

## **Alliance Resource Configurations and Implications for Subsequent Innovation in the face of Technological Change: An Integrated Model**

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**Abstract:** *This paper examines the effect of technological change on the utilization of different resource configurations shared among dyad alliance partners. The subsequent impact of the alliance's altered resource utilization on firm performance is discussed. More specifically, this research explores the impact of competency destroying and opportunity enhancing technological change on alliance resource utilization based on whether firms enter link or scale alliances. Link alliances leverage complementary resources whereas scale alliances leverage compatible resources. The resource based view which posits that the possession of rare, valuable, inimitable, and non-substitutable resources/capabilities results in a competitive advantage and organizational economics is used to explain why firms prefer to share redundant or complementary resources among allies resulting in desired performance improvements. This article posits that technological complementary-based alliances are more apt to produce enhanced firm performance given the two types of technological changes discussed in strategic literature – opportunity enhancing and opportunity destroying based on incumbent positions. In this study, performance is defined as alliance product or service innovations resulting from resources shared between firms.*

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### **1. INTRODUCTION**

Organizational forms are becoming increasingly complex as witnessed by recent research. Strategic alliances are one such complex organizational type where firms enter into long standing agreements to exploit an opportunity (Calabrese, 1988; Combs and Ketchen, 1999; Harrigan, 1988; Mitsuhashi and Greve, 2009), to reduce risks (Zaheer and Zaheer, 1997), to maximize innovation (Atuahene-Gima and Murray 2007; Joshi and Nerkar, 2011; Wiklund and Shepherd, 2009; Yalcinkaya, Calantone, and Griffith 2007), to build a competitive advantage (Oliver, 1997; Gulati, Nohria, and Zaheer, 2000), or to reduce costs. Organizational economic research suggests that reducing costs associated with control and monitoring is one key factor motivating alliance formations. Composed of transactions cost economics and agency theory (Barney and Ouchi, 1986), organizational economics theory enlightens researchers about how alliance formations offer a more cost-effective alternative to market exchanges. Pursuing such an organizational form also reduces opportunistic behavior by alliance members.

The efficient acquisition of knowledge and resources also motivates the formation of ongoing cooperative arrangements (Inkpen; 2008; Kogut, 1988; Hamel, Doz and Prahalad, 1989). By acquiring relevant knowledge and gaining access to scarce resources, organizations attempt to reduce environmental uncertainty (Ahuja and Katila, 2001), to increase their competitive advantages and market positions (Oliver, 1997; Gulati, Nohria, and Zaheer, 2000; Porter and Fuller, 1986), to build new capabilities (Pucik, 1988; Lyles and Salk, 1996; Mothe and Quelin, 1998), to increase dynamic capabilities (Tece, Pisano and Shuen, 1997; Eisenhardt and Martin, 2000), or to reshape existing resources for increased competitiveness (Hitt, Nixon, Clifford and Coyne, 1999; Katila and Shane; 2005). However, the utility of these shared resources is affected by subsequent technological change since such environmental changes may cause increased uncertainty and market disruptions. When significant enough, technological change can destroy competencies and competitive advantages through creative destruction (Schumpeter, 1932).

Competency-destroying technological change subsequent to alliance formations results in increased environmental turbulence (Tushman and Anderson, 1986), which may erode existing technology and capabilities (Alfuah and Bahram, 1995). Opportunity-enhancing technological change (Henderson and Clark, 1990) allows those firms with the appropriate resources to build upon their existing capabilities. Hence, the utility of resources is dependent upon the markets in which they are employed (Arora and Nandkumar, 2012; Katila and Shane, 2005). Alliances exist to facilitate resource access. Hence, knowing which resource-based alliances to form is of importance (Misuhashi and Greve, 2009) especially given the possibility for technology-based change.

Despite these insightful discussions regarding strategic alliances and technological change, many unanswered questions still exist regarding our understanding of alliance performance and survival (Dutta and Weiss, 1997; Mowery, Oxley, and Silverman, 1996; Joshi and Nerkar, 2011). For instance, we know little about what types of resources within horizontal alliances are most likely to yield the desired performance outcomes in the face of technological change. The literature does not adequately address how competency-destroying and opportunity-creating technological changes affect alliance performance characterized by complementary and redundant resources. Extant research fails to identify what effects horizontal alliances that are in place have on performance when competency-destroying technologies are introduced. Moreover, understanding how this effect changes given the introduction of opportunity creating technological changes is of importance both theoretically and practically. Perhaps most importantly, it is important to know whether the resulting boundary expanding activities will likely produce product or service innovation in spite of the types of technological change that may occur.

Hence, this paper addresses important gaps in the literature. First, arguments are made to suggest that technological change will impact resource utilization and alliance performance based on the resource configurations desired prior to alliance formation. More specifically, by applying resource and organizational economics theoretical lens, the effects of competency-destroying and opportunity-creating technological change on the innovative capabilities of alliances that share complementary and redundant resources are explored. While there are theoretical reasons for alliances based on complementary and redundant resources, interfirm cooperative arrangements based complementary resources will outperform those based on redundant resources in industries where innovation is a critical performance measure and where technological change occurs. This is particularly true when the technological changes are competency-destroying which produce increased environmental turbulence (Tushman and Anderson, 1986). This type of environmental change will increase uncertainty and have an impact on strategic alliances' performance according to the resources that they share. Redundant-based alliances will yield lower innovation potential. On the other hand, competency-enhancing (Henderson and Clark, 1990) technological change will yield complementary-based alliances with increased innovation potential. The conceptual framework presented in this manuscript helps predict alliance innovation potential based on its resource utilization following technological change, thereby increasing alliance formation utilities.

Examining the impact of technological change on alliance resource utilization is important for at least two reasons. First, I offer a conceptual framework that diagrams alliance resource utilization following two types of technological change. Although antecedent factors are important for resource utilization, this framework suggest that firms must also consider the resulting attributes of the strategic alliance and its ability to cope with environmental change if they are to be successful in dynamic industries. Second, this framework offers theoretical explanations why alliance formations may fail. The argument for both complementary and redundant resource-based alliances is made and the subsequent impact of technological change on performance is addressed in this article. When organizations no longer perceive a resource fit with their ally or between their ally and the environment based on the types of resources utilized, complementary or redundant, survival of the alliance is negatively impacted. Theoretically, this encourages researchers and practitioners to look beyond the antecedents of an alliance to predict its performance and survival (Misuhashi and Greve, 2009).

The paper begins with a brief review of strategic alliance literature. The impact of technological change on strategic alliance performance is then examined. The resource based view, resource

dependence and organizational economics perspectives are leveraged to explore why firms would engage in alliances based on complementary and redundant resources followed by propositions of performance. Finally, I discuss the implications for theory and future research.

## **2. THEORETICAL BACKGROUND**

### **2.1 Alliances**

Organizations enter into cooperative arrangements for two broad reasons: (1) to pool resources to exploit market opportunities; or (2) to reduce the costs typified by market exchanges - often referred to as the competence and governance perspectives. Research based on the competence perspective proposes that while engaged in the alliance formation, organizations attempt to gain access to the resources of other firms while protecting their own resources. The pursuit of increased organizational capabilities (Pucik, 1988; Lyles and Salk, 1996) and the development of dynamic capabilities (Teece, Pisano and Shuen, 1997; Eisenhardt and Martin, 2000) represent competence-based explanations for strategic alliances. Firms also cooperate to gain access to rare and valuable resources and knowledge (Kogut, 1988; Hamel, Doz and Prahalad, 1989).

The governance perspective which is also grounded due to its roots in organizational economics has received much attention. It suggests that firms form alliances to reduce transaction costs and the potential to pursue opportunistic ongoing behavior. Information asymmetry, authority questions and inconsistent organizational goals make it difficult for non-alliance interfirm relationships to yield the desired performance outcomes. Alliance relationships attempt to minimize the costs and the probabilities of opportunistic behavior of pursuing increased performance goals between firms through binding commitments. In summary, hybrid organizational arrangements are developed to create more formal interfirm relationships. These cooperative arrangements are designed to minimize opportunistic behavior of firms by tying individual firm goals to the alliance outcomes and by sharing the costs of failure between the firms. Additional benefits associated with alliance formations include the reduction of monitoring, control costs and production costs (Williamson, 1975), the enhancement of knowledge and resource sharing through formal and informal exchange activities, and faster access to otherwise unobtainable markets by utilizing resources other than their own (Oviatt and McDougall, 1994).

### **2.2 Resources Based View**

The Seminal work of Penrose (1959) suggested that firms should be analyzed from a resource perspective to explain performance. This perspective encourages the realization that the environment alone does not determine organizational performance. Researchers and practitioners should look inside the organization to understand those elements, which are equal if not greater determinants of success. Wernerfelt (1984) described these resources as tangible and intangible to include brand names, knowledge, capital, etc. Consistent with the basis for many alliance decisions, Barney (1991) directs firms to focus internally to determine its ability to develop a sustainable competitive advantage. His examination of linkages between firm resources and sustained competitive advantages points to those resources, which are valuable, rare, inimitable and non-substitutable as key performance indicators. The amassed resources of the firm determine what it can do (Sherali, Desai, and Glickman, 2008). Hence, firms who possess value-creating resources, which are unique, are better positioned to develop competitive advantages, which may become the source of above average returns. Resources may be combined to form capabilities such as financial and physical assets, knowledge, human capital and other skills (Wernerfelt, 1984; Grant, 1991 and Amit and Schoemaker, 1993). I use the terms resources and capabilities interchangeably. Based on the work of Combs and Ketchn, Jr. (1999), this perspective helps to explain why competing firms might engage in cooperative behaviors despite the competitive landscape. They offer empirical evidence that organizations often place resource fit concerns before organizational economics when deciding whether to form an alliance relationship.

### **2.3 Organizational Economics**

This resource perspective offers an alternative explanation to the transaction cost perspective for alliance formation. The transaction cost perspective argues that firms enter into hybrid arrangements to reduce the overall transactions costs associated with exchange and production

activities (Coase, 1975; Williamson, 1975). This efficiency argument is complemented by the opportunity exploitation argument where resource sharing is the basis for interfirm arrangements. Strategy research has shown that organizations rarely have all of the resources needed to grow and achieve performance goals (Misuhashi and Greve, 2009). Resource integration becomes the reason that firms engage in cooperative conduct. This cooperative behavior among competing firms typically happens when firms either have valuable resources available for sharing or when they are in need of such resources (Eisenhardt and Schoonhoven, 1996). Das and Teng (2000) argue that firms form alliances to gain access to other firms' resources and to retain and develop their own resources. The heterogeneous and perfect immobility of resources suggests that organizations seek, exchange, and share particular resources to develop a favorable resource position by creating new resources and capabilities (Joshi and Nerkar, 2011). This combination of resources allows businesses to collaborate and achieve performance goals through alliance arrangements where firm boundaries are expanded that would otherwise be unobtainable given their individual limited resource endowments (Barney and Tyler, 1991). Expanding upon the work of Kogut (1988), Das and Teng (2000) argue that strategic alliances permit firms "to obtain others' resources" and "to retain and develop one's own resources by combining them with others' resources". Park, Chen and Gallagher (2002) found that resource-rich organizations behave differently than resource poor ones in volatile markets. Interestingly, firms lacking resources may perform well in small and competitive markets (Katila and Shane, 2005).

Strategic alliances offer access to other firms' needed resources except where transaction costs are "not high enough to justify vertical integration..." (Gulati, 1995). In this way, alliances are a good alternative to resource-lacking non alliances, offering the benefits of internalization where full internalization is not possible (Ramanathan, Seth and Thomas, 1997) and providing the opportunity for market exchanges where efficient exchanges do not exist possibly due to the embedded nature of some resources (Chi, 1994). Strategic alliances also give organizations who are contemplating the acquisition of another firm the opportunity to better view how the target firm's resources may be synergistic with the acquiring firm's resources. This study considers innovation as a performance measure so I look at the impact of change on an alliance's ability to develop new products. Leonardo-Barton (1992) and Teece (1992) explain how the technological capabilities and knowledge of firms may be pooled to develop new products. Still, when compared to mergers and acquisitions, alliances offer particular benefits where only the targeted resources of another firm may be accessed without the need to and cost of doing away with its less desired resources.

## **2.4 Resource Perspective**

The resource dependence perspective offers another explanation as to why organizations enter into strategic alliances. It suggests that firms strive to be in command of resources that minimize their dependence on other firms and those that maximize the dependence of other firms on themselves (Pfeifer, 1981). An alliance formation permits accesses to resources like knowledge that are transferable through learning. The exchange of resources like knowledge, markets and brand recognition create a power shift between organizations. Consistent with Eisenhardt and Schoonhoven, 1996 who argue that organizations with greater amounts of valuable resources and those with fewer amounts of valuable resources are more likely to form alliance relationships, the resource dependence perspective explains that in the pursuit of power, organizations form hybrid arrangements to exchange resources. Such exchanges may be mandated by organizations with limited resource endowments that require and search for scarce and valuable resources for their own survival (Pfeffer and Salancik, 1978). The incomplete nature of contracts yields limited protection against the withdrawal of truly scarce and valuable resources needed for survival when compared to those afforded in mergers and acquisitions.

## **2.5 Complementary and Redundant Resources**

Building on the work of Seabright, Levinthal and Fichman (1992), Das and Teng (2000) I argue that the "resource alignment" is the critical test for the alliance decision between firms. Alliances are formed based on link or scale resources and have different goals and expected strategic outcomes (Porter and Fuller, 1986; Dussauge, Garrette and Mitchel, 2000). Efficiency gains and expansion for opportunity exploitation are two such goals. Scale alliances are hybrid arrangements between competitors whereby organizations provide similar resources to the

alliance formation. These redundant resources improve the efficiency of the new hybrid organization.

Sustaining a competitive advantage depends largely on the ability of firms to prevent other competitors from gaining access to rare and valuable resources (Barney, 1991). Alliances are formed to combine resources between organizations to create new resources or to utilize underutilized resources to improve performance. This expansion argument implies that organizations can expand into new markets with existing or new products and services. In this model, I define performance as product/service innovation by dyad firms who share resources. Although Mitchell, Dussauge and Garrette (2002) found empirical evidence for aligned partners with different geographical origins to have a greater tendency to form link alliances, I exclude geographical expansion as a performance measure to focus on resources committed to product and service innovations rather than the mere exploitation of previously developed products. This performance measure lends itself to studies involving industries such as technology and pharmaceuticals.

Link resources are described as those in which alliance partners share and utilize different types of strategic organizational assets. They are complementary (Porter and Fuller, 1986) in the sense that one firm's resources "fit" with the resources of the other alliance partner based on each partner's contribution of a resource different than its own (Misuhashi and Greve, 2009). Researchers have found that brand name recognition and marketplace presence are complementary assets allowing market entry for highly recognized goods and services. Complementary resources may also be compatible based on technology, which fuels innovation. Rotharmel (2001) argued that alliances based on complementary assets are antecedent of new product development. These existing and new products allow alliance partners to enter new product and geographical markets. They also permit supernormal profit creation that cannot be generated by either firm individually (Dyer and Singh, 1998). Complementary alliances are often observed in technology firms (hardware, software and chip producers) and pharmaceutical firms due to the speed to market requirements and the high costs of research and development respectively. They attempt to create synergies between the alliance partners that can subsequently be used to exploit market opportunities based on new products in current and new markets or on existing products in new markets.

*P1: Firms enter into alliances based on complementary resources to maximize exploitation opportunities.*

A competitive advantage based on the efficiency argument may be achieved by combining similar and unique resources. Organizations who pursue alliances based on redundant or similar resource may seek to increase economies of scale (Mitchell, Dussauge and Garrette, 2002). By combining production capabilities between organizations, companies may decrease the per item cost of production thereby increasing productivity efficiencies. These types of alliances will often result in performance (profitability) improvements in stable environments.

Another explanation for scale alliances may be to reduce the risks (Zaheer and Zaheer, 1997). Such risks include the risk of resource or firm appropriation. To the extent that firms can deny other firms access to rare and valuable resources through contractual relationships, they may be able to sustain a competitive advantage in a given industry. For example, larger technology development firms may form alliances with smaller similar firms based on similar development projects. That the firms offer similar resources does not preclude the expected possibility of the firms possessing divergent goals. The larger more resource abundant firm may offer its relatively unique technological know-how to prevent other firms from gaining access to the smaller firm's innovative products, which may be based on similar technologies. This type of action may precede a potential merger or acquisition. The smaller or targeted firm may enter into the alliance to improve its innovation capabilities and to subsequently gain access to capital for future collaborations. Although different, these goals are not necessarily competing and represent alternative explanations for alliances based on scale resources.

*P2a: Firms enter into alliances based on redundant resources to maximize efficiency gains.*

*P2b: Firms enter into alliances based on redundant resources to minimize appropriation risks.*

## 2.6 Technological Change

I argue that subsequent to alliance formation, technological change will have a direct effect on the utility of combined resources shared by the alliance, which will subsequently affect firm performance (see Figure 1). Technological change is defined as opportunity creating or competency destroying change in the marketplace that affects the availability of desired goods and services. Unique alliance capabilities may make existing technology and capabilities (Alfuah and Bahram, 1995) obsolete in the face technological change (Tushman and Anderson, 1986). Technological changes may also create opportunities (Henderson and Clark, 1990) for those strategic partnerships that possess the appropriate recourses. Tushman and Anderson (1986) argue that new firms initiate competence-destroying technological changes whereas existing firms initiated competence-enhancing technological change. These alternatives reflect the discontinuous and incremental natures of technological change suggesting that resources and alliances do not always produce improved innovation capabilities (Katila and Shane, 2005; Joshi and Nerkar, 2011).

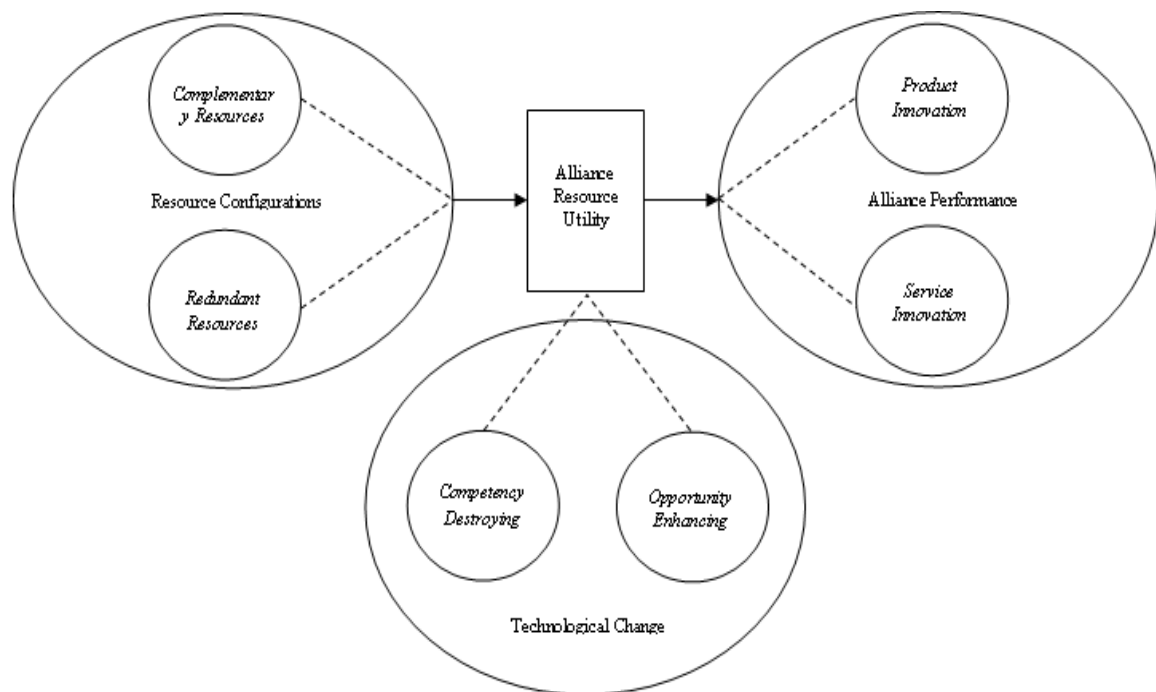


Figure 1. Resource Utility Research Model

## 2.7 Resource Utilization and Performance Outcomes

Das and Teng (2000) define resource utilization as “the degree to which the resources contributed by the partners are utilized for achieving the goals of the alliance. I adopt this definition and expand upon it. In my model, resource utilization involves the extent to which resources shared within the alliance are subsequently used to address marketplace challenges and opportunities in the pursuit of the collective goals of the hybrid arrangement. The utility of these resources will directly impact innovation as a performance measure, thereby enhancing or reducing it. Consistent with the definition of technological change, innovation is limited to that which affects the availability of new goods and services in the marketplace and not necessarily the production of such. However, I do acknowledge that technological change can affect manufacturing processes shared between organizations. Discussions of such changes are beyond the scope of this study.

Alliance performance can be defined in a variety of ways based on the desired goals of the alliance and its individual firms. Alliance profitability, its ability to survive over time and new product development are a few such performance measures (Beamish, 1987; Cullen, Johnson and Sakano, 1995; Deeds and Hill, 1996; Misuhashi and Greve, 2009). I define performance as innovation, which involves new product or service development (Deeds and Hill, 1996). I argue that performance based on the outcome of the interfirm relationship rather than on the individual

objectives of the alliance partners best identifies the performance outcome more closely related to innovation. The value of the whole is expected to be greater than the sum of its parts.

**2.8 Complementary Resources**

As discussed previously, link-based alliances involve firms sharing different strategic resources (Porter and Fuller, 1988; Misuhashi and Greve, 2009). Hence, alliances based on complementary resources will typically minimize firms having competing objectives. These firms are more likely to realize that without the addition of the other organization, new product development or market expansion is limited. This is particularly true since the basis for the alliance will be competence-based, whereby firms enter into interfirm relationships to gain access to rare and unique resources that minimize their own resource constraints. Deeds and Hill (1996) and other researchers have pointed out the benefits of alliances based on complementary resources. These benefits have been discussed in the context of stable environments. Different market environments produce different outcomes (Arora and Nandumar, 2011; Katila and Shane, 2005).

I believe that these complementary resources shared between organizations put them in a much better position to adapt to technological change that is either competency destroying (Tushman and Anderson, 1986) or opportunity creating (Henderson and Clark, 1990). Empirically, link alliances have been shown to lead to greater levels of learning (Dussauge, Garrette and Mitchel, 2000). Competency destroying change will result in two actions. Any innovative capabilities developed by the firms' relationship will likely be offset in the short run by the discontinuous change in the market place. Because the technological basis of the change will be new for the alliance partners, the increased uncertainty will have a negative impact on innovation as firms look inward for strategic direction. Firms who do not possess the technological know-how will either collaborate to develop this know-how or attempt to create their own change in the marketplace based on their complementary skill sets that are designed for expansion into new markets with new or existing products. Provided that alliance partners are sharing R&D resources, those used for product and technological development (Amit and Schoemaker, 1993), the continued sharing of these types of resources will create more opportunities for market expansion. For this reason, opportunity creating technological change should only improve the performance outcomes of such alliances. The incremental change that builds marginally on the technological strengths of the alliance creates more expansion opportunities for the alliance. The firms receive greater incentives to dedicate more resources in their collaborative efforts to capitalize on the market opportunities. The potential to generate greater returns as a result of enhanced learning and the development of new capabilities (Harrison, Hitt, Hoskisson and Ireland, 2001) fuels their attempts to create more products and services and results in greater innovation within the alliance. See Figure 2.

|                      |                       |   |   |
|----------------------|-----------------------|---|---|
| Technological Change | Competency Destroying | <i>Low Alliance Innovation Potential</i>      | <i>Moderate Alliance Innovation Potential</i> |
|                      | Opportunity Creating  | <i>Moderate Alliance Innovation Potential</i> | <i>High Alliance Innovation Potential</i>     |
|                      |                       | Redundant                                     | Complementary                                 |
|                      |                       | Resource Configurations                       |   |

**Figure2.** *Product/Service Innovation Potential Based on Resource Configurations in the Face of Technological Change*

*P2a: Strategic alliances based on complementary technological resources that are subsequently impacted by discontinuous change will yield no net gain or loss in their product/service innovation capabilities.*

*P2b: Strategic alliances based on complementary technological resources that are subsequently impacted by opportunity enhancing technological change will yield a net gain in their product/service innovation capabilities.*

## **2.9 Redundant Resources**

Earlier discussions regarding alliances based on scale-based resources explicate that organizations enter cooperative agreements to share similar or redundant resources often in the pursuit of efficiency gains or in attempts to reduce appropriation risks. Firms combine similar resources to achieve scale efficiencies thereby driving down production costs while driving up profitability. These benefits do not often lend themselves to improved innovative outputs (Wiklund and Shepherd, 2009).

Firms who share similar resources are not typically well positioned to adapt to technological change that is competency destroying. The achieved scale efficiencies they create are designed to reduce the cost of market expansion and the cost of manufacturing activities. I posit that the lack of a competence-based alliance will have a negative impact on new product development given its focus on exploitation rather than on exploration. Discontinuous technological change, which undermines the efficient production and sale of existing products, will eventually erode profits and may force current allies to pursue other alliances based on the exchange of competency building resources. These firms may also try to go it alone to develop new products and services. The resulting performance outcomes of competency destroying change on efficiency-based alliances include reduced profitability and the possible termination of the alliance. Technological change may alter the opportunity set based on the newly required fit of one firm's resource needs and another firm's resource offerings (Ven de Ven, 1976). Neither of the proposed outcomes will increase product or service innovations.

Opportunity enhancing technological change will have a positive impact on the potential for increased alliance innovation; however, the sharing of redundant resources requires that such partnerships be more focused on efficiency gains or market expansion opportunities based on the efficient and increased production of products for entry into more geographical markets. Such alliances may involve production efficiencies and the sharing of markets based on the combination of marketing and manufacturing resources. They will be positioned to exploit the opportunities created by the change based on the increased sale of goods and services. Larger revenues coupled with lower costs of production will result in increased profitability. However, it is not likely to yield greater innovation unless those financial resources are committed to new product development. Even this alternative is more likely to yield innovation improvements that are limited to the individual partners, not the alliance. See Figure 2.

*P3a: Strategic alliances based on redundant technological resources that are subsequently impacted by discontinuous change will yield a net loss in their product/service innovation capabilities.*

*P3b: Strategic alliances based on redundant technological resources that are subsequently impacted by opportunity enhancing technological change will yield no net gain or loss in their product/service innovation capabilities.*

## **3. DISCUSSION**

This paper makes several theoretical contributions regarding our understanding of alliance performance. I leverage the efficiency and competence perspectives to explore the following: under what circumstances organizations will engage in alliances based on redundant resources and; how alliances that share complementary or redundant resources are affected by discontinuous technological change. By examining strategic alliances from a resource perspective and by using organizational economics, I develop a strong rationale to explain why organizations would choose to share redundant resources. This delineation is important because I illustrate how organizations in different industries with different attributes behave differently. Researchers should be weary of applying broad theories to industries to explain and understand observed phenomena.



I discuss how antecedents contemplated for alliance partner selection help explain performance but are insufficient to address dyad alliance performance subsequent to two types of technological change, opportunity creating or competency destroying. Through our exploration of resource utilization following technological change, I offer a theoretical argument and a conceptual framework to predict firm performance. Theoretically, it is important to understand more than just how organizations select partners. It is also critical that researchers explore and explain how environmental changes affect alliance partner selection subsequent to performance. I propose that technological complementary-based alliances are more apt to have stable or increased levels of performance depending on the types of technological changes experienced. Complementary alliances confronted with competency enhancing technological change offer the greatest likelihood of new product development. This suggests that alliances that leverage complementary assets in an innovation dependent industry will outperform alliances that utilize redundant resources. I believe that an exchange among strategy researchers about alliance performance should examine the impact of the environment on alliance resource utilization.

### **3.1 Limitations and Future Research**

In this manuscript, a great deal of attention has been given to the study of strategic alliances. They are chosen mechanisms among firms to exploit opportunities, reduce costs, share risks or gain access to valuable resources. They require the commitment of strategic resources in the pursuit of sustainable competitive advantages. Unfortunately, such pursuits are not often achieved.

The implications, both theoretical and practical, for understanding conditions under which horizontal alliances ought to be formed in the face of ongoing or expected technological change given their shared resources are of significant importance. Researchers should focus on explaining why some alliances succeed in the development of sustainable advantages and longevity while others do not. Technological change offers one reasonable explanation. However, this explanation is insufficient without a clearer understanding of the types of resources firms employ in the alliance, how those resources affect individual and alliance goals and how resources are affected by discontinuous changes in the general and competitive environments.

Practicing managers should be aware that the rate of success among strategic alliances is low. There is much research to explain how the antecedents to alliance formations affect the subsequent rate of success. For organizations, due diligence with regard to these antecedents is necessary but not sufficient to increase the probability of success among alliance firms. For researchers, the antecedents provide an incomplete explanation of alliance performance and survival. Managers must be strategic-minded as they select potential allies. Poor decisions without adequate contingencies will decrease success rates of firms where significant technological change is reasonably expected. Such possibilities require a clearer understanding of how resource commitments affect long-term alliance success.

Future research must not only consider alliance performance in the face of technological change but must simultaneously consider the strategic fit of resources between firms and with their environment. The complexities associated with alliance performance require more than an analysis of individual resources. The impact of the environment on the alliance is worth discussion. Several testable propositions have been put forth in this article. Given the complex nature of the competitive environment, future researchers should also examine how other determinants of uncertainty subsequently affect alliances. Such determinants include significant shifts in market share, intensified competitive rivalry and the economic growth.

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