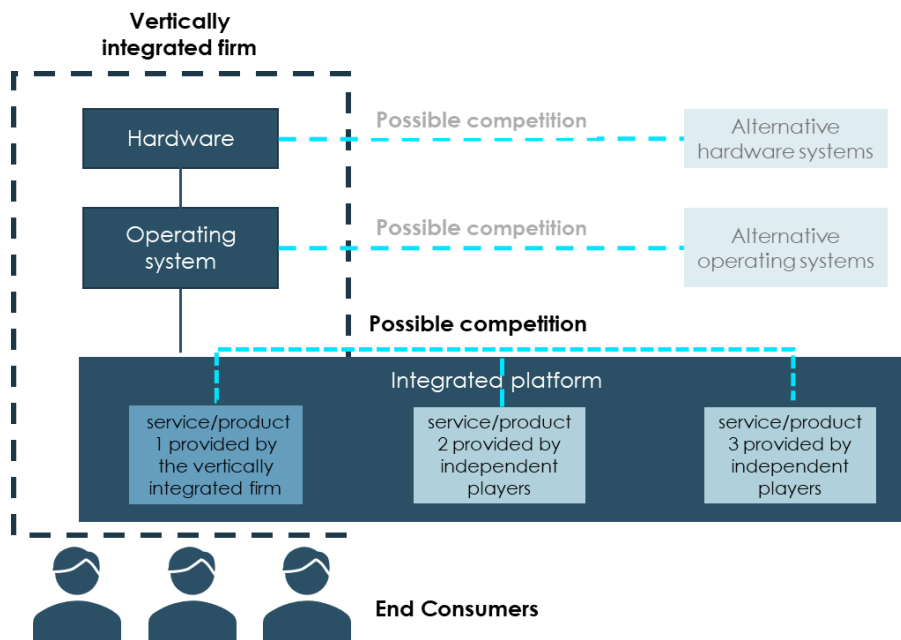
⁹⁸ Evans, P.C., Gawer, A., 2016. The Rise of the Platform Enterprise: A Global Survey. Center for Global Enterprise, New York. Available at: http://www.thecege.net/wp-content/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf

⁹⁹ Zhang, Y., Li, J. and Tong, T.W., 2018. Platform governance matters: How platform gatekeeping affects knowledge sharing among complementors. *Strategic Management Journal*.

¹⁰⁰ The platform cannot oblige users to stay and develop their services for the platform.

¹⁰¹ In a way, this could be seen as a kind of dual sourcing whereby inputs are sourced from two upstream markets, one that is vertically integrated and one that is not vertically integrated. Under certain conditions, this way of dividing up the source of inputs may generate a higher consumer welfare than if the firm would rely solely on the vertically integrated process. Having a portfolio of suppliers may function as a hedge for the firm in conditions of high uncertainty and help the firm to have a more flexible production process.

Figure 4
Overview of dual-role platform



Source: Copenhagen Economics

Vertically integrated firms with a platform dual role are common. Apples manages the App store where it also offers its own apps. Similarly, Amazon sells its own products next to third-party sellers on its own Amazon Marketplace. Google provides services that appear in the results of Google Search together with alternative services from third-party sellers, while Facebook offers its Marketplace through its social network.

Other important digital players could be considered dual-role platforms. For instance, Zalando¹⁰², the online fashion retailer, also hosts third-party retailers on its platform which controls for the risk of overpricing, product presentation etc. and which can compete alongside Zalando's own products. Other European online marketplaces such as Allegro in Poland, eMag in Romania and Fnac Darty in France share the same characteristic of managing the marketplace while also selling products and competing as standard retailers. There are also companies (e.g. Mirakl¹⁰³), whose service is to help retailers setting up marketplaces to allow third-party sellers to market their products alongside the retailers' ones.

Dual-role platforms include also Spotify's venture into producing its own podcast content, distributed for streaming on its platform next to other third parties' podcasts (and as a listening activity alternative to other parties' content e.g. music from other artists distributed).

¹⁰² European Commission, 2020. Evaluation support study on the EU competition rules applicable to vertical agreements in the VBER and the Guidelines, available at: <https://ec.europa.eu/competition/publications/reports/kdo420219enn.pdf>

¹⁰³ Mirakl.com, available at: <https://www.mirakl.com/>

In a B2B setting, Siemens Healthineers, the Siemens's arm that focuses on healthcare, medical solutions and systems, has also created its digital ecosystem which presents dual-role platform characteristics.¹⁰⁴ The ecosystem links healthcare providers and medical application/solution providers with one another and brings together their data, applications and services. As an entry point for healthcare providers (the final users), Siemens Healthineers offers a digital marketplace where the healthcare providers have access to a wide range of digital healthcare solutions developed either by third parties (solution partners) or by Siemens Healthineers itself.

Beyond the so-called tech sector, similar dual-role platform set ups appear in a wider set of industries. For example, in more "traditional" industries such as supermarkets/grocery retail, the supermarket may compete with its own private label products with products from other brands. While supermarkets usually have the ownership of the branded products they sell (they take a high risk but also have more freedom on pricing) they may still be categorised as two-sided platforms.¹⁰⁵ Furthermore, similar to online platforms, supermarkets can collect data on customers shopping,¹⁰⁶ e.g. through loyalty cards, and use this information to identify successful products and launch their own competing private label version.

Hagiu and Wright (2015)¹⁰⁷ model the economic choice of firms to behave as a marketplace (multi-sided platform) or as an integrated reseller. Among other factors, they find that a firm should choose to behave as a marketplace for *a*) products for which suppliers have better information on how to market them, *b*) products that require limited price and marketing activities, *c*) long-tail products and products from late-stage ventures. Notably, these innovation and industrial organisation scholars conclude that firms may embrace multiple approaches at once in order to find the most effective business offer delivering the highest value to consumers— e.g. a dual approach of as a marketplace and also an integrated reseller. This choice can rationally follow the nature of the product. Looking at the tech policy conversation, the above findings thus also relate to dual-role platforms, which are associated with so-called hybrid modes where the firm may choose which products/services to offer on a marketplace and which products to offer in a (re)seller mode. In the next section we further explore how policy measures applied to these business choices and firm structures may affect total welfare.

¹⁰⁴ Siemens Healthineers' Belgian website. Available at: <https://www.siemens-healthineers.com/fr-be/digital-health-solutions/digital-solutions-overview/partner-solutions/digital-marketplace-partner-applications>

¹⁰⁵ For a more detail analogy between supermarkets and online platforms see: Expert Group for the Observatory on the Online Platform Economy, July 2020, "Work Stream on Differentiated treatment", Progress Report.

¹⁰⁶ Turow, J., 2017. *The aisles have eyes: How retailers track your shopping, strip your privacy, and define your power*. Yale University Press.

¹⁰⁷ Hagiu, A. and Wright, J., 2015. Marketplace or reseller?. *Management Science*, 61(1), pp.184-203.

3.2.4 Emerging literature on the economic effects of dual role platforms on consumers

As we saw, it is quite common for (digital) platform owners to be vertically integrated downstream, i.e. the platform offers its own integrated services/products next to the ones of third parties. This dual role has attracted a lot of attention and scrutiny lately from policy makers and competition authorities with calls for possible *ex-ante* regulation. Authorities are concerned about the distorted incentives that may push platform owners to set platform rules and adopt discriminatory practices so to favour their own products/services over third party alternatives– the risk with “referee and player” role.

Platforms may have the ability to anticompetitively (partially) foreclose competitors, raising rival costs (e.g. platform fees) or imitate third-party products. Generally, however, third-parties and their services complement the platform, so platforms strive to maintain a rich and populated environment.

The above points relate to the business optima (profit-making) choice of strategy and thus its economic rationality. A wider question is that of the social welfare effects of such business strategies. Here the economic literature is emerging, though subject to further contributions¹⁰⁸.

The earlier literature that started to tackle the issue calls for caution towards possible one-size-fits-all regulatory interventions against dual role platforms. For example, consumer welfare may be affected if policymakers do not understand and consider the variety of business models present in digital sectors, since different business models reflect different incentives (for the firms) and different effects of their conduct on consumer outcomes. As a result, the incentives of a platform may be aligned with those of consumers to a greater or lesser extent depending on the circumstances. We double-click on key emerging literature below.

De Corniere and Taylor (2019)¹⁰⁹ investigate the potential effect of biased platform’s advice on consumers when choosing among sellers, particularly when the platform is integrated with one seller. They find that the effect of the bias (the platform’s recommendation favouring its own seller) depends on whether consumers and (integrated) sellers’ payoffs are *congruent* or *conflicting*. *Congruent* (*conflicting*) payoffs are present when quality (price) is the most important competition dimension. Specifically, when payoffs are *congruent* (*conflicting*) consumers may benefit (suffer) from the biased recommendation.

Under conflicting payoffs, platforms divert consumers to offers with lower utility, while under congruent payoffs the bias leads the firms that benefit from these payoffs to further improve the quality of its product, thus increasing consumer utility. Under competition on quality, the higher the quality of a product the greater the utility to the consumer and the larger the profit to the firm – this gives incentives for firms to invest the extra profits in quality improvements.

¹⁰⁸ The literature discussing competition *on* the platform is still at more infant stage compared to the literature on competition *for* the platform (see section 2.2).

¹⁰⁹ De Corniere, A. and Taylor, G., 2019. A model of biased intermediation. *The RAND Journal of Economics*, 50(4), pp.854-882.

The authors consider different policy options to reduce recommendation bias (platform's neutrality, i.e. forcing platform to grant equal prominence, divestiture of integrated product and transparency). They conclude that while those policies generally improve consumer welfare under conflicting payoffs, they may not do so under *congruent* payoffs when there is competition on quality. Under congruence, divestiture, neutrality and transparency interventions do not improve consumer outcomes. We may add that in markets where services are given at zero price, quality is important. Therefore, it is important to understand the different business models and competition dimensions in place before introducing regulation on platforms activities.

Kraemer and Schnurr (2018)¹¹⁰ looked at the literature on discriminatory practices of online platforms in the form of paid prominence and prominence granted to integrated services (when a platform has a dual role). They find that, from a static perspective, prominence and/or favouring own services, may sometimes be in favour of consumers when services are competing on quality. They make reference to De Corniere and Taylor (2019) presented above. They conclude that there is not sufficient evidence to justify a wide ex-ante measure for platform neutrality (inability of platforms to make certain services/product prominent). However, they note that favouring own services when they have a similar quality of competing third party services, may reduce dynamic efficiencies (incentive for future innovation and product variety from new entry on the platform).

In another recent work by Hagi, Teh and Wright (2020),¹¹¹ the authors model the economic interactions between a dual role marketplace and an independent seller. Assuming an outright ban on the dual role, (i.e. prohibiting a platform to sell its own products), the authors estimate the optimal choice of the dual platform, whether to remain a pure marketplace or become a pure reseller, i.e. without the possibility to host the third-party seller. They estimate that bans generally harm consumers while favouring third party sellers¹¹². One of their insights is that the platform's own products constrain the pricing of third-party sellers. They also expand the model by allowing for the possibility of the marketplace to steer consumers to its own products and they conclude that even in this setting a pure ban of dual role may be detrimental for consumers (as the dual platform turns to pure reseller). Furthermore, they investigate the possibility for the marketplace to imitate products introduced by third parties. Again, the ban does not always enhance consumers' welfare (only in the case of highly cost-efficient innovations) since the platform will choose to become a pure marketplace and will not be able to combine the superior product with its lower costs¹¹³. In both cases, less drastic policies, i.e. limit steering and imitations, are more effective¹¹⁴.

¹¹⁰ Krämer, J. and Schnurr, D., 2018. Is there a need for platform neutrality regulation in the EU?. *Telecommunications Policy*, 42(7), pp.514-529.

¹¹¹ Hagi, A., Teh, T.H. and Wright, J., 2020. Should Amazon be allowed to sell on its own marketplace?. *Available at SSRN 3606055*.

¹¹² In their model, third-party sellers can access consumers through their own direct channels.

¹¹³ Assuming platforms have cost advantages in reaching consumers and distribution; Zhu, F. and Liu, Q., 2018. Competing with complementors: An empirical look at Amazon. com. *Strategic management journal*, 39(10), pp.2618-2642.

¹¹⁴ Other ongoing work done by Etro (2020) set up an economic model to estimate when Amazon-type marketplace (optimally) chooses to compete with third party sellers on its platform and the effect on consumer welfare; Etro, F., 2020. Product selection in online marketplaces. *Available at SSRN 3641307*.

As additional argument, Jullien and Sand-Zantam (2019)¹¹⁵ suggest that vertical integration may provide additional benefits in the context of platforms as it helps internalizing network externalities. The authors bring the example of Amazon, which offers its own products next to third-party sellers on the Amazon marketplace. This guarantees a minimum quality and product offer to customers. Similarly, Apple develops its set of in-house apps to guarantee that iPhone users have access to a minimum set of functionalities and services when they start using their devices. This may help solve the platform chicken-and-egg problem (i.e. coordination problem). By integrating on one side of the market (e.g. by selling own products on the marketplace) the platform owner may convince consumers on the other side of the market to join the platform initiating the cross-group network effects described above¹¹⁶.

Generally, if established platforms offer services that compete directly with services provided by independent players, they might have the ability to (partially) foreclose their rivals. Jullien and Sand-Zantam¹¹⁷ point out that while they have the ability, they may lack the incentives, as they face a trade-off between collecting short term revenue from their integrated product or maximizing the long term platform success via user loyalty on both sides of the platform. Therefore, the incentives of possible foreclosure practices are, at the very least, difficult to identify and the overall welfare effects remain ambiguous. Zhu and Liu (2018), for example, show that Amazon's entry in the product space of third-party sellers increases product demand and reduces shipping costs for consumers.¹¹⁸ Moreover, Wen and Zhu (2019) show that successful-party service app developers can also preempt the threat of Google's entry with its own app by deploying their capabilities across a broader innovation domain.¹¹⁹ This may generate welfare efficiencies by reducing wasteful development efforts.

The recent report published by the Expert Group for the Observatory on Online Platform Economy (OPE)¹²⁰ provides some arguments to suggest that online platforms, under certain conditions, may have incentives to foreclose their rivals.¹²¹ While foreclosure may lead to static and dynamic inefficiencies, by making rival services less attractive and causing rivals to exit the platform or reducing investments, the OPE Expert Group recommends that this should be weighed against alternative benefits derived to the platform and consumers such as the elimination of double mark-ups and higher investments at the platform and product level.

¹¹⁵ Jullien, B. and Sand-Zantman, W., 2019. The economics of platforms: A theory guide for competition policy. *TSE Digital Center Policy Papers series*, (1).

¹¹⁶ Platform firms may solve this coordination problem and generate procompetitive effects also via vertical restraints such as exclusive dealings, see Evans, D.S., 2013. Economics of vertical restraints for multi-sided platforms. *University of Chicago Institute for Law & Economics Olin Research Paper*, (626).

¹¹⁷ Ibid, 115

¹¹⁸ Zhu, F. and Liu, Q., 2018. Competing with complementors: An empirical look at Amazon. com. *Strategic management journal*, 39(10), pp.2618-2642.

¹¹⁹ Wen, W. and Zhu, F., 2019. Threat of platform-owner entry and complementor responses: Evidence from the mobile app market. *Strategic Management Journal*, 40(9), pp.1336-1367.

¹²⁰ Expert Group for the Observatory on the Online Platform Economy, July 2020, "Work Stream on Differentiated treatment", Progress Report.

¹²¹ These arguments refer to the classic critiques of the Chicago School which argue that a monopolist upstream gains higher rents by supplying the more efficient downstream competitor rather than foreclosing it to favour its own downstream subsidiary.

In the same report, the OPE suggests that these foreclosure incentives may also be present in the case of dual-role platforms in other traditional industries¹²². Taking the previous example of supermarkets and grocery stores, the supermarket may have incentives to increase visibility of its own private label products by positioning them in more prominent places on the shelves of its aisles at the expense of competing brands. Yet, the OPE argues that concerns derived from this type of practices would be higher in the case of digital platforms compared to traditional supermarkets. This would primarily be due to data and scale effects - the ability of large digital players to implement their decision swiftly over a practically infinite number of shelves and to target consumer attention to certain products (possibly more effectively than supermarkets). We note, however, that these aspects are what makes online platforms efficient intermediaries and business enablers in the first place. Third-party players can and do rely on online platforms to experiment with their product and reach a large number of relevant customers with little cost.

In any case, according to a recent survey of platform's business users in nine European countries presented by the OPE supporting study, third-parties do not seem to consider possible platform' differential treatment as an issue for them. Among the 1667 business users surveyed, 65% either strongly agreed or agreed with the statement "*the platform treats all its business users in an unbiased and fair way*", while an additional 22% partially agreed with the statement.¹²³

¹²² In that case the (partial) foreclosure would be executed via differentiated treatment. For a more detail analogy between supermarkets and online platforms see: Expert Group for the Observatory on the Online Platform Economy, July 2020, "Work Stream on Differentiated treatment", Progress Report.

¹²³ Demary, V., Engels, B., Rusche, C., 2020. Differentiated Treatment of Business Users by Online Platforms - An Analysis of Incentives with an In-Depth Look at App Stores and E-Commerce Platforms. Analytical Paper, p.22. Available at: https://platformobservatory.eu/app/uploads/2020/09/Analytical-Paper-2-Differentiated-treatment_final.pdf

CHAPTER 4

CASE STUDIES

- Vertical integration between hardware, software and services is pursued also in traditional industries such as car manufacturing. Car manufacturers are system integrators, i.e. controllers of a “technology platform” onto which several modules (produced either in-house or outsourced) are integrated in the interest of a successful user (driver) experience. Nowadays, car manufacturers face the challenge to integrate vehicle hardware and software so as to improve safety, efficiency and ultimately consumer value (the overall car “user experience”)
- Apple’s in-house design of its own processors enables vertical integration between hardware and software. The customised hardware is designed and optimised so as to operate seamlessly with Apple’s OSs. The integration between silicon and software also allowed the creation of new functionalities such as Touch ID, Face ID and new machine learning-powered apps.
- Vertical integration between hardware, software and services helps achieving several App Store features highly valued by Apple’s customers, in the user experience, performance of the device/hardware and enhanced security.

In the following section we present three case studies where we identify types of vertical integration efficiencies presented in the previous chapters. The cases also provide examples of hybrid vertical strategies with platform business models where the control of the platform is necessary to guarantee quality externalities over the value chain.

In the *first case*, we investigate vertical integration strategies in a more traditional industry: car manufacturing. We will see that the car manufacturing business has, for a long time, been involved make-or-buy decisions and the key players have evolved in their management of vertical integration and the governance of collaboration with suppliers. Here we present car manufacturers as systems integrators, i.e. controllers of a “technology platform” onto which several modules are integrated in the interest of a successful user (driver) experience. This includes decisions to produce in house vs. buy from suppliers both key and peripheral mechanic and electronic components (i.e. steering mechanism, brake system, engine, powertrain, batteries) – and the economic reasons underpinning this choice. We start by focusing on the “hardware”, then we also introduce software and service/digital aspects emerging in car manufacturers’ further vertical integration strategies.

In the *second case*, we move to digital industries and focus on the vertical integration of hardware and software. An exemplary case is the strategy pursued by Apple in investing in the assets and capabilities needed to design its own processors for smartphones and other electronic devices. This vertical integration strategy presents elements of innovation and risk taking. In the case we test the extent of efficiencies and consumer benefits consistent with academic research on vertical integration. The customised hardware components have been designed and optimised to operate seamlessly with Apple’ OSs. The integration between silicon and software also allowed the creation of new functionalities such as Touch ID, Face ID, and now applications based on machine-learning with the Neural Engine processor.

Finally, the *third case* presents the paradigmatic choices in governing a marketplace such as Apple's App Store – i.e. a platform connecting consumers with businesses providing apps that use the platform's infrastructure. Here – building also on the role of the user experience and hardware/software/service integration from previous cases – we will set out and analyse the key elements that characterise the Apple's App store (including its tightly-knit closed system). We note that different consumer segments have heterogeneous preferences and face trade-offs that are met using different business strategies undertaken by app store providers. We will test the extent to which the App Store business strategy is consistent with findings in the scholarly literature (and wider business strategies) on how vertical integration and governance can be used to foster efficiencies and ultimately value-added for end consumers.

4.1 CAR MANUFACTURING: OEMS AS SYSTEMS INTEGRATORS

The automotive industry is a key sector in Europe and other major economies. Vehicles are composed by more than 20,000 components sourced from thousands of different suppliers through a complex global supply chain¹²⁴. Generally, the supply chain develops around Original Equipment Manufacturers (OEMs), such as Toyota, Volkswagen and FCA, which design, develop and assemble the vehicles delivered to the dealers.

As consumers demand increasingly personalised and experiential goods, there has been a move from mass manufacturing to mass customization. Against this backdrop, car manufacturers (OEMs) have taken the role of systems integrators i.e. controllers of a “technology platform” onto which several modules are integrated in the interest of a successful user (driver) experience.

We now test for the efficiencies described in chapter 2 and 3 to this particular case, according to economic literature. Our case analysis shows that OEMs can benefit from efficiencies related to vertical integration (see Table 7 at the end of the case), such as:

- Appropriability of quality externalities;
- Firm-specific capabilities; and
- Economies of scope.

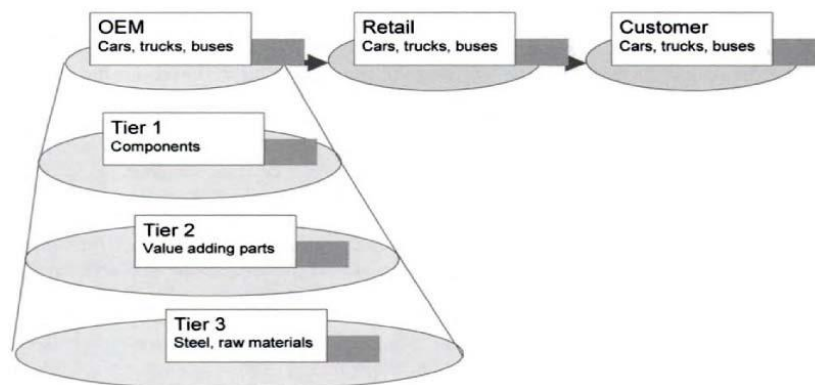
Appropriability of quality externalities and firm's specific capabilities

This product modularisation allows the design and production of more models while containing overall costs and improving efficiencies. Car manufacturers decide which tasks and core and peripheral components (modules) to produce in-house. These are related to key components that are not readily available and/or replaceable in the market and that differentiate the vehicle. In fact, OEMs usually keep critical functions in-house, such as the design of the body structure, which has a

¹²⁴ Kern, J. and Wolff, P., 2019. The digital transformation of the automotive supply chain—an empirical analysis with evidence from Germany and China: Case study contribution to the OECD TIP Digital and Open Innovation project.

unique brand function, and the assembly of the vehicle with the quality testing ¹²⁵. This is linked with integration efficiencies derived from the firm's unique capabilities and quality externalities. The value chain put in place to supply OEMs can be seen as a pyramid with different Tiers of suppliers, see Figure 5.

Figure 5
Basic structure of the automotive industry



Note: Original Equipment Manufacturers (OEM) are cars manufacturers such as Toyota, Volkswagen, Fiat etc.
Source: Heneric O et al. 2005. Europe's automotive industry on the move: Competitiveness in a changing world, Germany, Physica-Verlag Heidelberg.

Tier 1 suppliers like Bosch or Continental, manufacture entire technical units/modules such as airbags, tyres, glass, exhaust systems, replace brake linings¹²⁶ that are delivered directly to OEMs. Because of that, Tier 1 works closely together with OEMs. They undertake several collaborative initiatives and joint innovation efforts, e.g. joint ventures, although Tier 1 does not usually serve only one OEM. Tier 2 suppliers (also SMEs) provide individual components in the sub-assembly phase of Tier 1's modules, while Tier 3 usually supplies the raw material.

While overall suppliers may contribute to around 75% of a vehicle's components and technologies, OEMs keep the overall control of the technological trajectory of the vehicle seen as platform. This gives OEMs, as system integrators, a unique responsibility and a lead role. For that they must possess knowledge of the entire system. Additionally, the industry is going through multiple disruptive trends, i.e. autonomous driving, digitalization, mobility as a service and electrification, which requires car manufacturers to rethink of their role as hardware, software and service players.

Leveraging economies of scope

Car performance is increasingly becoming software driven. Most hardware components now contain some lines of software codes, while key differentiating features such as Advanced Driver-Assistance Systems (ADAS) are heavily based on software. Car manufacturers face the challenge to integrate a vehicle's hardware and software to improve safety, efficiency and, generally, consumer

¹²⁵ Chew E, April 2004. Automakers rely on suppliers for more key parts, available at <https://www.autonews.com/article/20040405/SUB/404050827/automakers-rely-on-suppliers-for-more-key-parts>

¹²⁶ European Commission, 2012. Ex-Post Evaluation and Impact Assessment Study on Enhancing the Implementation of the Internal Market Legislation Relating to Motor Vehicles. Annexes to Evaluation and Impact Assessment Reports.

value. Currently, the software layer is pretty fragmented: separate hardware modules or subsystems have their own software developed either by OEMs or Tier 1 suppliers (which are manufactured the hardware) often using different coding languages, OS and software architectures.¹²⁷ For example, ADAS installed some new luxury cars with demand real-time interactions between cameras, power-train sensors, and chassis actuators—three separate systems with their own software. OEMs may face the challenge to create an “end-to-end” platform to control the interface and connect all of the vehicle subsystems’ software. While, outside players, e.g. software companies, may possess specific competitive advantages, OEMs remain the ones that provide the hardware platform on which software solutions should be integrated and thus can leverage important economies of scope and complementarities.

Finally, car manufacturers have started to integrate downstream from manufacturing into mobility services by offering car and ride sharing services in several big cities¹²⁸. Daimler was the first OEM to launch its care sharing operations (Car2Go) already in 2009 and since then it has been followed by other OEMs which set up their own “mobile division”. Daimler also entered into a joint venture with BMW’s DriveNow in 2019. These types of services are competing in the digital sector with ride hailing online platforms such as Uber, Lyft, etc.

Integrated car manufacturers could also benefit from economies of scope derived from the excessive capacity of the main input (cars) and specific knowledge on car usability etc. for the optimal fleet management. The software that powers these platforms as well as the data collected through the rides may be leveraged by OEMs across the value chain and for further developments, e.g. self-driving cars.

We note, however, that more recently OEMs have reconsidered their involvement in mobility services and downsized their operations (Daimler and BMW have withdrawn their service from several cities) as they struggled to make the activity profitable.

¹²⁷ McKinsey, January 2020. The case for an end-to-end automotive-software platform. Available at: <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-case-for-an-end-to-end-automotive-software-platform>

¹²⁸ Medium, April 2018. Vertical Integration Among Carmakers and Mobility Services. Available at: <https://medium.com/@mamblard75/vertical-integration-among-carmakers-and-mobility-services-ee809fe8595a>

Table 7
Vertical efficiencies from car manufacturers as systems integrators

TYPE OF EFFICIENCY	RELEVANCE TO THE CASE
Elimination of double mark-ups	
Quality externalities	√
Elimination of inefficient input substitution	
Support emerging markets	
Price discrimination	
Transaction costs and hold-up problems	
Economies of scope	√
Firm's capabilities	√

Source: Copenhagen Economics

4.2 APPLE'S INVESTMENT TO DESIGN OWN PROCESSORS

Since 2008, Apple has increasingly designed more and more of the processors that power its devices (which is a different activity from the actual manufacturing of the chip). This enables further integration between Apple's hardware and software. It further allows Apple to own the technology that is inside its devices without being dependent on components devised by other firms – thus entering the space previously covered by firms such as Samsung, (which incidentally provided the processor design for Apple's first iPhone) or other chip makers (Intel is still designing Mac processors for the moment but it will soon stop). This entry into new layers of the digital value chain reflects strategic investments in assets (both tangible and intangible, i.e. know how) that make these business activities more contestable.

As discussed in chapter 2 and 3, according to economic literature, vertical integration can be motivated by potential efficiencies. In the present case, the rationales for vertical integration can include (see Table 8 at the end of the case):

- Elimination of double mark-up;
- Quality externalities;
- Transaction costs and hold up problem; and
- Economies of scope

Elimination of double marginalization

Concerning elimination of double mark-up, by designing its own processors Apple is able to reduce component costs¹²⁹ and avoid paying the margins charged in a concentrated industry such as semiconductor.

Appropriability of quality externalities

¹²⁹ Bloomberg, January 2018. How Apple Built a Chip Powerhouse to Threaten Qualcomm and Intel. Available at: <https://www.bloomberg.com/graphics/2018-apple-custom-chips/>

Concerning quality externalities, the customised hardware components have been designed and optimised for the creation of new functionalities such as Touch ID, Face ID, customise wireless pairing and new applications based on machine-learning with the Neural Engine processor. Those functionalities may generate positive externalities along the value chain as Apple and app developers can create new applications and develop complementary services around the new functionalities which increase the value and quality delivered to consumers.

Solving the hold-up problem and transaction costs

Concerning transaction costs and hold up problems, the development of next generation processors requires sizable costs and investments in specific know-how that suppliers may not have incentives or resources to undertake in at a specific time. The development and launch of new products may risk being delayed for the lack of performing components. By designing its own chips, Apple can control the technological trajectory of innovation and new functionalities as it controls the research and development. A concrete example is provided below with the Apple shift away from Intel processors for its Macs.

Leveraging economies of scope

Concerning economies of scope, the development of the hardware is done in close integration with Apple' software to guarantee seamless function at high performance levels. This tightly knit development process benefits also from the large data derived from the device and the software that Apple can use to improve its devices. A good example of successful integration of silicon and software is the Apple Watch³⁰.

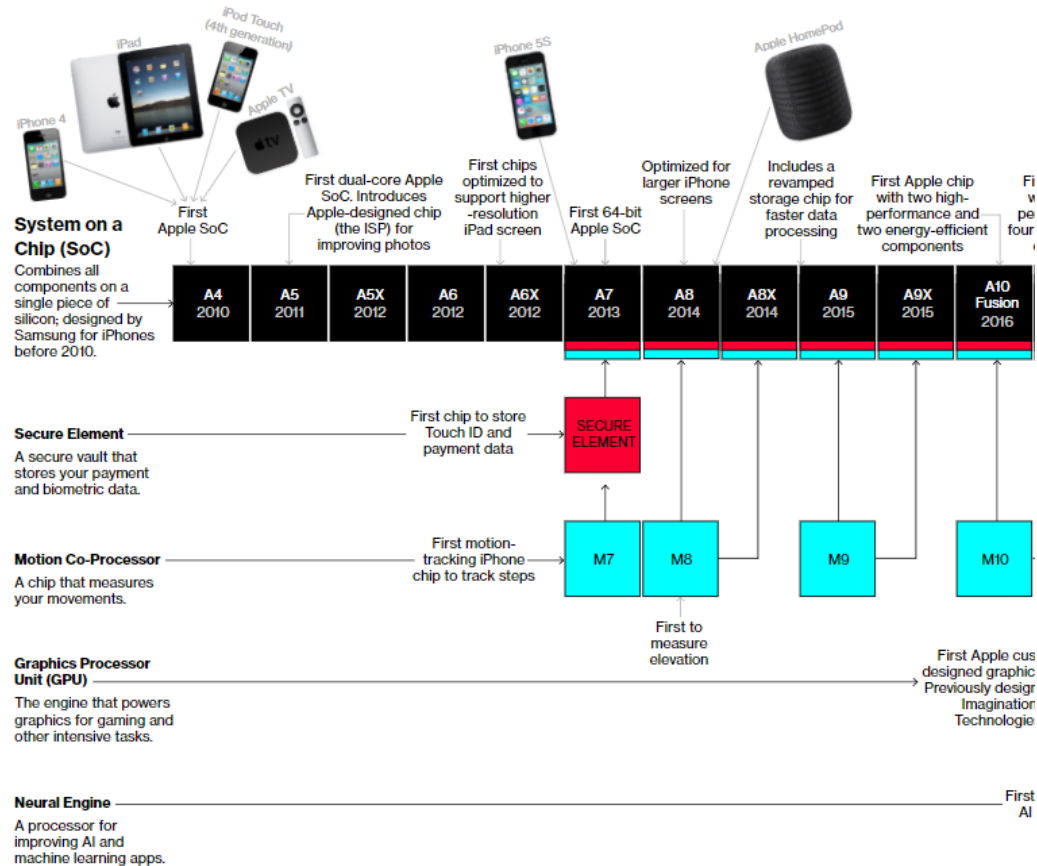
Apple processors, marked as Apple Silicon, are Systems-on-a-Chip (SoC) and Systems-in-a-package (SiP) based on ARM architecture. SoC incorporates in one integrated circuit (IC) various computer components, e.g. Central Processing Unit (CPU), Graphic Processing Unit (GPU), system memory (RAM) etc. SiP has multiple of those integrated circuits stacked one on top of one another which makes it more contained and suitable for Apple watch devices. SoC and SiP consume less battery, require less space and are more reliable than multi-chip systems. ARM is a UK company that licenses out the architecture of this type of processors. Currently, most mobile devices used throughout the world function with processors based on ARM architecture.

The first Apple processor (SoC) completely designed in-house, the A4, appeared on the market in 2010 with the launch of the first iPad.³¹ Since then, Apple has introduced 18 versions of the A series (the ones used on iPhones and iPad), see Figure 6, until 2018. Apple has developed other 5 series (A, S, T, W, H, U) that serve different functionalities and/or devices: series S, for example, are the processors for the iWatch, while series W are processors focusing on wireless and Bluetooth connectivity (e.g. AirPods). The series T processors power the TouchID function and processed fingerprint authentication.

³⁰ Verge, October 29. Buying Fitbit won't help Google overcome Apple's biggest smartwatch advantage. Available at: <https://www.theverge.com/2019/10/29/20937257/google-fitbit-wear-os-qualcomm-processors-fitness-strategy-acquisition>

³¹ Ibid 129

Figure 6
Apple's most important mobile chip devices until 2018



Source: Bloomberg, January 2018. "How Apple Built a Chip Powerhouse to Threaten Qualcomm and Intel".

Recently, Apple announced that it will also design in-house processors for the Macs, which was the only product line still relying on Intel chips. One of the reasons stated by the company is the better battery performance from ARM architecture³². Furthermore, Intel's repeated delays in launching next generation chips could also be a reason for the shift to in-house processors. Experts also evidenced the high occurrence of bugs and the poor-quality assurance provided by Intel³³. Again, these two last points could be interpreted as transaction costs and hold-up problems which could be overcome through a vertical integration strategy.

Finally, integration between hardware, software and services will be further enhanced by the in-house design of Mac's chips, as all applications developed for iPhone, iPad etc. will be able to

³² Intel had another delay in the manufacturing of 10-nanometer chips in 2018. Source: Haselton T., July 2020. Intel's latest delay shows exactly why Apple was right to ditch the company and make its own chips, available at <https://www.cnbc.com/2020/07/24/intel-chip-delay-shows-exactly-why-apple-is-right-to-move-to-arm.html>

³³ Blake A., June 2020. Former Intel engineer reveals the truth about the Mac's switch to Apple Silicon, available at <https://www.digitaltrends.com/computing/former-intel-engineer-reveals-why-apple-switched-apple-silicon/>

function also on a Mac without needing to adapt to the different processors (initially Apple will provide a program, Rosetta 2, for the conversion)¹³⁴.

Table 8
Vertical efficiencies from vertical integration of processors

TYPE OF EFFICIENCY	RELEVANCE TO THE CASE
Elimination of double mark-ups	√
Quality externalities	√
Elimination of inefficient input substitution	
Support emerging markets	√
Price discrimination	
Transaction costs and hold-up problems	√
Economies of scope	√
Firm's capabilities	√

Source: Copenhagen Economics

4.3 MARKETPLACE GOVERNANCE: APPLE'S APP STORE

In 2008, one year after the launch of the first iPhone, Apple – while persisting in a vertically integrated strategy – chose to hybridise by seeking and distributing third-party developers that would create their own apps for iOS, introducing Software Development Kits (SDKs) and thus creating an innovation platform around iOS.¹³⁵

This approach is unlike what was previously established for both feature-phones and internet-enabled phones. These severely limited the possibility for mobile users to choose their favourite software/applications and – the reverse side of the coin – for software developers to be able to vie for the end user's business.

Consumer choice ("there's an app for that") and competition between software providers followed. Today as smartphone consumers (on any OS), we take for granted the ability to discover, download and update those apps. In the case of iOS the range of apps available also includes Apple's first party apps – which are all accessible via the Apple's App Store, functioning as a distribution platform. For this reason, we can deem the App Store to be a dual-role platform since Apple is vertically integrated with its own applications (e.g. iCloud, Apple Books, Apple Music etc.). The App Store is the only app store present on Apple devices and comes pre-installed.

¹³⁴ Apple, June 2020. Apple announces Mac transition to Apple silicon, Press Release, available at <https://www.apple.com/newsroom/2020/06/apple-announces-mac-transition-to-apple-silicon/>

¹³⁵ Initially, Apple thought third party developers would offer their services and products through web-based apps.

Consistent with the theoretical concept of hybrid vertical integration strategies, the development of the App Store represents a vertical integration strategy of Apple into services which created an entire new market. The expansion of the complementary services (apps) available on its devices enhanced the value to consumers. The size of the effect can be observed in more than 1.8 million apps reported on the App Store in 2020 (fewer than 60 are owned by Apple) from just 500 in 2008.¹³⁶ The Apple App Store must constantly compete to attract and retain developers. Other mobile application stores are present in the market with large market shares (considering all brands of devices), i.e. Google Play Store. Moreover, consumers can always access most services through the web.

The App Store allows third party developers to choose their business models and how apps are monetised. Applications can function as i) a distribution channel, i.e. sales of (physical) goods and services through the app like Amazon or Uber; ii) paid downloads (e.g. FaceTune), iii) subscription services (e.g. Netflix), iv) in-app purchases (IAP) (e.g. Candy Crush), v) in-app advertising (e.g. Waze), vi) Freemium services (e.g. Spotify) or as a mix of the above.¹³⁷ To support the risk-taking initiatives and reduce barrier to entry for developers, Apple asks an annual fee of 99 US dollar (independently of developer size). Apple also asks a commission of 30% for the sale of digital goods and services, typically download fees or In-App-Purchases. For subscriptions the commission is 30% for the first year and 15% for any subsequent years. In general, of all of the sales and billings supported by the Apple App Store in 2019, around 85% went solely to third-parties.¹³⁸

We now test for the efficiencies described in chapter 2 and 3 to this particular case, according to economic literature. By comparison, we find that the rationales for vertical integration in this context likely include:

- Appropriability of quality externalities;
- Solution of hold-up problem; and
- Firm-specific capabilities

Appropriability of quality externalities

Concerning the quality externalities, an integrated smartphone manufacturer, such as Apple, has a strong incentive to develop and maintain the most efficient and high-quality application store since that will ultimately affect the sales of its smartphones.

¹³⁶ Statista, October 2020. Number of apps available in leading app stores as of 3rd quarter 2020, available at <https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/> Statista:

¹³⁷ Deloitte, 2020. The App Economy in the EU in 2020, available at: <https://actonline.org/wp-content/uploads/Deloitte-The-App-Economy-in-the-EU-2020.pdf>

¹³⁸ Ibid, 95.

A predominantly product-funded business model that receives most of its revenues from its own devices (that support the platform) is better able to internalise the value brought by the platform to consumers by being able to set the price of its devices. This gives incentives to the product-founded firm to invest in improving the quality of its ecosystem at the platform level. This was also recognised by the Dutch Competition Authority (ACM) in its “Market study into mobile App Stores”: *“To be able to continue to charge its customers higher prices, it is essential for Apple to offer the best possible user experience. This can be achieved by ensuring that software and hardware connect seamlessly and offering developers easy-to-use tools so they can make apps that get the best out of the hardware.”*¹³⁹

Apple pursues this strategy on quality by focusing on maximising elements such as user experience, privacy and security which is reflected, among other things, in the design and governance of the App Store. Apple applies a strict review process on new apps to ensure the apps meet specific quality standards and provide value to consumers. Apple’s review guidelines specify the standards apps must meet in terms of quality, security and privacy. Those relate to allowed content (e.g. no pornographic content), functionality (e.g. battery consumption), originality (no copycats), no invasive ads-based apps, control on what apps can have access to in the device, and compliance with data protection and privacy law.

Approximately 100.000 new applications are submitted to the App Store every week worldwide.¹⁴⁰ The approval process is carried out through a combination of automatic and manual checks by the Apple team. Apple is considered to have a stricter review process compared to alternative stores.¹⁴¹ Also as a result of this strategy, Apple’s App Store was able to maintain a reputation of high security and privacy standards.¹⁴² Recent sector reports confirm that Apple is leading in terms of security and they “rarely host dangerous apps”.¹⁴³ According to a Nokia’s Threat Intelligence report of 2019, iPhones were only 0.85% of all mobile devices infected by malwares in 2018¹⁴⁴. Linking security and user experience, the developed Apple In-App Purchase system may be seen as improving Apple’s users experience on an Apple device. Users can easily make payment transactions on third party apps in a secure way thorough Apple Touch ID and/or Face ID without the need to insert e.g. credit cards details each time. This type of feature is consistent with the scholarly finding that vertical integration and governance arrangements, such as a closely integrated systems, can deliver efficiency and generate consumer value.

Different consumer segments have heterogeneous preferences and face trade-offs that are met using different business strategies undertaken by app store providers. While investments in quality and securities may generate efficiencies for vertically integrated companies, other strategies such as

¹³⁹ Authority for Consumers & Markets (ACM), 11 April 2019. ‘Market study into mobile app stores’, p.37. available at: <https://www.acm.nl/sites/default/files/documents/market-study-into-mobile-app-stores.pdf>,

¹⁴⁰ 46% in the case of consumers opting for an iOS phone vs 30% for those opting for an Android phone. Source: Ibid, 139.

¹⁴¹ Ibid, 123, p.29.

¹⁴² Brandom R., March 2019. Apple wants to be the only tech company you trust, available at <https://www.theverge.com/2019/3/26/18282158/apple-services-privacy-credit-card-tv-data-sharing>

¹⁴³ Softpedia, March 2020, Apple’s App Store is Fort Knox, Malware Apps in Google Play Store Going down, available at: <https://news.softpedia.com/news/apple-s-app-store-is-fort-knox-malware-apps-in-google-play-store-going-down-529345.shtml>

¹⁴⁴ Android accounted for 47% while Windows/PCs for 36% and others for the remaining 16%. Source: Nokia, 2019. Nokia Threat Intelligence Report -2019. Available at: <https://www.nokia.com/about-us/news/releases/2018/12/04/nokias-threat-intelligence-report-2019-warns-on-the-fast-growing-and-evolving-threat-of-malicious-software-targeting-internet-of-things-iot-devices/>

lower prices and wider user reach may be preferable for other companies based on different business models. A US survey finds that consumers that had chosen to switch from iOS to Android phones indicated price as an important driver. At the same time, of those consumers with experience with both OSs (switching iOS to Android or vice versa), a larger share of consumers indicating a preference for iOS phones stressed the role of user experience.¹⁴⁵

Solving the hold-up problem and transaction costs

Concerning transaction costs and hold-problems, control over the App Store also reduces the risk of hold-up problems for Apple. Apple must undertake sustained investments to maintain the App Store, integrate it with its software and hardware and develop the necessary technical tools for third-party developers to innovate and create on the iOS. By integrating, Apple is not dependent on, for instance, updates of the App Store guidelines or rules from other parties. This is supported by the Digital Methods Initiative of the University of Amsterdam¹⁴⁶ which showed that changes made by Apple to developers' policies happened closely in time with new releases of the iOS.

In turn, Apple's vertically integrated model allows general iOS updates to be delivered simultaneously to all Apple devices. This contrasts with the lag associated with the flow of system updates under looser ecosystem orchestration, as is the case with the Play Store and Android and the set of smartphone manufacturers that use Android.¹⁴⁷ Thus, these features demonstrate the types of efficiencies that can be generated by integration between hardware, software and services.

Firm-specific capabilities

Finally, concerning firm's capabilities, Apple's consistent ability to innovate and develop intuitive and reliable products and services may also justify the decision to vertically integrate the App Store on quality and efficiency grounds. By integrating this operation, developers can benefit from Apple's capabilities through the access of, for instance, simple coding language designed for iOS (Swift), dedicated testing tools for beta apps, etc. This helps creating applications with higher quality and better user experience which, thanks to numerous public APIs, are interoperable with Apple's more advanced hardware features, e.g. augmented reality. Apple's capabilities to provide value to consumers are also reflected in the higher profits per app that third-party developers gain on the App Store compared to other application stores¹⁴⁸.

¹⁴⁵ Griffith E., August 2018. Why Do People Switch Between Mobile Operating Systems? Available at <https://uk.pcmag.com/why-axis/117036/why-do-people-switch-between-mobile-operating-systems>

¹⁴⁶ Digital Methods Initiative (UvA) Winter School 2019, Part III: Store Policies and Developer Conditions, available at: <https://wiki.digitalmethods.net/Dmi/WinterSchool2019AppsStoriesPolicy>

¹⁴⁷ Bohn T., September 2019. Google can't fix the Android update problem, available at <https://www.theverge.com/2019/9/4/20847758/google-android-update-problem-pie-q-treble-mainline>

¹⁴⁸ Iqbal M., October 2020. App revenue statistics 2019, available at <https://www.businessofapps.com/data/app-revenues/>

Table 9
Vertical efficiencies from vertical integration of App Store

TYPE OF EFFICIENCY	RELEVANCE TO THE CASE
Elimination of double mark-ups	
Quality externalities	√
Elimination of inefficient input substitution	
Support emerging markets	
Price discrimination	
Transaction costs and hold-up problems	√
Economies of scope	
Firm's capabilities	√

Source: Copenhagen Economics

CHAPTER 5

CONCLUDING REMARKS

Firms are constrained more and more by fierce competition arising from unexpected directions and in order to survive they have to be creative and reinvent themselves to different degrees.

One way for firms to do that is to seek efficiencies by integrating vertically, both upstream (entering their input markets) or downstream (entering their client markets) in the value chain. Firms can also enter adjacent markets which can complement their core products or services.

Policy-design should be fully aware of the functioning of dynamic markets, which often see vertical integration strategies involving investments and new competition at different steps of value chains. The benefits of vertical integration are well acknowledged by the economic theory, such as:

- By combining or developing complementary assets, firms can serve consumers more efficiently using product quality (e.g. higher user experience, security, privacy) as crucial differentiator in their business models.
- Knowledge-based economies and efficiencies rely on sustained innovation spanning across multiple steps of the value chain, which enables innovative firms to enter into new markets.

Theoretical literature analyses both the pro-competitive as well as the potential anti-competitive aspects of vertical integration. As is demonstrated in the theory and practice of competition economics, vertical integration strategies are associated not just with harm to competition but also with efficiency and consumer benefits. In fact, these positive aspects are routinely considered and evaluated by competition and regulatory authorities in cases involving markets and regulatory design. Researchers' ex-post evaluations have found a degree of support for vertical mergers and acquisitions to be favourable in terms of their market and consumer outcomes, due to these efficiencies. As highlighted by the OECD (2019), quoting the Lafontaine & Slade (2007) survey study, "*evidence on the consequences of vertical mergers suggests that consumers mostly benefit from mergers*" – a finding confirmed reviewing empirical studies published after 2008. That notwithstanding, in competition enforcement, the merits of the facts and effects of conduct have to be considered in a case by case assessment.

A fortiori, vertical integration (which is not necessarily the result of M&A but can often follow new investments in own assets to promote entry and expansion) should be expected to be pursued by firms and to generate the same efficiencies and consumer value when considering digital / tech sectors. This is because these industries feature characteristics such as a) high complementarity between product components e.g. hardware and software, b) highly specific assets c) quality externalities across the value chain, d) economies of scope e) high technological uncertainty, f) crucial role of intangible assets and knowledge capabilities indicate that many of the conditions necessary for vertical integration to be efficiency enhancing are present.

At the same time, we observe that the level of integration varies substantially across firms in the digital sector as firms test strategies and bet on different ways to generate value and thus outcompete their rivals. Digital business models encompass generally different levels in the value chain.

Diversification and integration happen in many directions, to provide a better and more complete service to consumers. Any policy measures should not interfere with a level playing field and the firms' incentives and strategies whether to take risks and pursue different degrees and types of vertical integration, based on their competitive advantage and vision of where to generate customer value.

Vertically integrated firms may open-up one (or more) layers of their value chain by creating and managing platforms where other independent players can develop new services and functionalities that go together with the firm's products. A platform governance structure generates positive efficiencies in the presence of strong (cross-side) network effects – when the contribution of independent players to the platform attracts more consumers and vice-versa. Therefore, integrated firms may have incentives to open their value chain when those network externalities are present – in that case firms gain from attracting the greatest number of contributors to the platform.

Firms can benefit from striking the right degree of openness that allows new services to be created and offered on the platform (by attracting the best independent players in the highest number), while securing the well-functioning and quality of its products via setting the rules and monitoring mechanisms of the platform. The orchestrating function, which includes the responsibility to coordinate and manage access to the platform, is important to guarantee the well-functioning of the system. This is even more so for predominantly vertically integrated firms where the success of the platform layer impacts the investments and consumer value that integrated firms generate in the other parts of the value chain. Here, the incentive to ensure the creation of high-quality platforms is even stronger for integrated firms.

Moreover, if established platforms offer services (downstream) that compete directly with services provided by independent players, they could have the ability to (partially) foreclose their rivals. In competition economics, a full analysis of abuse of dominance requires appraising not only the ability but also the incentive to foreclose. The choice of business model, including – most importantly – the extent of pursuit of a vertically integrated strategy is a relevant factor to consider. The balance of incentives to foreclose is underpinned by a trade-off between collecting higher short-term revenues from one or few of their own downstream services vs. maximising the long-term platform success via user loyalty on both sides of the platform. A deeply vertically integrated business will have a lot at stake in the end-to-end success of its products, which can tilt the balance further away from foreclosure at any specific stage of the value chain (and why open it up in the first place?). As is often the case, policy makers analysing potential foreclosure concerning these markets benefit from a case by case approach, which – in order to appraise the full welfare effects of conduct – depend inter alia on the extent of vertical integration in the business activities.

Policy makers that consider regulation of one market must be aware that it may represent only one step in the value chain of certain integrated players. Policy makers should be aware of the well-established economic evidence on achievable benefits and business drivers of vertical integration so to avoid unintended effects of undue policy/regulatory interventions (do not throw the baby out with the bathwater). This can be the case for example when impact assessments of potential policy measures focus narrowly on one specific market and/or step in the value chain without considering spillover effects to the rest of the business activities and wider consumer and market outcomes.

More concretely, we can consider what are risks associated with policies targeting vertical integration in the tech sector. While policy evaluation is a case by case exercise and can only be done relative to specific, concrete rules identified, we can identify factors that can significantly affect the outcomes of regulations. By way of example, let us consider the case of vertically integrated device manufacturers and of rules tackling (i) app pre-installation, (ii) access of third-parties; and (iii) interoperability management.

We have analysed the key role of quality externalities (a failure to maximise quality in value chains, absent vertical integration) as a driver of economic efficiency via vertical integration.

By designing their own applications and ensuring pre-installation so that these standards are readily included in the device, they can promote quality on the convenience dimension – by offering and guaranteeing consumers a good level of experience and functionality from the device start-up moment.

Consumers may differ as to the value placed on convenience and when and how much to search for various functionalities and apps. Thus, a result of pre-installation is removing the need (not the possibility) for users to incur search costs to complement the device experience with other functionalities, which can be sought and tested at any later time – thus meeting consumer preferences for convenience. A vertically integrated firm's incentive to foster quality is reflected in the practice of designing and pre-installing own apps since this: a) makes consumers (and the vertically integrated firm) less dependent and subject to defects and flaws that might occur with other third parties' products – i.e. the hold-up inefficiency, b) raises competitive responses by 3rd party app providers, including over the quality dimension in apps, thus promote high quality levels in 3rd parties too.

Any blanket prohibition of such practices may reduce the efficiencies generated by quality improvement of the integrated player and may increase the risk of hold-up problems. They may undermine the incentives of vertically integrated firms to innovate and invest in downstream services that enhance the value of final products and thus consumer welfare – including via privacy and safety levels that respond to users' preferences.

Fostering quality and tapping into synergies (economies of scope) are crucial vertical integration efficiencies. Under platform models access to third-party services already take place as a result of commercial incentives to serve consumers, as discussed above. Instead, an obligation forcing uncontrolled access to third-parties' services, taken to the extreme, would allow the provision of third-parties' services without the vertically integrated firm having the option to impose any rules over it. Therefore, consumer value-enhancing economic incentives to foster quality and synergies may be put at risk by blanket rules mandating platform firms to completely open up their products/platforms only granting uncontrolled access to third-parties' services on their devices.

As found in this study, vertical integration in tech can unlock welfare-enhancing efficiencies via a carefully designed and managed interdependence across the different layers of hardware devices, software and services. Managing the above interdependence between value chain layers is a key path to the quality of the end user experience and thus to promote economic efficiency and consumer value. When vertical integration strategies include platform models, 3rd parties play a role in some of these layers (e.g. software) and can thus affect the extent of synergies between layers and their management. Therefore, any policies curtailing the vertically integrated firms' extent of

control of those hardware/software/services interdependencies risks impairing the overall quality of the user experience and thus undermining a major driver of economic efficiency via vertical integration.

Similar welfare concerns hold for rules forcing full interoperability and interconnection of own services and technical features with third parties' services. While incentives towards interoperability already exist, the management of interoperability and interconnection is a means to an end, i.e. the fostering of the overall value for the ecosystem. Any 3rd parties interconnecting to the vertically integrated platform generally have less at stake than the platform owner – making a balancing exercise of the risk of access difficult. Furthermore, accommodating solutions that allow full compatibility with all services may come at the expense of lower product performance and quality.

Thus, blanket rules forcing full interoperability may hamper the ability of vertically integrated firms to yield consumer value via tightly designed systems. In other words, regulation may curtail realising some of the benefits predicted in the literature on vertical integration, such as the efficiencies from economies of scope and complementarities. In the case of tech this includes the complementarities between hardware, software and services over integrated system design.

The above examples point at a clear risk. Regulation that harms efficient, consumer value-enhancing vertical integration practices will preclude or reduce incentives for firms to invest and benefit from economies of scope across the value chain. Dynamic efficiencies would therefore risk to be curtailed, thus placing at risk future innovation and consumer value, new markets and the creation of new layers in the value chain. These are some of the key benefits of digital transformation, which remains a key strategic and policy objective for our societies.

REFERENCES

- Acemoglu et al, 2005. Determinants of vertical integration: Finance, contracts, and regulation, *National Bureau of Economic Research*, p. 3, available at https://www.nber.org/system/files/working_papers/w11424/w11424.pdf
- Allen & Overy, 2019. Global Trends in Merger Control Enforcement, available at <https://www.allenoverly.com/en-gb/global/news-and-insights/global-trends-in-merger-control-enforcement>
- Analysis Group, 2019. How Large Is the Apple App Store Ecosystem? – a global perspective in 2019. Available at: <https://www.apple.com/newsroom/pdfs/app-store-study-2019.pdf>
- Apple, June 2020. Apple announces Mac transition to Apple silicon, Press Release, available at <https://www.apple.com/newsroom/2020/06/apple-announces-mac-transition-to-apple-silicon/>
- Armstrong, M., 2002. The Theory of Access Pricing and Interconnection, *Handbook of Telecommunication Economics Vol. 1*, pp. 297-386, available at https://mpira.ub.uni-muenchen.de/15608/1/MPRA_paper_15608.pdf
- Atalay, E. et al, 2014. Vertical Integration and Input Flows, *American Economic Review*, p. 1121, available at <https://www.jstor.org/stable/42920735?seq=1>
- Authority for Consumers & Markets (ACM), April 2019. 'Market study into mobile app stores', p.37, available at <https://www.acm.nl/sites/default/files/documents/market-study-into-mobile-app-stores.pdf>,
- Barret, B., July 2017. Adobe Finally Kills Flash Dead, available at <https://www.wired.com/story/adobe-finally-kills-flash-dead/>

- Beck, M. and Scott Morton, F.M., 2020. Evaluating the Evidence on Vertical Mergers, available at https://www.ftc.gov/system/files/attachments/798-draft-vertical-merger-guide-lines/beck_scott_morton_comments_on_draft_vertical_merger_guide_lines_022620.pdf
- Blake A., June 2020. Former Intel engineer reveals the truth about the Mac's switch to Apple Silicon, available at <https://www.digitaltrends.com/computing/former-intel-engineer-reveals-why-apple-switched-apple-silicon/>
- Bloomberg, January 2018. How Apple Built a Chip Powerhouse to Threaten Qualcomm and Intel, available at <https://www.bloomberg.com/graphics/2018-apple-custom-chips/>
- Bohn T., September 2019. Google can't fix the Android update problem, available at <https://www.theverge.com/2019/9/4/20847758/google-android-update-problem-pie-q-treble-mainline>
- Bourreau, M. & de Streel, A., 2019. Digital conglomerates and EU competition policy, p. 10, available at <http://www.crid.be/pdf/public/8377.pdf>
- Brandom R., March 2019. Apple wants to be the only tech company you trust, available at <https://www.theverge.com/2019/3/26/18282158/apple-services-privacy-credit-card-tv-data-sharing>
- Bresnahan, T. F. & Levin, J. D., 2012. Vertical Integration and Market Structure, *Stanford Institute for Economic Policy Research*, p. 29-30, available at <http://www.siepr.stanford.edu/RePEc/sip/11-010.pdf>
- Carlton, D. W and M. Waldman, 2002. The strategic use of tying to preserve and create market power in evolving industries. *The RAND Journal of Economics* 33(2): 194-220, available at <https://www.jstor.org/stable/3087430?seq=1>
- Chew E, April 2004. Automakers rely on suppliers for more key parts, available at <https://www.autonews.com/article/20040405/SUB/404050827/automakers-rely-on-suppliers-for-more-key-parts>

- Chipty, T., 2001. Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry, *The American Economic Review*, p. 428, 450, available at <https://www.jstor.org/stable/2677872?seq=1>
- Ciborra, Claudio, 1993. *Teams, Markets and Systems*, Cambridge University Press.
- Cohen, W.M. and Levinthal, D.A., 1990. Absorptive capacity: A new perspective on learning and innovation, *Administrative science quarterly*, p.128-152, available at <https://www.jstor.org/stable/2393553?seq=1>
- Crawford G. S. et al, 2018. The Welfare Effects of Vertical Integration in Multichannel Television Markets. *Econometrica*, p. 893-894, 938, available at <https://web.stanford.edu/~ayurukog/ECTA14031.pdf>
- Cusumano, M.A. and Gawer, A., April 2002. The elements of platform leadership. *MIT Sloan management review*, 43(3), p.51, available at <https://sloanreview.mit.edu/article/the-elements-of-platform-leadership/>
- De Corniere, A. and Taylor, G., 2019. A model of biased intermediation. *The RAND Journal of Economics*, 50(4), p.854-882, available at <https://onlinelibrary.wiley.com/doi/abs/10.1111/1756-2171.12298>
- Deloitte, 2020. The App Economy in the EU in 2020, available at <https://actonline.org/wp-content/uploads/Deloitte-The-App-Economy-in-the-EU-2020.pdf>
- Demary, V., Engels, B., Rusche, C., 2020. Differentiated Treatment of Business Users by Online Platforms - An Analysis of Incentives with an In-Depth Look at App Stores and E-Commerce Platforms. Analytical Paper, p.22, available at https://platformobservatory.eu/app/uploads/2020/09/Analytical-Paper-2-Differentiated-treatment_final.pdf
- Digital Methods Initiative (UvA) Winter School, 2019. Part III: Store Policies and Developer Conditions, available at <https://wiki.digitalmethods.net/Dmi/WinterSchool2019AppsStoresPolicy>

- Etro, F., 2020. Product selection in online marketplaces. Available at SSRN 3641307
- European Commission, 2012. Ex-Post Evaluation and Impact Assessment Study on Enhancing the Implementation of the Internal Market Legislation Relating to Motor Vehicles. Annexes to Evaluation and Impact Assessment Reports, available at <https://op.europa.eu/en/publication-detail/-/publication/35589d5b-c42f-4430-82dc-246e99f96ec7/language-en>
- European Commission, 2020. Evaluation of the Vertical Block Exemption Regulation. SWD(2020) 173, available at https://ec.europa.eu/competition/consultations/2018_vber/staff_working_document.pdf
- European Commission, 2020. Evaluation support study on the EU competition rules applicable to vertical agreements in the VBER and the Guidelines, available at: <https://ec.europa.eu/competition/publications/reports/kd0420219enn.pdf>
- European Commission, 2020. Expert Group for the Observatory on the Online Platform Economy, available at <https://ec.europa.eu/digital-single-market/en/expert-group-eu-observatory-online-platform-economy>
- European Commission's Press release, 12 May 2017. Mergers: Commission clears acquisition of Brocade by Broadcom, subject to conditions, available at https://ec.europa.eu/commission/presscorner/detail/en/IP_17_1309
- European Commission's Press release, 12 November 2019. Mergers: Commission clears Telia's acquisition of Bonnier Broadcasting, subject to conditions, available at https://ec.europa.eu/commission/presscorner/detail/en/IP_19_6271
- European Commission's Press release, 24 February 2015. Mergers: Commission clears Liberty Global's acquisition of controlling stake in De Vijver Media, subject to commitments, available at https://ec.europa.eu/commission/presscorner/detail/en/IP_15_4481
- Evans and Gawer, 2016. The Rise of the Platform Enterprise: A Global Survey, available at

https://www.thecge.net/app/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf

FCC's news, 18 January 2011. FCC GRANTS APPROVAL OF COMCAST-NBCU TRANSACTION, available at <https://www.fcc.gov/document/fcc-grants-approval-comcast-nbcu-transaction>

Global Antitrust Institute, 2018. Vertical Mergers, available at <https://gai.gmu.edu/wp-content/uploads/sites/27/2018/09/GAI-Comment-on-Vertical-Mergers.pdf>

Grant, R.M., 1996. Toward a knowledge-based theory of the firm. *Strategic management journal*, 17(S2), p.109-122, available at <https://www.jstor.org/stable/2486994?seq=1>

Griffith E., August 2018. Why Do People Switch Between Mobile Operating Systems? Available at <https://uk.pcmag.com/why-axis/117036/why-do-people-switch-between-mobile-operating-systems>

Hagiu, A. and Wright, J., 2014. Marketplace or reseller? *Management Science*, 61(1), p.184-203, available at https://dash.harvard.edu/bitstream/handle/1/14358172/hagiu_wright_marketplace-or-reseller.pdf?sequence=1

Hagiu, A., Teh, T.H. and Wright, J., 2020. Should Amazon be allowed to sell on its own marketplace? Available at https://pro-file.nus.edu.sg/fass/ecsikdw/hagiu_teh_wright_may2020.pdf

Hart and Moore, 1988. Incomplete Contracts and Renegotiation, *Econometrica*, 56(4), p.755-785, available at <https://www.jstor.org/stable/1912698?seq=1>

Haselton T., July 2020. Intel's latest delay shows exactly why Apple was right to ditch the company and make its own chips, available at <https://www.cnbc.com/2020/07/24/intel-chip-delay-shows-exactly-why-apple-is-right-to-move-to-arm.html>

Heneric O et al. 2005. Europe's automotive industry on the move: Competitiveness in a changing world, Germany, *Physica-Verlag Heidelberg*.

- Hernández, H., Grassano, N., Tübke, A., Amoroso, S., Csefalvay, Z., and Gkotsis, P.: The 2019 EU Industrial R&D Investment Scoreboard, available at <https://iri.jrc.ec.europa.eu/sites/default/files/2020-04/EU%20RD%20Scoreboard%202019%20FINAL%20online.pdf>
- ICN & CMA, 2018. ICN Vertical Mergers Survey Result, para 60, available at https://www.international-competitionnetwork.org/wp-content/uploads/2018/10/MWG_SurveyreportVerticalMergers2018.pdf
- Investopedia, March 2020. Apple's 5 Most Profitable Lines of Business, available at <https://www.investopedia.com/apple-s-5-most-profitable-lines-of-business-4684130>
- Iqbal M., October 2020. App revenue statistics 2019, available at <https://www.businessofapps.com/data/app-revenues/>
- Joskow, P. L., 2006. Vertical Integration. *Issues in Competition Law and Policy*, p. 20.
- Jullien, B. and Sand-Zantman, W., 2020. The economics of platforms: A theory guide for competition policy. *TSE Digital Center Policy Papers series, (1)*, available <https://www.econstor.eu/handle/10419/223535?locale=en>
- Kaplan, S., Schenkel, A., von Krogh, G. & Weber, C, 2001. Knowledge-Based Theories of the Firm in Strategic Management: A Review and Extension, *Academy of Management Review*, p. 13, available at https://www.academia.edu/21579523/Knowledge_Based_Theories_of_the_Firm_In_Strategic_Management_a_Review_and_Extension
- Kern, J. and Wolff, P., 2019. The digital transformation of the automotive supply chain—an empirical analysis with evidence from Germany and China: Case study contribution to the OECD TIP Digital and Open Innovation project, available at https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/system/files/imce/AutomotiveSupplyChain_GermanyChina_TIPDigitalCaseStudy2019_1/index.pdf

- Ketokivi and Mahoney, 2017. Transaction Cost Economics as a Theory of the Firm, Management, and Governance, *Oxford Research Encyclopedia of Business and Management*, p.7, available at <https://oxfordre.com/business/view/10.1093/acrefore/9780190224851.001.0001/acrefore-9780190224851-e-6>
- Krämer, J. and Schnurr, D., 2018. Is there a need for platform neutrality regulation in the EU? *Telecommunications Policy*, 42(7), p.514-529, available at <https://ideas.repec.org/a/eee/tel-pol/v42y2018i7p514-529.html>
- Lafontaine, F. and M. Slade 2007. Vertical Integration and Firm Boundaries: The Evidence. *Journal of Economic Literature*, Vol. 45/3, p. 629-685, available at [http://masonlec.org/site/rte_uploads/files/Masten_Lafontaine-Slade_JEL_2007\(1\).pdf](http://masonlec.org/site/rte_uploads/files/Masten_Lafontaine-Slade_JEL_2007(1).pdf)
- Luenendonk M., February 2018. The Apple product design, available at <https://www.cleverism.com/apple-product-design/>
- McKinsey, January 2020. The case for an end-to-end automotive-software platform, available at <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-case-for-an-end-to-end-automotive-software-platform>
- Medium, April 2018. Vertical Integration Among Car-makers and Mobility Services, available at <https://medium.com/@mamblard75/vertical-integration-among-carmakers-and-mobility-services-ee809fe8595a>
- Mirakl.com, available at <https://www.mirakl.com/>
- Nokia, 2019. Nokia Threat Intelligence Report -2019, available at <https://www.nokia.com/about-us/news/releases/2018/12/04/nokias-threat-intelligence-report-2019-warns-on-the-fast-growing-and-evolving-threat-of-malicious-software-targeting-internet-of-things-iot-devices/>
- O'Brien, D.,2008. The Antitrust Treatment of Vertical Restraints: Beyond the Possibility Theorems, *Pros and Cons of Vertical Restraints*, available at

https://www.researchgate.net/publication/241686512_The_Antitrust_Treatment_of_Vertical_Restraints_Beyond_the_Possibility_Theorems

OECD (2019) Vertical Mergers in the Technology, Media and Telecom Sector, p. 31, available at [https://one.oecd.org/document/DAF/COMP\(2019\)5/en/pdf](https://one.oecd.org/document/DAF/COMP(2019)5/en/pdf)

OECD, 2014. The digital economy, new business models and key features. Addressing the Tax Challenges of the Digital Economy. *OECD Publishing*, available at <https://doi.org/10.1787/9789264218789-7-en>.

OECD, 2016. Price Discrimination, p. 9, available at [https://one.oecd.org/document/DAF/COMP\(2016\)15/en/pdf](https://one.oecd.org/document/DAF/COMP(2016)15/en/pdf)

Oracle.com, available at <https://www.oracle.com/sun/>

Ordover, J.A., Saloner, G. and Salop, S.C., 1990. Equilibrium vertical foreclosure. *The American Economic Review*, p.127-142, available at <https://www.jstor.org/stable/2696356?seq=1>

Osterloh, M. & Frey B. S., 1999. Motivation, Knowledge Transfer, and Organizational Forms, *Organization Science*, p. 546-547, available at http://www.econ.uzh.ch/static/wp_iew/iewwp027.pdf

Penrose, E. T., 1959. The Theory of the Growth of the Firm, *Journal of management*, 17(1), p.97-211, available at https://www.researchgate.net/publication/301774842_Penrose's_The_Theory_of_the_Growth_of_the_Firm_An_Example_of_Engaged_Scholarship

Perry, Martin K. 1989. Vertical Integration, *Handbook of Industrial Organization*. Ed. Richard Schmalensee and Robert Willig, Amsterdam: North Holland.

Popa B., March 2020. Apple's App Store Is Fort Knox, Malware Apps in Google Play Store Going Down, available at <https://news.softpedia.com/news/apple-s-app-store-is-fort-knox-malware-apps-in-google-play-store-going-down-529345.shtml>

- Rey, P. and J. Tirole, 2006. A Primer on Foreclosure, *Handbook of Industrial Organization Vol. 3*, Chapter 33, p. 2145-2220, available at <http://idei.fr/sites/default/files/medias/doc/by/tirole/primer.pdf>
- Rochet and Tirole, 2003. Platform Competition in Two-Sided Markets, *Journal of the European Economic Association*, available at <https://www.jstor.org/stable/40005175?seq=1>
- Salop, S.C. and Culley, D.P., 2016. Revising the US vertical merger guidelines: policy issues and an interim guide for practitioners, *Journal of Antitrust Enforcement*, 4(1), p.1-41, available at <https://scholarship.law.georgetown.edu/facpub/1530/>
- Salop, S.C. and Culley, D.P., 2018. Vertical Merger Enforcement Actions: 1994-July 2018, available at <https://scholarship.law.georgetown.edu/facpub/2002/>
- Sanchez, R. & Mahoney, J. T., 1996. Modularity, Flexibility and Knowledge Management in Product and Organization Design, *Strategic Management Journal*, p. 67, available at [https://josephmahoney.web.illinois.edu/BA545_Fall%202019/Sanchez%20and%20Mahoney%20\(1996\).pdf](https://josephmahoney.web.illinois.edu/BA545_Fall%202019/Sanchez%20and%20Mahoney%20(1996).pdf)
- Schwarz M., Takhteyev Y., August 2008. Open Source and Economics: How the Hold Up Problem Explains the Flash Wars, available at <https://gi-gaom.com/2010/08/08/open-source-and-economics-how-the-hold-up-problem-explains-the-flash-wars/>
- Siemens, 2020. Digital Marketplace, Get access to a curated and growing portfolio of digital solutions to digitalize healthcare, available at: <https://www.siemens-healthineers.com/fr-be/digital-health-solutions/digital-solutions-overview/partner-solutions/digital-marketplace-partner-applications>
- Slade, M.E., 2020. Vertical Mergers: A Survey of Ex Post Evidence and Ex Ante Evaluation Methods, available at https://econ2017.sites.olt.ubc.ca/files/2020/02/pdf_paper_Slade-Margaret_Vertical_Mergers.pdf

- Statista, 2020. Facebook's annual revenue from 2009 to 2019, available at <https://www.statista.com/statistics/268604/annual-revenue-of-facebook/#:~:text=In%202019%2C%20Facebook's%20revenue%20amounted,of%20income%20is%20digital%20advertising>
- Statista, October 2020. Number of apps available in leading app stores as of 3rd quarter 2020, available at <https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/>
- Stigler, 1951. The Division of Labor is Limited by the Extent of the Market, *The Journal of Political Economy*, p. 188, available at <https://www.sfu.ca/~allen/stigler.pdf>
- Suzuki, A., 2009. Market foreclosure and vertical merger: A case study of the vertical merger between Turner Broadcasting and Time Warner, *International Journal of Industrial Organization*, p. 533, available at <https://www.sciencedirect.com/science/article/abs/pii/S0167718708001410>
- Tech Crunch, December 2019. Facebook is building an operating system so it can ditch Android, available at <https://techcrunch.com/2019/12/19/facebook-operating-system/#:~:text=Facebook%20doesn't%20want%20its,on%20its%20Android%20operating%20system>
- Teece, D.J., 1980. Economies of scope and the scope of the enterprise. *Journal of economic behavior & organization*, 1(3), p.223-247, available at <https://www.sciencedirect.com/science/article/abs/pii/0167268180900025>
- Teece, D.J., 1986. Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy, *Research Policy*, p. 285-305, available at http://www.politicipublice.ro/uploads/technological_innovation.pdf
- Teece, D.J., 2018. Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy*, 47(8), available at <https://daneshyari.com/article/preview/7384252.pdf>

- TelecomTV, December 2016. Vodafone's strategy for IoT in key vertical markets. Available at: <https://www.telecomtv.com/content/iot/vodafone-strategy-for-iot-in-key-vertical-markets-14232/>
- Tirole, J. and Jean, T., 1994. The theory of industrial organization, p. 179-180, available at <http://www.library.fa.ru/files/Tirole-Theory.pdf>
- Turow, J., 2017. The aisles have eyes: How retailers track your shopping, strip your privacy, and define your power. Yale University Press, available at <https://script-ed.org/article/the-aisles-have-eyes-how-retailers-track-your-shopping-strip-your-privacy-and-define-your-power/>
- U.S. Department of Justice Press Release, 30 June 2020. "Department of Justice and Federal Trade Commission Issue New Vertical Merger Guidelines". Available at, <https://www.justice.gov/opa/pr/department-justice-and-federal-trade-commission-issue-new-vertical-merger-guidelines#:~:text=A%20primary%20goal%20of%20the,competitive%20impact%20on%20the%20marketplace>
- United States Securities and Exchange Commission, 2019. Google Form 10-K, available at https://abc.xyz/investor/static/pdf/20200204_alpha_10K.pdf?cache=cdd6dbf
- Verge, October 29. Buying Fitbit won't help Google overcome Apple's biggest smartwatch advantage, available at <https://www.theverge.com/2019/10/29/20937257/google-fitbit-wear-os-qualcomm-processors-fitness-strategy-acquisition>
- Wen, W. and Zhu, F., 2019. Threat of platform-owner entry and complementor responses: Evidence from the mobile app market. *Strategic Management Journal*, 40(9), pp.1336-1367, available at http://www.fengzhu.info/entry_threat.pdf
- Wong-Ervin, K. 2019. Antitrust Analysis of Vertical Mergers: Recent Developments and Economic Teachings, *ABA Antitrust Source*, available at <https://awards.conferences.com/IMG/pdf/wong->

[erwin_vertical_mergers_article_fi-
nal.pdf?46818/b56292701c1be5f37a135f45751e24
2f81b2c583](https://onlinelibrary.wiley.com/doi/abs/10.1002/smi.3191)

Zhang, Y., Li, J. and Tong, T.W., 2018. Platform govern-
ance matters: How platform gatekeeping affects
knowledge sharing among complementors. *Strat-
egic Management Journal*, available at
[https://onlineli-
brary.wiley.com/doi/abs/10.1002/smi.3191](https://onlinelibrary.wiley.com/doi/abs/10.1002/smi.3191)

Zhu, F. and Liu, Q., 2018. Competing with comple-
mentors: An empirical look at Amazon.com. *Strat-
egic management journal*, 39(10), pp.2618-2642,
available at [https://onlineli-
brary.wiley.com/doi/abs/10.1002/smi.2932](https://onlinelibrary.wiley.com/doi/abs/10.1002/smi.2932)

ABOUT COPENHAGEN ECONOMICS

Copenhagen Economics is a specialised economics consultancy and leader in the Nordic region. Our economists provide advice and analyses in the fields of competition, regulation, international trade and impact assessment.

We solve complex problems for private- and public-sector clients in the areas of:



We provide hard facts and clear stories, enabling our clients and their stakeholders to make superior decisions based on sound analysis.

We advise companies, authorities and policy makers when market meets regulation and conflicts arise. We help our private sector clients handle conflict cases and guide them on how to prosper through regulatory management. We help our public sector clients evaluate and devise new regulation. We support the judiciary process as court-appointed or party-appointed experts.

In particular, in the area of digital economy, our company has worked on a broad set of research questions of socio-economic importance for a range of public authorities, industry associations, as well as firms across the digital space – starting with a seminal contribution on the value of the EU Digital Single Market nearly a decade ago.

Founded in 2000, the firm is based in offices in Brussels, Copenhagen, Helsinki and Stockholm and

- is independent and partner-owned
- counts more than 90 employees, mostly with Ph.D. or M.Sc. in Economics
- includes economists from various nationalities / languages: Danish, Dutch, English, Finnish, French, German, Hungarian, Italian, Lithuanian, Norwegian, Portuguese, Romanian, Spanish, Swedish
- and operates across the world.

Global Competition Review (CGR) lists Copenhagen Economics as one of the top 20 economic consultancies in the world.

www.copenhageneconomics.com