

COUNTERING THE GOOGLE THREAT: PLATFORMIZATION, STRATEGIC CHOICES AND INCUMBENT ADVANTAGES

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Abstract

In this article we examine how incumbents in industries that follow a value chain logic, where firms develop, produce and sell physical products and complementary services, may counter the threat posed by the adoption of a platform in their industry (a process we term “platformization”) and the associated entry of platform companies (like Google). A platform acts as central hub facilitating the coordination and integration of different products and services and thus introduces a value network logic, which potentially shifts advantages to firms that dominate the platform, alters the dynamics of competition, and potentially nullifies prior advantages. We argue that incumbents may have specific advantages stemming from their customer relationships and specific capabilities that help them leverage prior advantages into the platformized industry. We also identify strategic choices available to incumbents that help shape the structure of the platformized industry to their advantage, such as exploiting customer-specific synergies through bundling or allying with competitors to sponsor a common platform. However, we argue that the viability of incumbent advantages is conditioned on the opportunity structure and, specifically, on the type of network effects and the relative value creation of the platform and the services it enables versus the product and its characteristics.

Keywords: platformization, incumbent advantage, platform dominance, competitive scope, cooptation

INTRODUCTION

Platforms are central hubs that facilitate the coordination and integration of different products and services in an industry ecosystem (Thomas, Autio, & Gann, 2014). Platforms have traditionally been central in some industries, such as the PC industry where Microsoft controls the operating system and thus the standard by which complementary software application providers may create value (Bresnahan & Greenstein, 1999). Generally, control over a platform is a critical source of advantage in a platform-based industry (Gawer & Cusumano, 2012). Recently, platforms have started to be adopted in many industries that develop and supply physical products (like cars, machines or elevators), where they enable novel ways of creating value for customers through the delivery of new types of services that are complementary to the physical product. Often, firms from other platform-based industries, like Google, Microsoft or Apple, seek to establish their platforms in these industries (e.g., Google's Android Auto or Apple's CarPlay allow seamless use of smartphone apps in cars) or new entrants (like Uber and Lyft in the car industry) aim at commercializing novel platform-based business models. Platform control confers advantages in terms of managing complementors and access to customers and their data and at the same time may lead to commoditization and thus fewer possibilities for differentiation in the physical products connected to the platform. Therefore, for traditional incumbents in product-based industries (which we refer to as "industrial incumbents") the process of adoption of a platform in their industries (which we refer to as "platformization" of that industry) has the potential to undermine the sustainability of their competitive position. The smartphone industry is a prime example of an industry that has undergone platformization, which has led to the demise of former industry leaders Nokia and RIM/Blackberry and the dominance of platform owners such as Apple (providing an integrated bundle of hardware with its operating

system platform) and Google (partnering with smartphone manufacturers that use its operating system Android). In this article, we thus examine the impact of platformization on industrial incumbents and the conditions under which they can sustain or even enhance their prior competitive position.

Platformization centrally affects the logic of value creation and the nature and dynamics of competition. Specifically, platformization introduces a value network logic into an industry that is traditionally based on a value chain logic (Stabell & Fjeldstad, 1998). This leads to a central role of network effects and product interoperability as well as the associated dynamics that often lead to winner-take-all outcomes (Katz & Shapiro, 1985; Shapiro & Varian, 1999). At the same time, however, elements of the traditional value chain logic that are based on product differentiation and cost-efficient operations may be retained (Porter, 1985), leading to an industry with a hybrid logic where platform dominance is a key source of advantage yet traditional sources of advantage based on controlling specific assets and capabilities may keep their value. Furthermore, due to platformization incumbents' products become part of a wider ecosystem that also comprises the products and services of other firms, which may be providers of complementary services but also of competing products. Platformization therefore has a systemic impact that alters the nature of competition (which may shift to integrated bundles of product and platform) and cooperation (because firms need to decide about which platforms to sponsor and make their products compatible with).

We argue that in a platformizing industry, under specific circumstances incumbents may have advantages against new entrants stemming from their prior assets and capabilities. Their value, however, is contingent on the opportunity structure (Shane & Venkataraman, 2000), i.e. how the platform creates new value for customers in terms of the type of network effect (where

we distinguish between network effects based on the availability of complementary services, e.g., through an app store in a smartphone ecosystem, and those based on product interoperability, e.g., in allowing connecting different smart home appliances) and the relative value creation of the platform and the services it enables as opposed to the product and its features. Incumbents' existing customer relationships may provide a strength that can be used to dominate a platform (Farrell & Saloner, 1986). If platform dominance is not possible for incumbents and platformization threatens to lead to commoditization of incumbents' products, they may nevertheless possess specific capabilities that allow them to continue differentiation through exploiting customer-specific synergies (Schmidt, Makadok, & Keil, 2016) or creating a series of temporary advantages (Brown & Eisenhardt, 1997). Another possible alternative is to become a supplier to competitors or new entrants if firms possess unique and scalable capabilities (Porter, 1985). Finally, whether incumbents can capitalize on their advantage depends on the specific strategic choices they make that help shape the structure of the platformized industry to their advantage. Here we distinguish between choices about competitive scope (whether to offer a platform and which services to provide) and about integration and cooperation (which platforms to make one's product compatible with and whether to jointly establish a platform among competing incumbents to compete against new entrants).

Our findings contribute to the strategy literature in three ways. First, we identify sources of advantage and strategic choices available to incumbents that allow them to deal with a changing industry environment due to platformization, thus adding insights on the content side of change to a literature that has largely been inward-looking and focusing on firms' dynamic capabilities and organizational structures in dealing with change (O'Reilly & Tushman, 2013; Teece, 2007). Second, our findings provide a baseline for studying the dynamics of platformization of an

industry and, specifically, for identifying the conditions under which incumbents indeed capitalize on the advantages we have identified, which includes examining the impact of timing of the strategic choices (Lieberman & Montgomery, 1988) as well as examining how incumbents' managers understand the advantages they have (Tripsas & Gavetti, 2000). Third, our findings also provide a basis for studying the changing competitive dynamics that occur in a platformizing industry when incumbents and entrants alike vie for platform dominance and incumbents seek to maintain differentiated positions, and the process of industry convergence that ensues as a result (Chen & Miller, 2012; Hacklin, Battistini, & Von Krogh, 2013).

Our article is structured as follows. We first show how platformization affects value creation and competition in incumbents' industries before discussing the structure of opportunities in platformizing industries. We then derive propositions about whether platformization will occur, the assets and capabilities that possibly provide for incumbent advantages, and the strategic choices available to incumbents. We then discuss implications of our findings and chart opportunities for further research.

PLATFORMIZATION AND COMPETITION

The challenge from platformization for industrial incumbents

In industries where incumbents develop and sell physical products and complementary services, platforms enable new types of services to be created for customers, which provides opportunities for both incumbents to extend the scope of their offering and for new entrants, whose entry thus threatens incumbents' position. Such platforms are often, but not necessarily, based on technologies that comprise software algorithms and interfaces, allowing managing and integrating different services and applications and connecting different players. Thus, they allow creating and exploiting network effects, which they may do in one of two ways. First, they

enable the availability of a variety of complementary services. As an example, the smartphone industry was fundamentally changed when application stores allowed users to enhance the capabilities of their phones through a large variety of applications developed by third-party complementors (Boudreau, 2012). The resulting strong network effects led to Google’s Android platform’s dominance and the demise of formerly dominant manufacturers (Nokia and Blackberry) that did not adopt Android. A second form of network effect derives from enabling interoperability among physical products, such as machines, and managing and optimizing their usage. Such technologies rely on the availability of information from various devices and their integration and are associated with big data and analytics services. Examples can be seen in how Uber is connecting individual cars with their drivers into a transportation system, or how Rolls Royce is remotely monitoring and maintaining their global fleet of jet engines. It should be noted that while the two types of network effect are conceptually distinct, in practice they may overlap. For example, the complementary services or applications for smart homes, which benefit from the interoperability of different products, may well be provided via an app store that leverages the installed base of interoperable products to create incentives for third-party application developers. Table 1 provides a list of examples.

Insert Table 1 about here

We refer to the adoption of a platform in an incumbent’s industry as “platformization” of that industry. The specific challenges posed to industrial incumbents by platformization are largely unaccounted for in the strategic management literature. In fact, while the strategy literature is centrally concerned with the sustainability of competitive positions in the face of

changing environments, it has been largely inward-looking, focusing on firms' processes or dynamic capabilities (Teece, 2007; Teece, Pisano, & Shuen, 1997) and organizational design or ambidexterity (Gilbert, 2006; O'Reilly & Tushman, 2013) that allow addressing changing environments. The literature that specifically deals with the effect of platforms on incumbents either concerns industries that have already earlier operated based on a platform logic (Casadesus-Masanell & Zhu, 2010) or fails to account for the prior position and the specific assets and capabilities held by incumbents (Gawer & Cusumano, 2012). More generally, in accounting for how incumbent firms may deal with changing environments, the strategy literature often neglects the specific structure of the environment faced by firms (e.g., how value can be created for customers or the scope and cooperation strategies of firms in an industry) which influences which assets and capabilities will retain or even appreciate in their value and how industry structure may be endogenously shaped by firms to their advantage (Priem & Butler, 2001; Schmidt & Keil, 2013).

Platform businesses have been studied in their own right both in terms of the underlying economic drivers, such as network effects (Katz & Shapiro, 1985; Rochet & Tirole, 2003) and synergies derived from complementary offerings (Schilling, 2000), and in terms of the strategic options available to firms and their effects, such as making products compatible (Katz & Shapiro, 1994), granting access to and managing providers of complementary products (Boudreau, 2010), dominating a platform (Gawer & Cusumano, 2002; Suarez, 2004) and the strategic trade-offs faced by firms (Cennamo & Santalo, 2013). For industrial incumbents that develop and sell physical products platformization of their industry poses two novel challenges. First, platformization shifts the sources of competitive advantage. Specifically, while industrial incumbents' business traditionally has followed a value chain logic, where the capabilities to

develop products, to coordinate suppliers of inputs, and to efficiently manufacture and distribute the firm's product centrally affect firms' competitive advantage and performance (Barney, 1991; Eisenhardt & Martin, 2000), in businesses based on platform technologies the creation and exploitation of network effects to integrate and mediate between different types of users as well as the providers of complementary services is central (Stabell & Fjeldstad, 1998). Second, platformization affects competition and industry structure by altering the set of players and how they compete or cooperate with each other. In an industry that is subject to platformization, the incumbents' products become part of a wider ecosystem that also comprises the products and services of other firms, which may be providers of complementary services but also of competing products. Thus, platformization has a systemic impact by altering and redefining the ecosystem surrounding the product, which can affect how the product is used, enable complementary services, and even change the very definition of products and industries (Hacklin, 2007; Normann, 2001).

Strategy and competitive advantage in platform businesses

In platform markets strategy is centrally concerned with the creation and exploitation of network effects (Cennamo & Santalo, 2013; Eisenmann, Parker, & Van Alstyne, 2006; Stabell & Fjeldstad, 1998). Because of increasing returns to the adoption of a network by users (Arthur, 1996; Katz & Shapiro, 1985), platform markets contain inherent dynamics that favor one or a few networks or platforms and that lead to tipping and winner-takes-all dynamics (Gawer & Cusumano, 2012; Katz & Shapiro, 1994). These dynamics lead to firms and industries being locked into particular networks and standards (Arthur, 1989), granting a sustainable position to those firms that control these networks and standards while requiring other firms to vigorously compete, e.g. through product innovation (Bresnahan & Greenstein, 1999; Garud &

Kumaraswamy, 1993).

For firms that seek to gain control over a platform, various strategies have been proposed for managing these dynamics and, in particular, for building a critical mass of users and thus outcompeting rivals. The challenge of building a large network is exacerbated by the fact that platforms often facilitate the coordination and interaction of at least two distinct types of users that may differ in their preferences and the utility they derive from the interaction with others (Rochet & Tirole, 2003; Rochet & Tirole, 2006). While pricing is central to incentivize users to adopt a platform and thus to create network effects, product bundling and envelopment can be used to gain control over adjacent markets (Eisenmann, Parker, & Van Alstyne, 2011). While these strategies focus on rivalry, other arguments highlight the role of cooperation. For example, because of increasing returns to the adoption of a network, agreeing on a common standard will lead to a larger installed base and often benefit both firms and customers (Farrell & Saloner, 1985; Matutes & Regibeau, 1988). This means that in platform markets cooperation is often, though not always, beneficial and firms may thus benefit from “coopetition”, where firms cooperate to increase the size of the pie but at the same time compete for its division (Brandenburger & Nalebuff, 1996).

Generally, insights on the sources of competitive advantage in platform markets and the strategies available to firms competing in such markets is relevant to understanding the challenges and opportunities platformization provides for industrial incumbents. However, they only provide an incomplete perspective because they do not take into account the fact that there is a pre-existing industry with firms that have accumulated and deployed resources and capabilities and that enjoy varying degrees of success in the industry under a value chain logic. It is thus necessary to examine how platformization changes competition in an industry that is

characterized by a value chain logic.

The effect of platformization on competition in the incumbents' industry

In industries that follow a value chain logic competitive advantages stem from developing and deploying idiosyncratic resources and capabilities that allow firms to develop innovative and high-quality products or enable efficient production and distribution and so ultimately confer a position of low cost or differentiation (Barney, 1991; Porter, 1985). However, in a platformizing industry, sustainable competitive advantage and performance may ultimately hinge to a lesser degree on differential assets and capabilities (Barney, 1991) but rather on managing network effects and controlling access to the platform (Thomas et al., 2014). Generally, this would imply that platformization would lead to discontinuous change and would be competence-destroying for industrial incumbents (Tushman & Anderson, 1986), leading to their resources and capabilities losing their value when their industries are platformized (Schmidt & Keil, 2013). However, because platformized industries will be hybrids that are subject to both a value chain and a value network logic, this need not generally be the case. In fact, there may be certain resources or capabilities that even give incumbents a particular advantage when faced with platformization. In particular, as has been noted in the literatures on switching costs and network effect, locked-in customers or an installed base can serve as assets that may confer competitive advantage in platform industries (Farrell & Klemperer, 2007; Farrell & Saloner, 1986).

While some of incumbents' assets and capabilities may be sources of competitive advantage in a platformized industry, platformization also changes the nature of competition by altering the set of players and the products or services based on which firms compete. Specifically, the fact that in platformized industries the incumbents' products are merely one element in an ecosystem that also includes complementary products and services introduces a second level to competition.

Subsequently competition may shift from the product to the systems level, where firms compete on the basis of integrated offerings rather than isolated products (Farrell, Monroe, & Saloner, 1998; Katz & Shapiro, 1994) or suppliers of integrated offerings may compete with specialists that each supply one or several of complementary products (Matutes & Regibeau, 1988). Because of network effects, competition for services based on a platform technology may be particularly fierce and incumbents may be vying for control of the platform through bundling such services with their physical product (Cusumano, Kahl, & Suarez, 2014; Oliva & Kallenberg, 2003). However, providing these additional products and services may also incentivize new entry from other industries. In fact, it may be that in particular such firms that successfully operate platform businesses in other industries (like Google, Microsoft or Apple) will find it attractive to enter industries where they believe they can leverage their platform by connecting it to incumbents' products. The new entrants may focus on applying their platform in the newly entered industry, or they may even bundle it with the physical product (in which case they may become providers and maybe even producers of the physical good), thus directly competing with incumbents also on the level of the incumbents' products (for example, Uber has announced that once autonomous driving technology is established it will run its own fleet of cars). As a result, competition may take place at the level of individual products or services and (alternatively or simultaneously) at the level of the integrated system bundle (Katz & Shapiro, 1994; Schmidt et al., 2016). A key determinant of the level at which competition takes place is to what extent products and services are mutually compatible (so that customers can freely mix and match products; Matutes and Regibeau (1988)) or not (so customers will be limited in their choice among competing platforms).

The above arguments imply that industrial incumbents, when faced with platformization of

their industries, will face challenges of retaining their competitive positions, but that there are nevertheless two factors that may allow them to not only retain but even enhance their competitive position. First, incumbents may benefit from their prior assets and capabilities that they can leverage into the platformized industry (Klepper & Simons, 2000). Second, there may be particular strategies (e.g., alliances with competitors or providing an integrated product-platform bundle) that incumbents may engage in that may affect the structure of the ecosystem to their favor (Gawer & Cusumano, 2002). As we argue, the viability of these factors will depend on characteristics of the industry and, in particular, on the way the platform technology provides opportunities for novel value creation.

PLATFORMIZATION AND VALUE CREATION OPPORTUNITIES

Opportunities from platformization

While the competitive dynamics discussed above are a product of the interplay of different firms within a platformizing industry, it is in fact novel value creation opportunities that provide the inducements for firms to apply platform technologies within an industry in the first place (Shane & Venkataraman, 2000). Specifically, platforms enable new combinations through adding services or applications to products (Cusumano et al., 2014), which not only enhances variety and thus allows a better match with customer needs (Langlois & Robertson, 1992) but also allows additional and new customer needs to be addressed (e.g., by enhancing or allowing new ways of using the physical product). Because addressing new needs of customers by enhancing existing products and adding new services may be a key motivation for firms in an industry to adopt platform technologies, to understand the viability of platformization strategies it will be critical to understand the structure of demand, i.e. how customers use incumbents' products and how new value may be created (Priem, 2007).

While it will not be possible for researchers to predict the type of applications that firms innovate or the way in which customers will use particular products and services, there are nevertheless regularities in the structure of demand and how value can potentially be created that may be used to generate insights into the viability of particular strategies and competitive positions in a platformizing industry. Specifically, there are two factors that are critical: (1) the type of network effects and (2) the relative value creation of the physical product on the one hand and the platform and associated services on the other hand across customer segments.

Types of network effects

Network effects are the key source of value creation in platform markets. In fact, the value that customers or users derive from participating in a network may far outweigh the benefits of the particular products in isolation. This implies that the size of a network matters (and thus, as noted above, firms often benefit from compatibility across competing products). Apart from the size of the network, the type of network effect induced by a platform is also critical. As we noted above, there are in fact two distinct ways in which platforms around physical products may create novel value. First, the core product may be augmented by complementary services or applications. Concretely this means that there are cross-platform (i.e., indirect) network effects between customers on the one side and providers of complementary services or applications on the other side (Rochet & Tirole, 2003). While industrial incumbents often have for a long time provided additional services to their products in-house or through partners (Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1989), platform technologies enable the provision of such services through a platform. The value of having third parties provide additional services and applications stems from higher innovative capacity of third-party service providers and a better match with customer needs because of increased variety (Boudreau, 2010; Langlois & Robertson, 1992).

Thus, the platform provider benefits from granting access to third-party service providers to create and exploit these network effects (Boudreau, 2010). Examples of this type of network effect are app stores that incentivize application developers to provide a variety of applications. As can be seen in the smartphone industry, the network effects generated by app stores have led to interesting competitive dynamics.

A second way to create and exploit network effects is to directly enhance the interoperability of the product with competing products (which is an instance of direct network effects; Katz and Shapiro (1985)). Specifically, because customers may use or employ a variety of products from different manufacturers, the coordination and improved usage of these products may yield benefits for customers. Interoperability may include competing products of the same category (like cars or drills) or they may extend across product categories (e.g., allowing smart home devices, like heating and light to be operated in conjunction). Interoperability also allows new, complementary services to be offered. Examples of interoperability include the smart home or complex business sites such as harbors where usage of products of different firms need to be coordinated (Adner, 2012). As we already noted above, while the two types of network effect are conceptually distinct, in practice they may often overlap and both be present in the same industry.

Relative value creation across customer segments

Not only do the network effects generated by a platform differ in terms of network size and type, but there are also differences between the value created through the network effect on the one hand and the value created by the physical product itself (including the associated services supplied by the seller). This difference has two dimensions. First, different products may vary in terms of the degree to which they may be enhanced through a platform. For example, products

that are dedicated to narrow uses (like microwave ovens) may have lower potential for being augmented through integration with other devices or services than products that have wider potential uses (such as smartphones). Second, there may be differences among types of customers or users in terms of the relative value creation of the platform for the same physical product (i.e., there is customer heterogeneity; e.g., Adner and Zemsky (2006)). For example, while for some customers or users owning a car of a particular brand is important (and they are willing to pay a premium for a particular brand), others may see cars merely as a means of transport but perceive much value in having particular services (e.g., self-driving features, entertainment) available in their car. Generally, while incumbents will find it relatively easy to maintain their position in segments that continue valuing the traditional benefits of the incumbents' products and services, their position is under severe threat in segments where the benefits from the platform and the services it enables dominate.

PLATFORMIZATION AND INCUMBENT ADVANTAGES

In the following, we develop propositions about the conditions under which incumbents may benefit or suffer from platformization of their industry. We first discuss how demand conditions influence the propensity for and degree of platformization. We then shed light on how specific assets and capabilities provide an advantage to incumbents in platformizing industries. Finally, we discuss how specific strategies that seek to influence the structure of the platformized industry are prone to be more or less successful.

Opportunity structure and platformization

Not every industry will be subject to platformization. Specifically, because the adoption of a platform technology is associated with investment and fixed costs, if the size of the opportunity is too small it will not be profitable for firms to invest in it. This means that industries or industry

segments that are of relatively small size are unlikely to attract investment in particular from outside firms and thus are relatively safe from platformization. Likewise, if there is relatively little added value from platform technology (e.g., because the products serve very specific purposes) platformization is unlikely to occur.

Proposition 1. *The smaller the segment and the higher the relative value creation of the product, the lower the propensity for platformization.*

If platformization occurs in an industry, its effect on competition depends on the type of network effect. Generally, network effects based on the availability of complementary services by their nature allow addressing heterogeneous customer segments (Langlois & Robertson, 1992). This is because the availability of a range of additional services provides a better match with customer needs and thus increases the potential size of the market (i.e., they may unify distinct segments). For example, in the case of smartphones, the network effects that resulted from a wide range of apps made the initially exclusive and highly priced smartphones attractive to a broad mass of consumers. A product that has a high range of additional services may also substitute for related products and thus invade other segments, as has occurred in the tablet industry where applications have led to tablets replacing, e.g., physical maps in airplane cockpits. On the other hand, network effects based on product interoperability may be more specifically tied to particular applications. However, because customers may benefit from interoperability between different types of products, in the latter case platformization may lead to integration across hitherto distinct product categories. For example, in a complex business site such as a harbor, there may be benefits from optimizing the joint usage of trucks, cranes and other machines.

Proposition 2. *If platformization occurs, in the case it exploits network effects based on*

interoperability it will likely be restricted to specific customer segments, whereas in the case it exploits network effects based on availability of complementary services it will apply to a broader range of customer segments.

Proposition 3. *If platformization occurs, in the case it exploits network effects based on interoperability it is more likely to lead to integration across product categories, whereas if it exploits network effects based on availability of complementary services it will remain on the basis of individual products.*

Incumbent advantages from assets and capabilities

As noted in the previous section, incumbents may be safe from platformization. If platformization indeed occurs or if there is a high propensity for platformization in an incumbent's industry, the higher the relative value creation from the platform, the higher the pressure on incumbents and the more likely their ex ante competitive position will deteriorate and, consequently, the less valuable the assets and capabilities that underlie their position will be. Specifically, if the benefits from the platform are large enough, customers in their purchasing decisions will care more about the platform and its benefits than the product and its characteristics. This will potentially lead to incumbents being relegated to being commodity suppliers or driven out of business completely, unless they have assets or capabilities that allow them to retain or even enhance their competitive position. We identify two classes of such assets: an incumbent's customer relationships or installed base (Farrell & Saloner, 1986), and specific technological and innovation capabilities that incumbents can leverage when faced with commoditization.

Customer relationships and installed base. Customer relationships may be one of the most important assets held by a firm whose industry is being platformized. While customer

relationships may generally help firms that are subject to discontinuous change retain or even enhance their competitive position (as, e.g., in the case of IBM in the early 1990s; Agarwal and Helfat (2009)), in the case of platformization there are specific benefits to having established customer relationships. Generally, in a platformizing industry customer relationships are likely to continue being valuable because they guarantee access to customers. For example, there may be limited retail shelf space (as in the case of smartphones) or products require installation offered by the seller (as in the case of elevators). Additionally, in platformizing industries customer relationships may also be leveraged to the platform side and thus constitute a potential source of novel advantage. Specifically, established customer relationships may provide incumbents with an installed base of locked-in customers that are subject to switching costs (Klemperer, 1987). Because of the positive dynamics of network effects, customer relationships are valuable to incumbents in a platformizing industry as they can potentially be used as an installed base that allows incumbents to dominate or control the platform (Farrell & Saloner, 1986). Here, firms that already provide complementary services (Oliva & Kallenberg, 2003) may have a further advantage in developing the provision of these services into a platform that they can dominate.

Whether an incumbent with established customer relationships will indeed be able to dominate or control the platform and how it may do so depends on the type of network effect. For network effects based on the availability of complementary products, the size of the incumbent's installed base as well as its relative market share are critical (Farrell & Saloner, 1986). This is because dominating the platform is the more likely the more complementary services will be offered through the platform, and a larger installed base makes it more attractive for third-party service providers to offer such services (Rochet & Tirole, 2003). Being able to successfully dominate the platform, however, is subject to the specific strategies used, such as

pricing (Eisenmann et al., 2006). Additionally, the potential benefits from an installed base are subject to an important caveat. Specifically, there is a second-order effect arising from the reaction of other firms in response to an incumbent's vying for platform dominance. Because of potential winner-takes-all dynamics, a relatively large installed base of customers may not be sufficient for platform dominance if competitors cooperate and agree on a competing platform. While this means that for incumbents it may sometimes be a better strategy to cooperate with competitors or to agree on an open standard for the platform (cases which we will discuss in more detail below), there are nevertheless two specific cases in which established customer relationships and an installed base will confer an incumbent the opportunity to dominate a platform even in the face of competitor cooperation. First, if the market is big enough or customer requirements heterogeneous enough to support more than one platform, the incumbent's installed base may be big enough in relation to competitors to allow it to establish its own platform that competes with other platforms. Second, even if there are strong pressures towards convergence on a single industry-wide platform standard, an incumbent with large market share may be able to enforce its own platform as the industry standard (Suarez, 2004). For example, in the context of digital SLR cameras, while a variety of third party providers are developing software and accessories, Nikon has been able to enforce its own platform as industry standard. Generally, the implication is that with network effects based on the availability of complementary products, the role of an installed base in conferring advantage to incumbents is discontinuous: there is a threshold value above which the installed base becomes valuable. In the smartphone industry Nokia even as a market leader with over 50% market share failed to dominate the industry platform (which may, as we note below, also be attributable to failure of proper timing; furthermore, it had an alliance of competitors against it, who joined Google's

Android). That threshold value may be different for the two identified cases.

Proposition 4 *If the underlying platform exploits network effects based on availability of complementary products, an incumbent's installed base of customer relationships provides it with an advantage for dominating a platform if its installed base exceeds a threshold value and either (1) the market is big enough or customer requirements are heterogeneous enough to support more than one platform (in which case it has a proprietary platform) or (2) it can enforce its own platform as the industry standard.*

On the other hand, for network effects based on interoperability between products, established customer relationships do not provide an advantage because of their number but rather because of their quality. Specifically, incumbents with established customer relationships may be in a better position to convince their customers to buy the platform and associated services from it rather than from competitors. For example, while offering a service that allows managing and optimizing the use of equipment on construction sites may be done by any firm, an incumbent with established customer relationships may have an advantage over competitors because it can, for example, exploit its knowledge of customer needs (Zander & Zander, 2005) or create customer-specific synergies between the product and the platform (Schmidt et al., 2016). However, because network effects based on interoperability between products are direct network effects, they (except for the case where all products and services are provided by one firm) critically depend on whether interoperability between different and competing products can indeed be achieved (note that this is not a concern with network effects based on the availability of complementary products discussed above, where a common standard across competitors enhances the availability of complements, which is an indirect network effect, and firms can still –under specific circumstances– dominate a platform that is incompatible with their competitors).

Thus, unless interoperability is achieved by competitors making their products mutually compatible (which we will discuss below), an incumbent's established customer relationships provide it with an advantage to the extent that interoperability can be unilaterally enforced (Farrell & Saloner, 1992). Two factors promote unilateral enforcement of interoperability. First, it may be technologically possible to integrate other products into one's own offering (e.g., by a service that allows managing and optimizing hardware devices). For example, loudspeaker manufacturer Sonos allows customers to connect competitors' loudspeakers to its own platform using an adapter. Second, established customer relationships allow incumbents to make their customers mandate their other suppliers to make their products compatible with the incumbent's service. For example, the operator of an industrial site may force the manufacturer of equipment used at the site to supply data from their machines' sensors in a specific data format). We thus propose:

Proposition 5. *If the underlying platform exploits network effects based on interoperability of products, an incumbent's customer relationships provides it with an advantage for dominating a platform if it can enforce interoperability across different products.*

Leveraging technological and innovation capabilities. Generally, in a platformizing industry the assets and capabilities of incumbents that underlie the performance characteristics of their products will retain their value to the extent that these performance characteristics continue to be valued by customers when compared to the new attributes made possible through the platform and their performance characteristics. However, for products where the additional value creation of the platform is high relative to the value created through the product, platformization generally leads to commoditization of the products (a situation which is characterized by the absence of isolating mechanisms; Garud and Kumaraswamy (1993); Rumelt (1984)) and thus to

fewer possibilities to differentiate in terms of product features. Platformization may lead to a bifurcation of the market, where certain segments still highly value the original performance characteristics, whereas others place higher value on the platform and the services it enables, with the latter leading to commoditization of the physical products.

Nevertheless, the dynamics introduced by platformization may lead to the augmentation of the value of some existing capabilities of incumbents even in the face of commoditization. We identify three types of such capabilities. First, commoditization may allow incumbents with specific technological capabilities to specialize in providing these capabilities to competitors (both ex ante competitors and new entrants) and thus to become their suppliers (Jacobides & Winter, 2005). For example, commoditization increases the value of capabilities that enable to produce and supply the product at lower cost (Porter, 1985). Thus, incumbents that have such capabilities, which may include manufacturing or procurement capabilities, will be able to supply the physical products or parts of it at lower cost. Likewise, firms with technological capabilities (e.g., developing sensors, such as Sony) may be able to achieve scale advantages by offering these capabilities to other players in the industry. For example, Nokia's technological capabilities have increased in value because other players in the smartphone industry are using its patents even though Nokia itself ultimately exited the smartphone industry. Because benefiting from these types of capabilities is based on achieving scale, their value depends on the size of the market or segment (Jacobides, 2008; Stigler, 1951).

Proposition 6. *Platformization increases the value of capabilities that allow an incumbent to become a supplier of these capabilities to competitors and new entrants.*

Second, firms may benefit from those capabilities that provide customer-specific synergies with the platform or specific services enabled by the platform, i.e. the platform or the specific

services create higher value in conjunction with the incumbent's products than with competitors' products, which may be achieved, e.g., through co-specializing hardware and software (Schmidt et al., 2016). Incumbents that control or dominate the platform may use their superior insights into the technology behind the platform to create such synergies or adapt the platform and services enabled by it in a way that enhances or takes advantage of particular idiosyncratic features of their products, such as durability (Garud & Kumaraswamy, 1995). For incumbents that do not control the platform, however, the opportunity for exploiting customer-specific synergies is more limited, but may exist if there is a specific niche that values the capabilities offered specifically by that firm (such as technological parameters or brand). For example, in the case of digital SLR cameras, incumbent players such as Canon or Nikon have been able to build on their capabilities through bundling camera body, lenses, as well as image management and editing software.

Proposition 7. *Platformization increases the value of capabilities that allow an incumbent to exploit them through creating customer-specific synergies with the platform or specific services enabled through the platform.*

Third, even if the incumbent's product is commoditized there may be opportunities for short-term advantages by introducing new features or services. Thus, firms that have innovation capabilities that allow introducing new features or services faster than competitors may be able to temporally differentiate their offering (Brown & Eisenhardt, 1997). Specifically, while commoditization may lower the value of specific technological capabilities, these capabilities retain their value if coupled with innovative capabilities. For example, in the smartphone industry Samsung has churned out a large variety of phones, with its flagship models incorporating technological features that would later be imitated by rivals.

Proposition 8. *Platformization increases the value of technological capabilities if paired with innovation capabilities that allow an incumbent to create temporary advantages by introducing novel features or services earlier than competitors.*

While incumbents may benefit from the capabilities that we have identified above even in the face of commoditization arising from platformization, deploying these capabilities in a platformized industry may also require incumbents to make other, related strategic choices. For example, exploiting capabilities for cost-efficient production may require an incumbent to assume the role of a supplier to its competitors. Likewise, exploiting customer-specific synergies may require a bundling strategy that leads the incumbent to expanding its competitive scope. These strategic choices also have an impact on the structure of the industry or ecosystem. We next explore several key strategic choices available to incumbents and their impact on their position within the industry.

Incumbents' strategic choices

There are two interrelated types of strategic choices incumbents will need to make in a platformizing industry. First, they need to decide on the scope of products and services they offer to customers and, in particular, whether they seek to provide the platform and/or particular services enabled by the platform as well as whether they seek to become providers of integrated solutions (competitive scope). And second, if they don't seek to control their own platform they need to choose which platform to support and integrate their product with as well as decide whether to develop or promote a platform jointly with others (integration and cooperation). Through making such choices incumbents may influence the structure of the platformizing industry to their advantage. However, in their decisions incumbents also have to factor in the fact that the outcome of their choices also hinges on the choices made by other players, such as their

competitors and new entrants.

Competitive scope. Incumbents in industries that supply physical goods have in many cases already earlier extended their scope into offering complementary service, like maintenance or monitoring, to their existing customers (Cusumano et al., 2014; Oliva & Kallenberg, 2003). In providing such services, and in particular “smoothing” and “adapting” services that complement and enhance the physical product (Cusumano et al., 2014), incumbents have an advantage in servicing their own installed base, i.e. there are customer-specific synergies between the product and these services (Oliva & Kallenberg, 2003; Schmidt et al., 2016).

Because platformization may reduce these incumbent advantages, it will make it easier for other firms to provide such complementary services. While this is particularly true for novel services that are enabled and mediated by the platform, it may also extend to services so far provided by incumbents to their installed base, which are under increased threat of substitution as a result of platformization (for example, RollsRoyce may lost its advantage in providing monitoring and maintenance services for its jet engines if the data that enable these are available to others through a platform in a standard format). Specifically, commoditization may lead to “unbundling” of the product and these services, with complementary services being provided by others through the platform, or to new entrants who provide the product as part of a substituting service where the customer only pays for using the product but does not buy and own it, such as Uber (Cusumano et al., 2014). If such unbundling happens, incumbents will lose their advantage over their installed base of customers and their scope is reduced to focusing on the physical product. If the relative value created by the platform and associated services is relatively high, in that position they may be relegated to undifferentiated commodity suppliers of the physical product (they may continue to be suppliers of low-value services like installation but will be

unable to offer high-value services such as optimizing usage based on data analytics).

Platformization will thus be detrimental to them unless they are able to draw on alternative sources of advantage. Two such potential advantages were discussed above: First, incumbents may use their technological capabilities to become suppliers to their competitors. This may also include providing the physical product to new entrants from outside of the industry who seek to control the platform (e.g., car manufacturers may become suppliers to companies like Google, Apple or Uber). Second, incumbents may draw on technological capabilities that allow them temporary advantages among some customer segments.

Proposition 9. *If platformization leads to unbundling products and services and if at the same time the relative value of the platform and the services enabled by it is high incumbents will be relegated to be commodity suppliers of the physical product unless they can draw on prior capabilities by (1) making these capabilities available to their competitors and become key suppliers or (2) are able to generate successive temporal advantages through innovative capabilities.*

On the other hand, incumbents can avoid the commoditizing forces of platformization and unbundling if they can create and exploit customer-specific synergies between the product and the platform and the services it enables or, alternatively, if they have an installed base of customers they can leverage to dominate the platform in the industry or particular segments. In these cases, they can benefit from retaining or extending their scope by providing additional services, integrated packages of products and services, or complete solutions to their customers (Davies, Brady, & Hobday, 2006). For example, digital SLR camera manufacturers Canon and Nikon have been able to bundle their hardware with accessories and software technologies to create and exploit synergies for professional photographers who rely both on image capturing

technology and on tools for managing a digital image bank. As we have noted above, however, these options are only available under specific conditions. Dominating or controlling a platform requires a large installed base (in case of network effects based on complementary products) or the ability to unilaterally enforce interoperability (in the case of network effects based on product interoperability). Exploiting customer-specific synergies is made difficult by being part of a platform that one does not control (which, e.g., requires delivering data generated through sensors embedded in the product in a standard format, preventing the ability to develop unique services that take advantage of these data). It may thus be the case that, often, the exploitation of customer-specific synergies also requires some degree of control over the platform.

Proposition 10. *If platformization occurs in an industry, an incumbent can benefit from widening its scope by (1) using its installed base of customer relationships to dominate the platform and bundle it with its products or (2) exploiting customer-specific synergies between its products and the services particularly tailored to these.*

Integration and cooperation. The above arguments imply that for an incumbent it is critically important to either control its own platform or, alternatively, to be able to play out its strengths if its product is part of a platform it does not control (it should be noted that there are also intermediate cases where firms may control parts of a platform, e.g., by having sponsored a particular standard which thus allows for superior insights and thus an ability to develop superior services; Garud and Kumaraswamy (1995)). If it is not possible to control one's own platform, the strategic choice for incumbents is to decide which other platform to support.

Two options are available to incumbents for supporting other platforms. First, they may simply choose to support and make their products compatible with other players' platforms (e.g., have their products run on a particular third-party operating system). This may entail choosing a

single platform that is provided by another firm (which may also be an entrant into the industry, like Google) or, alternatively, making one's product compatible with several platforms (i.e., the firm engages in "multi-homing"; Rochet and Tirole (2003)). For example, in the smartphone industry, Samsung has continued to launch models with Windows Phone (and even its own platform, Bada) even though most of its models were running on Google's Android. The two rationales for a multi-homing strategy are to support platforms that cater to different customer segments and to hedge against dominance of a single platform owner. In the latter case, however, the incumbent only has leverage against a dominant platform owner to the extent that it can hope to control its own platform, which is conditioned by its ability to achieve a critical mass, as noted above. Generally, in choosing a platform, an incumbent is in a dilemma: It needs to support a platform that achieves critical mass (or is expected to do so) and becomes dominant in some customer segment (Katz & Shapiro, 1985), but on the other hand ceding control to the platform owner at the same time weakens its prior competitive position unless it has specific capabilities that allow it to differentiate its offering in a way that is valuable to customers. For example, Nokia's management justified its decision not to join the Android platform by arguing that doing so would allow fewer opportunities to differentiate its hardware. Nokia eventually became the dominant hardware provider for Microsoft's Window platform which, however, only had a niche position with less than 5% market share against Android's over 80% market share.

Proposition 11. *When platformization occurs and an incumbent cannot expect to dominate or control its own platform, it benefits from joining that platform that is expected to become the dominant platform in the industry or a specific customer segment. In that case, its ability to differentiate is conditioned on it having specific capabilities valued by customers.*

If another firm controls the platform that an incumbent joins, the incumbent cedes control to

that firm. Because all incumbents face the same challenges of ceding control, a second option available to incumbents for supporting other platforms is to establish a strategic alliance to jointly support one common platform. Such a strategy may prevent incumbents from becoming dependent on a single platform they do not control, and it may even deter entry of firms that seek to enter the industry to become a platform provider. For example, in the smartphone industry the Symbian consortium was formed to keep control of the operating system (the platform) among the manufacturers (and prevent Microsoft from gaining a foothold). Similarly, the German car manufacturers Daimler, BMW and Audi jointly acquired Nokia's maps service to control the map information, which is a critical part of the platform for autonomous driving and other potential service in the automotive industry. Generally, because a strategic platform alliance of incumbents allows them to retain control, such an alliance will also grant them more leeway in differentiating their offering (specifically, they can agree on the performance parameters that will be common and those where each firm will be able to differentiate). Because they merge their installed base of customers, an alliance of incumbents will also make it more likely that that platform will dominate as opposed to a situation where an entrant (like Google) would dominate the platform. However, such platform alliances may also be unstable because some incumbents may eventually defect (this is particularly the case for incumbents that have low market share, because they may expect to gain share from rivals with higher market share if they join a competing platform that they expect to replace the established platform), as has eventually happened in the smartphone industry where the Symbian alliance broke down and some incumbents eventually allied with Google (an entrant providing Android as a platform) while the dominant incumbents at that time (Nokia and RIM) were left out of that alliance. This points to the importance of aligning incentives and interests among the alliance partners (which will be

particularly difficult in cases of rapid technological progress that threatens to make the platform technologically obsolete).

Proposition 12. *When platformization occurs and an incumbent cannot expect to dominate or control its own platform, it benefits from joining an alliance with competitors to create a joint platform if that platform can be expected to become the dominant platform in the industry or a specific customer segment.*

DISCUSSION

We have identified several factors that provide industrial incumbents with advantages when faced with platformization of their industry and thus with means to counter the threat from platform entrants like Google. We have furthermore discussed several strategic choices incumbents can make to take advantage of their advantages and shape competition and the structure of the platformized industry to their advantage. Figure 1 provides an overview of our framework. In the following, we discuss the implication of our findings for strategic management theories.

Insert Figure 1 about here

Incumbent advantage and the sustainability of competitive positions in the face of platformization

Examining how firms can successfully cope with a changing environment and sustain their competitive position and competitive advantage has been a central research topic in the field of strategic management. The majority of effort has gone into examining the underlying processes of how firms deal with change (under the headline of dynamic capabilities or ambidexterity;

(O'Reilly & Tushman, 2013; Teece, 2007; Teece et al., 1997)). Less attention has been devoted to the content side of dealing with change, which entails examining the specific resources and capabilities as well as specific strategies available to incumbents given the environmental conditions they are facing. Here, we contribute to the content side by identifying the environmental conditions (opportunity structure in terms of two types of network effect: product interoperability and availability of complements, and the relative value creation potential of the platform and the services it enables versus the product and its features) under which specific assets and capabilities (specifically, established customer relationships and certain technological capabilities) retain their value (Schmidt & Keil, 2013) as well as the specific strategic choices (specifically, choices about competitive scope as well as integration and cooperation) available to incumbents (Brandenburger & Nalebuff, 1996) that may help them sustain or enhance their position and leverage it into a platformizing industry.

Generally, we argue that the extent to which assets and capabilities and specific strategic choices may confer an advantage to incumbents is conditioned on the opportunity structure faced by firms. Because in a platform-based industry, control of the platform confers advantages (Thomas et al., 2014), established customer relationships are particularly important because they may provide the critical mass necessary for platform control (Farrell & Saloner, 1986). If platform control is not possible (we identify the conditions under which it is so) and, at the same time, the platform and the services it enables account for high relative value creation, incumbents are at a danger of losing their prior competitive position. A key factor that helps mitigate this concern is the ability to create and exploit customer-specific synergies (which hinges on technological capabilities to co-specialize the product and the platform and specific services (Schmidt et al., 2016) as well as a bundling strategy, e.g. by packaging the product and services

into a comprehensive solution; Davies et al. (2006)). Furthermore, firms may still be able to leverage their technological capabilities by becoming suppliers to new entrants (Porter, 1985) or by generating a series of temporary advantages (Brown & Eisenhardt, 1997). Finally, incumbents face a critical choice about which platform to make their products compatible with. Here, incumbent firms may cooperate to sponsor their own platform to compete against platform entrants, which also helps them to exploit their capabilities and differentiate despite the commoditizing forces of platformization.

Incumbents' platform strategy, agency and the emergence of platform competition

Our findings not only provide a baseline for assessing incumbent advantages and disadvantages in a platformizing industry, they also provide insights into the structural factors and firm strategies that together shape the emergence of a platformizing industry. Specifically, our identification of the levers that incumbents can pull to sustain their position in the light of platformization highlights the role of agency (as opposed to technological change being externally imposed on firms), yet is realistic about incumbents' prospects for dealing with such change (as opposed to very optimistic prescriptions about firms' abilities to achieve platform control; Gawer and Cusumano (2012)). In any case, we assert that platform strategy critically matters to the performance of incumbents in platformizing industries, and by pulling the levers we have identified incumbents (and entrants alike) can shape the structure of a platformizing industry to their advantage (Jacobides, Knudsen, & Augier, 2006).

While the emergence of platform competition in incumbents' industry can in principle be modeled game –theoretically (as we discuss below), which would imply that incumbents can potentially play this platformization game with inherent advantages and thus would be guaranteed to benefit from their advantages (MacDonald & Ryall, 2004), the question whether

incumbents actually capitalize on these and successfully leverage their position into a platformizing industry depends on at least two additional conditions. First, we have abstracted from the fact that platformization is a dynamic process that unfolds over time. Specifically, because of the positive dynamics associated with network effects (Arthur, 1989; Katz & Shapiro, 1985)) there may be windows of opportunity that may eventually close to incumbents who do not act in time to exploit their structural advantage (Christensen, Suarez, & Utterback, 1998; Lieberman & Montgomery, 1988). Second, incumbents' managers differ in how they perceive these advantages and, specifically, while they may well perceive the advent of platform technologies in their industry they may misjudge the value of their own resources and fail to understand the strategic options available to them (Barr, Stimpert, & Huff, 1992; Danneels, 2011; Tripsas & Gavetti, 2000). Generally, there may be a host of potential strategies available to incumbents and new entrants alike that allow them to shape the emerging platformized industry or attain a favorable position within this industry. Furthermore incumbents and entrants may develop or acquire relevant new capabilities during the platformization process. However, while differences in timing and managerial cognition may be critical to the eventual outcome, our findings provide insights into the structural reality facing managers in making strategic decisions in a platformizing industry which thus serve as a critical baseline against which to assess these strategic decisions.

Platformization, competitive dynamics and industry convergence

A platformizing industry is by definition subject to industry convergence (Hacklin, 2007; Hacklin et al., 2013), both from a technology and a market perspective (Stieglitz, 2003), which changes the nature of competition. In terms of technological convergence, platformization is associated with the advent of a new technology that complements prior technologies and allows

for novel types of services and benefits to be delivered. Because there are firms in other industries that have accumulated experience with platform technologies and that often also have an installed base of customers associated with that technology which they can leverage into the platformizing industry, technological convergence is associated with entry of firms that may have an advantage against incumbents. From a market-based perspective, platformization is associated with the advent of new services that complement and enhance the physical product. While market-based convergence may benefit incumbents, in particular if they are able to exploit customer-specific synergies between their product and the new services (Oliva & Kallenberg, 2003; Schmidt et al., 2016), it also leads to competition from new entrants that focus on the platform to dominate and squeeze incumbents who may be relegated to a position of supplier of a commodity product. In fact, new entrants may themselves seek to exploit customer-specific synergies and become suppliers of not only the platform but an integrated bundle that includes the physical product (e.g., as a substituting service that substitutes ownership for access, such as Uber in the car industry; Cusumano et al. (2014)).

Because of the nature of industry convergence, the competitive dynamics in a platformizing and converging industry are likely different from prior dynamics, which have played out in a more stable environment with clearly defined competitors and a knowledge of the history of their actions (Chen & Miller, 2012; Chen, 1996). In fact, the competitive dynamics ensuing in a platformizing industry, and especially the strategic decisions made by both incumbents and entrants as well as their reactions to others' moves, critically contribute to and cumulatively determine the eventual outcome in terms of a newly converged industry (which can be thought of the process from one stable industry equilibrium to a new one; Jacobson (1992)). Our findings suggest that there may be a number of potential moves that firms take to capitalize on their

strengths as well as shape the industry structure to their advantage, such as launching new services or engaging in alliances and cooperation.

Limitations and further research

Our analysis is subject to a number of limitations. Specifically, we have made a number of simplifying assumptions whose relaxation may provide opportunities for further research. For example, we have focused on the position of incumbents and thus neglected the specific capabilities of and strategic choices available to new entrants. Furthermore, while we have discussed some of the implications of our research for examining the dynamics of platformization, our analysis does not delve into the nature of these dynamics. Finally, we have focused on only some of the interactions between different factors, such as capabilities and strategic choices.

A fruitful initial area for further research on platformization is the formalization of our arguments. Our propositions are in principle amenable to mathematical, game-theoretic modeling, which would allow for including additional factors whose interactions with the main effects discussed in our paper may enhance or qualify some of our findings (Adner, Polos, Ryall, & Sorenson, 2009). In a second step, the results derived from such formalization may then serve as the structural baseline for examining the specific choices made by firms, including their timing and the cognitive understanding of firms' managers (Oxley, Rivkin, & Ryall, 2010). This structural baseline allows the comparison across similar as well as different cases in terms of the dynamics playing out among incumbents and entrants in a platformizing industry. Hereby, comparative cases studies (Eisenhardt, 1989) may shed light on the specific choices made by firms and the conditions under which ex ante structural advantages are translated into advantages in the platformized industry. Because the process of platformization is currently playing out in a

number of industries, it is possible to study this process in real time and, in particular, to get insights into the cognitive aspects without problems of recall bias that plagues retrospective case studies (Miller, Cardinal, & Glick, 1997). Furthermore, from a competitive dynamics perspective, new insights may be gained by examining the sequences of moves and counter-moves in a platformizing industry and how they contribute to shaping the converging industry.

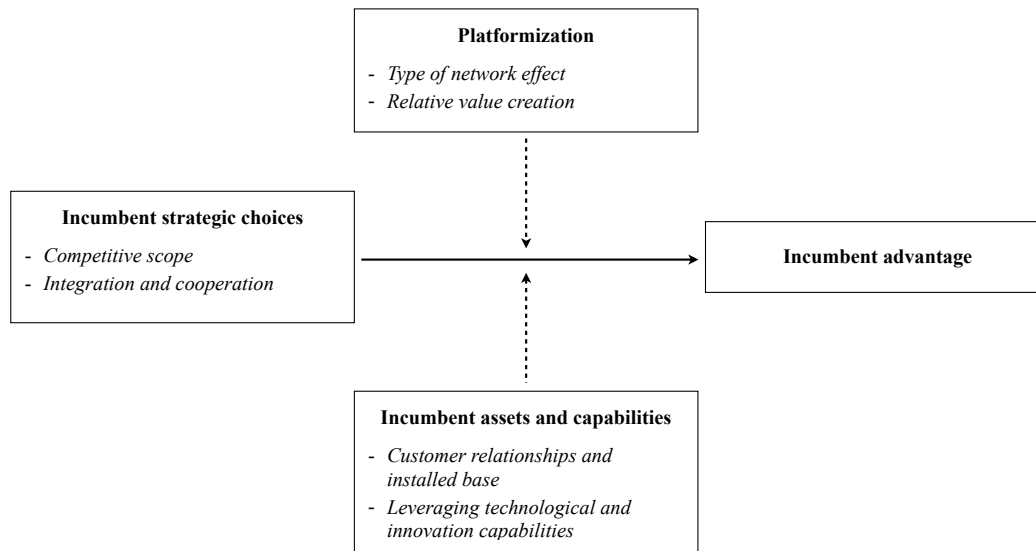
TABLE 1

Examples of industries subject to platformization

<i>Industry</i>	<i>Network effects based on complementary services</i>	<i>Network effect based on product interoperability</i>
Automotive	<ul style="list-style-type: none"> • Navigation (TomTom, Google) • Autonomous driving (Google) 	<ul style="list-style-type: none"> • Car sharing (car2go) • Taxi, limousine services (Uber, Lyft)
Smartphones	<ul style="list-style-type: none"> • ‘Apps’ (e.g., Apple AppStore) 	<ul style="list-style-type: none"> • Cloud-based services across device categories (e.g., Dropbox, iCloud)
Power tools		Managing and optimizing power tool usage <ul style="list-style-type: none"> • (Hilti)
HVAC (Heating, ventilation, air conditioning)	<ul style="list-style-type: none"> • Energy management and optimization 	<ul style="list-style-type: none"> • Smart home applications
Elevators	<ul style="list-style-type: none"> • Maintenance services 	<ul style="list-style-type: none"> • Building automation
Ships	<ul style="list-style-type: none"> • Analytics, optimizing fuel usage 	
TV sets	<ul style="list-style-type: none"> • Digital set-top boxes, apps, Apple TV, Google ChromeCast 	<ul style="list-style-type: none"> • Home entertainment (e.g., games and music connected to TV through open interfaces)
White goods	<ul style="list-style-type: none"> • Amazon: Button for ordering e.g. detergent 	
Home lightning		<ul style="list-style-type: none"> • Wireless light bulbs (e.g. Philips Hue)
Loudspeakers		<ul style="list-style-type: none"> • Turning standalone speakers into wireless multi-room system (e.g., Sonos)
SLR digital cameras	<ul style="list-style-type: none"> • Lenses 	<ul style="list-style-type: none"> • Digital imaging/editing software

FIGURE 1

Factors affecting incumbent advantage in a platformizing industry



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