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# Innovation in Digital Ecosystems: Challenges and Questions for Competition Policy

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2020S-10
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**ISSN 2292-0838 (online version)**

# Innovation in Digital Ecosystems: Challenges and Questions for Competition Policy

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**Abstract/Résumé**

Digital ecosystems development is characterized by a paradox in terms of innovation. At no time in history has the pace of innovation been so fast and never before have third-party firms been able to benefit so much for their own innovations from their integration into a keystone player's ecosystem. However, such a keystone player may be encouraged to implement non-cooperative strategies to capture the innovations developed by its own complementors. Such strategies may be detrimental to trading partners, innovation and consumers. This article aims to analyse these two possible effects of the development of digital ecosystems on innovation and to infer recommendations in terms of competition policy to counteract the detrimental effects that may result from potential unbalanced co-opetitive situations.

**Keywords/Mots-clés:** Innovation, Competition, Digital Ecosystems, Keystone Player, Co-Opetition

**JEL Codes/Codes JEL:** L12, L13, L25, L41

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## Introduction

The dynamics of digital markets reveal a paradox. On the one hand, digital ecosystems are characterized by a pace of innovation rarely seen in economic history. Indeed, an industrial revolution is underway with the development of breakthrough technologies such as artificial intelligence, advanced robotics, 5G and quantum computing, to cite just a few. Not only are innovations driven by large companies - the keystone players (Iansiti and Lieven, 2004) -, but they are also developed by companies that are smaller participants in their ecosystem, the so-called complementors. Thus, if innovations are produced by diversified players that can adapt to the various user profiles, they are compatible with each other. The logics of customization and mass production are reconciled and each innovation benefits from the positive externalities linked to the resources provided by the ecosystem in which it takes place.

On the other hand, the same trends can also be understood with a less optimistic perspective. In the latter context, innovations developed by keystone organizations in the technology sector would be mainly aimed at consolidating their dominant positions and extending them to adjacent markets. The long-term counterpart of the gains for consumers would be a strengthening of the competitive foreclosure of dominant positions and their extension to related markets. This would be to the detriment of both competitors and firms participating in the ecosystems of the platforms themselves.

The model of open digital ecosystems is usually based on three elements: (1) complementarities between players, (2) the pooling of resources and (3) the facilitation of innovations developed by complementors. The literature interested in market competition is increasingly focused on two important questions: (1) the damage to innovation that can result from the strategy of dominant firms and (2) the damage to trading partners that can also stem from these strategies. These questions were initially developed by analogy with the biotechnology sector around the issue of killer acquisitions (Cunningham et al., 2019). In this context, it would be in the interest of dominant platforms to acquire firms that could eventually prove to be competitors on the original market or that could eventually acquire a dominant position on a related market that could be a growth driver.

The acquisition strategy is not systematically negative for the consumer in terms of welfare. Indeed, the very investment capacities of dominant operators, their technological resources and advantages of size and scope combined with the network effects the dominant platforms have at their disposal may lead these "potential" innovations initially developed by complementors being improved and proposed at a much lower price, if not free. However, two competitive harms remain: the reduction of consumers' freedom of choice and possibly the freedom of competitors to enter the market. Indeed, there is an alternative to takeover to eliminate an innovative competitor: that of anti-competitive foreclosure. This can be done through cloning innovation, through predatory strategies such as tying or, when the target firm can only access the market through a key gateway, the dominant platform, a strategic reduction in interoperability.

A key point is that these strategies for eliminating potential competition can also be implemented within digital ecosystems. Relationships with complementors can be characterized by both cooperative and non-cooperative logics. A platform can be encouraged to supplant its own complementors. It can implement such a strategy all the more easily if it controls access to

the market and to the key resources of the ecosystem, and if it can detect potential competitive opportunities and threats even earlier.

The platform not only controls a critical infrastructure but also enjoys a decisive informational advantage over its complements, as illustrated by the formal procedure opened in September 2018 against Amazon by the European Commission.

What are the advantages of the platforms vis-à-vis their complementors? They are at least fourfold: (1) the capacity for early detection (nowcasting), (2) the financial capacity necessary for external growth, (3) the market position that makes anti-competitive foreclosure possible and (4) finally the technical, financial and human capacities to outperform third parties in terms of innovation. About the latter point, thesecapacities are amplifiedby the two-sided business model, the advantages linked to network effects and the economies of scale and scope.

Innovation and hence the competition process itself can be hampered by this economic power, which has the effect of making the market less and less contestable. Moreover, the development of artificial intelligence and quantum computing could further strengthen the advantage of dominant firms in informational and computational terms.

The scenarios of "damage to innovation" and "damage to trading partners" could then be confirmed. However, how can we assess the effects of digital ecosystems on innovation incentives both for the dominant platform and for the other members of its ecosystem? Will the former benefit from a right to be lazy and the latter be discouraged from innovating? This is precisely the main question of this article. We want to study the incentives for innovation in digital ecosystems in a context of consolidation of dominant positions and in a model of cooperation with complementors. We analyze the effects of this industrial structure by taking into account the dynamics of innovation and the phenomenon of innovation clusters.

The article is structured as follows.

A first section presents the impacts of the ecosystem cooperation model on the incentives to innovate of both the dominant platform and its complementors.

The second section shows that incentives to innovate remain important for the dominant platform despite its ascendency. Innovating is an important strategy for the platform for two reasons: (1) so as not to be disrupted, and (2) to benefit from renewed flows of data. Also, platforms have a high interestin encouraging innovations developed by its complementors to promote and maintain the attractiveness of its ecosystem in a perspective of inter-platform competition.

Our third section, which is conclusive in nature, makes some recommendations for competition policy.

## I. The Paradox of Innovation in the Age of Platform Ecosystems

The academic debate in the field of competition economics is polarized on the question of the market power of dominant platforms in the digital economy sector. Since the reduction in consumer surplus is difficult to measure in sectors where free service often prevails (at least in terms of direct monetary compensation), discussions focus on the damage to the market process that could result from a blockage of competitive dynamics (if market positions are no longer contested) and possible harm to innovation. This may be difficult to characterize. Dominant

operators devote a very significant proportion of their revenues to research and development and, moreover, support the innovations brought by their complement-companies by guaranteeing them access to the market, a critical mass of users and by providing them with financial, informational and technical resources to lower the barriers to innovation. According to Iansiti and Lieven. (2004): "Keystones can increase ecosystem productivity by simplifying the complex task of connecting network participants to one another or by making the creation of new products by third parties more efficient. They can enhance ecosystem robustness by consistently incorporating technological innovations and by providing a reliable point of reference that helps participants respond to new and uncertain conditions."

At the same time, the literature highlights the risk of damaging innovation through innovations that lock consumers into a given ecosystem - thereby limiting their freedom of choice and the market access opportunities of competitors. Innovations could harm consumers and competition if they have the effect of increasing consumer captivity to the platform. The keystone player can consolidate its dominance through its innovations to the detriment of the consumer by reinforcing its foreclosure. Such a strategy echoes the concept of predatory innovation as coined by Schrepel (2018). This predatory innovation may involve the supply of complementary goods and services that will be lost in the event of platform shifts. Consumers who face increasing switching costs are less likely to opt for an exit strategy. In other words, innovation may increase its potential switching costs. The European Commissioner for Competition's speech of 9 December 2019 reflects this concern. Stressing the low significance of tests such as the SSNIP for free services, she insists on the interest of considering tests based on the platform's capacity to keep its users despite a decline in the quality of its service. This test was used by the Commission in its Android decision of 18 July 2018.

Damage to innovation through innovation may come through other channels than the defence of the current dominant position. It may pass through tying strategies that may lead to the extension of the dominant position on a basis other than its merits (in other words in a way that a competitor as efficient as the operator in question would not be able to replicate because it does not have the advantages directly related to the dominant position). This tying strategy was one of the practices sanctioned by the Commission in the Android case cited above. It recalls in its operation the practices that led Microsoft to be sanctioned by the European Commission in March 2004.

This tying practice damages innovation because it leads to the abusive foreclosure of a competitor offering a service distinct from that of the main operator. The consumer is deprived of an alternative technical solution, which might have been more satisfactory to him in view of his specific needs. Tying may result in an implicit price reduction and possibly an improvement in the quality of the service provided. This improvement can take place through two channels. The first is through the gains from integrating both services. Integrating the functions now provided by applications directly into the mobile operating system can crowd out application developers from the market but improve the user experience and increase system performance. Tying may also be able to enhance the quality of the tied service compared to the quality that would have been achieved in the absence of tying.

However, the practice induces indirect harm to the consumer beyond even reducing his short-term choices: it deprives her of subsequent potential innovations. These are innovations that could have been developed by the firms and that were crowded out.

The model corresponds to the foreclosure of a firm competing with the dominant operator that would be active in a related market. As highlighted in the academic literature, the problem is that these evictions can also take place within ecosystems. Such eviction may seem paradoxical with the characteristics of certain numerical ecosystems whose performance depends on the existence of cooperation between their various players.

The literature in strategic management shows the mutual benefits that different members of the digital ecosystems can derive from cooperation in innovation (Marty and Pillot, 2019). As already noted, complementors enjoy access to boundary resources that enable them to lower their innovation costs. They can even benefit from direct financial support, as shown by the European Commission's Google Android decision. In return for the pre-installation of certain Google services, they received financial payments from Google. The latter should not be interpreted solely as a tool for locking in a bilateral relationship (and therefore for crowding out competing services). They also constitute an incentive related to the additional data flows collected by Google through this pre-installation.

The osmosis between the different players on the platform also takes the form of facilitating innovation in relation to an innovation that would be developed outside the platform. Indeed, belonging to the ecosystem guarantees interoperability with the services developed by other members and gives access to a larger volume of users. Not only are the latter co-producers of the services rendered by the applications (if we continue on the case of mobile operating systems), but the very performance of an algorithm depends on the mass of data available for its training and operation. Leaning on a powerful ecosystem increases the performance of its innovations, *ceteris paribus*. Moreover, the distribution by the platform itself of a service developed by a complementor allows faster and more efficient access to the consumer, by reinforcing the confidence that the latter can have in the proposed innovation. In this way, belonging to an eco-system makes it possible to lower the barriers to entry to innovation and to solve the problem of cold starts.

Ecosystem structuring is therefore a priori favourable to innovation. How can this premise be reconciled with kill zone approaches? Should we conclude that the dominant platform captures the potential gains linked to the innovations developed by its complementors? On the contrary, it must make a credible commitment not to do so in order to give them some ex ante incentives. However, the question remains: what are the incentives to innovate on a dominant platform?

## II – Incentives to innovate despite dominance

**Doesn't a monopoly need to innovate?** The economic literature has long produced contradictory conclusions about the incentives for innovation that weigh on dominant firms. The ultra-dominance phenomena that characterize digital ecosystems could lead to the platforms concerned being positioned as quasi-monopolies protected by virtually unbreakable barriers to entry. From a Schumpeterian perspective, this situation would indeed be the most favourable to investment. The platform has the capacity to make costly investments whose prospects of return are remote and uncertain because it is protected from any competitive threat. However, if the monopoly has a definite capacity to invest, does it have enough incentives to do so? For Arrow (1962), only competition generates the necessary incentives for innovation … with the very purpose of escaping competitive pressure. The monopoly, for its part, has no incentive to dissipate part of its rent in order to… replace itself (Bresnahan et al.,

2012). Indeed, if it already manages to extract all the available rent, it maximizes its profit by renouncing innovation.

This balance between incentives and capacities to innovate has found a translation with the inverted U-curve described by Aghion et al. (2005). Investments in innovation are impossible in perfect competition and have no rational interests in a monopoly situation. However, digital platforms are characterized by very high market shares and seem to be protected by the most significant barriers to entry. These barriers relate to the financial investments required to enter the market, the risks associated with investments in algorithms (which will be stranded costs in case of failure), technological barriers (not all technologies are accessible to all market players under the same conditions) and finally possible informational barriers. Since the performance of algorithms depends on the mass, speed of renewal and diversity of available data, an entrant will not be as efficient as a dominant operator. Moreover, since service performance is linked to network effects, both direct and indirect, an entrant cannot be efficient if a high percentage of users do not switch to the new service.

The assumption of non-contestability underlies neo-structuralist approaches (the neo-Brandeis movement for instance). It would lead to advocating the dismantling of firms to make competition possible and should correspond to a situation in which dominant firms would no longer innovate. On the other side of the spectrum, proponents of antitrust minimalism argue that no dominant position is sustainable in the sector because of the very pace of innovation and network effects that can have a negative impact, as was the case with MySpace.

Our aim is to shed a nuanced light on this debate. Incentives to innovate from dominant firms exist but can be biased. The incentives of dominant firms to encourage innovation by complementors may also be biased.

First, a dominant firm, even if protected by barriers to entry, may have incentives to innovate. First, even beyond the digital world, dominant players may have incentives to innovate in very specific cases. They may do so if they market durable goods. Innovation is needed to induce customers to renew their equipment. The competition for the dominant operator is that of the installed base. Second, in some service activities, innovation is needed to meet competition from non-consumption.

Second, in the case of platform industries, two other reasons may explain the persistence of incentives to innovate. The first is the competition with other digital platforms, which can disrupt one of their competitors by innovating. Not only does the convergence of markets mean that we do not have an archipelago of isolated monopolies, but an oligopoly made up of firms with a dominated market but competing on their margins and potentially for their core business. These firms are also competing in their future markets (Evans, 2017). The second reason why these firms have an incentive to innovate is to ensure the continuity of the data flows they have at their disposal and thereby increase their predictive capabilities. The predictive capabilities of algorithms are higher the more recent the data, the more complete the history and the more diverse the data.The more a platform diversifies its services, the better its predictive performance is.

Finally, innovation can be a means of sustaining and expanding its dominant position. In which case, the strategy of the dominant operator is not one of more performance competitions (i.e. competition on the merits) but one of hindering competition (i.e. technological foreclosure or anti-competitive foreclosure). The innovation strategy may reveal itself under certain

harmful conditions not only in terms of consumer welfare but also in terms of innovation dynamics: we therefore speak of foreclosure innovation or predatory innovation.

**Innovation incentives from complementors.** We should keep in mind that the development of an ecosystem is highly dependent on the keystone player ability to foster innovation by complementors. Therefore, the keystone player has to consider - in the definition of its own strategy - its possible adverse effects on the complementors' capacities and incentives to innovate (Gawer and Cusumano, 2002; Diestre and Rajagopolan, 2012). This importance is shown positively in the case of Android, where the catch-up with iOS has been achieved by pooling resources, developers' skills, network operators and handset manufacturers. It appears negatively in the case of Windows Phones, where the ecosystem has fallen into an attrition spiral: the low number of users reduces the incentives to develop applications and in return, the reduction in the number of available applications increased user disaffection.

Belonging to an ecosystem encourages the development of innovations by lowering their cost and reducing the associated risks. As we have seen, the pivotal platform is encouraged to provide technological resources (data, interface protocols…), and even financial incentives to help the development of complementary innovations. The provision of boundary resources is likely to lower the technological and financial "barriers" for complementors (Gawer and Cusumano, 2002).

In addition, there are three additional reasons why complementors have an incentive to innovate. The first reason is competition among the complementors themselves. The platform has every interest in encouraging them to single-home, but it has no valid reason to opt for a single sourcing strategy. The second reason lies in the risk that the platform will integrate the service provided into its own offering (either by cloning or not tied selling) if it is dissatisfied with the quality or performance of the service provided. The third reason is the need to diversify the risk if a strategic change driven by the platform questions the sustainability of its technology or business model. The fall of Criteo's share price in January 2020 reflects the risks associated with technological decisions made by the platform, in this case the end of cookies within two years (see Geradin and Katsifis, 2020).

Innovation is therefore essential for a complement-maker in a cooperative model. Complementors face a specific situation: their success in their innovation strategy depends on belonging to a dynamic ecosystem; at the same time, innovating in this context is like "swimming with sharks" (Diestre and Rajagopolan, 2012). A crucial innovation may expose them to a *Killing Zone* phenomenon; a low rate of innovation may expose them to being supplanted by other complementors or even to being crowded out by the platform. An implicit contract could then consist in not crowding out a complementor (by vertical integration for example) if it is successful.

**The notion of damage to innovation in digital ecosystems.** According to Geradin (2018), dominant operators' market strategies could harm the competitive process by depriving consumers of future or even potential innovations through technological and competitive foreclosure. The European Commission's Microsoft decision of 24 March 2004 (37,792) was already based on this notion of harm to subsequent innovation. By foreclosing competitors from related markets affected by the practices, competitive foreclosure deprived consumers of innovations that could potentially have been developed by them. First of all, this question can be analyzed through the prism of the essential facilities theory. For instance, a refusal to access the protocols for interfacing with the Windows operating system leads to depriving the

consumer of an innovation, which could have satisfied a need not yet covered by the dominant operator's offer or which could have been made in a different way, more adapted to his specific needs. This same question can then be considered from the point of view of tying. By including a service previously provided by a third party in its offer, the dominant operator may hinder its access to the market and deprive the consumer of his freedom of choice. This situation corresponded to the foreclosure of Internet search engines competing with Windows Explorer once the latter was integrated into Windows. Using a third party search engine was tantamount to paying twice as its cost was built into the price of the tying product, the operating system, for which Microsoft had a de facto monopoly.

Thus, the notion of harm to innovation can both induce consumer harm in the long term, prevent the challenging of positions acquired by competitors and extend dominance to other markets (Zhu and Liu, 2018; Todd, 2018). The specificity of digital ecosystems is that foreclosure can occur to the detriment of firms outside the ecosystem, but also to the detriment of firms participating in it. In other words, the dominant firm may innovate by harming its own complementors. It may do so for fear of being disrupted in its core business or in order to take control of related activities that are profitable either in terms of revenues or data flows. Echoing the European Commission's June 2019 Regulation on Platform to Business relationships, crowding out can occur in two ways. The first way is the cloning of regulators' innovations; the second way is the termination of business relationships in the form of, for example, account suspension, access to the application store or the termination without notice of the provision of boundary resources. It is therefore in the keystone player's interest to find the right balance between its value capture models as well as the pace of innovation coming from its complementors. The keystone player needs to leave some space to prevent innovation disruptions for the complementors (Wen et al., 2016).

Damage to innovation may also take the form of innovations that the dominant operator refrains from developing - because there is no competitive threat - or innovations that competitors fail to develop or cannot effectively offer on the market. Finally, it may also take the form of predatory or foreclosure innovations. In the latter case, the aim is to innovate in order to increase the captivity of platform users by increasing their possible costs of change, or to innovate in order to reduce the interoperability of services. Innovation in such situations may *a priori* be favourable to the consumer but has the effect of reducing the contestability of the dominant position and thus harming the market process.

## III. Discussion and proposals for competition laws

The effects of ecosystems on innovation lead to contrasted results that highlight the strong position of the pivotal platform - the keystone player - in relation to the various stakeholders, especially the complementors.

The aforementioned tools can reinforce the dominance of the major platforms and lead to damage for consumers, for competitors deprived of the possibility of competition on the merits and for the complementors themselves. The problem is that these dynamics can be difficult for competition authorities to detect (as we have just pointed out for nowcasting). In the same way, the damage suffered by the complementors can be read from the angle of contractual imbalances and thus be either dismissed outside the scope of competition law or confined to the notion of abuse of economic dependence, the punishment of which is particularly difficult.

Moreover, the integration of the services provided by the complement-suppliers by the pivot firm itself may be favourable to the consumer in terms of welfare and could be defended based on efficiency. Such vertical integration can generate efficiency gains through, for example, ending the phenomenon of double marginalization; it can also do so by increasing the degree of performance and quality of the service offered. Tying or bundling strategies can be damaging to innovation or complements without being harmful in terms of consumer welfare. This raises the question of the capacity of the consumer welfare criterion alone to capture all the competitive risks to be addressed by the competition authorities. Where appropriate, the question arises as to which additional criteria should be taken into consideration and how they can be reconciled in a situation of imperfect, i.e. incomplete and asymmetrical information.

A comparable issue is also to be considered with regard to merger control rather than punishment for eviction abuses. Damage to innovation and complementarities can be done through killer acquisitions. The acquisition of a potential disruptor may indeed be part of a strategy to hinder innovation. It may be a strategy to reduce the contestability of market dominance, which may even go as far as "suppressing innovation".

However, how can these risks to competition be detected at an early stage? With nowcasting, dominant platforms can further strengthen their advantage over the authorities in charge of merger control, even if the latter could abstract themselves from the structural rules in terms of market share that weigh on them. Secondly, how to avoid the risk of false positives, i.e. the risk of considering as anti-competitive a merger that could ultimately be consumer-welfare enhancing? On the question of innovation, we have seen that the direct integration of a service by the platform can increase its performance and therefore be favourable. In the same way, it is possible to consider that the fact of being acquired is part of the very development plan of innovation by the complement-maker (and in the logic of its business plan). The initial innovation is a kind of demonstrator. Its real potential can only be obtained by its integration into the platform itself. Such a logic may lead to the defense of ex-post merger control mechanisms based on their effects, as proposed by the Competition Authority.

A final competitive issue arises. The competition enforcement authorities must have access to the right tools to address the risks of harm to innovation in the context of digital ecosystems. However, spectacular, financial penalties suffer from various biases. Firstly, they only intervene ex post. They do not restore the competitive situation that would have prevailed in the absence of the anti-competitive practice. They only act as a deterrent. If they are too weak or too predictable, they amount to a cost for doing business; conversely, if they are too high, they can have very damaging consequences in the event of false positives, i.e. decisions that wrongly classify a practice as anti-competitive. However, this risk is very easy to envisage in the case of predatory abuses, particularly when the lawsuit is filed by a former or a current competitor.

It therefore remains to consider the conditions for the effectiveness of the latest instruments available to the competition authorities to restore the competition conditions on the merits or at least to put an end to anti-competitive practices. Which measures could prevent damages to innovation?

A first set of measures can work ex ante. The European Regulation of June 2019 promoting fairness and transparency for companies using online intermediation services provides for a number of them. If not, they can help re-balance contractual relations between platforms and aggregators, at least limit the risks of distortions in access to data and offer guarantees in terms

of non-discriminatory access to the platform and conditions relating to possible account suspensions or closure of access to the platform.

A second set of measures could fall under the activation of the essential facilities theory.

Under European competition rules, a dominant operator who controls an asset to which access is indispensable for third parties to carry out their activity on a related market but which cannot be replicated under reasonable technical and financial conditions may be sanctioned for abuse of foreclosure if it refuses access under conditions that are not objectively justified or if it grants access under discriminatory conditions (from a technical or tariff point of view) and if these conditions are likely to hinder the development of competition on the merits on the downstream market.

In such situations, the European Commission can compel the dominant firm to grant access to its competitors under reasonable and non-discriminatory pricing conditions. Of course, several conditions still need to be met. Access to the infrastructure must be indispensable for its activity on the market; the refusal of access must be objectively justified, the service offered must be new and the infrastructure must be effectively non-reproducible. On the other hand, it cannot - at least in principle - be argued that access to an ecosystem or platform is indispensable as it is the cheapest and most efficient way to access the market. It must also be shown that it cannot be replaced by infrastructure or that the asset to which access is sought has no substitute, even if imperfect and even more costly. Moreover, European decision-making practice requires (for intangible assets) that a balance of incentives is made to ensure that access does not reduce the incentives to invest and innovate of the operator concerned … but also those of its competitors who benefit from it.

These restrictive conditions are only partially respected in decision-making practice. For instance, the new product test was limited in the 2004 Microsoft decision to the possibility of benefiting from specific subsequent software developments, and access obligations could be imposed on firms that were active in the same market as the dominant operator and not in a related market.

How and under what conditions could these remedies based on essential facilities theory be activated in the context of digital ecosystems?

First, they have already been in the Microsoft case with respect to interface protocols to the Windows operating system. The aim was to prevent MS from extending its dominant position to related markets (browsers, media players, etc.) by playing on the technical complementarities between the different services. Giving access to interface protocols made it possible to ensure competition on related markets by guaranteeing the interoperability of services.

Next, it would be necessary to question the qualification as an essential facility of a mobile operating system in itself, an application store or even a market place. It is not because an infrastructure provides the most efficient access to the market that it can be classified as an essential infrastructure, as the Bronner judgment of the Court of Justice has shown. However, some platforms are market access locks: gatekeepers. These gatekeepers are all the more tightly controlled because users have opted for single-hosting strategies and because the platform is a competitor of the firms that need to access it in its downstream activities. Two solutions are possible. The first would be to prohibit the platform from developing downstream activities - in other words, to give up its vertical integration (see Khan, 2019). The second would be to

impose platform neutrality through remedies. This does not only apply to marketplaces; it can also be imposed on ecosystems in the form of a neutrality device. Access to the dominant platform would make it possible to limit the problems of cold starts, which can penalize the innovations developed by new entrants due to the absence of network externalities, economies of scale and scope, etc.

Finally, the activation of the essential facility theory has also been proposed for access to data controlled by the dominant operator and thus, if not compensate for its competitive advantage, at least limit informational asymmetries to the detriment of complement-makers and competitors. To the extent that the performance of algorithms depends on the quantity and quality of data and that a small difference in available data leads to large differences in predictive capacity, then such a remedy is likely to strengthen competition through innovation.

Such remedies are not obvious in competitive terms. Is data an asset that can be appropriated by a given platform and as such can it be qualified as an essential facility? Similarly, are algorithms or computational capabilities not assets at the core of competitive advantage that are difficult if not impossible to replicate by new entrants or competitors with small market shares?

Defending the contestability of markets and preventing damages to innovation could lead to intrusive remedies or even asymmetric regulation of competition. They would make more sense in an "industrial policy" based mindset aimed at making technologies accessible and lowering barriers to market entry. This would make sense if we consider that the increasing concentration of markets is not only the result of a weakness in the activation of competition rules but also of a growing productivity gap which may be aggravated by the control of critical digital technologies such as AI and quantum computing.

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