VALUE CHAIN CONFIGURATION AND COOPETITION

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Abstract

Our paper argues that the ongoing discussion on coopetition can be enriched by a value chain configuration (VCC) perspective on firm strategy. To this end, we first explain what value chain configuration is and why it is important to understand its configuration (Asgari, Singh, & Mitchell, 2017; Mitchell, 2014). We then highlight under-explored issues in the coopetition literature (Hoffmann, Lavie, Reuer, & Shipilov, 2018) that an understanding of value chain configuration can shed light on. We conclude by outlining inductive approaches of configuration (Harrigan, 1985; Ketchen & Shook, 1996) and recent interest in correlational analysis (Athey & Imbens, 2019)that can help advance studies of coopetition. Our essay is shaped by the fact that SMR seeks to "promote integration of strategic management research by encouraging research closely connected with the field's canonical problems as defined by management practice."[1]In light of the conceptual and theoretical advancements in Coopetition (Brandenburger & Nalebuff, 2011; Dagnino, 2009) and value chain literature (Alcácer, 2006; Jacobides & Tae, 2015; Porter, 1985), we avoid lengthy ex-post reviews in favor of suggesting how viewing firms from a value chain perspective can generate valuable insights for the coopetition literature. While the essay will be theoretical in tenor, it will mainly refer to the context of the biopharmaceutical industry as an example—biopharmaceutical value chains are characterized by an extensive mix of cooperative and competitive interactions.

VALUE CHAIN CONFIGURATION

The concept of the value chain has a long history in strategy and economics scholarship, arising at both the industry and firm level. The idea of the industry value chain traces back at least to input-output analysis in the 1950s by Wassily Leontief. This concept and empirical approach became the cornerstone of national accounting systems to plan what commodities and services need to be offered to adjust the output of other commodities and services (see Leontief, 1966). In parallel, the notion of the firm-level value chain activity dates to at least George Stigler's (1951) discussion of vertical integration and division of labor, highlighting tensions between internalization and outsourcing of economic transactions, including the evolution of these choices over time.

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[1]www.strategicmanagementreview.net

Industry and Firm-Level Value Chains

Since its early days, research on value chains has reflected two extremes: emphasizing internal activities of a firm while deemphasizing overall industry architecture versus emphasizing industry architecture while deemphasizing firms' internal activities. At the firm level, Michael Porter's work in the 1980s presented thefirm's value chain as a "constellation of activities that are performed to design, produce, market, deliver, and support its products" (Porter, 1985: 36). At the industry level, Brandenburger and Stuart (1996) used cooperative game theory logic to assess value capture in the context of industry value chains. They suggested that, so long as there are no restrictions on bargaining, the value that a focal firm adds to the overall industry's sequence of value chain activities imposes an upper bound on how much value the individual firm can capture, with these ideas becoming the powerhouse of the value capture theory(Gans & Ryall Michael, 2016).

Building on these bases, the idea of the value chain has been developed at both firm- and industry-levels of analysis. Firm-level studies highlight the agency of firms in value chains (e.g., Alcacer & Oxley, 2014; Jacobides & Billinger, 2006; Kapoor, 2013). In parallel, industry-level examinations of value chains emphasize the distribution of gains across industry value chains (Lieberman, Balasubramanian, & Garcia-Castro, 2018) as a function of their macrostructures. This work has produced strong insights yet has historically under-emphasized both the role of firms as active agents in shaping gains that arise in industries and the role of industry value chains in creating templates for firms' strategic choices.

More recently, work by David Teece (2007), Michael Jacobides and co-authors(e.g., Jacobides, 2005; Jacobides & Tae, 2015), and others has begun to pull these two levels of analysis together, stressing the idea that firm-level strategy needs to be considered in terms of industry value chains. This work has the goal of understanding forces that jointly shape a firm's performance through value creation and value capture. Such arguments commonly invoke resource-based logic(Alcacer, 2006; Arora & Gambardella, 1990; Capron & Mitchell, 2012; Cassiman & Veugelers, 2006; Lee & Lieberman, 2010)to suggest that a firm's performance is associated with what value chain activities it undertakes and, in turn, how it organizes the transactions that associate with theactivities.

As the basis of our work at the intersection of the firm- and industry-level value chains, we adopt Jacobides' (2005: 465) definition of the value chain to mean "the structured set of activities that take place in an industry, regardless of whether they take place within the boundaries of one integrated or many co-specialized firms" while relaxing the condition of co-specialization in that definition; ourbroader definition allows us to include arm's-length contractual relationships for goods and services within the scope of value chain activities(Stabell & Fjeldstad, 1998).Moreover, we allow the firm's choices to change over time.

In this formulation, a value chain encompasses a collection of actors in related industrial arenas. In the biopharmaceutical sector, for instance, relevant actors include drug discovery firms, instrumentation companies, hospitals, and test sites, large pharmaceutical firms, pharmacy benefit management firms, and others, each contributing to the production of final goods such as cardiovascular medicine and the services that support their use.Each firm, in turn, has its internal value chain that is embedded in the larger industry value chain. Hence, together, the sets of activities that create and deliver value in the industry provide a template from which firms can pick which activities to engage in.

Figure 1 represents a hypothetical industry that encompasses activities S_1, S_2 through S_n. Each firm can decide where along the industry value chain to operate, which is the first element of firm-specific choices of value chain configuration. Firm 1 has chosen to take up S_2 and S_3 stages of its industry value chain, a choice thatfor shorthand defines it as an upstream firm. Firm 2 instead operates the downstream activities of the industry. Irrespective of where the focal firm operates, the firms whose positions precede its value chain positions serve as its suppliers, and the firms whose positions succeed its value chain position serve as its customers. Hence, the firms in Figure 1 that take up S_1 activities are suppliers of Firm 1,while the firms that operate S_4 activities are its customers.

********** Figure 1 about here **********

Figure 1 captures the firms' choices at a point in time. Over time, these value chain configuration choices are dynamic. In the biopharmaceutical sector, for example, Genentech initially operated as an upstream player in the industry during the 1970s, and then its strategy shifted over time as it chose to develop capabilities in the downstream steps. Genzyme,

meanwhile, began as a midstream player in the 1980s, then added activities at both upstream and downstream ends of its initial choices via a mix of partnerships and internal investments.

The second element of value chain configuration entails decisions on how transactions within the firm's value chain should take place.Firms have two broad choices: internal hierarchy or external partnerships via multiple forms of governance mechanisms, including arm's-length, non-equity, equity, and joint ventures(Capron & Mitchell, 2012; Powell, 2003; Williamson, 1991). In other words, each firm has its own internal value chain (Porter, 1985), where it can choose how to organize activities of each stage (Williamson, 1991). Figure 2 represents these choices: Firm A relies on external partners more for its downstream activities (i.e., S2) than it does for its upstream activities (i.e., S1) activities. By contrast, Firm B relies entirely on external partners for its S1 activities. Firm C made value chain choices in contrast to Firm A's. Of course, other combinations of choices are possible.

********** Figure 2 about here **********

Therefore, we suggest that a firm's value chain configuration entails what stages of a value chain the firm is involved in and the volume of activities that are performed internally or externally (i.e., through partnerships with various governance mechanisms) at each stage. Stated differently, VCC is a set such as $\{V_{I,S1}, V_{E,S1}, V_{I,S2}, V_{E,S2}\}$, where $V_{I,S1}$ refers to the volume of S1 (i.e., upstream activities) performed internally, $V_{E,S1}$ signifies the volume of S1 performed externally, $V_{I,S2}$ represents the volume of S2 (i.e., downstream activities) performed internally, and $V_{E,S2}$ indicates the volume of S2 performed externally.

An extensive body of work has considered the two elements of where and how a firm's value chain configuration activities occur. The underlying mechanisms of the first stage choices are suggested by firm-scope scholarship (e.g., Blit, Liu, & Mitchell, 2016; Helfat & Eisenhardt, 2004; Jacobides, 2005; Kaul, 2012; Leiblein & Miller, 2003; Levinthal & Wu, 2010; Sakhartov, 2017). Independent of the first stage, the second stage choices have been examined in great detail by firm-boundary scholarship (e.g., Capron & Mitchell, 2012; Hennart, 1991; Williamson, 1991).

Unfortunately, while the value chain concept is frequently invoked in strategy literature, its configuration remains understudied (Teece, 2007). Further, how these choices relate to firm

performance is not clear, perhaps because of two challenges. First, developing a deductive research paper can be difficult due to many competing logics as to why firms may opt for various value chain configurations. Second, archival data on such choices are not easily available, making it hard to empirically analyze the relationship between VCC and performance.

VCC and Firm Performance

Why should strategy scholars, and practitioners alike, care about VCC beyond a metaphor? We suggest that configuration choices will correlate with above-average performance—andmay contribute to strong performance—whentwo conditions are met: internal fit and external fit. First, a firm's finite resources (Penrose, 1959) are allocated according to activities that are complementarity with one another (Miller & Friesen, 1982;Nadler and Tushman, 1992 Siggelkow, 2001; Siggelkow and Porter, 2008); this situation creates the internal fit. Second, the choices of activities are appropriate for the environmental conditions the firm faces (Drazin and Van de Ven, 1985); this situation creates an external fit.

Combinations of internal and external fit may be important in creating competitive advantages (Siggelkow, 2001). Teece (2007: 1341) suggests that managers can improve their firm's position vis-à-vis other industry players by discovering "new value-enhancing combinations inside the enterprise, and between and amongst enterprises, and with supporting institutions external to the enterprise," which Teece, Pisano, and Shuen (1997) refer to as orchestration. In turn, orchestration choices underpin "an enterprise's capacity to successfully innovate [(i.e., to create value)] and capture sufficient value to deliver superior long-term financial performance" (Teece, 2007: 1320).

Because firms in the same market are exposed to the same set of external conditions—at least within a reasonable time interval while the environment does not drastically shift—performance differences can arise from variation in internal fit as well as from interactions of internal choices with the external environment. In this logic, top performers are firms that find ways to allocate resources to VCC choices that reinforce one another internally and complement their external relationships. Various theoretical frameworks can explain why firms may choose a specific VCC represented by the set $\{V_{I,S1}, V_{E,S1}, V_{I,S2}, V_{E,S2}\}$. For instance, limited benefits of scale economies (Cohen & Klepper, 1996; Scherer & Ross, 1990) may explain why firms may

choose to perform their upstream and downstream activities both internally and externally (i.e., opt for a VCC where $V_{I,S1}$, $V_{E,S1}$, $V_{I,S2}$ and $V_{E,S2}$ are large)—when a firm does not gain much scale economies from its internal upstream and downstream activities, it may also form partnerships to perform a portion of such activities externally. Further, performing upstream or downstream activities internally gives the focal firm a better understanding of the tasks making it easier for the firm to monitor its partners (Mayer & Salomon, 2006; Parmigiani & Mitchell, 2009), increasing firm tendencies to form partnerships. That is, the greater the $V_{I,S1}$, the greater the $V_{E,S1}$ and the greater the $V_{I,S2}$ the greater $V_{E,S2}$. Similarly, absorptive capacity reasoning could also explain the co-occurrence of the value chain choices—performing a particular value chain stage (e.g., R&D) internally may increase returns from a partnership for that stage (Arora & Gambardella, 1990; Cassiman & Veugelers, 2006).

If one takes a Penrosian perspective (Penrose, 1959), however, a different picture may emerge where a larger firm's resource-base (high $V_{I,S1}$ and $V_{I,S2}$) compels the firm to continue expanding them internally (i.e., lower $V_{E,S1}$ and $V_{E,S2}$). In other words, internal and external activities substitute one another. Substitutive relationships may also exist among internal value chain activities (i.e., $V_{I,S1}$ and $V_{I,S2}$), particularly in later stages of industry evolution when processes and products' modularization require firms to specialize in dealing with technological complexity and demand heterogeneity (Baldwin & Clark, 2000; Langlois, 2003).

In the interest of brevity, we will not discuss other theoretical perspectives that can explain how value chain elements may either complement or substitute one another. The point is that $V_{I,S1}$, $V_{E,S1}$, $V_{I,S2}$, and $V_{E,S2}$ can interact in complex ways through various mechanisms.

How a firm configures its value chain is likely to be associated with its performance because the careful arrangement of activities could minimize the cost and maximize the benefits of economic transactions within and beyond firm boundaries. The lowest-performing firms will tend to be those whose VCC choices include co-occurrence of activities that lack complementarity. In the same vein, the best performing firms will be those that make VCC choices that follow the normative logics, which can be mapped to value creation and capture (Brandenburger & Stuart, 1996; Lepak, Smith, & Taylor, 2007).

For instance, specialization in either internal upstream or internal downstream activities (Baldwin & Clark, 2000; Langlois, 2003) that implies a compromise between $V_{I,S1}$ and $V_{I,S2}$, could help the firm increase its value creation. At the same time, a more selective (and even restrictive) approach to partnerships to avoid the loss of proprietary knowledge (implying a substitutive relationship between $V_{I,S1}$ and $V_{E,S1}$ or between $V_{I,S2}$ and $V_{E,S2}$) would help value capture. These moves then result in a specific VCC that facilitates greater value creation and capture, leading to higher firm performance.

Optimization of value creation and value capture could also be achieved by other configurations. For example, achieving absorptive capacity through performing value chain activities internally complements partnerships (i.e., the co-occurrence of $V_{I,S1}$ and $V_{E,S1}$ or $V_{I,S2}$ and $V_{E,S2}$), helping the firm to improve its value creation in the value chain. At the same time, an improved understanding of the tasks through performing them internally would also help the firm in monitoring its partners and reducing the possibility of shirking and slacking (i.e., the co-occurrence of $V_{I,S1}$ and $V_{E,S1}$ or $V_{I,S2}$ and $V_{E,S2}$) leading to better value capture.

The myriad of mechanisms underlying different VCC suggests conditions under which a choice must be made or avoided (Donaldson, 1990), but does not specify whether a firm can adopt a beneficial configuration. That is, firms do not always behave according to the implications of our performance logic. As we discuss below, differences in a firm's choices may arise because of ignorance of superior choices or, more commonly, from lack of capabilities needed to organize decisions across complex organizations, especially in changing environments.

Figure 3 depicts this scenario, showing the status of three firms in an industry. For simplicity, we assume that in this case, there are two dimensions in VCC choices—the maximum value is created when a firm adopts certain quantities along choices 1 and 2 dimensions. Firms strive to approach the frontier value creation curve. For at least two reasons, firms might become stuck far beneath the convex curve: lack of knowledge and lack of capabilities. First, optimal configurations of their value chain (desirable combinations of choices 1 and 2 along the frontier curve) may be unknown to them. Second, even when firms possess relevant information about desirable configurations, they may lack the required VCC capabilities (Mitchell,2014) that are often asymmetrically distributed among firms (Teece, 2007) due to frictions in the market for capabilities(Wernerfelt, 1984).

********** Figure 3 about here **********

While value chain is frequently invoked in both academic research and practitioner publications (e.g., Hansen & Birkinshaw, 2007), it remains conceptually and empirically understudied (Teece, 2007). However, the arguments above suggest that different VCCs may correlate with firm performance.Next, we suggest that, as at least as a concept, it could enrich the study of coopetition, among other phenomena.

VALUE CHAIN CONFIGURATION AND COOPETITION

Competition and cooperation are fairly well-researched concepts in strategy. Traditionally, the competition literature, steeped in the dictums of neo-classical economics (Friedman, 1962), viewed cooperation as a form of collusion (Hoffmann et al., 2018). Similarly, for cooperation scholars, competition typically represented friction that undermines trust (Zaheer, McEvily, & Perrone, 1998). The coopetition literature, while noting the diverging motivations behind competition and cooperation, has highlighted their complementarity and complex interactions (e.g., Chen & Miller, 2015).

As there are multiple papers, including a recent special issue on definition, antecedents, and consequences of coopetition, we avoid a general review of this vast literature. In 2018, for instance, Strategic Management Journal published a special issue on coopetition [https://onlinelibrary.wiley.com/toc/10970266/2018/39/12].More focally, in this section, we explore how our exposition of value chain configuration can help scholars address under-explored issues in coopetition.

The majority of coopetition studies deal with cooperation and competition from an inter-firm perspective. These studies investigate coopetition's antecedents and consequences in the context of alliances. Since others have systemically reviewed the coopetition literature and categorized the studies (e.g., Bengtsson & Raza-Ullah, 2016; Dorn, Schweiger, & Albers, 2016; Gnyawali & Ryan Charleton, 2018; Hoffmann et al., 2018), we avoid repeating a review of the literature. Instead, we offer how VCC perspective can contribute to the study of coopetition literature by *broadening* the concept.

The coopetition studies are usually investigations of the interplay or consequences of a focal firm that has to manage competition while cooperating with another firm (Arslan, 2018; Ross, 2018) or a collection of firms (Asgari et al., 2018). Nevertheless, the value that accrues to a firm as a result of striking a balance between value creation and capture is first generated in the broader industry value chain that the focal firm is a member of (Brandenburger & Stuart, 1996; Gans & Ryall, 2016; Porter, 1985).At a lower resolution, firms belong to a sector (e.g., drug discovery platforms) that, in turn, is exposed to coopetition with other sectors (e.g., contract research organizations) of the entire industry value chain. Conceptualizing firms in this manner allowed Jacobides and Tae (2015) to show how these macro-sectors compete to capture the value that is distributed across the industry value chain. Their analysis shows that when there is a dominant firm with superior capabilities in a specific sector of the industry value chain (e.g., semiconductors), that sector captures more value from the overall value chain of the industry (e.g., PCs) through mechanisms such as technological leadership. The share captured by the sector in which the firm is embedded is then subject to capture through coopetition within the sector. The concept of VCC, therefore, helps broaden the empirical map of possible origins of coopetition that moves past tendencies in the coopetition literature to restricting competition to a merely firm-level variable.

When one adopts a macro-level value chain view of coopetition, it will be hard to ignore its dynamic nature (Ritala & Tidström, 2014). The dynamism of coopetition is important to address because a static perspective falls short of explaining the emerging coopetition among firms from different sectors. When a firm that belongs to a specific sector of an industry value chain (e.g., Sony as a supplier of audio systems to car manufacturers) expands its operations to other value chain stages (e.g., Sony moving to electronic car segment[2]), it could find itself competing and cooperating with firms from the new stages that it has expanded to. Current literature falls short of explaining such dynamics (Chung & Cheng, 2019) in the face of decreasing transaction costs and loosening industry boundaries (Atluri, Dietz, & Henke, 2017).

However, we are not suggesting that value chain literature is complete and the best candidate to enrich the coopetition literature. There are many shortcomings in the former that are yet to be addressed. For instance, the phenomenon of value migration and no-profit zones across

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[2] The New York Times, accessed on February 05, 2022

value chains (Slywotzky, 1996) is yet to be explored empirically and developed conceptually. However, integrating it into the coopetition literature widens conceptual and empirical opportunities in the coopetition literature.

Broadening the concept of coopetition also generates opportunities to study the consequences of coopetition. Our earlier discussion suggests that a firm's VCC strategy involves two choices: first, where along the industry value chain template the firm wants to operate, and second, how the chosen value chain activities need to be organized under internal hierarchy and/or through cooperation with external partners. Therefore, cooperation is a major feature of value chains. We suggest that competition is another major feature and together with cooperation can shape a firm's performance.

Figure 4 helps clarify the discussion. The focal firm may have upstream or downstream cooperative relationships with partners (solid lines). At the same time, some of its partners (e.g., P_1 and P_5) could be its competitors (dashed lines). Further, the partners (e.g., P4 and P5) could be competitors.

********** Figure 4 about here **********

This scenario resonates with studies that take a portfolio view of cooperation among firms (e.g.,Asgari *et al.*, 2017, 2018; Hoffmann *et al*., 2018).Lavie, 2007 investigates the beneficial effects of competition among a focal firm's partners on the focal firm's financial performance. Asgari *et al.* (2018), meanwhile, explore the negative consequences of such a form of competition for alliance stability while taking into account the potential for coopetition between a focal firm's partners. Neither study, though, perhaps for the sake of parsimony and limitations that seeking causality imposes, directly examined the nature of coopetition when partnerships are formed for both upstream and downstream activities (akin to what Figure 4 represents). Nevertheless, as Asgari *et al.* (2018) integrate Lavie's (2007) arguments, we use their discussion to highlight why competition is an embedded feature of VCC.

Table 1 summarizes Asgari *et al.*'s (2018) logic about how a focal firm and its partners perceive competition among the focal firm's partners (i.e., inter-partner competition). The focal firm prefers inter-partner competition for three reasons. First, competitors are likely to have different, yet similar, resources, giving the focal firm combinatorial opportunities from sharing

among partners(Gnyawali & Park, 2011; Mahmood, Chung, & Mitchell, 2012; Vasudeva &Anand, 2011). Second, bridging between competitors provides the focal firm with bargaining opportunities(Dovev Lavie, 2007; Shipilov, 2008). Third, the focal firm benefits from hedging risks and dependence when partners have overlapping resources(Jiang, Tao, & Santoro, 2010; Singh & Mitchell, 1996).

********** Table 1 about here **********

At the same time, each of the three benefits for the focal firm generates concerns for the partners. First, combinatorial opportunities to the focal firm could imply leakage of each partner to other partners(Katila, Rosenberger, & Eisenhardt, 2008; Oxley & Wada, 2009). Second, bargaining opportunities of the focal firm correspond to the partners' loss of rents(Doven Lavie, 2006). Third, the focal firm's risk hedging and risk mitigation activities could imply the focal firm's loss of attention to and distraction from its cooperation with its partners(Singh & Mitchell, 1996).

As Figure 4 indicates, competition can be between partners within (e.g., P_1 and P_2) and across value chain stages (e.g., P_3 and P_4). We suggest that the benefits of concerns noted in Table 1 vary between intra-stage (e.g., P1 and P2, or P_4 and P_5) and inter-stage (e.g., P3 and P4) competitions. Table 2 and Table 3 summarize the differential effects.

********** Table 2 and Table 3 about here *********

These intricate relationships can impact the co-occurrence and substitution mechanisms stated above. The point is that there are strong reasons to expect VCC to associate with – and even influence – the way that coopetition shapes firm performance. Our current empirical approaches fall short of advancing theory or generating new insights for decision-makers concerning these complicated relationships.

EMPIRICAL ANALYSIS OF VCC AND COOPETITION

Looking at coopetition from a VCC perspective brings about both opportunities and challenges. In this section, we first discuss some empirical opportunities that VCC provides for coopetition literature. We then turn to the challenges that VCC causes and offer some possible solutions to address them.

Opportunities: Measuring coopetition could be challenging because often what two partners compete and cooperate for might not be exactly the same. Usually, two firms' coopetition involves competing in the market for final products (e.g., Samsung and Apple in the mobile phone market; Pfizer and GlaxoSmithKline in the bio-pharmaceuticals market) and cooperating in developing their final products (e.g., Samsung supplying flash memory, DRAMs, and application processors to Apple; Pfizer and GSK cooperating in the HIV/AIDS medications market as well as in the consumer health business).

One relevant aspect of the more complicated relationship between cooperation and competition that reflects aspects of value chain configuration is concurrent sourcing. Parmigiani and Mitchell (2009) and Capron and Mitchell (2012) explored concurrent sourcing where a firm simultaneously undertakes a given stage (say, S_k) of their industry value chain internally (i.e., make) and through cooperation with firms that compete in the same final product market. In this case, the two firms' competition is not limited to their final products; rather, the two firms can compete in the market S_k of their value chains (Hoffman *et al.*, 2018). In the industrial organization literature, this phenomenon is referred to as tapered integration (see Kessler and Stern, 1959; Harrigan, 1983). In this scenario, the two firms cooperate on a specific task in the value chain. But, they also compete for the same task because they may be supplying other firms with the exact resource for which they cooperate. This scenario creates a cleaner context for empirically analyzing the interplay of competition and cooperation.

Another challenge in the empirical investigation of coopetition is establishing causality. The evolution of value chains, often caused by exogenous technological and institutional forces (Asgari *et al.*, 2017, Asgari & Singh, 2017), could be a useful context for studying why competing firms may form cooperative ties, particularly when these forces bring about value migration across industry value chain templates.

For instance, biotechnology firms that occupied upstream stages of the pharmaceutical value chain traditionally collaborated with incumbent pharma firms that occupied downstream stages of the pharmaceutical industry value chain to access their complementary resources. However, several exogenous technological and institutional changes altered the role of biotechnology firms and induced them to seek value in the downstream stages of the industry value chain (Asgari, Tandon, Singh, and Mitchell, 2019). Hence, biotechnology firms changed

from collaborators to coopetitors of pharma companies—for instance, the once-small biotech firm Amgen is now simultaneously competing and collaborating with successful incumbents such as Pfizer, Janssen, and Merck.

Challenges: As we suggested, the value chain concept is a useful framework. However, it is fraught with two major challenges. First, it has been used at different levels of analysis, and its patterns are yet to be discovered. *Value chain becomes a useful, valid theoretical perspective only when its archetypes and classifications are understood*(Ketchen & Shook, 1996; Miller, 1996). More broadly, classification has played an important role in the advancement of scientific knowledge since Aristotle's (384-322 BC) work on species, if not earlier in human history.

Second, possible theoretical frameworks that can explain its configurations often yield conflicting predictions making deductive reasoning difficult. We think that the recent discourse on empirical challenges of the field (Bettis, 2012) and the interaction of inductive and deductive reasoning (Shrestha, He, Puranam, & von Krogh, 2021), that echos the useful but neglected practice of careful descriptive analysis and inductive reasoning (Locke, 2007), could provide a solution for both challenges.

The first challenge (i.e., poor understanding of value chain archetypes) can be addressed using methods that have precedence in strategy research. For example, while the concept of strategic groups was introduced as a concept in the early 1970s by Hunt (1972), Harrigan (1985) used exploratory cluster analysis to uncover the structure of these groups and their membership patterns. Recent developments in statistical learning (a.k.a., machine learning) have expanded the tools that are available for understanding similar patterns (Hastie, Tibshirani, and Friedman, 2009). These advancements, aided by increasing computing power and availability of data, can help strategy scholars determine if there is a coherent pattern in co-occurrence, substitution, or independence among value chain activities that often involve coopetitive relationships.

This step results in classifying firms into different groups according to how they orchestrate such activities and ties. In the parlance of machine learning, each firm will be given a "label" (i.e., a category number). For example, a sample of 400 firms may fall into three or six distinct groups based on how the firms orchestrate their value chain activities and for which activity they cooperate and/or compete with others.

The second challenge that comes with VCC framework is its complexity which could make deductive reasoning difficult. The solution to this challenge could come from the recent discussion on the value and direction of research in strategy (Locke, 2007). Several scholars argue that to advance the boundaries of the field, scholars have to break away from the hypo-deductive paradigm that perpetuates overfitted models and non-replicable results (Shrestha et al., 2021). This suggestion is particularly relevant to the study of VCC because numerous and competing logical premises—as explicated in this essay—make deductive reasoning prone to the so-called HARKING problem (i.e., Hypothesizing After Results Are Known) (Kerr, 1998).

To facilitate deductive reasoning, one can first use an inductive approach and rely on supervised machine learning techniques applied to a slice of the dataset to pick the relevant variables—regularization techniques such as "least absolute shrinkage and selection operator" (LASSO) could be used for this purpose. While the results of these models indicate correlations rather than implying causality (Mullainathan and Spiess, 2017), they help determine stylized facts (Kaldor, 1961; Lerner & Wulf, 2007; Vidal & Mitchell, 2017)as inputs into generating assumptions, concepts, and potential causal mechanisms for subsequent deductive reasoning.

Propositions from the inductive step can be used to generate hypotheses to be tested in separate samples from the same or different empirical contexts. This step is similar to what is generally practiced in several social sciences fields, including management and strategy, which offer a rich set of research design and analytical tools for testing such hypotheses. The power here is that the new inductive initial step helps to identify limited sets of precise hypotheses. Consequently, we can develop more parsimonious answers to the questions about coopetition and value chain configuration. Such inductive steps provide a powerful way of employing Occam's razor to avoid errors that arise from overly complex explanations.

MANAGERIAL IMPLICATIONS

The value chain concept is helpful to managers mainly when it has implications for their firms' performance. There is evidence that proactive management of value chains bestows firms with greater performance (Mitchell, 2014; Normann & Ramírez, 1993). In this paper, we suggest that collaboration and competition are two indispensable facets of value chains, making their conceptual integration necessary. Therefore, the broad implication is that firms should pay

attention to the balance of cooperation and competition in their value chains. But, more often than not, this kind of broad statement would leave managers high and dry.

Fortunately, though, the recent recognition of data analytics and big data signals the possibility that complex managerial scenarios could be mapped and evaluated. For instance, computational linguistics can be used to detect the overlap between firms' offerings and capabilities along their value chains (Hoberg & Phillips, 2016) by mining their legal and media records (Asgari *et al*., 2017) and their traces on the web. Cloud computing and other advances have made such endeavors possible, albeit for larger corporations (Zolas *et al*., 2021). Of course, as technology advances, such tools become widely available to smaller firms too.

Similarly, other technologies such as blockchain would make proactive alliance management possible. Combining the power of these technologies would then allow firms to manage their value chains based on reliable insights rather than mere abstractions. For instance, recently, a coffee farmers' cooperative in Honduras worked with IBM and Heifer International (an economic development charity) to combine the power of AI and blockchain to improve their value chain management.

CONCLUSION

We suggest that value chain theory offers both conceptual and empirical contributions to research on coopetition. The perspective helps broaden the concept of coopetition as it recognizes the competition across value chain stages for value which will then be distributed among the firms within each stage. Further, the VCC perspective helps scholars tease out the benefits and costs of coopetitive relationships in a more nuanced way. Looking at coopetition in the context of value chains also provides empirical opportunities leading to a richer understanding of coopetition.

Nonetheless, while a VCC approach can be valuable theoretically, it adds to the already-high level of empirical complexity that exists in coopetition research. To address the complexity, we outline analysis based on a mix of inductive and deductive reasoning. Advances in inductive techniques involving unsupervised and supervised machine learning can provide robust inferences about the nature of these key strategic choices. The inductive pattern-identification also lays a base for deriving generalizable stylized facts and propositions that can then be tested

using deductive reasoning and causal logic. We believe that the conceptual and empirical

opportunities from value chain configuration concepts offer a strong base for extending research

on coopetition.

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Table 1. Competition between partners: Benefits to focal firms and partners' concerns

Benefits to the focal firm (F) from competition between partners (P and PCs)	Partner's (P) concerns arising from competitors (PCs) in portfolio
• Combinatorial opportunities from sharing among partners with overlapping resources (Vasudeva and Anand, 2011; Gnyawali and Park, 2011; Mahmood *et al.*, 2013)	1. Leakage of resources to other partners (Katila *et al.*, 2008; Oxley and Wada, 2009)
• Bargaining opportunities (Lavie, 2007; Shipilov, 2009)	2. Loss of rents (Lavie, 2006)
• Hedging of risks and dependence, when partners have overlapping resources (Jiang *et al.*, 2010; Singh and Mitchell, 1996)	3. Other alliances distracting F from the F—P alliance(Singh and Mitchell, 1996)

Table 2. Focal firm's benefits from intra-stage versus inter-stage competition between partners

	Intra-stage competition	Inter-stage competition
Combinatorial opportunities from sharing among partners with overlapping resources	++	+
Bargaining opportunities	++	++
Hedging of risks and dependence, when partners have overlapping resources	++	No effect

Table 3. Partners' concerns about intra-stage versus inter-stage competition

	Intra-stage competition	Inter-stage competition
Leakage of resources to other partners	- -	-
Loss of rents	- -	- -
Other alliances distracting F from the F—P alliance	- -	-

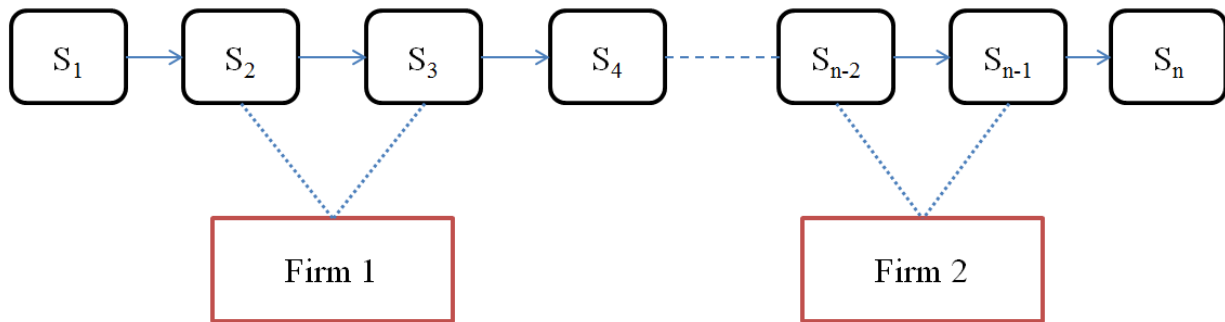**Figure 1. Industry value chain template and firms' position**

Figure 2. Transaction choices of firms

S1: Upstream stage; $V_{I,S1}$: Volume of S1 performed internally; $V_{E,S1}$: Volume of S1 performed externally
S2: Downstream stage; $V_{I,S2}$: Volume of S2 performed internally; $V_{E,S2}$: Volume of S2 performed externally
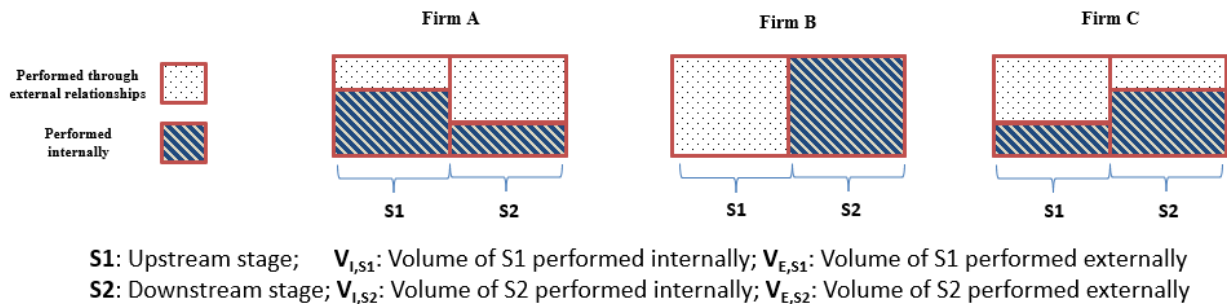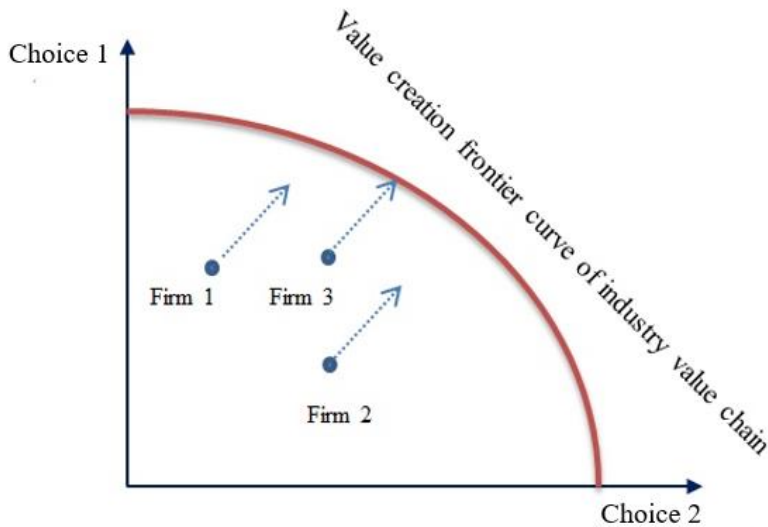
Figure 3. Value Creation Frontier of an Industry Value Chain

Figure 4. Coopetition and Value Chain

External
Partners

Internal
Development

Competitive
Relationship

Cooperative
Relationship

P₁ P₂ P₃ P₄ P₅

Upstream Stages

Downstream Stages