A CONCURRENT RECONCEPTUALIZATION OF CONCURRENT SOURCING

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Keywords: Concurrent sourcing, governance choice, similarity

The authors thank Pierre Azoulay, Michael Leiblein, and attendees at the 2009 Academy of Management meeting for their thoughtful comments. Any errors are the responsibility of the authors.

Abstract

Firms often procure the same input via multiple means, e.g., making and buying. Recent papers exploring such concurrent sourcing modes have yielded rich, but inconsistent, theoretical and empirical insights. We suggest that resolving these inconsistencies and setting the foundation for future work requires reconceptualizing two aspects of concurrent sourcing: what and how. "What" refers to a surprising lack of clarity of what is meant by "same" inputs. We reconceptualize "same" as a spectrum of degrees of similarity and propose how similarity might be measured. "How" refers to the governance modes combined in concurrent sourcing. Extending the literature's predominant focus on make/buy, we reconceptualize concurrent sourcing as a set of combined governance modes—make/buy, make/ally and buy/ally—distinguished from single modes of governance by certain shared characteristics, but differing from each other in their capabilities and limitations. We demonstrate the potential of our reconceptualization with propositions predicting the use of concurrent sourcing and choice of specific concurrent sourcing modes as a function of similarity, technological volatility and performance ambiguity. Concurrently reconceptualizing "what" and "how" resolves strains between existing studies and strengthens the foundation for future work. Furthermore, enhanced understanding of the trade-offs and synergies among governance modes generates theoretical, empirical and managerial insights relevant to governance choice situations beyond concurrent sourcing itself.

Keywords: Concurrent sourcing, governance choice, similarity

INTRODUCTION

What is the best governance mode (i.e., make, buy, or ally) to organize a particular transaction? Answering this question has a long tradition in management literature (e.g., Williamson, 1985; 1991; Oxley, 1997; Oxley, 1999; David and Han, 2004). Typically, this question has been answered in either-or terms favoring one governance mode over another depending on the underlying transaction characteristics. However, recent research on concurrent sourcing has begun to explore the possibility that firms combine generic governance modes to better respond to a rapidly changing environment and increasing knowledge and performance requirements (e.g., Parmigiani 2007; Parmigiani and Mitchell, 2009).

Concurrent sourcing is a governance form where multiple governance modes of market, hierarchy, and hybrids are combined in a systematic way. Concurrent sourcing differs from hybrid governance forms such as alliances since it is not in between market and hierarchies, but rather is a combination of multiple governance forms in their full manifestation (Harrigan 1984, 1985; Bradach, 1997; Bradach and Eccles, 1989; Gulati and Puranam, 2006; Parmigiani, 2007). While the concept has a long history, reaching back at least to Kessler and Stern (1959), it is a set of recent work (Gulati and Puranam, 2006; Heide, 2003; Parmigiani, 2007; Parmigiani and Mitchell 2009) that has finally created a critical mass of theoretical and empirical insights into the phenomenon.

The recent growth of the literature has started to reveal strains across various theoretical conceptualizations of concurrent sourcing and the empirical results they yield. We believe the time is ripe to revisit the body of highly insightful individual works in a more holistic sense, resolving some of the strains between them and laying a more theoretically consistent foundation for examining concurrent sourcing. We begin by observing that there are two substantial areas in need of reconceptualization: what and how.

By "what", we refer to a surprising lack of clarity regarding what actually represents concurrent sourcing. Generically, concurrent sourcing refers to the simultaneous occurrence of multiple governance forms for the sourcing of the same inputs. However, the boundaries of "same" are inconsistently defined across and even *within* papers. Few would disagree that making and buying coal represents concurrent sourcing. Nor would many suggest that buying automotive tires and making car doors is an example of concurrent sourcing. However, an empirically and theoretically relevant grey zone exists: Does making 80 gigabyte hard-drives and buying 120 gigabyte hard-drives qualify as concurrent sourcing? Would conducting exploratory research on mechanisms of cell growth via an alliance and conducting slightly less exploratory research internally qualify? We will show how different conceptions of "same" have manifested in the literature, clouding theoretical progress and perhaps generating seemingly contradictory empirical results. We then reconceptualize "same" as a spectrum of degrees of "similarity" and propose how similarity might be measured. Reconceptualizing concurrent sourcing as the sourcing of more-or-less similar inputs via more than one governance mode helps resolve theoretical and empirical tensions in the existing literature and allows us to apply the theoretical insights generated in the concurrent sourcing literature to a broader set of circumstances.

By "how", we refer to the governance modes combined in concurrent sourcing. The overwhelming majority of the literature has considered the combination of make and buy, sometimes termed "tapered integration" (e.g., Gulati and Puranam, 2006; Heide, 2003; Parmigiani, 2003, 2007). However, other combinations of governance modes, such as make-and-ally or buy-and-ally are equally valid theoretically and are frequently observed in practice (e.g., Veugelers and Cassiman, 1999). Therefore, we reconceptualize concurrent sourcing as a set of combined governance modes—make/buy, make/ally and buy/ally—that are distinguished from single modes of governance by certain

shared characteristics, but also differ from each other in their particular capabilities and limitations.[1] This reconceptualization provides a common framework for studies of different concurrent sourcing modes. Additionally, it provides the foundation for more nuanced consideration of the relative benefits of each mode in specific circumstances.

To begin our reconceptualization of concurrent sourcing, we will examine the limitations of both "what" and "how" in their current conceptualization. We then introduce our proposed reconceptualization of each, discussing their theoretical motivation and practical application. We then demonstrate the potential of our reconceptualization by incorporating them into a set of propositions, which predict the use of concurrent sourcing and the choice of specific concurrent sourcing mode as a function of similarity and two dimensions of uncertainty: technological volatility and performance ambiguity. These propositions are empirically useful and important. More importantly, they illustrate how the enhanced understanding of the trade-offs and synergies among governance modes generated by reconceptualizing concurrent sourcing generates new theoretical insights (of uncertainty in our case) relevant to governance choice situations beyond concurrent sourcing itself. Achieving that enhanced understanding requires concurrently reconceptualizing both "what" and "how".

CURRENT CONCEPTUALIZATIONS OF CONCURRENT SOURCING

Existing theoretical work largely maintains that concurrent sourcing can be explained by traditional concerns such as safeguarding and behavioral uncertainty (Dutta *et al.*, 1995; Heide, 2003; McNaughton, 2002). Empirical findings have been both intriguing and inconsistent. Dutta *et al* (1995) found a positive effect of asset specificity on concurrent use of house accounts and sales representatives in distribution, but no effect in procurement. Parmigiani (2003, 2007) and Heide (2003) conceptually identified performance ambiguity as driver of concurrent sourcing in different industrial procurement

[1] Trinary modes, e.g, make/buy/ally, have also been observed. For simplicity, we constrain our theoretical development to the situation of two modes being combined.

contexts. However, while some papers have found empirical support for this relationship (Heide, 2003; Parmigiani, 2003), others have not (Parmigiani, 2007). Furthermore, Parmigiani (2003, 2007) showed that technological uncertainty may lead not to hierarchical governance, as usually predicted, but to concurrent sourcing "indicating the benefit of learning from both internal and external suppliers." (Parmigiani, 2003: 3).

The "what" of concurrent sourcing: same versus similar inputs

Concurrent sourcing refers to the simultaneous occurrence of multiple governance forms for the sourcing of similar inputs. Most extant studies on concurrent sourcing conceptualize concurrent sourcing as making and buying the exact same input (e.g., Gulati and Puranam, 2006; Heide, 2003; Parmigiani, 2003, 2007). For example, Gulati and Puranam (2006) state that "[F]irms often make and buy the same thing." (Gulati and Puranam, 2006: 3). Similarly, Parmigiani (2007: 285; emphasis in the original) specifically points out that " 'Concurrent sourcing' emphasizes that firms are making and buying the *same* good, in contrast to considering a broader unit of analysis and/or one with more heterogeneity."

However, the "same input" may be difficult to delineate precisely from a "very similar input" because the identification of the salient feature based on which to determine similarity depends on the context in which the inputs are compared (Escobedo, Smith and Caudell, 1993; Tversky, 1977). For example, Parmigiani (2003: 208; emphasis in the original) mixes similar and same inputs stating that "Importantly, more similar inputs tended to be concurrently sourced rather than bought. This finding supports one of the key ideas presented throughout this dissertation that firms make and buy the *same* input." As Table 1 indicates, the blurring of "same" and "similar" appears common.

----------Insert Table 1 here----------

Azoulay and Henderson (2001) study concurrent sourcing in drug development and find that "while a proportion of development activity is outsourced, there exists inside pharmaceutical firms a core of 'insiders' that are engaged in exactly the same activities as the CRO employees." However, this study also identifies relevant differences in the apparently "exact same" activities: "We have shown in previous work that the allocation of projects to inside and outside teams present a very specific pattern: *knowledge-intensive* projects are more likely to be assigned to internal teams, while *data-intensive* projects are more likely to be outsourced." (Azoulay and Henderson, 2001: 22; emphasis in the original).

The identification and evaluation of relevant differences between seemingly "same" inputs is crucial both theoretically and empirically. From a theoretical perspective, it is important to ensure that inputs that are sourced via concurrent sourcing are sufficiently similar to constitute concurrent sourcing. For example, making specific inputs in-house and sourcing generic inputs from external suppliers does *not* represent concurrent sourcing because the choice of different sourcing modes can be explained by relevant differences in the underlying transaction (Williamson, 1985). To empirically control for this possibility a theoretical conceptualization of how to distinguish between same or similar inputs and less similar inputs is necessary.

The difficulty and confusion in delineating "exactly the same" inputs from "very similar" inputs may imply that some papers that intend to study concurrent sourcing of same inputs are in fact studying concurrent sourcing of very similar inputs. Hence, explicitly accounting for concurrent sourcing of inputs that are similar, but not exactly the same, may help clarifying extant inconsistencies in theoretical explanations and empirical findings in concurrent sourcing research such as the contradicting effects of performance ambiguity on concurrent sourcing (Heide, 2003; Parmigiani, 2003, 2007). For example, although focusing on "same" inputs, Parmigiani (2007) includes similarity as

control measure in her study and reports that input similarity is significantly negatively correlated with asset specificity, volume uncertainty and technological uncertainty, whereas it is significantly positively correlated with performance uncertainty. The reported correlations in Parmigiani's (2007) study may indicate that, for example, performance ambiguity is only a driver for concurrent sourcing if inputs are "more similar, [as] it should be less costly and easier for the buying firm to compare the offerings of internal versus external suppliers." (Parmigiani, 2003: 201).

While existing research has acknowledged the importance of similarity in explaining concurrent sourcing, two significant gaps remain in the treatment of similarity. First, testable hypotheses about the effect of similarity on concurrent sourcing have not yet been developed. Second, the measurement of similarity in extant concurrent sourcing studies is missing. Our reconceptualization addresses both.

The "how" of concurrent sourcing: Multiple combinations governance modes

The overwhelming majority of the literature has focused on the combination of make and buy (e.g., Gulati and Puranam, 2006; Heide, 2003; Parmigiani, 2003, 2007). However, other combinations of governance modes, such as make-and-ally or buy-and-ally are equally valid theoretically and are frequently observed in practice (e.g., Veugelers and Cassiman, 1999). For example, Veugelers and Cassiman (1999) studied the organization of innovation activities and found that out of the 73% of the firms in their sample using concurrent sourcing, 12% were making-and-allying, 33% were making-and-buying, and 55% were making-buying-and-allying. Their results seem to support the absorptive capacity argument: "[T]hose who are attempting to encourage cooperative research ventures in quickly advancing fields should recognize that the direct participation in the venture should represent only a portion of the resources that it will take to benefit from the venture. Participating firms also must be prepared to invest internally in the absorptive capacity that will permit effective exploitation of the venture's knowledge output." (Cohen and Levinthal, 1990: 149).

Including combinations of make or buy with collaborative governance modes completes the picture of the variety of concurrent sourcing modes. Further, it allows us to bring to bear work that is not yet perceived of informing the concurrent sourcing literature.

RECONCEPTUALIZATIONS OF CONCURRENT SOURCING

Reconceptualizing "What": Moving from "the same" to "degrees of similarity"

As we demonstrated above, defining concurrent sourcing as the procure of the "same input" via multiple modes is problematic when "the same" has been used to describe both sets of inputs that truly are identical and sets of non-identical inputs that share many common attributes. Therefore, we propose to reconceptualize the problematic term "same inputs" into degrees of "similarity". "Similarity" can be conceptualized as a spectrum that is anchored at one end by identical inputs and extends towards infinity in the direction of dissimilarity. At a minimum, inputs have to be destined for the same function in the downstream production process to be examples of considered concurrent sourcing (Parmigiani, 2003). Beyond this, we use substitutability of production inputs as a heuristic to classify the degree of similarity (Parmigiani, 2003). Substitutability describes the ease with which one input to production can be substituted for another one. The better one input can be substituted for another input the more similar the inputs are.

There are multiple dimensions along which two inputs could be more or less substitutable and hence, similar. We expand on Parmigiani (2003) to suggest a partial list:

(1) Overlap of the scientific/technological basis refers to possibility that two inputs can perform the same function in the production process but based on different principles. For example, car engines can work with internal combustion, but also with the use of electricity or hydrogen. The less similar the scientific principles underlying an input are, the more production routines are likely to differ and hence, the more difficult it will be to switch from using one input to using another one. Also, the more

the underlying scientific principles differ the more the knowledge required to produce/use the input will differ.

(2) Similarity of the production techniques and equipment refers to the possibility to utilize production investments that have already been made to use input A to use input B. The more similar production techniques and equipment are the less likely are losses of economies of scale and scope. The more similar production techniques and equipment the quicker and less cost-intensive production facilities can be adjusted to use the different inputs.

(3) Comparability of costs of using different inputs refers to the ability to substitute one input (e.g., sugar) for another (e.g., corn syrup) in the production process while still achieving a given output at a given cost. The greater the cost differences, the less flexibility a firm has to switch from one input to another as the same output can only be produced with higher costs or the output has to be reduced when the cost are kept constant.

(4) Comparability of consumer perception of a product made using different inputs refers to the possibility that consumers might not equally value a product that is manufactured using a different input. Consider as an example the impact of replacing organic food ingredients with non-organic ingredients.

(5) The quality of a product made with different inputs refers to potential differences in quality along dimensions not immediately available to consumers. For example, two different types of fastener might influence the durability of furniture. This difference may have long-term implications, e.g., increased warranty costs, even though customers will not be aware of the difference at the time of purchase.

In judging how similar two inputs are, different dimensions will be more important under different situations.[2] For example, for a capital intensive product, dimensions 1 and 2 are probably most important, while for a product with high price sensitivity (e.g., soda) dimension 3 might be the most important. For a luxury consumer good, dimensions 4 and 5 might be most important. Thus, whether procuring two inputs via different modes represents concurrent sourcing depends on the context-specific managerial decision about which are the most relevant dimension(s) and how similar are two inputs along those dimensions (Tversky, 1977).

We illustrate our logic using an exemplary input to car manufacturing, the engine. Hyundai produces two versions of its Genesis sedan, one with a V6 engine, the other with a V8. If Hyundai procured the V6 and the V8 via different modes, to what degree should we think of this as concurrent sourcing? Clearly, they are not the same input. However, if they were very similar, much of the logic of concurrent sourcing would be relevant and we could usefully consider it an example of concurrent sourcing. How similar, then, are they? In terms of the scientific principles on which they operate, they are very similar. Both repeatedly introduce a gasoline-air vapor mixture to a chamber, cause the mixture to explode via an electrical spark, and capture the resulting energy to drive reciprocating pistons that connect to a rotating drive shaft and ultimately the tires.

The production techniques and equipment used with both are similar. Indeed, both the V6 and the V8 model are built on the same production line (Vasilash, 2008). The cost Hyundai pays for the V8 is likely to be higher. The quality of the end product is unlikely to differ systematically with the engine and the average consumer's perception of the V6 and V8 sedans are not radically different (see, e.g., Bell, 2009). Overall, the V6 and V8 input represent very similar inputs for the Hyundai Genesis and could be thought of as potential concurrent sourcing.

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[2] This list of dimensions is not meant to be exhaustive. Rather, it lists dimensions that existing research suggests will be important in many cases.

It is worth noting that customer perception might differ dramatically depending on another context. In a racing vehicle or a sports car, as opposed to a luxury sedan, substituting a V6 for a more powerful V8 engine would dramatically affect customer perception of the resulting vehicle. Hence, although substitutable on all dimensions except consumer perception, engines may in fact not be substitutable based on non-substitutability on a single dimension. This example illustrates that depending on the context two inputs may be considered similar in one context and dissimilar in another context.

In contrast, compare a V8 internal combustion engine to an engine powered by a hydrogen fuel cell. The relevant scientific principles differ dramatically. Rather than an explosion, fuel cells use a chemical reaction to generate electricity. Production of a car using a fuel cell, rather than internal combustion, requires different tools and techniques to incorporate an electrically powered engine and to protect the fragile fuel cell from vibration and extremes of temperature. Hydrogen fuel cells are much more expensive than internal combustion engines. Also, consumer perceptions are likely to differ as hydrogen cars are more likely to be perceived as being "greener", but also less convenient. Quality differences of the end product are unknown at this stage. So, while several automakers are purchasing fuel cells (primarily for experimental designs, rather than production), it does not seem reasonable to consider the procurement of V6 engines and hydrogen fuel cells via different means as concurrent sourcing.

This reconceptualization addresses the difficulties we identified above. At the most basic level, it is more linguistically precise. Rather than describe non-identical inputs as the "same", we can refer to inputs being more or less similar. Additionally, it provides a more nuanced approach to defining concurrent sourcing. Lastly, as we will develop in our propositions below, the degree of similarity serves as an explanatory variable in models of concurrent sourcing. Our approach moves us from

debating about whether something is concurrent sourcing or not to a productive application of similarity as an explanatory variable.

Reconceptualizing "How": Multiple combinations within concurrent sourcing

We believe that reconceptualizing the "how" of concurrent sourcing can help unify and extend existing studies. In particular, attempts to relate causal mechanisms to the presence of "concurrent sourcing" are hampered by either (a) only considering one form of concurrent sourcing, typically make-and-buy, or (b) considering all forms of concurrent sourcing to be the same. Researchers can address the former by expanding their definition of concurrent sourcing to include any combination of multiple governance modes. While this may have implications for the design of survey instruments or gathering of secondary data, the change is straight-forward to implement.

Addressing the latter point is more challenging. We submit that, just as each single mode of governance has its own strengths and weaknesses, so does each concurrent sourcing mode. This expands the question from whether concurrent sourcing occurs to which form of single or concurrent sourcing occurs.

Understanding concurrent sourcing modes requires that we consider both the properties of each constituent governance mode in isolation and also their interaction. Interaction between the constituent governance modes of a concurrent sourcing mode can take two forms. First, two modes can be combined such that they augment each other's strengths. For example, learning from external suppliers can be more effective in the presence of absorptive capacity created by internal suppliers (Parmigiani, 2003). While R&D can be performed effectively by either governance mode alone, combining them increases the firm's ability to learn and adapt to technological changes significantly (Cohen and Levinthal, 1990).

Alternatively, the modes may compensate for each other's weaknesses. For example, the diminished incentives of internal supply can be partially offset by combining it with external sourcing, which provides information needed to benchmark the performance of the internal supplier (e.g., Heide, 2003; Parmigiani, 2003).

APPLICATION OF THE RECONCEPTUALIZATION OF CONCURRENT SOURCING

In this section, we put our reconceptualization of the "what" and "how" of concurrent sourcing into practice. We develop a set of propositions that predict the use of concurrent sourcing and the choice of specific concurrent sourcing modes as a function of similarity and two dimensions of uncertainty: performance ambiguity and technological volatility. Following much of the literature on concurrent sourcing, we remain within the transaction cost economics tradition.[3]

Importantly, our aim is not to provide an exhaustive explanation of concurrent sourcing, but to demonstrate how one could apply our reconceptualization and the benefits of doing so. Nevertheless, the propositions we develop are empirically useful and important. More importantly, they illustrate how the enhanced understanding of the trade-offs and synergies among governance modes generated by reconceptualizing concurrent sourcing generates new theoretical insights (of uncertainty in our case) relevant to governance choice situations beyond concurrent sourcing itself.

We begin by considering performance ambiguity. After considering the governance challenges posed by performance ambiguity, we discuss the strengths and weaknesses of each singular governance mode as responses to those challenges. By considering how these strengths and weaknesses interact, we develop our first proposition, predicting which mode from the full range of possible singular and concurrent sourcing modes is optimal in the presence of performance ambiguity ("how"). Next, we

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[3] We take a fairly expansive view of the boundaries of TCE, including extensions that consider the value of learning (see e.g., Argyres, Bercovitz and Mayer, 2007).

turn to the issue of similarity of inputs ("what"), positing that the benefits we have identified for concurrent sourcing in response to performance ambiguity are increasingly salient as inputs become more similar.

After our discussion of performance ambiguity, we follow the same steps to develop two parallel propositions related to technological volatility. Critically, our predictions regarding optimal governance mode and the role of input similarity differ from the predictions related to performance ambiguity. These differences show the additional theoretical and empirical insights made possible by our concurrent reconceptualization of "what" and "how". Table 2 shows the characteristics of generic governance forms in responding to different types of uncertainty.

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Performance ambiguity

Performance ambiguity occurs when the causes of good or bad performance are not clearly identifiable due to the interplay of bounded rationality and opportunism (Williamson, 1975). Ambiguity increases the likelihood of opportunistic behavior since opportunism may go unnoticed when perceptions of behavior are ambiguous (Carson, Madhok and Wu, 2006; Ouchi, 1980). Also, in situations of ambiguity cooperative acts may be incorrectly sanctioned as opportunistic, reducing incentives for cooperation (Carson *et al.*, 2006). To measure performance as the efficiency of input-output ratios the firm needs to determine either production process input or output (or both) correctly. In reality, however, inputs such as the performance of workers or the effort of the supplier and outputs such as the quality or functionality of a good or service may be difficult to determine (Heide, 1994). This difficulty may be driven by difficulties in measurement (Barzel, 1982) or the non-separability of effort across actors (Alchian and Demsetz, 1972).

Market exchange (buy) is difficult in the presence of performance ambiguity (Wathne and Heide, 2000; Williamson, 1975). Not only is it difficult to establish performance criteria initially, the buyer may be unable to determine when the supplier is acting opportunistically (Heide, 2003). Furthermore, in the event of disagreement, third parties such as the courts will find it difficult to ascertain fault (Arrow, 1971; Masten, 1984). While hierarchy (make) mitigates these difficulties, it is not a complete solution (Alchian and Demsetz, 1972; Williamson, 1985). Williamson (1985) explicitly discusses shirking and inferior performance based on weak incentives within hierarchies. Similarly, Ouchi (1980: 134) suggests that "Bureaucracies can fail when the ambiguity of performance evaluation becomes significantly greater than that which brings about market failure."

Hybrid governance (ally) also fails to address performance ambiguity. Hybrids are based on social sanctioning mechanisms that are only effective when justified by a correct evaluation whether the transaction partner has behaved opportunistically or not, which cannot be accomplished under conditions of high performance ambiguity (Carson *et al.*, 2006; Heide, 2003). Masters *et al.* (2004) strengthen this argument and state that relational contracting actually increases the risk of opportunism because a firm creates a small numbers bargaining situation by developing closer ties to its exchange partners without the safety of complete integration. Hence, in situations of ambiguity reliance on a single governance form as source of performance measurement may be insufficient as markets, hierarchies and hybrids suffer from substantial inefficiencies (Heide, 2003).

In all three singular governance forms, these inefficiencies result from the difficulty of objectively measuring the input and/or the output of a production process. Assessing performance by benchmarking one output with another one can help reducing performance ambiguity (Heide, 2003).[4]

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4 This parallels the concept of a promotion tournament from labor economics: the decision of which employee to promote is likely to depend more on the employee's performance as compared to peers than based on objective performance measures when performance is difficult to measure (Lazear and Rosen, 1981).

"In practice, measurement problems could exist that require different monitoring mechanisms to be employed simultaneously. […] If a meaningful standard for some reason is unavailable, output measurement may need to be supplemented with behavior controls and/or socialization processes." (Heide, 1994: 77). By combining two modes, each governance mode within concurrent sourcing counteracts the weaknesses of the other involved governance mode. However, combinations of modes differ in their effectiveness.

Reliably assessing performance of an input requires the firm to have knowledge about the input.[5] This favors inclusion of "make", since internal organization usually generates understanding and knowledge about the characteristics of an input (Grant, 1996; Kogut and Zander, 1992). However, as hierarchies suffer from weak incentives, monitoring compliance with performance objectives may be costly and inefficient.

Markets are powerful in counteracting weak incentives, filling the incentive gap posed by "make". By combining making and buying, a firm increases incentives for both internal and external suppliers by maintaining a credible threat of switching to the better performing supplier when necessary. Combining making and buying also decreases the risk of opportunism by filling the knowledge gap left by buying along (Dutta *et al.*, 1995; Heide, 2003). The detection of opportunistic behavior becomes more likely based on benchmarking the performance of internal and external supply together with internal understanding of the performance drivers.

Concurrent sourcing modes that include hybrids fall short in addressing performance ambiguity, as hybrid governance fills neither the knowledge nor the incentive gaps left by buy and make respectively. Hybrids cannot substitute for internal production in creating the knowledge needed for

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5 Heide (2003) shows that firms solve information asymmetry problems not by establishing multiple market relationships but by shifting from exclusive reliance on market transactions to concurrent sourcing. Information asymmetry is closely related to performance ambiguity in its effect that it increases the risk of opportunism (Heide, 2003).

benchmarking. Nor can hybrids substitute for market governance because contractual commitments and the need for renegotiations limit the firm's flexibility to act upon poor performance outcomes.

Hence, we derive the following proposition:

Proposition 1: Performance ambiguity is most strongly associated with make-and-buy.

In situations of performance ambiguity the ability to benchmark performance increases with increasing similarity of inputs. Performance ambiguity requires assessing performance based on the comparison of production process inputs and/or outputs that are coming from diverse sources of supply (Heide, 2003). Comparing identical inputs provides the best grounds on which to identify differences between inputs and/or outputs of production. Differences in output performance may be identified using, for example, relative performance tests in laboratories or in the field. Internal understanding about the characteristics and production process of an input allows the firm to trace back the origin of potential performance differences and to evaluate whether performance differences are based on opportunism (Parmigiani, 2003).

However, as inputs become less similar, it becomes more difficult to identify the source of performance differences because the inputs and/or outputs are not directly comparable. Comparing less similar inputs to reduce ambiguity bears the risk of not identifying opportunism or incorrectly sanctioning non-opportunistic behavior.

Hence, the ability of concurrent sourcing to reduce performance ambiguity increases with increasing similarity of inputs. The following proposition summarizes the above reasoning:

Proposition 2: Performance ambiguity is associated with concurrent sourcing of more similar inputs.

Technological Volatility

Technological volatility occurs when the future development of technologies cannot be assessed ex ante due to bounded rationality (Geyskens, Steenkamp and Kumar, 2006; Walker and Weber, 1984; Balakrishnan and Wernerfelt, 1986). In many markets, only a single or few technological standards survive. Firms that fail to ensure access to or compatibility with the dominant technological standard risk being locked out of the market (Schilling, 1998). Hence, two related aspects are crucial in dealing with technological volatility (Cohen and Levinthal, 1990; Parmigiani, 2007): First, technological volatility requires the firm to constantly learn about diverse potential technological developments and trajectories to avoid obsolescence. Second, technological volatility creates the need for flexibility to adapt to technological change once a dominant technological standard is (about to be) selected (Schilling, 1998). We consider the need for learning first.

The ability to learn about and evaluate potential future development requires the firm to have sufficient knowledge about the input. Internal production provides the absorptive capacity required to enable the firm to absorb knowledge about technological developments (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Veugelers and Cassiman, 1999). However, when only making an input, a firm's learning potential is limited because weak incentives and inertia may constrain a firm's ability to renew and augment existing technological know-how and the firm may not have access to diverse knowledge (Parmigiani, 2007; Powell, Koput and Smith-Doerr, 1996; Schreyögg and Kliesch-Eberl, 2007; Sorensen and Stuart, 2000). Market transactions are an inefficient means to transfer and integrate knowledge (Grant, 1996). Even in combination with make, external procurement does not facilitate knowledge transfer as well as hybrid governance does because markets usually do not involve the same amount of coordination and cooperation (Gulati, Lawrence and Puranam, 2005; Gulati and Puranam, 2006).

Hybrids provide knowledge transfer enabling the firm to learn from partners through coordinated resource exchange and mutually beneficial interest alignment (Kale, Singh and Perlmutter, 2000; Mowery, Oxley and Silverman, 1996). Coordination improves access to knowledge (Dyer and Nobeoka, 2000) whereas cooperation enables the mutually beneficial use of knowledge and resources (Hamel, 1991; Kale *et al.,* 2000; Khanna, Gulati, and Nohria, 1998; Powell *et al.*, 1996). "Learning alliances, in which the partners strive to learn or internalize critical information or capabilities from each other, constitute an important class of such alliances (Prahalad and Hamel, 1990; Hamel, 1991; Khanna *et al.*, 1998)." (Kale *et al.*, 2000: 217). However, when relying solely on hybrid governance, the firm's learning is limited because the firm is lacking internal knowledge which serves as a basis for absorbing diverse knowledge (Cohen and Levinthal, 1990; Grant, 1996). Hence, augmenting internal organization with hybrid governance (make-and-ally) improves the firm's ability to learn about potential future technological developments (Parmigiani, 2007).

The desire to maintain flexibility to adapt to technological change presents a different set of calculations. Market exchange allows the firm to switch among suppliers, choosing whichever supplier currently provides the optimal technological solution (Williamson, 1985; Williamson, 1991). Because the commitment to a given supplier is limited, changing suppliers faces few organizational barriers and incurs a minimal loss of investment (Williamson, 1991). Hybrids are less flexible (Williamson, 1991). Although alliances allow the cost of investments in physical and intellectual capital to be shared, each participant still must make substantial investments that may be rendered obsolete by technological change. Additionally, alliances require managerial attention and the development of relationship-specific routines for coordination and governance. Thus, alliances are difficult and costly to unwind rapidly in the face of change (Williamson, 1991). Internal production is the least flexible of all options (Balakrishnan and Wernerfelt, 1986). Not only does the firm bear the full cost of potentially

obsolescing investments, flexibility is reduced by bureaucratic adaptation procedures (Williamson, 1985).

Flexibility cannot be completely separated from learning. Having access to at least some knowledge about technological developments is important to decide whether and when change may be required (Cohen and Levinthal, 1990). Thus, despite the apparent advantages of the market, exclusive reliance on external suppliers may lead to dependency as the firm's knowledge about technologies becomes outdated with technological volatility (Williamson, 1985). Access to an alliance partner's knowledge provides the firm with access to external knowledge without the costs and inflexibility of internal organization (King, Slotegraaf and Kesner, 2008). Hence, augmenting external procurement with hybrid governance (buy-and-ally) improves the firm's flexible adaptability to change.

Thus, in situations of technological volatility, both the need for learning and a desire for flexibility favor concurrent sourcing modes that include hybrid governance (Dyer, 1996). Whether it is combined with internal organization or market exchange depends on whether learning or flexibility is more important. Make-and-ally is more appropriate to enable learning as it combines the absorptive capacity of internal organization with knowledge transfer advantages of hybrid governance. Buy-and-ally is more appropriate to support flexibility because external procurement preserves flexibility while hybrid governance provides knowledge to assess the need for change while limiting flexibility less than internal organization.

We derive the following proposition:

Proposition 3: Technological volatility is most strongly associated with concurrent sourcing that includes hybrids.

In contrast to performance ambiguity, concurrent sourcing becomes less useful as a means of addressing technological volatility as the inputs being sourced become more similar. Technological

volatility requires that firms learn about multiple competing technological trajectories. Only by doing so the firm can monitor developments along each, compare their progress, and be prepared to pursue the trajectory that ultimately dominates (Schilling, 1998). Concurrent sourcing of identical or very similar inputs via multiple modes provides learning about only a narrow range of technologies, as the knowledge associated with each overlaps to a large degree. Decreasing similarity of inputs increases the potential for learning because firms can acquire knowledge about production processes that are sufficiently diverse to represent new knowledge (Dusseauge, Garrette and Mitchell, 2000; Lane and Lubatkin, 1998; Mowery, Oxley and Silverman, 1998).

In much the same manner, concurrent sourcing of identical or very similar inputs does not provide the firm with sufficient flexibility to adapt to technological change as developments that made one obsolete are likely to render the other obsolete as well. Rather than hedging its bets, the firm would have increased its bet on a narrow subset of the technological outcomes. In contrast, sourcing dissimilar inputs enables the firm to diversify the risk of obsolescence and to switch to the more technologically dominant source of supply (Henderson and Cockburn, 1996; King *et al.*, 2008). Hence, the ability of concurrent sourcing to reduce the risks of technological volatility decreases with increasing similarity of inputs.

The following proposition summarizes the above reasoning:

Proposition 4: Technological volatility is associated with concurrent sourcing of less similar inputs.

DISCUSSION

In this paper, we reconceptualize two aspects of concurrent sourcing to resolve some of the strains between existing concurrent sourcing studies and to lay a more theoretically consistent

foundation for examining concurrent sourcing. Both reconceptualizations have important implications for theory, empirical research, and managerial practice.

First, we reconceptualize the "what" of concurrent sourcing to clarify what actually represents concurrent sourcing. We do so by conceptualizing concurrent sourcing as the sourcing of more-or-less similar inputs (instead of the "same" inputs) via more than one governance mode. From a theory perspective, conceptualizing concurrent sourcing as sourcing of inputs with different degrees of similarity allows us to explain how different types of governance problems can be addressed more effectively by concurrent sourcing depending on the similarity of inputs involved. By considering inputs with different degrees of similarity we highlight the different motivation and characteristics of concurrent sourcing in responding to uncertainty. For example, whereas less similarity of inputs provides the firms with a greater learning potential and flexibility in situations of technological volatility, greater similarity of inputs supports a firm's ability to benchmark performance in situations of performance ambiguity. Considering inputs with different degrees of similarity specifically addresses the question of when a governance mode starts to qualify as concurrent sourcing and where it stops. Broadening the scope of concurrent sourcing to situations of sourcing of similar inputs allows us to apply the theoretical insights generated by concurrent sourcing research to a broader set of circumstances. While the question where this scope begins and ends has likely to be answered on a case-to-case basis, we provide empirically relevant dimensions of similarity of inputs to improve and develop measurement of concurrent sourcing. As managerial implication we were able to predict the role of similarity in inducing concurrent sourcing.

Our second reconceptualization refers to the "how" of concurrent sourcing and specifies the different possible and relevant governance mode combinations in concurrent sourcing. Extending the literature that has predominantly considered the combination of make-and-buy, we include make-and-

ally or buy-and-ally in our conceptualization. Importantly, we do so not by merely widening the definition of concurrent sourcing, but by considering each combination's unique characteristics. This reconceptualization provides a common framework for studies of different concurrent sourcing modes. Additionally, it provides the foundation for a theoretically and empirically more nuanced consideration of the relative benefits of each mode in specific circumstances and connects to our first reconceptualization by specifying which governance mode combinations best allow addressing the different governance problems.

We applied our concurrent reconceptualization to the situations of technological volatility and performance ambiguity as these generate distinct but relevant governance problems. However, this is just one application and we believe the concurrent reconceptualization can be helpful in understanding the role of other drivers of concurrent sourcing, such as expertise and capabilities. Parmigiani and Mitchell (2009) for instance, study how within-firm and inter-firm expertise is associated with concurrent sourcing. They find that "firms often need to make in order to know, but can partially outsource if they possess sufficient expertise." (Parmigiani and Mitchell, 2009: 1065). Our reconceptualization can add to understanding those relationships by examining how similar or different inputs and thus firm and supplier related expertise and capabilities need to be to best support knowledge creation or flexibility. Also, using our reconceptualization, examining how different governance mode combinations support knowledge creation represents an interesting path for future research.

In practical terms, integrating our reconceptualization into empirical research begins with "what", that is, determining the dimensions of potential similarity that are most relevant to the empirical setting at hand. The next step is to develop a measurement scale for how substitutable inputs are along the relevant dimensions, recognizing that the scale may vary across dimensions. The last step is to develop

a weighting scheme among the dimensions, which may be driven by data, theory or a mixture of the two. While we have offered recommendations on each step throughout the paper, industry expertise will be extremely valuable throughout the process.

Expanding the full set of potential governance choices ("how") begins with determining the governance challenges to be overcome. The next step is to consider the degree to which each single governance mode addresses them. If significant challenges are left unaddressed by any single governance mode, consideration turns to what combination of governance modes will more completely address governance challenges. The optimal mode of concurrent sourcing may or may not include the optimal single governance mode.

From a broader perspective, this paper contributes to a more detailed understanding of governance choice and governance combinations in general. We highlight the different ways in which governance mode combinations work depending on the type of governance problem at hand: Performance ambiguity triggers an opportunism-based governance problem that can be addressed by inducing competition between governance modes (such as in make-and-buy). Technological volatility, however, triggers a knowledge- and flexibility-based governance problem that can be addressed by inducing collaboration between governance modes within concurrent sourcing. A more nuanced study of the way how governance modes may interact represents an interesting path for future research.

Based on our reconceptualization, a more nuanced understanding of concurrent sourcing involving two governance modes lays the foundation for studying concurrent sourcing involving three governance modes (make/buy/ally) as a further interesting path for future research.

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TABLE 1 Conceptions of sameness of concurrently sourced inputs

Paper	Type of input	Conceptualization of the "sameness" of inputs	"Same" or "Similar"?
Azoulay & Henderson (2001)	Drug development activity	"[T]here exists inside pharmaceutical firms a core of "insiders" that are engaged in exactly the same activities as the CRO employees." (p. 22; emphasis in the original)	Similar: "*[K]nowledge-intensive* projects are more likely to be assigned to internal teams, while *data-intensive* projects are more likely to be outsourced." (p. 22; emphasis in the original)
Heide (2003)	Components purchased by OEMs in general machinery, electrical and electronic machinery, and transportation equipment	"This article examines the phenomenon of *plural governance*, a firm's simultaneous use of market contracting and vertical integration for the same basic transaction." (p. 18)	Same: Measurement of dependent variable: "What percentage, if any, of your needs for this component do you produce internally?" (p. 21)
Parmigiani (2007)	5 inputs: Die design, die build, die maintenance, Part machining, Part coating	" 'Concurrent sourcing' emphasizes that firms are making and buying the *same* good, in contrast to considering a broader unit of analysis and/or one with more heterogeneity." (285; emphasis in the original)	Similar: Input similarity is measured as control variable. Results show that more similar inputs are rather concurrently sourced than bought
Veugelers & Cassiman (1999)	Innovation activity	"[…]the decision of the innovative firm to produce technology itself (Make) or to source technology externally (Buy) [...]" (p. 63)	Similar: Inputs are complementary. "But there are ample arguments to stress the complementarity between in-house R&D and external know-how [...]" (p. 64)

TABLE 2 Characteristics of generic governance forms in responding to different types of uncertainty

	Technological Volatility	**Performance Ambiguity**
Nature of Uncertainty	Uncertainty about future technological change	Uncertainty about current performance states
Nature of Governance Problem	Adaptation	Performance Evaluation
Market characteristics in responding to …	- Weak knowledge transfer + Strong adaptability and flexibility	- Risk of opportunism + Strong incentives
Hybrid characteristics in responding to …	+ Enabling knowledge transfer - Lack of absorptive capacity	- Closer ties to exchange partners without safety of complete integration - Social sanctioning mechanisms ineffective in detecting opportunism
Hierarchy characteristics in responding to…	+ Absorptive capacity - Risk of obsolescence of investments - Risk of inertia	+ Administrative support by bureaucracy - Weak incentives