Mandated interoperability in digital markets

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1. Overview

1.1 Interoperability refers to the ability of different hardware, systems or apps to work together effectively and to exchange information. With respect to communications, interoperability has played an important role in enabling universal end-to-end services, such as voice telephony, SMS and email. As part of the liberalisation of communications markets, interoperability with respect to incumbent infrastructure has also facilitated unbundling of networks and enabled competition from downstream operators.

1.2 This discussion paper considers interoperability in the context of digital markets. We take a broad interpretation of "digital markets", to include any market where digital technologies play an important part in the development, delivery and/or consumption of goods and services, without drawing conclusions in relation to specific markets, services or firms.

1.3 In such markets, a lack of interoperability has been widely discussed as a potential obstacle to effective competition and innovation. For example, the Furman Review identified a need 'to facilitate competition and entry through making it easier for consumers to move and control their data, and for new digital businesses to interoperate with established platforms'.[1] The Competition Markets Authority (CMA) identified limited interoperability as a potential competition concern in its analysis of social media[2] and mobile ecosystems.[3] Our recent work on cloud services[4] and online personal communication services[5] discusses interoperability and its potential implications for competition.

1.4 Where interoperability is limited, users can find it difficult to leave their current providers or reduce usage. This might occur if users:

a) Value the presence of other users on a particular platform (network effects);
b) Value complementary services that integrate with a current provider's service; or
c) Find it difficult to switch due to their data or content being held by an existing provider.

1.5 Where such effects are strong, they can create barriers to entry or expansion, limiting contestability.

1.6 For these reasons, mandated interoperability has gained momentum as a potential remedy to address competition concerns in digital markets. For example, the UK's Digital Markets, Competition and Consumers Bill (which is undergoing Parliamentary scrutiny at the time of writing) would allow the CMA to impose conduct requirements for the purpose of preventing restrictions on interoperability, among other things.[6] Internationally, the EU's Digital Markets Act introduces several new interoperability and data portability requirements.

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[1] Page 5, Digital Competition Expert Panel, March 2019, Unlocking digital competition.
[2] Page 2, CMA, July 2020, Online platforms and digital advertising market study final report, Appendix W.
[3] Page 47, CMA, June 2022, Mobile ecosystems market study final report.
[4] Ofcom, October 2023, Cloud Services Market Study (Final Report).
[5] Ofcom, October 2023, Personal online communications services (Discussion document).
[6] Conduct requirements may be applied to firms with strategic market status. See Section 20, Bill 350 2022-23 (as amended in Public Bill Committee), 12 July 2023.

1.7 At the same time, some digital markets have features that could reduce the need for any such intervention or increase the risk of unintended consequences. Where low-cost multi-homing (that is, usage of multiple services in parallel) is possible, this may help to maintain contestability even in the absence of interoperability. Where innovation is dynamic, mandated interoperability could risk entrenching technologies that are not yet mature.

1.8 Against this backdrop, this discussion paper explores concepts and complexities that may arise when considering mandated interoperability as a pro-competitive remedy in digital markets. Any other rationales for interoperability (e.g. as part of industrial policy considerations, or universality and fairness objectives) are not discussed in this paper. Below we summarise the issues covered in the rest of the paper.

What is interoperability?

1.9 It is important to understand interoperability as a nuanced and multi-faceted concept. Key distinctions include horizontal and vertical interoperability (i.e. interoperability between competing services or between complementary services) and alternative technical forms of interoperability that enable different levels of openness, e.g. proprietary gatekeeper specifications and interfaces, or widespread adoption of common standards.

Why might firms provide or restrict interoperability?

1.10 Firms will often deliver some degree of interoperability voluntarily, where it is in their best commercial interests or mutually beneficial to multiple firms. However, a given firm will lack incentives to invest in interoperability when it would benefit third parties, rather than the firm itself. Firms with market power may be able to foreclose competitors by restricting interoperability, although in some cases other firms might still develop interoperable solutions, e.g. through reverse engineering.

How can a lack of interoperability limit competition?

1.11 A lack of interoperability between competing services offered by different providers can give an advantage to larger platforms due to network effects. A lack of interoperability between complementary services offered by different providers can facilitate leverage of market power and foreclosure of competitors. Other informational barriers resulting from low interoperability or data portability can prevent switching, multi-homing and shopping around.

Which factors tend to support a case for intervention?

1.12 On the demand side of the market, the case for intervention will tend to be stronger when a lack of interoperability is preventing users from choosing services based on price and quality considerations. The case may be strongest when multi-homing is difficult or costly.

1.13 On the supply side of the market, the case for intervention is partly dependent on the presence of certain core functionalities that are relatively common across services and based on mature technologies. There is a key link to innovation, with a possibility that interoperability dampens incumbent incentives to innovate but boosts innovation from third parties.

How can authorities mandate interoperability in practice?

1.14 The impact and effectiveness of any intervention will depend on its exact design and implementation, including factors such as the firms and functionalities in scope of new interoperability obligations, the appropriate level of openness and technical approach, the terms for provision of interoperability by gatekeepers and the governance arrangements. We also briefly discuss wider implications in areas such as privacy and security, where interoperability could give rise to heightened risks, but also new opportunities for improvement.

2. What is interoperability?

2.1 In this section we introduce the concept of interoperability and its significance in digital markets. In particular:

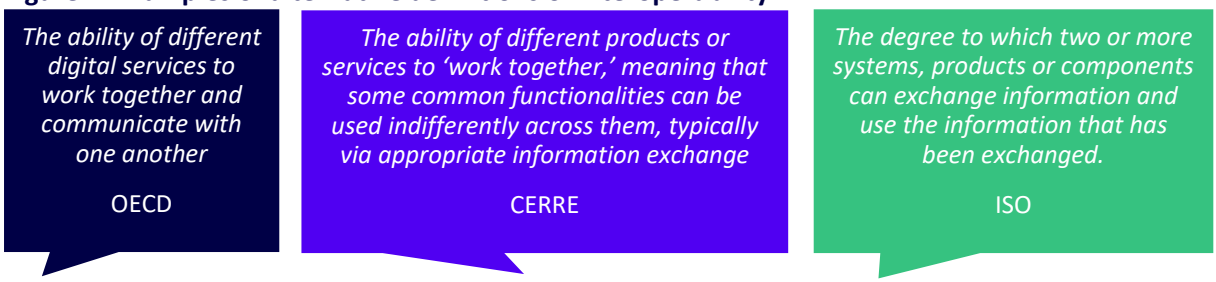
a) We highlight the important distinction between horizontal and vertical interoperability.
b) We explain that different technical forms of interoperability are possible, potentially resulting in different levels of openness.

Interoperability allows different products to work together and communicate

2.2 The concept of interoperability applies across a wide range of contexts and can be fundamental to how we use products and services in everyday life. Interoperability allows any electrical device to be connected into any plug socket; it allows any phone users to call one another, regardless of the networks or types of phone that they use.

2.3 Alternative definitions of interoperability exist. However, at its core, interoperability can be understood as the ability of different products, services or systems to communicate with one another and work together effectively.

Figure 1: Examples of alternative definitions of interoperability



Source: OECD ; CERRE; ISO.

Interoperability can exist between competing or complementary services

2.4 Digital markets encompass a wide range of diverse services. Some of these compete directly with one another by offering similar features and functionalities. Alternatively, two services that exist at different levels of the value chain, or serve different needs, may be complementary when used together.

2.5 In this context, it is important to distinguish:

a) **Horizontal interoperability**, which occurs between competing services. For example, interoperability of email services allows email communication between Outlook users and Gmail.
b) **Vertical interoperability**, which occurs between complementary services. For example, interoperability between Apple's iOS operating system and third-party email apps allows Apple device users to use apps such as Outlook and Gmail.

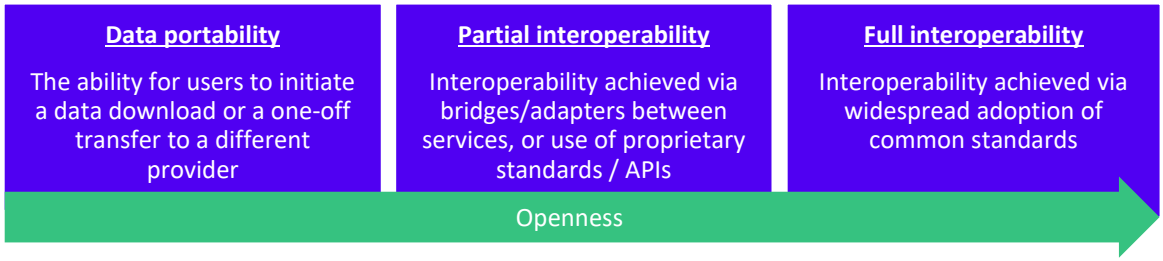
2.6 As discussed in later sections, interoperability can give rise to different incentives and competition considerations depending on whether it is horizontal or vertical in nature.

Different forms and degrees of interoperability are possible

2.7 Whether horizontal or vertical in nature, interoperability is a matter of degree, rather than a binary concept. Typically, different approaches to achieving interoperability will be possible, potentially resulting in different degrees of openness.

2.8 Options for achieving interoperability will depend, to some extent, on the market context. Nevertheless, it is possible conceptually to distinguish types of interoperability at a high level. The simplified framework presented in Figure 2 illustrates some different forms that interoperability may take in practice. It does not seek to capture every possibility or distinction that may arise in any given context, while some real-life examples may not fit neatly into these stylised categories.

Figure 2: High-level examples of different forms of interoperability[7]



Source: Ofcom analysis

2.9 The highest degree of interoperability is achieved with **widespread adoption of open and common technical standards**. This is also sometimes referred to as "full protocol interoperability".[8] Common technical standards have historically been prevalent in the communications sectors – underpinning traditional telephony, email and mobile technologies such as 5G – and have provided a foundation for the development of the internet through the Hypertext Transfer Protocol (HTTP).

2.10 Where an open standard does not exist or has not been uniformly adopted, a **partial degree of interoperability** may be possible. For example, a firm may allow one-to-one interoperability between its service and a third-party service by providing the necessary proprietary technical information and interfaces. In some cases, a third party may act as a bridge that sits between multiple other services, such as an app that enables the transfer of playlists between music streaming platforms.

2.11 **Data portability** is somewhat distinct from interoperability, but as the two concepts can overlap, we include it here.[9] Data portability itself can take different forms, such as a user-initiated download of their data from one service which they can then manually transfer to a new service, or a direct service-to-service transfer of user data initiated at the user's

[7] As discussed further below, different forms of data portability may be possible, including real-time data transfers (which may provide a greater degree of openness) as well as one-off data transfers. For the purposes of the illustrative and non-exhaustive comparisons shown here, one-off data portability is included as a counterpoint to other solutions that can provide greater openness.
[8] Crémer, Montjoye and Schweitzer, 2019, Competition policy for the digital era.
[9] Page 10, OECD, 2021, Data Portability, Interoperability and Digital Platform Competition.

request.[10] More sophisticated emerging implementations of data portability – for instance involving real-time and continuous data transfers[11] – can require adoption of standardised formats or data architectures, which entails a degree of interoperability between different systems.

2.12 Interoperability is often achieved via Application Programming Interfaces (APIs). APIs allow access to defined data or functionalities and are already widely used to enable different digital services to work together. An API may be "closed" in the sense that it is unique to a specific service (as in the case of partial interoperability as described above), or "open" where it is based on open standards adopted across platforms (as in full interoperability). APIs may vary in the breadth of data or functionalities to which they allow access.

[10] UK citizens have a right to portability under data protection law. See https://ico.org.uk/for-organisations/uk-gdpr-guidance-and-resources/individual-rights/individual-rights/right-to-data-portability/
However, enhanced forms of data portability may be possible. Explanatory notes to the Data Protection and Digital Information (No. 2) Bill (going through parliament at the time of writing) state that "smart data" schemes could 'provide enhanced data portability rights beyond the right to data portability in Article 20 of the UK GDPR. The government's view is that the UK GDPR does not guarantee provision of customer data in "real time" or in a useful format, does not cover wider contextual data and does not apply where the customer is not an individual'. https://bills.parliament.uk/bills/3430

[11] This form of real-time data portability is sometimes referred to as "data interoperability".

3. Why might firms provide or restrict interoperability?

3.1 In this section we summarise different incentives that firms may face, in the absence of mandated interoperability. We discuss how a degree of interoperability may arise organically, but with the possibility that the level of interoperability provided is sub-optimal.

Where commercial incentives exist, firms may voluntarily provide interoperability

3.2 Economic theory would indicate that profit-seeking firms will invest in or provide interoperability only where they expect to benefit, net of any costs involved.

3.3 Benefits often arise where a firm's own services are interoperable with one other, as this can increase the usefulness or appeal of those services to users. In this scenario, the benefit from interoperability is fully captured by the firm itself (that is, it does not benefit any other firms). Therefore, interoperability between proprietary services is common in digital markets. For example, many proprietary devices and services within the respective ecosystems of Google, Microsoft or Apple are designed to work seamlessly together.

3.4 Interoperability can also emerge voluntarily between services offered by different firms. This may benefit an individual firm in different ways:

a) When a firm's service interoperates with *complementary* services offered by other firms (vertical interoperability), this complementarity increases the value of the service to its users. This is evident, for example, in the ability for mobile operating systems to interoperate with apps developed by third-party firms.
b) When a firm's service interoperates with *competing* services offered by other firms (horizontal interoperability), it may increase the appeal of the service, if users value the ability to connect with other platforms. For example, competing videogame platforms allow cross-platform play for popular games such as Call of Duty.

3.5 Even where certain firms lack the incentive to pursue interoperability, it may be possible for third parties to unilaterally develop some level of interoperability. This concept is sometimes referred to as "adversarial interoperability".[12] Various cases exist where interoperability has been achieved through reverse-engineering, from Apple's efforts to achieve compatibility with Microsoft Office file formats, to third-party manufacturers developing printer cartridges.[13] However, achieving this type of interoperability may be very costly or infeasible in some cases, for instance if the service in question is subject to frequent changes or is linked to patents that could be infringed by developing adversarial interoperability.

[12] EFF, October 2019, Adversarial interoperability.
[13] EFF, July 2019, Interoperability: Fix the Internet, Not the Tech Companies.

Where commercial incentives are weaker, the degree of interoperability may be sub-optimal

3.6 While firms can benefit from greater interoperability in some cases, there are countervailing effects that may cause firms to favour a more closed approach.

3.7 One important factor is the possibility of externalities. In general terms, a firm's decision to invest in or provide interoperability can be expected to depend on its ability to monetise benefits through charging its own customers. However, as discussed below, interoperability may have significant knock-on benefits for third parties that the first party firm cannot monetise, such as benefits to rival platforms or firms in adjacent markets, as well as the customers of those firms.

3.8 Greater openness can enhance the appeal of a firm's own service, but also the appeal of other firms' services with which it interoperates. Where firms are in competition with one another, there is therefore a risk of benefiting a competitor by pursuing interoperability. Depending on each firm's existing competitive position in each market, interoperability could increase the intensity of competition and lead to a loss of customers for certain firms, as their customers become more exposed to other firms' products.

3.9 Externalities are also relevant when considering incentives for investment and innovation. With greater openness, it can become more likely that one firm's investment also benefits other firms who may "free-ride" on this. Therefore, a more closed approach may be necessary in some cases to protect a fair return on investment. However, this depends greatly on the specific interoperability scenario, as well as the possibility that intellectual property (IP) rights prevent free-riding. (The relationship between interoperability and innovation incentives is explored further in Section 5.)

3.10 In digital markets, where some large firms are vertically integrated and provide products as part of an ecosystem, each firm's overall business strategy can influence its approach to interoperability. The degree of interoperability may have significant implications for user adoption, competitive dynamics or revenues in specific product markets, while it can also affect the degree of control that the firm can exert over the ecosystem as a whole. We illustrate this below with a high-level comparison of Apple and Google business models.

Example: Apple's and Google's mobile ecosystems[14]

Apple and Google's activities overlap significantly. Both offer hardware, including smartphones and other connected devices, and software such as operating systems (OSs), app stores and various types of apps or services (e.g. browsers, streaming services, communication apps, maps, productivity software, payments).

However, the business models differ. Apple's revenue mostly comes from device sales, whereas Google mainly generates revenue through advertising, which is displayed to users of its services (e.g. Google search and YouTube) and targeted by leveraging data about those users. Under

[14] For a detailed analysis of mobile ecosystems, see CMA, June 2022, Mobile ecosystems market study final report.

these business strategies, Apple may largely seek to maximise adoption of its devices, while Google may largely seek to maximise adoption of its services regardless of the devices used.

These incentives are reflected in each firm's approach to interoperability. Apple takes a relatively "closed" approach with respect to some (but not all) aspects of its ecosystem, which could contribute to user loyalty or enhance the appeal of Apple devices compared to alternatives. For example:

- Most Apple apps are only available on Apple devices,[15] whereas most of Google's apps are available on iOS as well as Android.
- There are limitations on the compatibility of the Apple Watch with Android, whereas Google wearables are generally compatible with iOS.
- Apps may only be downloaded via Apple's App Store on iOS, whereas Android allows some use of third-party app stores or app downloads from the web. Apple argues that the relatively strict governance over apps listed on its App Store benefits Apple users, for example through reduced risk of fraud or privacy and security breaches.[16]
- Apple's OS (iOS) is only available on Apple devices, whereas Google allows other manufacturers to licence the Android OS.

3.11 Added to the above, there are practical barriers that can discourage the pursuit of greater interoperability by firms. Achieving interoperability may be costly, time-consuming and reliant on specialist technical resources. Where many firms are involved and competing priorities exist, coordination issues can arise.

3.12 It should be noted that firms with market power may have incentives and ability to restrict interoperability, even where the technical capabilities exist, for the purpose of limiting contestability or foreclosing competitors. There are examples where this type of conduct has been found to constitute an abuse of dominance, including a landmark European Commission decision in 2004 concerning Microsoft's refusal to provide interoperability information to competitors in the work group server operating system market.[17]

[15] Exceptions exist, such as Apple Music and Apple TV.
[16] See e.g. Apple, June 2021, Building a Trusted Ecosystem for Millions of Apps. Note that considerations in areas such as privacy and security are explored further in Section 6.
[17] For more information see Banasevic, Sitar and Piffaut, 2004, Commission adopts Decision in the Microsoft case.

Example: The European Commission's 2004 Microsoft decision

This case stemmed from a complaint by Sun Microsystems, which competed with Microsoft in the supply of work group server operating systems. These were systems which depended on a degree of compatibility with client PC operating systems, for which Microsoft was the leading provider. The complaint alleged that Microsoft had withheld interoperability information necessary for third parties to compete in the supply of work group server operating systems.

According to the Commission's analysis, Microsoft's refusal to supply the information constituted an abuse of dominance. Microsoft was fined for its conduct – a record amount at that time – and ordered to make interoperability information available.

3.13 In practice it may be difficult to precisely establish the root cause of sub-optimal provision of interoperability by any party or parties, including whether any conduct constitutes an abuse of dominance. This paper does not consider in detail the questions of which conduct by firms is justifiable, or which legal routes authorities may use to intervene.

Incentives can change over time as competitive dynamics evolve

3.14 As incentives depend on the respective competitive positions of the firms involved, it can be expected that these will change over time. Because of the externalities described above, a firm might favour a relatively open approach when they are small and therefore more likely to be net beneficiaries of interoperability. It may then move to a more closed approach if it gains market power and expands into additional markets, such that there is a greater risk that interoperability exposes the firm to stronger competition in those markets.

3.15 Consistent with this, there are several cases where firms with market power appear to have deliberately degraded interoperability over time. The possibility of interoperability being reduced has also influenced several merger cases and resulted in commitments by firms to maintain interoperability.

Examples: Concerns over (potential or actual) degradation of interoperability

- In the aforementioned Microsoft case, Microsoft had freely provided interoperability information to third parties, prior to entering the work group server operating system market itself.[18] It was later found to have opted to withhold this information.
- The CMA's market study on online platforms and digital advertising found that "Facebook is able to worsen smaller competitors' offerings to consumers by degrading the functionalities enabled through interoperability", either as part of a general policy change or targeted at specific third-party developers.[19]
- In relation to Google's acquisition of Fitbit, the European Commission identified a risk that interoperability with the Android operating system could be degraded for third-party manufacturers of wearable devices, or that access to the Fitbit API could be

[18] Page 21, Kerber and Schweitzer, 2017, Interoperability in the digital economy.
[19] Paragraph 3.228, CMA, July 2020, Online platforms and digital advertising market study final report.

degraded for digital healthcare providers. Google made commitments to maintain access to relevant APIs.[20]

3.16 There may even be incentives for firms to provide or withhold interoperability strategically. For example, in 2017 Google withdrew its YouTube app from Amazon streaming devices, due to Amazon not selling some of Google's own smart devices and not making Prime Video available on them.[21] YouTube returned to Amazon's Fire TV devices in 2019, at which point Amazon's Prime Video was made available on Google's streaming platforms and Amazon was selling some of Google's Nest smart devices.[22]

3.17 The next sections explore in more detail the ways in which a lack of interoperability may limit competition in the markets affected.

[20] European Commission, December 2020, Mergers: Commission clears acquisition of Fitbit by Google, subject to conditions.
[21] The Guardian, December 2017, Google v Amazon: YouTube app pulled from Fire TV and Echo Show.
[22] CNBC, July 2019, YouTube launches on Fire TV, ending dispute between Amazon and Google; Yahoo! Finance, July 2019, YouTube returns to Amazon Fire TV devices.

4. How can a lack of interoperability limit competition?

4.1 Where interoperability is absent or limited, the impact of this on competition depends on the type of interoperability in question. Some key interactions between interoperability and competition are summarised below and explored in more depth in the following section.

A lack of horizontal interoperability can lead to firm-specific network effects

4.2 Many digital markets are characterised by interactions between different users of a platform. This can give rise to network effects, meaning that the value of the platform to one user depends on the presence of other users. Without interoperability, users may find it difficult to leave large platforms or reduce usage, as they would lose the benefit of these network effects by moving to a rival platform with fewer users. This can weaken contestability and increase the risk of markets tipping in favour of one or a few firms.

Examples: Concerns about limited horizontal interoperability and network effects

- The EU's Digital Markets Act introduces the possibility of interoperability between certain "number-independent interpersonal communications services", which include instant messaging and video calling apps. [23] The text of the Act sets out the view that 'the lack of interoperability allows gatekeepers that provide number-independent interpersonal communications services to benefit from strong network effects, which contributes to the weakening of contestability'. [24]
- The CMA's investigation of online platforms and digital advertising found that "the market power of Facebook derives in large part from strong network effects stemming from its large network of connected users and the limited interoperability it allows to other social media platforms". [25]

A lack of vertical interoperability can facilitate leverage of market power

4.3 Another common feature of digital markets is the presence of large firms that offer many different products or services, sometimes as part of so-called ecosystems. This can include firms offering services with similar or substitutable functionalities (such as Meta's Facebook Messenger and WhatsApp), or services that are complementary (such as Apple's devices and its iCloud service). Where economies of scale and scope are prevalent, such business models can give rise to significant efficiencies.

[23] Article 7, REGULATION (EU) 2022/1925 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.
[24] Paragraph 64, REGULATION (EU) 2022/1925 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.
[25] Paragraph 91, CMA, July 2020, Online platforms and digital advertising market study final report.

4.4 Where a firm offers multiple services that complement one another from an end user perspective, restricting vertical interoperability between its services and third-party alternatives may confer a competitive advantage to its own services. A lack of interoperability could facilitate the leverage of market power into related markets, limiting contestability in those markets and potentially foreclosing competitors.

Examples: Concerns about limited vertical interoperability and leverage of market power

- The EU's Digital Markets Act includes requirements for gatekeepers to allow "sideloading" of apps and app stores; that is, certain firms designated as gatekeepers will need to allow third-party app stores and apps to be used on the gatekeeper's operating system.[26] The rationale is that restrictions on users' ability to do this would weaken contestability.[27]
- In 2022, Meta acquired Kustomer, a company supplying Customer Relationship Management (CRM) software. In its analysis of the merger, the European Commission found that Meta could use foreclosure strategies against Kustomer's competitors and new entrants, such as restricting access to APIs for Meta's messaging channels. Meta made commitments to maintain API access.[28]

Other informational barriers may hinder effective competition

4.5 A strength of digital technologies is that they can facilitate efficient exchange and use of information, which powers many digital services to the benefit of users. However, a lack of data portability or interoperability can give rise to barriers or frictions that prevent users from accessing or using information held by a provider. This can make switching or multi-homing more difficult, if it makes it harder for users to shop around or change providers.

Examples: Concerns about limited interoperability and informational barriers

- The CMA's investigation of the retail banking market investigation found, among other things, that customers faced barriers in accessing information from providers and in using their own financial data to shop around. Open Banking measures aimed to facilitate secure data exchanges as a means to strengthen competition.[29]
- In 2022, Italy's competition authority opened an investigation into Google, over a complaint that it had abused a dominant position by hindering data portability, with respect to a third-party app (Weople) that helps users to monetise their data and relies on Google's user data as an input. Google has responded with commitments to improve its data portability tools, including improving the user experience for individuals and the usability of Google's data for third parties.[30]

[26] Article 6 REGULATION (EU) 2022/1925 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.
[27] Paragraph 50, REGULATION (EU) 2022/1925 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.
[28] European Commission, January 2022, Mergers: Commission clears acquisition of Kustomer by Meta (formerly Facebook), subject to conditions.
[29] CMA, August 2016, Retail banking market investigation final report.
[30] AGCM, July 2022, A552 - Italian Competition Authority, investigation opened against Google for abuse of dominant position in data portability.

5. Which factors tend to support a case for intervention?

5.1 For the reasons set out in previous sections, digital markets may not always reach an optimal level of interoperability on their own. In such cases, interventions to promote or mandate interoperability have the potential to:

a) Reduce the market power of incumbents or gatekeepers, enabling greater competition and innovation from smaller firms and potential entrants.
b) Benefit users through greater variety, higher quality and/or lower prices.

5.2 However, the precise impacts of any intervention are likely to be uncertain. There are risks of adverse effects, such as undermining innovation incentives for incumbents, imposing excessive homogeneity between services, or causing unwanted effects (price increases or quality reductions) due to the costs of implementing interoperability.

5.3 Moreover, it is also clear that interoperability is not a silver bullet to address any and all competition concerns that might arise in digital markets. Greater interoperability is unlikely to be a solution to problems created by barriers to switching or entry that exist independently of the level of interoperability in the market (for example, barriers linked to economies of scale, brand equity, behavioural biases or capital constraints).

5.4 In this section we consider some demand- and supply-side factors that are linked to potential positive and negative effects of greater interoperability in digital markets, noting how certain factors tend to strengthen or weaken any case for intervention. The analysis is closely linked to Section 6 which discusses specific considerations about the design and implementation of any intervention; these can influence what the demand- and supply-side impacts will ultimately be.

5.5 For the avoidance of doubt, this paper only considers the notion of mandated interoperability as a mechanism to support effective competition in digital markets. Other rationales for interoperability may exist in some contexts, for example where public policy supports a universality or fairness rationale (regardless of the state of competition in the market), or where interoperability can support other policy objectives.[31]

[31] For example, the EU legislation to mandate interoperability of consumer device chargers using the USB-C standard is informed by environmental factors, among other things. European Parliament, June 2022, Deal on common charger: reducing hassle for consumers and curbing e-waste.

Demand-side factors

5.6 From a demand-side perspective, the level of contestability in a market is usually linked to users' willingness and ability to switch or multi-home. The lower the barriers to switching or multi-homing, the greater the scope for providers with relatively cheap, high quality or innovative service to enter the market and expand.[32]

5.7 To ascertain the extent to which greater interoperability can be expected to facilitate switching or multi-homing in any given market, it is necessary to understand current switching and multi-homing behaviours, as well as the underlying user preferences. The significance of these factors is explored in more detail below.

Horizontal interoperability may be most impactful if network effects are strong and multi-homing is limited

5.8 With respect to competing services, a lack of interoperability can have different implications for switching and multi-homing:

a) As described in the previous section, limited interoperability can discourage users from moving away from a large platform, as users would become disconnected from the many other users of that platform. For the same reason, it may encourage greater usage of large platforms. These effects tend to limit contestability.
b) A lack of interoperability can also incentivise multi-homing, where this is necessary to connect with different user groups who are present on different platforms.[33] Where multi-homing is easy and low-cost, this may help to maintain some degree of contestability.

5.9 Where network effects are particularly strong, users may choose providers mainly based on the presence of other users, rather than deciding based on price, quality and functionality. This can weaken the competitive pressure on large platforms to provide high quality or low prices, an effect which may be exacerbated in cases where multihoming is costly or inconvenient. Greater interoperability would reduce the influence of these firm-specific network effects, facilitating user adoption of smaller platforms and potentially reducing barriers to entry or expansion for smaller platforms.

5.10 Where users do multi-home, interoperability reduces the incentive to multi-home for the purpose of connecting with different users, but it maintains incentives for multi-homing to enjoy the different features offered by competing services. Therefore, the case for greater interoperability will be stronger if it can still allow scope for significant differentiation between services, which can motivate users either to switch or to multi-home. (See Section 6 for related discussions of remedy design.)

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[32] Note that smaller platforms may also be able to grow by attracting new users to the market, rather than users of rival platforms. In some cases, the ability of smaller platforms to attract new users may itself depend on the behaviour of existing users; for example, if existing users do not switch or multi-home and new users prefer to join the same platform as certain existing users (e.g. friends), then new users may be drawn to larger or more established platforms.
[33] To some extent, limited data portability may have a similar effect. That is, if a user cannot easily transfer data between services, they may be more likely to continue using multiple services when different important data is held on each of them.

5.11 It should be acknowledged that the role of network effects in a market is not static but can change over time. The above discussion focuses on *positive* network effects, where the appeal of a platform tends to increase as it adds more users. These effects are not necessarily constant and could weaken or, in some cases, become *negative* as a platform grows. There are various reasons why the appeal of a platform could decrease once it becomes very large; there could be a loss of quality due to congestion or increased spam, or perceptions among some cohorts that a platform has lost its "coolness" by becoming mainstream. Where negative network effects exist, or could plausibly arise in the future, they may maintain a degree of contestability absent intervention.

Vertical interoperability can address specific barriers to switching or multi-homing

5.12 With respect to complementary services, a lack of interoperability can discourage switching and multi-homing, because users may prefer using different services from a single provider which are able to work together effectively. The extent to which this raises competition concerns is likely to depend on the strength of complementarities between products, from a user perspective. That is, where the need for any new service to integrate effectively with existing services is outweighing considerations about price, quality and functionality in users' decision-making, the case for greater interoperability tends to strengthen. This applies particularly where the existing services in question are relied upon as "must-have" services by users, such that they value compatibility with those services very highly.

5.13 Understanding the nature of user preferences and usage requirements is also relevant. If users have particularly diverse requirements and use cases, they are more likely to benefit from a mix-and-match approach using different services from different providers, which greater vertical interoperability would facilitate.

5.14 It should be noted that various other factors may discourage or prevent users from switching or multi-homing in a specific market context. Examples include consumer inertia, behavioural biases, contractual restrictions or fees, or procurement issues (in the context of a B2B market). Where these other barriers are prominent, it may be that greater interoperability has little effect on user behaviour, unless complementary measures are taken.

In summary, the case for mandated interoperability is likely to be strongest when demand-side analysis of a market indicates that:

- User choice of provider is primarily driven by (i) presence of other users i.e. positive network effects, (ii) ability to integrate effectively with complementary products from the same provider, and/or (iii) data-induced barriers – rather than other price/quality factors.
- Rates of switching are low or they predominantly see users transferring from smaller providers to those with market power.
- Multi-homing is infeasible or infrequent (e.g. because it is costly or seen as inconvenient).

Supply-side factors

5.15 While demand-side factors may point to possible changes in user behaviour from greater interoperability, such analysis is incomplete without considering how firms themselves may respond.

5.16 Supply-side factors are explored in more detail below.

Horizontal interoperability may be less appropriate for highly differentiated products

5.17 With respect to interoperability between competing services, the extent of differentiation between services is relevant. In broad terms, a high degree of differentiation between services may mean that there are greater technical difficulties and costs involved in providing interoperability. At the same time, where services are highly differentiated, there may also be a greater risk of consumers suffering from reduced variety, to the extent that interoperability reduces the scope for differentiation.

5.18 However, differentiation between digital services is a nuanced concept. Digital services often encompass several layers of functionality and components, some of which may be relatively similar across services and others which are more differentiated. Even where significant differences exist between services overall, a case for greater interoperability may still exist if there are certain features or functionalities that are somewhat comparable across services and are valued by users.

Example: Social media interoperability and differentiation between platforms[34]

In its analysis of social media platforms, the CMA found a strong case for greater interoperability for cross-posting of content between platforms. This would preserve the ability of platforms to innovate in areas such as content curation, user interface design and options for engaging with content.

On the other hand, "content interoperability", whereby users could post, view and engage with content across platforms without having to switch service, would encompass a greater range of functionalities. This would help smaller platforms overcome network effects by allowing their users to engage with other users and content through their preferred platform, regardless of the presence of other users on that same platform. However, the CMA recognised a potential risk of homogenisation of services, as well as an additional administrative and technical burden on platforms.

[34] CMA, July 2020, Online platforms and digital advertising market study final report, Appendix W.

A lack of vertical interoperability may arise where there are proprietary ecosystems of complementary products

5.19 With respect to interoperability between complementary products, the dynamics of competition across related markets are highly relevant. Where the leading firms are vertically integrated – that is, they provide a number of complementary products or services – and vertical interoperability with third parties is limited, competition may take place largely between ecosystems rather than between individual services or components of those ecosystems.

5.20 Greater vertical interoperability could enable more competition to take place at a more granular level over individual services, components or functionalities, including from providers that are not vertically integrated.[35] The potential benefits of this could include increased variety and innovation, more flexibility for users and benefits from specialisation of firms. Equally, there could be downsides where the increased competition and variety at component level entails greater costs and complexity at ecosystem level (for example, with regard to ensuring that quality and security standards are consistently met across the ecosystem as a whole).

5.21 Assessing the likely scale of benefits to users is related to the earlier demand-side discussion about user requirements and the extent to which facilitating a mix-and-match approach would be valuable. From a supply-side perspective, an understanding of specific business models and the underlying cost and technology stacks may be important in assessing potential undesired effects of greater interoperability.

Greater interoperability does not guarantee more innovation, as important trade-offs must be considered

5.22 There is a fundamental interaction between innovation and interoperability, which merits careful consideration – noting that innovation itself is inherently unpredictable and therefore any assessment of innovation impacts is usually uncertain.

5.23 In general, it is relevant to consider a market's evolution over time and the maturity of its key technologies. If innovation in the market is still very dynamic and technologies have not yet matured, it may be that future disruptive innovation could allow for "competition for the market", where firms with better technology or products are able to displace incumbents. Implementing interoperability based on current technology could then have undesirable effects, such as wasted costs or delayed benefits. Investment incentives may be linked to the likelihood of competing for the market, or at least achieving significant market share in future; if investors perceive that this likelihood is being reduced by an interventionist approach to interoperability, then incentives could be dampened.

5.24 Even where technologies are relatively mature and stable, there is a potential trade-off from greater interoperability: it may reduce incumbent incentives to innovate further, as the benefits of innovation are shared amongst competitors, but by the same measure it may foster innovation by smaller firms and new entrants. This trade-off was explicitly recognised

[35] This is closely related to the idea of "modularisation" discussed in some of the literature.

by the European Commission's analysis as part of its landmark 2004 decision mandating Microsoft to provide interoperability information; the analysis proposed an incentive balance test and argued that any negative impact on Microsoft's incentives to innovate would be outweighed by the positive impact on industry-wide innovation.[36]

5.25 Assessing these opposing effects ex ante is particularly difficult. It is relevant to consider which firms have been responsible for innovation to date; if evidence indicates that some smaller challengers are already relatively innovative but failing to expand, this tends to strengthen a case for intervention. At the same time, a lack of innovation from third parties does not necessarily weaken the case, precisely because a lack of interoperability can itself be a barrier to the development of innovative products.

5.26 The trade-off may also be affected by the design of any interoperability obligation; for instance, if it allows for an incumbent to earn remuneration from providing interoperability, this may better preserve incumbent incentives to innovate, but potentially at the expense of weaker incentives for third-party innovation. This is discussed further in the next section 6.

5.27 Whether interoperability is horizontal or vertical can also affect the nature of any innovation impacts. However, it is impossible to generalise about which type of interoperability has the greatest impact on innovation and the trade-offs described above may apply in either case. As discussed earlier, vertical interoperability can facilitate innovation from providers of complementary services, creating new entry points for such services within established ecosystems. In some cases, a wide variety of innovative and unforeseen third-party services could emerge within the value chain.[37] On the other hand, horizontal interoperability affects directly competing services and innovation impacts would tend to result from enhanced competition within the relevant product category.

5.28 As part of the above considerations, it should be noted that innovation is a broad concept and not all changes that might be deemed innovative are equal. Whilst some innovations are genuinely transformative and clearly generate value for users, in many cases products evolve incrementally and it may be difficult to assess their value. In fact, some product changes or redesigns could serve primarily to make it more difficult for third parties to interoperate, rather than to benefit users; past examples include redesigned medical devices to eliminate interoperability with third-party needles, or redesigned hot beverage brewers to make competitors' cartridges incompatible.[38] Assessing these types of behaviours and achieving an objective understanding of innovation dynamics in digital markets is often likely to be a fact-intensive process requiring deep technical expertise.

[36] See e.g. Kerber and Schweitzer, 2017, Interoperability in the digital economy.
[37] For instance, the growth of the so-called "app economy" could be seen as linked to the ability of third-party apps to interoperate with Apple and Google app stores and wider mobile ecosystems.
[38] Torpey and Kellerman, June 2021, The Unilateral Conduct Gap Sacrificing Interoperability and Innovation.

In summary, the case for mandated interoperability is likely to be strongest when supply-side analysis of a market indicates that:

- There is high concentration, with stable market shares and a lack of recent entry/expansion suggesting that market power is entrenched.
- There are certain core features or functionalities which are not highly differentiated and are valued highly by users.
- The underlying technologies used by providers are relatively mature and stable.
- There is little or no prospect of disruptive innovation which could render the current technological paradigm obsolete or allow a new entrant to successfully compete for the market.
- Voluntary or adversarial interoperability is absent, or where it exists it has not materially affected user choices.

6.How can authorities mandate interoperability in practice?

6.1 In any given context, different approaches to mandating interoperability are likely to be available. Each approach may entail different considerations regarding the expected effectiveness, proportionality, costs to firms and risks of adverse effects. Though such considerations will be highly context-dependent, in this section we summarise some relevant areas for consideration in general terms.

6.2 We categories these considerations as follows, recognising that there are important interactions between some of these areas:

a) The firms that should be in scope of any interoperability obligations.
b) The functionalities or data that should be made interoperable.
c) The level of openness required and the associated technical approach.
d) The relevance of standard-setting processes.
e) The terms under which interoperability should be provided to third parties.
f) Any governance and monitoring arrangements linked to implementation.
g) Potential implications of mandated interoperability in areas such as privacy and security.

Firms within scope of interoperability obligations

6.3 Any decision to intervene must consider which firms are captured by new interoperability obligations, which would typically be informed by market analysis and the factors described in the previous section.

6.4 Where mandated interoperability is pursued in practice or hypothesised in the literature as a pro-competitive intervention, it tends to be asymmetric, meaning that it targets specific firms rather than applying new obligations on all firms in the market. This typically reflects concerns over insufficient provision of interoperability by specific firms that have market power or act as gatekeeper. It also avoids the imposition of new regulatory provisions on smaller firms or new entrants, for whom any new obligations might be more onerous.

6.5 Where this asymmetric approach is taken, criteria or processes must be defined to identify the firms subject to interoperability obligations. Various factors may need to be balanced, including the desirability of a flexible and future-proof approach, as well as the need to provide transparency and regulatory certainty.[39] Applying interoperability obligations to a very broad set of firms – for instance, by setting low thresholds for applicable firms – could risk unintended consequences, such as dampening investment incentives for early-stage companies that could quickly fall under the scope of the obligations if their growth strategies are successful.

[39] Related to this, there is a wider question about the process and criteria by which firms should be designated as having gatekeeper or strategic status, which varies under different pieces of legislation internationally. We do not consider this issue further in this paper.

6.6 Equally, while a pro-competitive rationale is often likely to favour asymmetric obligations, it is also true that the benefits from greater interoperability are most likely to be maximised when all firms adopt an interoperable approach. Therefore, there could still be instances where it is socially optimal for an authority to mandate or encourage this outcome.

Functionalities within scope of interoperability obligations

6.7 Where interoperability is mandated, it is necessary to consider which functionalities or data should be interoperable. There is a general trade-off between a narrow or a broad scope. An overly narrow scope may mean that interoperability only has limited impact on user experience and behaviour. On the other hand, an overly broad scope may increase the cost and time required for implementation, while it could increase homogeneity across services, potentially reducing scope for differentiation and innovation in the longer term.

6.8 In principle, an appropriate balance would typically be achieved where interoperability focuses on certain basic or core functionalities that are sufficiently valued by users to drive material changes in behaviour (that is, increased willingness to switch or multi-home). It may also be helpful for the interoperable functionalities to be somewhat similar and substitutable across providers from a user perspective and based on relatively stable and mature technologies.

6.9 The scope of interoperable functionalities could also vary over time, to target only the most basic functionalities in the first instance, or to reflect that certain functionalities may require longer timeframes to be made interoperable. For example, the EU Digital Markets Act mandates interoperability for certain online communication services, starting with one-to-one messaging functionalities and expanding to group messaging and calls at a later stage.[40] Timing decisions entail trade-offs, for example between the risk that benefits are delayed excessively and the risk of unintended consequences from intervening too early.

Level of openness required by obligations

6.10 As outlined in Section 2, different technical forms of interoperability can provide for different levels of openness. Where an authority decides to act, the least onerous intervention may be one that seeks to increase transparency of existing interoperability options amongst market participants. However, this is also likely to be the least impactful option, whilst defining and policing transparency rules is also difficult in practice.

6.11 Where an intervention does seek to increase the level of interoperability, a spectrum of options may be feasible. In general, the higher the level of openness, the greater the potential impact on competition, but costs and risks may also increase. Some potential implications are summarised in Figure 3 (these are non-exhaustive).

[40] Article 7, REGULATION (EU) 2022/1925 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.

Figure 3: Potential implications of different levels of openness

Data portability (one-off)[41]	Partial interoperability	Full interoperability
• May be well suited to addressing specific informational barriers. • Has no impact on network effects or on the ability of different services to work together continuously.	• Can address network effects or the ability of different services to work together continuously. • May be burdensome for third parties seeking to interoperate with multiple incumbents. • Ensuring equality of access provided to each party may be difficult.	• May create the most level playing field for competition. • May reduce the burden on smaller firms and the complexity of policing the regime. • Most onerous and complex solution, with potentially higher risks of excessive homogeneity and loss of flexibility.
Increased openness and potential impact, cost and risk…		

Source: Ofcom analysis

6.12 Again, there may be circumstances where it is appropriate for the approach to evolve over time, for example moving towards a higher degree of openness if previous steps have been deemed to be insufficient.

Standard-setting processes

6.13 There is a general question of who should influence or decide on the specifics of an interoperability solution. There is likely to be a trade-off between a prescriptive definition of the interoperability approach by an authority, or a more flexible outcomes-focused approach, where the development of the technical solution is more market-led. A more prescriptive approach increases the authority's control, but may give rise unintended consequences unless industry evidence and views on technical and commercial factors are fully taken into account. A more flexible approach, allowing greater discretion given to firms, might be more open to gaming by firms with market power.

6.14 In practice, many variants of standard-setting approaches exist, including where a standard-setting organisation (SSO) is tasked with designing and/or implementing interoperable solutions, which may involve different degrees of input or oversight from industry, government and other stakeholders.[42]

[41] As recognised in Section 2, different forms of data portability may be possible, including real-time data transfers (which may provide a greater degree of openness) as well as one-off data transfers. For the purposes of the illustrative and non-exhaustive comparisons shown here, one-off data portability is included as a counterpoint to solutions that provide greater openness.

[42] There is a literature discussing the key role played by standard-setting organisations, as well as potential risks involved, such as the possibility that firms with market power and vast resources could have undue influence in these organisations' processes. For brevity we do not explore these issues further in this paper.

The role of standard-setting organisations

Technical standards are sometimes set collectively through standard setting organisations (SSOs). These bring together relevant stakeholders for such purposes as discussing, developing and updating technical specifications, and agreeing which standard(s) should be adopted or recommended. SSOs have played an important role, in the communications sectors and beyond, in shaping markets, for example through the common standards used by mobile phones.[43]

SSOs are often voluntary and industry-led, but they can have varying degrees of regulatory or governmental involvement (including but not limited to cases where an SSO is established to deliver mandated interoperability, for example in the case of the Open Banking Implementation Entity). The procedures followed by SSOs can vary significantly, but often amount to a negotiation process where technical experts have an influential role.

In principle, this collective and coordinated approach can be conducive to coalescing around effective standards, potentially avoiding inefficiencies that might otherwise arise, for example due to fragmentation of standards.

In practice, achieving such effective outcomes though SSOs may be challenging. Negotiations may be slow and are not guaranteed to succeed. Maintaining a neutral stance may be difficult, as certain firms, or groups of firms, may be able to influence the standard setting process to favour their own interests.

Therefore, the appropriateness of collective standard-setting approaches will vary case by case. Where SSOs are involved as part of mandated interoperability, minimising the above risks would require a proportionate level of regulatory oversight and mediation.

6.15 The process of implementing interoperability – including standard-setting and other practicalities – can be time-consuming, subject to scope and complexity of any intervention. For example, in the European Commission's Microsoft case, the Commission reached a decision in 2004, however Microsoft was then fined in 2009 for 'failing to allow its competitors access to interoperability information on reasonable terms'.[44] For Open Banking, the 6 largest banking providers declared to have implemented full interoperability standards by January 2023, following the CMA's decision in 2017[45]. Authorities can seek to maintain momentum by setting appropriate milestones or deadlines, noting that an overly compressed timeline could increase the risk of technical failures or unforeseen consequences.

Terms for provision of interoperability

6.16 If specific firms are being required to provide greater interoperability, it is necessary to consider the technical and economic terms upon which it may be provided. For example:

a) **Technical terms**. Measures may be needed to ensure that technical specifications provided by incumbents are transparent and adequate. There are parallels with the

[43] Global System for Mobile Communications (GSM), and subsequent standards e.g. for 4G and 5G mobile technologies.
[44] General Court of the European Union, June 2012, PRESS RELEASE No 89/12.
[45] CMA, 2023, Retail banking market investigation roadmap completion decision.

regulation of traditional telecoms services, where obligations to publish reference offers serve a similar purpose.

b) **Pricing**. There may be cases where free access is appropriate, or where some allowance for charging supports the objectives of the intervention. Allowing for remuneration is more likely to be justifiable where providing interoperability for free would lead to significant monetary losses, exposure of valuable IP, or reduction in investment incentives. Establishing any appropriate rate of remuneration may be challenging, including due to typical information asymmetries between authorities and firms.

c) **Fair and equal access**. Provisions may be used to promote fair treatment of third parties (beyond pricing) and prevent behaviours such as degradation of APIs for certain parties, for example with "FRAND" (fair, reasonable, and non-discriminatory) terms. The FRAND framework is flexible and has been applied in regulated industries;[46] however, its application to digital markets as part of competition measures is relatively nascent and legal precedent around its interpretation in this context is limited.

d) **Licensing or access criteria**. It may be appropriate to limit access based on certain criteria, for example to ensure that entities meet required privacy and security standards.

Governance and monitoring arrangements

6.17 Governance and monitoring activities can provide confidence that the intended outcomes are being achieved and to mitigate the risk of firms with market power obstructing or gaming the process. The appropriate arrangements will depend on the complexity of a particular case. They could include establishing independent monitoring trustees with powers to take remedial steps, ensuring access to relevant technical expertise for monitoring progress, providing routes for stakeholders to air any concerns, and allowing for appropriate sanctions for breaches of obligations.

6.18 Given that mandated interoperability in digital markets is a relatively nascent area, monitoring and evaluation of any interventions is likely to be valuable in informing future approaches. Developing qualitative findings and lessons learned, including with respect to governance and procedural aspects, can contribute to a better understanding of the various issues discussed in this paper.[47] Where feasible, the quantitative impacts of interoperability requirements could also be estimated, though this is typically challenging due to the uncertainty of the counterfactual (that is, the outcomes – such as market shares – that would have been observed in the absence of intervention).

Implications of interoperability in areas other than competition

6.19 Greater openness resulting from interoperability could have implications in various areas such as data protection (to the extent that a particular case of interoperability affects the treatment of personal data), security, resilience, online safety or IP rights. An in-depth analysis across these areas is outside the scope of this paper, but we present some high-level considerations below.

[46] See e.g. 4ip Council, A FRAND regime for dominant digital platforms?
[47] For an example, see Baker, 2022, Open Banking Lessons Learned Review.

Interoperability may give rise to risks in areas such as data protection and security, although mitigation tools exist

6.20 In general terms, interoperability tends to increase the number of points of connection between systems, as well as the number and heterogeneity of third parties who can access data or systems. Therefore, there could be a heightened risk of that data or systems being subject to attacks, breaches, misuses, or technical failures.

6.21 Incorporating appropriate safeguards when developing interoperable solutions can mitigate these risks as the level of openness increases. Where interoperability requires sharing personal data with third parties subject to user consent, putting in place clear consent management processes can promote transparency and empower consumers to make choices based on the relevant preferences and purposes. Relatedly, new privacy enhancing technologies (PETs) are emerging to support data minimisation and security when data is being shared between multiple parties;[48] ICO guidance sets out how PETs can help firms to demonstrate a 'data protection by design and default' approach.[49]

6.22 Existing cases, such as Open Banking, provide useful examples of approaches to address these risks.

Example: Mitigating privacy and security risks in Open Banking

The UK's Open Banking initiative facilitates information sharing between banks and other trusted third parties, with the express consent of the customer. Given the extensive volumes of personal, and potentially sensitive financial data involved, it has been a priority to ensure sufficient privacy and security safeguards were in place to protect customer data and ensure compliance with data protection legislation, while also building trust in the system and supporting take-up.

Open Banking was delivered by an independent organisation, the Open Banking Implementation Entity, which included a sub-group on privacy and security. A range of measures were adopted, including: selecting appropriate technical standards given the sensitivity of the data; whitelisting third parties before allowing them access to the ecosystem; providing tools for customers to authenticate their identity and exercise consent in a straightforward manner; mechanisms for customer complaints and redress; and maintaining close dialogue with relevant regulators during the development of the system.

6.23 The feasibility, effectiveness and cost of relevant safeguards may all be relevant considerations as part of any case for mandated interoperability. The approach taken to these issues could also affect the rate of user adoption of interoperable services and therefore the extent of any pro-competitive impact. The implications of interoperability can

[48] Such technologies may be relevant for mandated interoperability or other forms of data-related intervention. Relatedly, a joint statement by the ICO and CMA states: 'Should data access interventions be an appropriate remedy, we therefore think any perceived tensions can be resolved through designing them carefully, such that they are limited to what is necessary and proportionate, are designed and implemented in a data protection-compliant way, that related processing operations are developed in line with the principles of data protection by design and by default, and they do not result in a facilitation of unlawful or harmful practices'. Competition and data protection in digital markets joint statement

[49] ICO, Privacy-enhancing technologies (PETs).

be complex for end users to understand; thus, it may be challenging for firms to provide explanations that ensure users are adequately informed when deciding whether to adopt a new interoperable service, without introducing unnecessary friction in the process that discourages users from adopting services that could benefit them.

Interoperability can also be an enabler of positive change in these areas

6.24 A core rationale for mandated interoperability is to help prevent users' choices being restricted by network effects or other barriers. Therefore, to the extent that users value factors such as privacy, security, resilience, protection from harm and so on, horizontal interoperability aims to make it easier for users to choose the services that best provide these. Competition over these factors may intensify and prospects for entry or expansion may improve for firms who offer higher quality or innovation in these areas. Similarly, vertical interoperability may facilitate the emergence and adoption of innovative third-party services, including plugins or add-ons, which can enhance dimensions such as privacy; an example of this is the emergence of third-party ad-blocking extensions for browsers.

6.25 As another example, interoperability can affect how processes such as online age assurance[50] work, with potential implications for online safety as well as competition.[51] Without interoperability, a user may have to go through age assurance multiple times when visiting different websites with age-restricted content. However, the age verification sector is exploring interoperability between providers,[52] which could mean that assurance is only needed once. This could support a more straightforward user experience and facilitate multi-homing across websites, but could also have other implications for effectiveness, competition, privacy and security, or innovation and variety in the supply of age assurance services.

6.26 Overall, assessments of risks to areas such as privacy, security and online safety may be an important element of any decision to mandate interoperability. However, it should be noted that perceived risks can also be used as a pretext by firms seeking to avoid or delay an increase in interoperability.[53] Assessing the level of risk and the potential effectiveness of any safeguards may require substantial evidence-gathering and analysis.

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[50] Note that the Age Verification Providers Association describes age assurance as the broadest term for methods to discern the age or age-range of an individual, which may include age verification, or age estimation which provides a somewhat lower level of confidence. AVP Association, Definitions.

[51] Under the Online Safety Act, certain providers are required to implement age verification or age estimation in relation to pornographic content (Part 5, Section 82). Ofcom's guidance for relevant providers may elaborate, among other things, on the principle of interoperability between different kinds of age verification or age estimation (Part 5, Section 83, paragraph (3)(c)). Ofcom may also make recommendations related to age assurance in a code of practice for the purpose of compliance with other duties for the protection of children. In deciding whether to recommend the use of age assurance, or which kinds of age assurance to recommend, Ofcom must have regard, among other things, to the principle of interoperability between different kinds of age assurance. (Schedule 4, paragraph 12(2)(g)).

[52] See e.g. AVP Association, February 2022, What is interoperability, and why is it such a priority for the AV industry?

[53] Related to this, the ICO and CMA's joint statement on competition and data protection in digital markets notes that there is a risk that data protection law is interpreted by large integrated digital businesses in a way that leads to negative outcomes in respect of competition, and that this risk can be managed through careful consideration of issues on a case-by-case basis and continued close cooperation. Competition and data protection in digital markets joint statement

7. Conclusions

7.1 Mandated interoperability shows potential to be a powerful tool for authorities seeking to address competition concerns in digital markets in certain situations.[54] However, various trade-offs come into play when assessing any case for greater interoperability and when considering the appropriate approach for intervention. This paper has sought to highlight some important factors for consideration, while acknowledging that not all context-specific factors will be captured in our generalised framework.

7.2 In practice, any assessment of these factors is likely to be made in an environment of uncertainty and imperfect information. The technology stacks and business models that underlie digital platforms can be highly complex, while the future direction of innovation is inherently uncertain. Even following a thorough and well-balanced assessment of economic and technical factors, some scope for unforeseen consequences may remain. Therefore, authorities face difficult decisions regarding the timing of any intervention to mandate interoperability, whereby any deferral might allow further market monitoring to reduce the level of uncertainty, but also delays the potential benefits to consumers and society.

7.3 Assessments may face added complexity when the prospect of interoperability raises challenging questions in areas such as privacy and online safety, as well as affecting competition. In such cases, cooperation between regulators is likely to be particularly important.

7.4 As authorities around the world explore the role of interoperability in digital markets, the interaction between steps taken in different geographies requires consideration. Digital platforms often operate across borders and interoperability is one of multiple areas where a patchwork of different regulatory approaches could emerge. Interventions in one geography could conceivably affect the provision or usage of services in another, depending on how global platforms respond, while questions around jurisdiction and identification of applicable users will arise (for example, where users roam across jurisdictions, hold multiple nationalities, etc). Therefore, as in other areas of online regulation, there are likely to be significant benefits from international co-operation to discuss approaches, seeking to avoid any avoidable misalignments, burdens on firms or adverse impacts on user experience.

[54] This paper does not consider any other possible (non-competition-related) policy rationales for mandated interoperability.