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From competitive advantage to nodal advantage: Ecosystem structure and the new five forces that affect prosperity

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Abstract In today's interconnected world, a web of entities rather than predominantly a single firm coordinates a set of activities that deliver utility to mutually connected consumers, thus creating ecosystems. In this article, we suggest that in the current, ecosystem-based production and consumption environment it is important to identify a new set of factors that determines business success. We then propose that in order to develop a network-centric strategic mindset it is important to make a transition from the notion of firm-based competitive advantage to ecosystem-based nodal advantage by which products, services, or processes held by a single firm and affecting one or more ecosystems are exploited individually to improve business. To this end, we offer a new set of five forces that are likely to affect not only a node's financial profitability but also its vulnerability within its ecosystem and the survival of the ecosystem itself. Based on these forces, we recommend strategic triangulation and the formulation of policies to prevent infra-nodal substitution, increase nodal stranglehold, and improve nimbleness to accommodate ecosystemic transitions.

1. Introduction

The strategy literature has long debated the relative contribution of firm versus industry related factors as the drivers of firm profitability. The industrial organization perspective on this issue suggests that the structure of an industry is a key determinant of profitability (e.g., Porter, 1979). On the other hand, the resource-based view of the firm posits that strategic advantages conferred by firm-specific competencies translate into increased profitability (Prahalad & Hamel, 1990; Wernerfelt, 1984). These resources reside in unique and difficult to imitate tangible or intangible assets of the firm (Barney, 1991).

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Despite the debate surrounding the relative contribution of firm versus industry-specific factors to profitability, an understanding of the industry structure remains one of the cornerstones of strategy formulation in practice. The assumption underlying this approach is that industries differ in their profit potential because of the systematic influence of a number of common, identifiable factors. And, because industry structure is relatively enduring, the role of these factors is assumed to last for a substantial period of time. It is therefore believed that the long-term profitability of a firm is determined, at least in part, by the industry it belongs to. One of the recommendations from the strategy literature is that managers need to understand an industry's structure before deciding to participate in it as well as when crafting strategies to compete within it.

2. From industries to ecosystems

The traditional concept of an industry is output-centric (Scherer & Ross, 1990) and is based on the premise that mutually competing businesses that produce relatively similar products and vie for a share of a common product market can be grouped together. It is also entity-centric and implicitly assumes that monolithic firms are primarily responsible for category-specific outputs and are interested in maintaining their category membership over the long run. Therefore, firms are clustered into categories based on similarities in what they produce. For example, the SIC codes of industrial classification are based on firm outputs. Following such an approach, we can identify different industries. The members of each industry are then assumed to be interested in developing some form of competitive advantage over their peers in order to sustain their business.

Output-based clustering naturally results in defining an industry's boundary and identifying external entities, such as customers and suppliers. Firms that provide raw materials, components, and services are an industry's suppliers, while those that purchase its outputs are its customers. Therefore, automobile ancillaries, which reside outside the bounds of the automobile industry, are classified as suppliers, and individual buyers and fleet owners are classified as the industry's customers.

However, over the last few decades, we have rapidly moved into the age of interdependence, relationship networks, and multidimensional, holistic competition (Nohria & Garcia-Pont, 1991). The dramatic changes in technology over this period have resulted in a corresponding shift in how products and services are designed, produced, distributed, evaluated, and consumed. In today's interconnected world, a web of entities rather than predominantly a single firm coordinates a set of activities that delivers utility to mutually connected consumers. Such networks can be thought of as business ecosystems whose producing and consuming members may be located all over the world (Dass & Kumar, 2014).

On the production front, ecosystems have helped distribute capacity and capabilities over a network of connected entities. For instance, the new Boeing Dreamliner uses six times as many foreign suppliers as did its predecessor, the Boeing 747. This network of over 400 partners, encompassing 45 major firms that contribute to the production of the new aircraft, includes specialists in management, design, materials, components, avionics, power systems, software, production, and testing. Similarly, many of Apple's well-known products are designed in California, sourced across the world, assembled in China, and distributed through a system of online and traditional retailers. In the food retailing business, produce, meat, seafood, dairy products, and baked goods are sourced through a tiered network of global suppliers, brokers, and facilitators, whereas franchisee networks often manage customer-facing, in-store operations.

Ecosystems have similarly evolved and become influential on the consumption front. For example, restaurant customers often make reservations on OpenTable, find discounts on Groupon, provide feedback through Yelp, and locate stores using Google Maps. Similarly, automobile customers evaluate products on Edmunds.com, compare prices on TrueCar.com, and may buy from AutoNation, CarMax, or Craigslist. Interconnections with these infomediary platforms increasingly determine customers' preferences, choices, and post-choice evaluations.

Individual firms are also building interlocking, multi-product ecosystems and competing aggressively to induce customers to migrate from rival ecosystems to their own. For example, Microsoft sometimes offers cash rebates to customers for trading in their iPads and abandoning the Apple ecosystem to migrate to Surface, a key component of Microsoft's own ecosystem. Similarly, Samsung restricted the initial compatibility of Gear, its smart watch, to Galaxy S3, its own smartphone, in order to build Samsung's mobile ecosystem. More recently, Apple is rumored to pursue a similar strategy for its iWatch wearable product. Along the same lines, Google Chromecast, Apple TV, Amazon Fire TV, and Roku are engaged in a battle of firm-centric consumption ecosystems as they make choices about the compatibility of their telecasting devices with alternative computing platforms and content distribution services.

Finally, online recommendation systems are creating multi-category ecosystems by mining co-consumption data and connecting seemingly unrelated products to generate customized consideration sets for individual buyers. These endorsement ecosystems may be anchored in expert opinions, peer-based evaluations, or algorithmic relationships, but in all cases drive preferences, sales, and post-sales evaluations. As a result, 'connectivity' with a broad array of products from within and outside the industry affects the likelihood of a product being sold.

In an environment of increasing connectivity, competitive battles are multidimensional and broad based, and are waged within and among larger ecosystems rather than merely among firms that vie for a share of a product market. For example, the Amazon ecosystem competes with the Walmart ecosystem. Each has its own supplier and reseller networks, customer acquisition systems, product evaluation and recommendation systems, and physical distribution systems. One visible facet of this ecosystem-based competition is that while Walmart has gradually enhanced its online presence (once an Amazon forte), Amazon is building distribution networks (the traditional Walmart strength). Similarly, at an industry level we have observed battles between film-based and digital photography ecosystems, within the mobile device and network ecosystems, and among alternative home entertainment ecosystems.

3. Factors driving the upsurge in ecosystems

Before examining the forces that may determine prosperity in a networked business environment, we discuss four factors that have contributed to an upsurge in ecosystems and may determine what factors lead to success or failure in networked environments.

3.1. Unbundling and the distribution of scope

One key factor that has contributed to the migration from monolithic unified entities to business ecosystems is the ongoing process of unbundling products and services into their constituents or components (Hagel & Singer, 1999). For example, the creation and marketing of a consumer electronics device, such as a tablet computer, can be unbundled into design, engineering, component procurement, subassembly, final fabrication, branding, market planning, promotion, and post-sales. Each of these processes are often better managed, and frequently at lower cost, by a network of independent but connected entities rather than a single firm. The evolution of collaboration technologies has facilitated higher levels of multi-entity coordination that has accelerated the unbundling and distribution of business activities and has resulted in powerful trends in outsourcing and offshoring. Consequently, the operations that resided within a traditional firm have dramatically declined and are now distributed across a global ecosystem.

Unbundling resulting from a decomposition and disaggregation of activities is creating ecosystems in the service sector as well. For example, under a traditional media model, unified, consolidated entities such as media houses created, edited, physically produced, and distributed content. Today, in contrast, independent bloggers can produce varied content (e.g., wordpress.com) that can be filtered by blog editors (e.g., bleditor.com) and distributed on social platforms (e.g., facebook.com) for widespread consumption. Other knowledge-based services—such as research and education—are similarly unbundling and migrating from unified entities—such as universities—into open ecosystems. Platforms like ResearchGate are creating meta-academic collaborative research networks across multiple institutions. In addition, innovations such as Khan Academy (khanacademy.org), faqulty.com, Udemy, and Coursera are unbundling the creation, aggregation, and delivery of educational content beyond institutional silos. Of course, migrating from unified entities to collaborative ecosystems does not guarantee success. Microsoft, for instance, recently abandoned the use of subcontractors on its MSNBC platform and, much like a traditional media house, has brought content production in-house.

3.2. The emergence of para-industrial influencers

Ecosystems have also evolved because of the emergence of external entities, which may not contribute toward the production of outputs but provide value through promoting operational efficiency, creating markets for underutilized assets, or facilitating networks of relationships. For example, para-industrial entities such as Orbitz.com have created travel ecosystems by connecting customers to networks of entities such as airlines, hotels, and car rental agencies. Along the same lines, ZocDoc.com has brought a number of otherwise-unrelated medical practitioners under one network and enables them to better manage their operations through customer-driven appointment schedules.

Para-industrial networks are, of course, continuously challenged by alternative, emerging ecosystems. For example, Airbnb and Uber are leveraging individually owned real estate and transportation assets to challenge traditional travel ecosystems. Likewise, peer-to-peer payment ecosystems (e.g., The Lending Club, Prosper) and innovation funding ecosystems (e.g., kickstarter.com) have created alternative ecosystems to the traditional financial industry. In all cases, these new ecosystem creators that develop networks by connecting various entities are themselves outsiders that may not create industry-specific outputs.

3.3. Decline in ecosystem setup costs

Advancements in technology have significantly improved coordination and lowered the cost of creating viable ecosystems. Today, a platform such as Quirky.com can develop an ecosystem of individuals and firms to create, brand, produce, and market new products at relatively low cost. This loosely connected set of entities can thus perform the entire range of activities from ideation, design, refinement, production, positioning, and supply chain development. Similarly, because of a decline in the cost of electronically sharing information, ecosystem setup costs for the global delivery of several services, such as healthcare, education, or retailing, has come down substantially.

3.4. Divergence between business concepts and models

Under a traditional, output-centric paradigm, a firm's business concept or selling proposition defines its industry membership. The membership criterion is based on the utility that a business provides to its customers through its products or services that, in turn, generates the demand for its outputs. As a result, differences in business concepts define industry categories. Therefore, the insurance industry appears distinct from the banking industry and the social media industry differs from the online search industry.

The business model, in contrast, relates to monetization mechanisms for generating financial returns on investments. Therefore, assuming that both retail banks and insurance firms generate income by investing external capital gathered through premiums or deposits, their business model is similar even though the business concepts are not. Similarly, social media and online search platforms that generate financial returns through advertising have similar business models despite noncomparable business concepts. More generally, business concept—based industries are being replaced by business model—driven ecosystems, where multiple noncomparable concepts are competing using comparable business models.

4. Ecosystems and the structure of nodal relationships

A business ecosystem is made up of a set of interconnected nodes, each corresponding to a product, service, or process. These ecosystems can be built around product classes, consumer benefits, brands, or industrial sectors. In this manner, we can identify ecosystems centered on the iPhone device, the Android operating system, cloud computing, Amazon, filmmaking, or in-home entertainment. Each node may contribute toward creation, production, distribution, facilitation, influence, consumption, or post-consumption. For example, an operating system is a node in the personal computing ecosystem. We define a nodal entity as a specific unit that occupies a node. For instance, Microsoft Windows is an entity that occupies the operating system node. A firm, in contrast, is defined as a financial holding organization for one or more nodal entities across the same or different ecosystems. For example, Google is a holding organization for entities corresponding to multiple, somewhat unrelated nodes, including a search engine, an operating system, a video warehouse, and an analytics engine.

While our goal is not to develop an ecosystems taxonomy, we deliberate on some of their characteristics to lay the foundation for identifying the forces that influence nodal prosperity. First, a nodal entity is the key unit of interest and a firm is merely a holding organization for a nodal portfolio that can be adjusted by creating, acquiring, or divesting nodes to either modify its involvement within current ecosystems or to participate in new ones. Hence, while a firm may continue into perpetuity, its ownership of specific nodal entities or participation in particular ecosystems may be for finite lengths of time. The endurance of a firm's financial performance is therefore a function of the management of its nodal portfolio over time.

Furthermore, the traditional firm-centric approach tends to be rigid and focuses on profits as the key terminal outcome of interest. However, this limited approach may be myopic because of frequent ecosystem reconfigurations that often eliminate nodal entities as well as the firms that hold them. Therefore, it is more useful to consider a broader measure of success, such as the overall prosperity of a nodal entity, which makes the financial outcome dependent on its substitutability, its influence within the ecosystem, and the vulnerability of the ecosystem itself. Firm prosperity can then be estimated through appropriate aggregation across its nodal holdings.

4.1. Anterior and posterior networks

Generally speaking, a specific node within an ecosystem has both upstream and downstream relationships. Upstream relationships precede the focal node either in terms of time, flow of subproducts or resources, or sequence of relationships and influence; downstream relationships follow the focal node in terms of the same. We label these subnetworks as the anterior and posterior ecosystems for the focal node. Members of the upstream supplier network may constitute an anterior network, whereas those of the downstream customer network may constitute a posterior network. However, all connections between the anterior and posterior networks may not necessarily go through the focal node. Furthermore, because the patterns of nodal relationships in ecosystems are complex, identifying the anterior and posterior ecosystems for every node may not be trivial.

The composition of the anterior network depends on the relative location of the focal node in the larger ecosystem. If, generally speaking, it is in the upstream part of the overall ecosystem, such as an assembler, the anterior network may consist of entities that provide raw materials, designs, services, or subcomponents. For example, for Levi-Strauss's focal node in the apparel ecosystem, the anterior network includes nodes held by supplier firms such as Delta Mills or Cone Mills. On the other hand, if the focal node is toward the downstream end, such as a reselling process, then manufacturing, branding, or consumer feedback nodes may occupy its anterior network. For example, the anterior network of a retailing node like the one held by Best Buy may include nodes from Whirlpool, Apple, and the Better Business Bureau.

Posterior networks generally include nodes corresponding to members of the downstream consumption communities. These are entities that utilize the outputs from the focal node and its upstream network. Posterior networks may also have a social dimension in that their members may be mutually connected and influence preferences and consumption patterns. For example, consumers today are connected through technology and share information about price, quality, and usage experience as well as provide suggestions to others for and against products and services.

4.2. Feeder-Detractor networks

The flow of relationships into a nodal entity is often facilitated through a set of out-of-category connections. Some of these connections are reinforcing and help increase these flows, while others are detracting and limit flows. For example, out-of-category products such as cake mix and icing may provide positive customer flows into a node corresponding to sprinkles (Dass & Kumar, 2014). In contrast, a smartphone may deter the flow of customers into a node corresponding to a free-standing GPS system. To that extent, cake mix and icing may belong to a feeder network for sprinkles while a smartphone may belong to a detractor network for GPS systems.

A second form of feeder-detractor networks are recommender systems. These consist of entities that are neither involved in production nor consumption yet influence the evaluation of some ecosystem members. For example, individual product evaluators channel their opinions through aggregators such as TechCrunch, Yelp, or CNET, which get redistributed by numerous online platforms and reach customer ecosystems. These review-based networks influence quality and price perceptions that determine what downstream customers select and reject.

4.3. Absorptive and eruptive counter-ecosystems

Finally, an emerging ecosystem can use the forces of bundling or unbundling and aggregation or disaggregation to challenge an entire existing or legacy ecosystem. This can happen in at least one of two ways. First, a superordinate ecosystem can absorb multiple subordinate ecosystems by integrating the utility provided by each one of them. For example, an integrated superordinate ecosystem corresponding to smartphones is increasingly absorbing independent, diverse, and unrelated ecosystems such as those for telephones, digital cameras, hand-held games, news, computing, music, and maps. Such absorptive ecosystems use the power of bundling and aggregation to create overarching networks that provide greater utility and/or higher efficiency than the set of multiple individual ecosystems that they fold into themselves.

Ecosystems can also be challenged by eruptive ecosystems, which work in exactly the opposite way. They fragment integrated and unified ecosystems and set up a series of smaller, nimble and focused ecosystems that collectively provide greater utility or higher efficiency. The stock brokering business has been successfully fragmented by a set of eruptive ecosystems that unbundled a consolidated service, resulting in smaller and separate ecosystems for analytics, ratings, recommendations, and order execution. For example, Morningstar has created an analysis and ratings ecosystem whereas Scottrade has created an order execution ecosystem. Analogous eruptive ecosystems are being created by products such as Chromebooks and Chromecast as well as by services such as cloud computing, real estate valuation, and online learning.

5. From industry structure toward ecosystem structure

A commonly used framework for understanding industry structure relates it to five distinct forces (Porter, 1979). These include buyer and supplier power, the threat from substitutes and new entrants, and the extent of rivalry among industry participants. Collectively, these forces are believed to affect an industry's cost structure and revenues, and ultimately its profitability. One of the assumptions underlying this approach is that an industry's boundaries are well defined so that its member firms can be easily identified and categorized. Because of its roots in price theory, the framework relates the effects of the five forces to an industry's pricing power or its cost structure, and conceptualizes competitive advantage in terms of the ability to charge a high price.

However, such output-centric, categorization-based frameworks tend to underplay several issues. First, they do not address the differences between a business concept and a business model. To that extent, they are likely to place a firm like Facebook within the social media industry based on its business concept, rather than within the advertising industry based on its business model. Second, they do not explicitly account for the disruption or the elimination of the entire ecosystem that is built around an industry. And third, they do not account for changing footprints of firms as they acquire, divest, or split nodes.

Because of these shortcomings, it is increasingly limiting to characterize the creation of products or services in terms of enduring, unified entities or firms that compete in well-defined industries. Instead, it is more appropriate to transition to the notion of ever-changing networks or ecosystems that create utility for a broad range of ultimate customer groups. For example, holding entities such as Snapdeal in India, Amazon in the United States, or Alibaba in China are creating interconnected ecosystems that span across retailing, healthcare, and media. And, in order to develop strategies in this world of ecosystems, it is also important to migrate toward a framework that accounts for continuously evolving connectedness across nodes as well as threats from competing, eruptive, and absorptive ecosystems.

6. The new five forces and nodal advantage

We therefore propose that strategists should consider changing their mindset from an industry orientation to an ecosystem orientation, thereby shifting the emphasis from tightly bracketed industries and accounting for the complex web of mutually interconnected nodes among business, consumer, and para-industrial entities. They should recognize that as the structure of such webs evolves, nodes might strengthen or weaken, new nodes may emerge, and existing ones or even the entire ecosystem may get eliminated.

In such a dynamic environment, where the survival of a node or even the larger ecosystem itself is not guaranteed, a broader measure of success beyond profit potential is needed. The concept of current profit is limiting because it is based on a prevailing set of relationships among the existing nodes. However, from an ecosystems perspective, entire webs of relationships may disappear when challenged by alternative ecosystems. And even within existing ecosystems, nodal entities may be vulnerable not only to substitutes but also to upstream or downstream nodes. Therefore, we propose that the measure of success should be the overall prosperity of a nodal entity, accounting for its profitability, nodal defense, and ecosystem perpetuity.

Building upon this broader notion of prosperity, we also propose a transition from the concept of competitive advantage to that of nodal advantage. Competitive advantage may be a limiting concept because it relates to the dominance of one firm over a within-category competitor in an existing ecosystem. For instance, Walmart may have a competitive advantage over Target because of superior logistics and lower operating costs. However, with dynamic ecosystems, it is important to consider not only the relative advantage of an entity at a specific nodal position, but also the vulnerability of the node as well as the perpetuity of the ecosystem. For example, Dell may have had a distribution-based competitive advantage over other desktop assemblers in the personal computer industry, but the relative importance of assemblers and the utility of desktops within the information technology ecosystem have eroded over time.

6.1. The multi-faced structure of threat

The concept of nodal prosperity suggests that we need a broader conceptualization of threats faced by a nodal entity. The first threat is infra-nodal (i.e., within the node) from different entities that can play the same role within an existing ecosystem and compete for being the preferred choice for occupying the nodal position. This form of competition involves infra-nodal substitution by other entities; for example, several electronic platforms compete for occupying the node for consumer tracking and analytics services in retailing ecosystems. The more comparable the nodal substitutes are in terms of output or efficiency, the greater the margin pressure at the node and the higher the threat of substitution for an entity.

Furthermore, the node itself faces threats from its anterior and posterior networks. This raises the risk of nodal redundancy: the ability of the upstream and downstream networks to exclude the node and directly connect without disrupting the ecosystem's output. For example, distribution nodes are made redundant in many ecosystems through disintermediation that directly connects manufacturers with customers. This nodal redundancy threat is unlike the substitution threat because the challengers are dissimilar from the focal node. To that extent, any entity occupying the node might similarly face the threat of exclusion through redundancy.

The third form of vulnerability pertains to the entire ecosystem rather than just a specific node or its neighbors. As we previously noted, absorptive and eruptive ecosystems can compromise the value of the output produced by an existing ecosystem and lead to its decline. A reduction in the likelihood of an ecosystem's perpetuity will compromise the prosperity of its member nodes that are unable to migrate to alternative ecosystems.

A nodal entity's prosperity can then be conceptualized as its conditional ability to generate and preserve margins relative to the investments necessary to maintain its position. Importantly, while a node may belong to a business concept—based ecosystem, the monetizing capacity of its business model will determine its baseline margins. The longevity of these margins will depend on the combined intensity of the three nodal threats. A rise in these threats will increase the vulnerability of the nodal entity and compromise its perpetuity. Taken together, margins at the node as determined by the business model and the likelihood of the nodal entity's survival as determined by the three threats will determine nodal prosperity.

Therefore, from an ecosystem-centric perspective, where nodal prosperity is the overarching goal, a new set of forces will influence business success. These forces are likely to be more complex than those that determine competitive advantage in industry-centric frameworks. In the remainder of this section, we propose a new set of five forces that account for the business model and multifaceted threats and provide a broad framework to identify the drivers of nodal prosperity (see Figure 1). In this discussion, we adopt the perspective of a nodal entity within a larger ecosystem. To be consistent with the shift in the unit of analysis from firms to nodal entities, we also propose a migration from a firm-centric concept of competitive advantage to an ecosystem-centric concept of nodal advantage. As we previously noted, a nodal entity is in an advantageous position if it enjoys high levels of prosperity. This would happen if its business model produces high margins and it faces low levels of threat from nodal substitution, direct connectivity between anterior and posterior networks, or the elimination of its ecosystem.

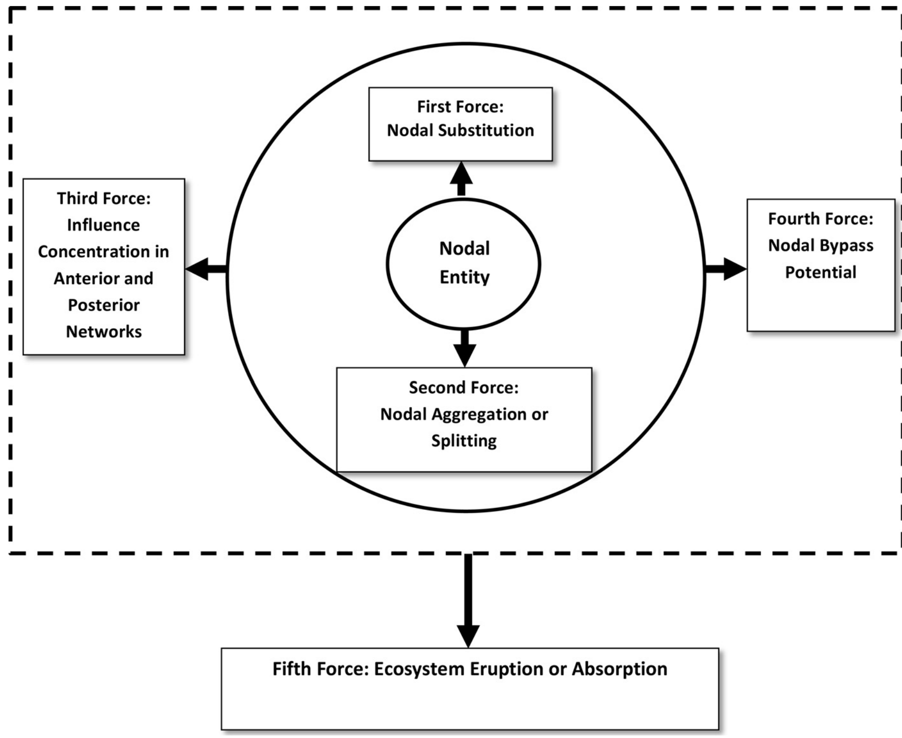
6.1.1. The first force: Nodal substitution

Under the conventional five forces—based approach, substitutes are assumed to pose a threat to the pricing power of an industry because they enhance customers' abilities to satisfy their needs through alternative means. By way of analogy, an entity occupying a nodal position faces a threat from substitute entities that have a comparable ability to contribute to the ecosystem. A rise in the threat of substitution will reduce the entity's margin-generating power. Furthermore, a nodal entity may be connected to external feeder or detractor networks that could enhance or reduce its margins (Dass & Kumar, 2014). These connections to external networks occur through what are commonly referred to as bridge nodes. As the label suggests, these nodes serve as conduits to other networks that may add or subtract influence or demand at the focal node. For example, multi-category product comparison and recommendation engines serve as feeder networks to certain nodes and as detractors for others. Similarly, when a customer adopts a product or service, the conditional likelihood of him/her adopting some related products increases while that of adopting others decreases. To that extent, a purchased product or service often becomes a part of a feeder or detractor network for specific nodes across many ecosystems. Connections to feeder networks will prevent substitution and increase nodal prosperity whereas connections to detractor networks will have the opposite effect.

6.1.2. The second force: Nodal splitting or aggregation

A nodal entity may also experience threats from nodal splitting or aggregation. As previously noted,

Figure 1. The new five forces that affect nodal prosperity



organizational unbundling is an ongoing process that is continuously changing the scope of activities performed at a node. Therefore, a node faces threats from micro-ecosystems that may be able to function comparably with higher efficiency. Such threats would arise when the overhead cost of operating a node is greater than the coordination cost of running a micro-ecosystem to produce the same output. Successful examples of nodal splitting are already visible in the education arena where teaching and assessment activities are increasingly being performed by efficient, distributed networks rather than integrated and institutionalized nodal entities.

Conversely, when the coordination cost of operating a node within a network of its neighbors becomes excessive, the node may face the threat of absorption by one or more neighboring nodes that may expand their scope. More generally, a collection of closely connected nodes may be replaced by an integrated, larger node with a lower overall cost. For example, owners of content distribution nodes in the video consumption business (e.g., Netflix, Amazon) have increasingly expanded their nodal footprint and have become content producers. Overall, the second force that affects nodal prosperity pertains to the threat from either a decomposition of nodal activities by micro-ecosystems or the absorption of collective activities by a larger node based on the tradeoff between overhead and coordination costs.

6.1.3. The third force: Influence concentration in anterior and posterior networks

While the first two forces pertain to the local threats at a node, the third force relates to the relationships of the node with its anterior and posterior networks. The structure of the anterior network can affect nodal prosperity in several ways. First, if the network is relatively fluid (i.e., has a large number of highly distributed connections among the nodes), then any specific node will not enjoy high power because of a lack of concentration. On the other hand, if there are one or more keystone or central nodes in the anterior network (Iansiti & Levien, 2004), they may each exert a large influence on the remaining anterior network, including the focal node. For example, from the perspective of an assembler node in the personal computer ecosystem, the anterior network consists of two keystone nodes—the microprocessor and the operating system—whose high relative influence compromises nodal prosperity for others.

Alternatively, the anterior network could consist of concentrated, tightly knit clusters that may be loosely connected among themselves. Such 'small worlds' types of ecosystems also correspond to structures where self-contained subsets of nodes may exert influence on the remaining nodes in the ecosystem (Watts, 1999). Therefore, if the anterior network moves from high fluidity to high concentration, either because of keystones or small worlds, the relative power of the focal node will reduce and its margin-producing ability will be compromised.

Posterior networks are collections of nodes that are downstream from the focal node. The partial product, service, or utility and the influence created upstream by the anterior network flow through the focal node over to its consumption or downstream side. Two aspects of the configuration of such posterior networks can influence nodal prosperity. The first is the strength of connections between the focal node and the downstream network. A higher depth of connections will increase the node's ability to penetrate the posterior network and exert greater control and influence. If the focal node has a large number of connections to downstream nodes, it will exhibit what is referred to as high levels of centrality within the posterior network (Marsden, 1990) and be able to generate greater margins with low vulnerability.

Second, much like for the anterior network, the structure of the mutual connectivity among members of the posterior network will also influence the threat at the focal node. The greater the concentration in connection among downstream nodes, the higher the influence of one or a few nodes relative to the focal node. In other words, the focal node will be more prosperous if the downstream network is fluid than if it has keystones or small worlds.

6.1.4. The fourth force: Nodal bypass potential

A node in an ecosystem tends to have some dependence on its upstream and downstream nodes. This is because the only connections between the anterior and posterior networks may not necessarily be through the focal node; in addition, two parts of the networks may have the potential to develop direct connections in the future. The ability of the anterior and posterior networks to connect in ways that decrease the influence of the focal node is what we call the node's bypass potential. The greater the bypass potential, the higher a node's vulnerability and the smaller its chances of survival. Conversely, the lesser the bypass potential, the weightier the node's criticality for the activity and influence flowing through it.

For example, within the smartphone ecosystem, the Android operating system is upstream from Samsung, a device maker. Final consumers are downstream from Samsung. However, it is not essential for Google, the owner of Android, to connect with these consumers only through the Samsung node. Google may not only use several other device maker nodes, but also produce its own devices. Both of these actions would decrease the nodal control of Samsung as a device maker and increase its bypass potential whereby the connection between Android and its downstream customers may not remain critical. Therefore, it is not surprising that Samsung has created its own operating system, Tizen, to develop a rival ecosystem rather than face a continuing threat of steadily increasing bypass potential. From a network perspective, the increase in bypass potential is analogous to reducing the bridging role of the focal node between the anterior and posterior networks without creating a structural hole. Such holes are present when two parts of a network cannot connect in the absence of an intermediary. To that extent, intermediary nodes that increase connectivity across a network exert great influence. However, if the remaining parts of a network can directly connect, then the bridging role of the node is compromised and its bypass potential increases.

6.1.5. The fifth force: Ecosystem absorption and eruption

As noted earlier, entire ecosystems can either unravel into smaller subordinate ecosystems or be absorbed into superordinate ecosystems. Therefore, the fifth force that would determine the prosperity of a nodal entity is the larger threat from ecosystem unbundling or bundling. For example, an institute of higher learning occupies a critical node within the traditional academic ecosystem and provides a consolidated, bundled offering of content selection, delivery, proficiency verification, and attestation of competence. However, the integrated bundle can unravel, and a network of independent, connected entities can provide the same overall set of services. To that extent, the traditional educational ecosystem and the nodes within it can be challenged through the forces of unbundling. Similarly, unbundling forces from entities such as Uber and Lyft are disrupting temporary transport services, while Airbnb is unbundling the temporary lodging industry. In both cases, newer and granular subordinate ecosystems are challenging existing consolidated ones.

Conversely, the threat of bundling from superordinate ecosystems can challenge smaller and more focused ecosystems. For example, the smartphone ecosystem has absorbed several subordinate ecosystems such as those related to photography, personal digital assistants, telephonic connectivity, fitness tracking, music creation and distribution, location-based services, and increasingly many others. Previously, each of these focused ecosystems provided highly disparate but dedicated services and was completely unrelated to one another. However, the ability to absorb them into a single device through a series of applications has compromised the prosperity of each and facilitated their absorption into a superordinate ecosystem.

7. The new five forces and strategic choices

In a world of dynamic, multidimensional interconnectivity, the locus of competition is multifaceted. A specific node has to engage in infra-nodal competition to prevent substitution within the current ecosystem as well as inter-nodal competition to reduce its bypass potential. At an aggregate level, the entire ecosystem has to compete against its current rivals and also meet challenges from ecosystem eruption or absorption. Therefore, firms must make strategic choices to strengthen the nodal entity to prevent nodal substitution, secure it to reduce its bypass potential, and contribute to the defense of the overall ecosystem. The goal of such decisions is to manage not only current profitability but also nodal vulnerability and ecosystem perpetuity. Strategic decision making within an interconnected world is thus more complex than making entry-exit decisions, identifying the drivers of costs and prices, or building industry-centric competitive advantage. Its scope has to expand to mitigate the forces that adversely affect the overall prosperity of the portfolios of nodal entities under a firm's ownership.

7.1. Network-centric mindset and strategy formulation

In order to begin this process, managers need to develop a network-centric mindset to formulate strategies for their portfolio of nodal entities that may belong to interlocking or separated ecosystems. They need to transition from a monolithic, output-centric, and category-based model of the firm toward a paradigm where the firm is a holding organization for a dynamic portfolio of nodal entities. These entities themselves are tradable units and may change hands among related or unrelated holding firms. Therefore, managers should consider a firm's participation within any ecosystem as dynamic, with the boundaries of its scope potentially changing over time. For example, eBay's participation in the auction ecosystem has expanded through the acquisition of entities corresponding to multiple nodes, such as price comparison, online payment, classified advertising, price forecasting, rapid fulfillment, and voice over IP. And because these entities are tradable, eBay later spun off its voice over IP business, which was acquired by Microsoft.

When we traditionally consider a firm as a monolithic unit that participates in a product market, we can use one of two alternative paradigms to assess the likelihood of business success. One is the industrial organization perspective, which implicates industry structure as the key driver of firm profitability (Porter, 1979). The other is the resource-based view of the firm, which associates business success to firms' unique and inimitable capabilities. However, we propose a third approach to complement these two, which is based on the conceptualization of a firm as a holder of a dynamic portfolio of nodal entities rather than as a fixed member of an industry. Under this view, nodal prosperity is associated with the underlying business model for margin generation as well as nodal vulnerability and ecosystem perpetuity. Firm prosperity is then an appropriate aggregation of the prosperity of the dynamic set of nodal entities in its portfolio.

A manager's role therefore has to expand to include handling each node's relationships with surrounding proximal and distant nodes. These relationships could be directional or non-directional. Directional relationships require the management of influence between nodal pairs, while non-directional relationships are merely associative and can be managed passively. However, bi-directional relationships with reciprocal influence require an emphasis on inter-nodal cooperation rather than exerting increased influence on the neighboring node. Furthermore, as the complexity of ecosystems increases, some nodal pairs may develop multiplexity and have more than one type of relationship between them. For example, Best Buy not only retails LG branded electronics and appliances, but also buys products from the firm to sell under its own private labels, Dynex and Insignia brands. Multiplexity in such cases would imply both stronger ties and greater complexity in the management of an inter-nodal relationship.

7.2. Nodal stranglehold and vulnerability

The management of each node requires mitigation of the substitution threat from infra-nodal competition and the bypass threat from inter-nodal competition. The former is a battle for value creation relative to alternative entities whose scope is at parity with the role of the focal node. There are two potential ways to succeed in this form of competition. The first is to increase value-based efficiency by lowering the total cost of operating the node or enhancing its contribution to the ecosystem. The second is to split the node into a set of smaller, interconnected nodes in order to build specialization and reduce the overhead cost of coordinating multiple activities that reside within the node.

From the perspective of inter-nodal competition, the key strategic goal for a firm is to increase the relative influence that its nodal entity exerts on the remaining network. Broadly speaking, efforts that increase a node's centrality within the ecosystem tend to reduce its bypass potential. Therefore, the firm would need to invest resources in maintaining or increasing nodal stranglehold; that is, the ability of its node to serve as a key bridge between its anterior and posterior networks. An increase in nodal stranglehold is likely to reduce vulnerability and correlate positively with the focal node's prosperity.

Several mechanisms can be used to increase a node's stranglehold within the ecosystem. First, the firm may be able to build firewalls that prevent direct communication between the node's anterior and posterior networks. Alternatively, it can strengthen the node's branding or invoke regulatory requirements in order to maintain its relevance to network members or ultimate customers. The purpose of such initiatives would be to either reduce the influence of current keystone or 'fat' nodes or to become a keystone itself. And third, the firm could continuously adjust its nodal portfolio within each ecosystem by altering its nodal footprint in order to maintain its stranglehold.

7.3. Ecosystem continuity, innovation, and business transformation

In a networked environment, firms not only need to protect their own node but also contribute to the defense and continuity of the ecosystem to which they belong. To that extent, they must manage competitive battles between legacy ecosystem defenders and disruptive ecosystem creators. The disruptors may not necessarily vie for a slice of an existing product market, but may instead deploy their innovation resources toward ecosystem reconfiguration. Their goal is likely to be a transformation process that significantly reduces the influence of key nodes with low bypass potential in legacy ecosystems and increases their redundancy. Therefore, the competition between legacy and disruptive ecosystems is likely to be in terms of non-parity battles. To that extent, both may need to shift innovation resources away from building competence and capabilities toward building readiness for variation in nodal footprints and ecosystem reconfiguration.

7.4. Managing para-industrial entities

Finally, ecosystems often contain influential para-industrial entities that impact nodal relationships. Their participation frequently redefines the strategic landscape, reorders the relative importance of performance dimensions, and acts as the driver of nodal stranglehold. They may also influence the success of the transition from one ecosystem to another. For example, ratings and evaluation systems define the relative importance of features and attributes, which places a constraint on the ability of the remaining ecosystem members to distinguish themselves from others. Firms that own production nodes therefore need to function within the restrictions in the positioning space imposed by para-industrial entities. They may also need to invest in a way that preserves their nodes in alternative ecosystem structures because para-industrial entities themselves alter the relative importance of factors in outputs or their endorsement of existing or newer ecosystem configurations.

8. Conclusion

In closing, we reemphasize that the notion of competition within and across ecosystems is more complex than that within industries. Therefore, a framework for assessing profit potential that relies on a rigid definition of an industry and on a partitioning of the profit drivers is likely to have increasingly limited application as ecosystems grow in popularity. Instead, there is a need to shift the focus from industry structure to ecosystem structure in order to identify the likely drivers of financial success conditional on strategic vulnerability. The new set of five forces outlined in this article should help managers in developing a network-centric mindset, giving increased importance to the drivers of nodal strangleholds and ecosystem defense, and shifting their end goal from profitability to nodal prosperity.

Appendix: Glossary of terms

Absorptive Ecosystem: Large, overarching network that can provide greater utility and/or higher efficiency than a set of smaller ecosystems it can fold into itself.

Anterior Network: The network of nodes that is upstream from the focal node of interest.

Business Concept: The selling proposition that defines the utility provided to customers.

Business Ecosystem: A network of business entities that delivers utility to connected consumers through coordinated activities.

Business Model: The monetization mechanism that generates financial returns on investment.

Bypass Potential: The ability of upstream and downstream networks to connect without need of the focal node.

Eruptive Ecosystems: Fragmented and smaller ecosystems that collectively provide the same utility as integrated larger ecosystems.

Feeder-Detractor Networks: Out-of-category networks that direct or restrict flows into a focal node.

Infra-nodal Competition: Competition among entities for substitution at a specific node.

Inter-nodal Competition: Competition between an entity at a node and its surrounding nodes.

Nodal Advantage: A nodal entity that faces low levels of threat from infra-nodal substitution, inter-nodal competition, and ecosystem absorption or eruption.

Nodal Aggregation: The absorption of a set of networked nodes into a larger node.

Nodal Entity: A specific unit owned by a holding organization that occupies a node.

Nodal Footprint: The set of nodes in an ecosystem owned by the same holding organization.

Nodal Prosperity: The conditional financial returns generated by a nodal entity after accounting for its vulnerability and the ecosystem's perpetuity.

Nodal Splitting: The breaking up of a node into a micro-ecosystem of a set of networked nodes.

Node: An element in a business ecosystem corresponding to a product, service, process, or influence.

Posterior Network: The network of nodes that is downstream from the focal node of interest.

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