Do Technology-Based Partners Share Resources, Costs and Risks in Emerging Markets?

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Abstract

The strategic entrepreneurship literature posits that a major motive of strategic alliances is to share resources, costs and risks. This study proposes that the validity of the argument depends largely on the level of environmental dynamism. Using data from 285 Sino-foreign joint ventures in various technology industries, we find that partners share resources, costs and risks at low and moderate levels of environmental dynamism, and that such sharing increases within intervals of low to moderate environmental dynamism. However, sharing decreases within intervals of moderate to high environmental dynamism.

Keywords: emerging markets, technology-based partners, resource/cost/risk sharing, environmental dynamism

Introduction

Do partners share resources, costs and risks? The answer is affirmative in the traditional strategic entrepreneurship literature. Traditionally, strategic alliances are defined as “the voluntary arrangements between partners involving exchange, sharing, or co-development of products, technologies, or services” (Gulati, 1998, p. 293). Such a definition explicitly implies that sharing resources, costs and risks is the main motive of strategic partners. However, traditional transaction cost theory indicates that such sharing leads to transaction costs, including partners’ opportunism, asset specificity and bounded rationality (Williamson, 1998). Due to such transaction costs, recent studies indicate that this type of sharing may have negative rather than positive impacts on firm performance (e.g. Joshi and Nerkar, 2011). The benefits and costs of sharing resources, costs and risks have been widely discussed in the existing entrepreneurship literature, but the relationship between the benefits and costs, as far as we know, has not been clarified; that is, under what conditions do the benefits surpass the costs, and vice versa? Clearly, when transaction costs are high, partners may not necessarily share resources, costs and risks, or such sharing may be minimal. As such, the traditional definition of strategic alliances may be problematic, and there is an urgent need to compare the benefits and costs of sharing resources, costs and risks between partners against the background of transaction costs.

Existing studies have offered a long list of the benefits provided by strategic alliances, including sharing resources/costs/risks, blocking the entry of a stronger competitor, collaborating to compete, organizational learning, improving innovativeness, external legitimacy and managing environmental dynamism (Gulati, 1998; Xia, 2011). These benefits vary with forms of strategic alliances. For example, Kogut (1988) summarizes the benefits of joint ventures into three motivations: transaction costs resulting from small numbers bargaining, strategic behavior that leads to higher market power and knowledge sharing between partners. Sampson (2007) suggests that inter-firm collaboration in the R&D field presents an alternative whereby firms can gain access to complementary capabilities, reap economies of scale in R&D and shorten development time while spreading the risks and costs of such new development. Even though the benefits of alliances vary with forms of strategic alliances, mainstream researchers claim that the fundamental elements remain the same; that is, to share resources, costs and risks (Joshi and Nerkar, 2011; Kumar, 2011). Some alliance researchers even refer to strategic alliances as “access relationships” (Stuart, 2000, p.791). Strategic alliances are created because firms have resources, such as knowledge and financial resources, which are beneficial to but not possessed by the others (Gulati, 1998; Lin et al., 2009). Sharing complementary resources improves partners’ knowledge and capabilities, while sharing costs and risks enhances firms’ financial power and reduces failure rates (Goerzen, 2007). However, firms entering alliances face considerable moral hazard problems because partners’ behavior is often unobservable and the costs of opportunism and information collection and processing are potentially high (Williamson, 1985). Such costs can be even higher when environments experience high dynamism (Baum et al., 2000). Existing studies find that the threats of opportunism arise because knowledge-based assets may not be well protected in technology industries (e.g. Sampson, 2007). Timely information is necessary to monitor partners’ behavior, but existing studies indicate that information collection and processing is difficult and expensive in unstable environments, such as emerging markets (Luo, 2007). Consequently, it is important for firms to determine the conditions under which entering alliances and sharing resources, costs and risks is beneficial.

This study aims to compare the benefits and costs of sharing resources, costs and risks between partners in the technology industries of emerging economies and examine how the benefits and costs of sharing change with the dynamism of micro and macro environments. We use technology industries and emerging economies as the research settings because firms in these environments experience frequent market jolts and consequently high transaction costs associated with environmental dynamism. Contradicting the traditional belief, this study proposes that sharing resources, costs and risks between partners depends, to a great extent, on the level of environmental dynamism. Because environmental dynamism is not a constant, sharing resources, costs and risks between partners may decrease or increase with dynamism.

Environmental dynamism is manifested in the rate and unpredictability of changes in government policies, technologies, competition structure and customers’ needs (Boyd and Dess, 1993; Dess and Beard, 1984). It consists of volatility at both industry and market levels (Luo, 2007). Its dimensions include the changeability, unpredictability, unverifiability or variability of a group of segments that comprise both micro (industrial) and macro (national) business environments. Existing studies suggest that technology industries and emerging markets experience more dramatic jolts compared to firms in other contexts (e.g. Meyer et al., 2009; Sampson, 2007). In emerging markets, the economy grows rapidly along with structurally changing industries, promising but volatile markets, weak legal protection systems and regulatory frameworks that undergo drastic transformations (Charii and David, 2012; Luo, 2007). Technology industries, however, experience short product life cycles, frequent product obsolescence or replacements, rapid changes in market demands and high competition intensity (Qian and Li, 2003; Zahra et al., 1997). More importantly, the dynamism at the industry and market levels is related. Existing studies have confirmed that an industry’s structural instability is a major force exacerbating environmental volatility in emerging economies (Luo, 2007). The characteristics of technology industries and emerging economies, when combined, often make information inaccurate, unavailable or obsolete. This results in high uncertainties, leading to high transaction costs (Goerzen, 2007). Given such high uncertainties and transaction costs, utilizing strategic alliances to share resources, costs and risks may not produce possible gains or even safeguard vital interests (Baum et al., 2000).

We believe that resource/cost/risk sharing between partners should decrease when environmental dynamism increases substantially. However, if environmental dynamism increases moderately, resource/cost/risk sharing between partners may increase as well because the benefits of such sharing exceed the transaction costs associated with the increased uncertainties.

Our hypotheses are tested with data collected among sample firms from technology-based joint ventures in China. China is selected as the research setting because it has been the largest emerging economy in the world and, in recent years, it has shown substantial variations in both micro and macro environments (Luo, 2007). Technology industries were selected because they have been regarded as highly volatile in the existing literature (e.g. Baum et al., 2000). Such a unique dynamic context enables us to examine high levels of environmental dynamism.

Overall, this study makes three important contributions to the existing literature. First, it challenges the traditional belief that strategic alliances are mainly used to share resources, costs and risks. The evidence collected demonstrates that sharing resources/costs/risks between partners is not a constant. It increases or decreases with changes in the environmental dynamism. Second, this study separates industrial dynamism from national dynamism and investigates how these micro- and macro-level environmental factors integrate to influence transaction costs. The influence of macro-level environmental factors on transaction costs remains relatively unexplored in the existing literature (Meyer et al., 2009). Third, this study uses different analytical tools (i.e., regression analysis, ANOVA tests and correspondence analysis) in combination to enhance the validity of our data analysis. Few studies have been reported to use such a methodology to improve the validity of data analysis.

Strategic Alliances in Highly Dynamic Environments

Recent research on strategic alliances has stressed the value of inter-organizational relationships for creating competitive advantages through the access of resources and capabilities (Baum et al., 2000). These inter-organizational relationships result from the independence between firms regarding external resources/capabilities, with the firms embedded in such independence (Goerzen, 2007). Prior research has distinguished among alliances as a spectrum in terms of control and coordination features (e.g. Gulati, 1998). At one end are the joint ventures that most closely replicate the hierarchical control features of firms. Existing studies indicate that firms which create joint ventures enjoy various important benefits, including transaction costs resulting from small numbers bargaining, strategic behavior that leads to higher market power and knowledge sharing between partners (Kogut, 1988). The foundation of these motivations is accessing resources that a firm needs, but does not possess (Kumar, 2011). Knowledge is an intangible resource (Lumpkin and Lichtenstein, 2005). Small numbers bargaining and increased market power both are based on the pooling of different but complementary resources/capabilities across firms (Lin et al., 2009). Moreover, in equity joint ventures, equity ‘hostage’ creates a risk-sharing structure that allows investing parties to reduce their commitments to a joint venture without losing all of the venture’s investments (Luo, 2007). At the other end are alliances that have few hierarchical controls built into them, such as R&D alliances or commercial ties. Firms enter these alliances to gain access to complementary capabilities, reap economies of scale in R&D or distribution, shorten development time and spread the risks and costs (Sampson, 2007). Regardless of what form an alliance take, the need for external resources/capabilities and the necessity of spreading costs and risks make firms independent, and this independence drives firms to enter partnerships (Dyer and Singh, 1998; Harrison et al., 2001). In other words, strategic alliances are blocks formed by firms to share dissimilar but complementary resources or capabilities and spread costs and risk. However, establishing such blocks incur transaction costs that typically arise from concerns over the opportunistic behavior of partners, including the costs of negotiating and writing contingent contracts, enforcing contractual promises, monitoring performance and addressing contractual breaches (Goerzen, 2007). Environmental dynamism is positively associated with these costs (Williamson, 1985). Environmental dynamism makes it difficult to specify each party's responsibilities in the contingent contracts. With high environmental dynamism, firms rarely write a complete contract for a long-term cooperative relationship because boundedly rational parties cannot recognize all contingencies or realize the need to specify all dimensions of contractual performance (Luo, 2007). An incomplete contract creates leeway for opportunism and generates moral hazards for cooperative relationships. Transaction costs are principally associated with guarding against opportunism, which is a function of uncertainty (Williamson, 1985), and existing studies find that uncertainty is at least partly a function of environmental volatility (e.g. Meyer et al., 2009). Opportunism is endogenous, not pre-fixed, and its strength is largely determined by a partner's anticipation of its risk-adjusted net returns, which are often discounted by market uncertainty (Luo, 2007). Environmental dynamism also increases the information asymmetry among partners because timely and accurate information is time- and location-specific in a dynamic context (Sampson, 2007). Such information asymmetry encourages opportunism. unpredictability in the environment also increases the difficulty of realizing the potential of combining complementary resources. Existing studies find that resource complementarity between partners generates more benefits for firms in stable environments than it does for those in dynamic environments (e.g. Lin et al., 2009). Firms need predictable organizational routines, stable information flow and smooth collaboration in alliances to develop and exploit the synergy of complementary resources and spread their costs and risks (Harrison et al., 2001).

Hypothesis Development

Low and moderate environmental dynamism

When the level of environmental dynamism is low, sharing resources, costs and risks among partners is both feasible and desirable. Technology industries may experience low dynamism between the development of revolutionary innovations. Emerging economies may have relatively stable stages before governments change their policies and new industrial structures emerge. In emerging economies, governments' industrial policies tend to be opaque and not verifiable (Charii & David, 2012). However, existing studies find that there can be stages during which opacity-related uncertainty is low when government regulations or policies are either absent or reasonably developed (Luo, 2007).

In such a relatively stable context, firms can easily judge whether the resources shared with partners are complementary and determine the degree to which they must share resources. Consequently, firms will take responsibility seriously for whatever they have promised to undertake. At the same time, they can decide and predict each other's cost structures relatively accurately. It would be easy for them, for example, to compute the actual costs involved in a particular joint project and control their overall costs in a predictable way. Firms can also confidently estimate the likelihood of success and failure because the accuracy of their risk and threat calculations is based on ongoing market and industry stability. Research suggests that firms typically use their history and past performance to forecast future contingences when environments remain relatively stable (e.g., Sitkin and Weingart, 1995). Such environmental stability certainly helps firms to avoid or reduce irregular variations in returns and costs so that partners can build up confidence in risk-adjusted returns from their cooperation (Charii & David, 2012).

Such sharing activities are expected to increase when environmental dynamism grows from a low to a moderate level. In technology industries, incremental improvements of technologies and controlled price decreases may, for example, lead to a moderate increase in dynamism. At the market level, small changes in governments' industrial policies, such as value-added tax or financing treatments, may also moderately increase environmental dynamism. Because moderately increased environmental dynamism increases the uncertainties in both task and institutional environments, firms may not have sufficient resources/capabilities to manage such uncertainties, and may not want to significantly commit their directly controlled resources to cover the increasing risks and costs associated with the upsurge of uncertainties. In other words, firms have greater incentives to share resources, costs and risks with partners.

Even though the increased uncertainties exaggerate costs and risks, moderate levels of environmental dynamism may not induce substantial variances in partners' strategic objectives, competition strategies and competences because the governance of contracting relations remains well defined and basically unchallenged (Das and Teng, 2002; Sirmon et al., 2007). Such moderate increases in uncertainty do not limit firms' desire to keep their collaborative incentives, strengthen their mutual confidence and trust and develop their forbearance and reciprocity (Das and Teng, 2002; Kumar, 2011). They do not constrain partners' ability to specify contract contingencies, clarify mutual responsibilities, control the implementation of alliance agreements or evaluate the outcomes of the agreements (Agarwal et al., 2010). Moreover, both cost structure and cost estimates will not be affected dramatically as the estimates can still remain basically accurate. Strategic alliances also provide partners with an advantage in exploring and exploiting opportunities in an uncertain context as the result of risk-sharing and resource-sharing effects. For example, in the case of equity joint ventures, under uncertainty, equity 'hostage' creates a risk-sharing structure that allows investing parties to reduce their commitments to a joint venture and spread the risks of investment loss (Luo, 2007). Complementary resources pooled from partners solidify partners' innovativeness because integrating different resources speeds up the innovations that are the key to success in dynamic environments (Barney, 1986, 1991; Stuart, 2000). Existing studies find that alliances are particularly useful when confronted by technological uncertainties because they provide the option to deter the internal development or acquisition of a target firm, in addition to a mechanism for capitalizing on growth opportunities (Luo, 2007). Therefore,

Hypothesis 1: In emerging economies, resource/cost/risk sharing between technology-based partners is positively correlated with strategic alliances at low and moderate levels of environmental dynamism.

High environmental dynamism

When environmental dynamism grows from a moderate to a high level, the propensity for partners to share resources, costs and risks diminishes. In technology industries, when a radical innovation emerges and replaces existing products, major structural attributes such as sales growth, profit growth and output growth may fluctuate sharply. Radical innovations are based on a different set of scientific or engineering principles from those of existing products, and they involve new components in a new architecture (Carayannopoulos, 2009). Radical innovations may ruin the existing resource complementarity between partners. In emerging economies, radical changes in government policies or competition structure may change the "rules of games", reshaping the interdependence between firms (Meyer et al., 2009). When governments change their decentralization and privatization policies, for example, the competition pattern can undergo strikingly dramatic changes (Luo, 2007). If such dramatic changes occur simultaneously at both industry and market levels, partners face high environmental dynamism.

Because high levels of environmental dynamism reshape the interdependence between firms, the dynamism can easily ruin the value of partners' existing resources or make partners' contributions to existing alliances replaceable (Goerzen, 2007). Technological resources may, for example, not be complementary once a partner's technology is replaced by that of its competitors, or when a competitor's new technology emerges. Such environments may also alter task requirements, rendering partners' existing operating systems and processes incompatible (Santoro and McGill, 2005). Each partner must frequently adapt its operating systems and processes to fit rapidly changing environments, and this adaption diverts a firm away from its existing routines, cultures and norms (Cui et al., 2011).

Opportunism, which is a function of a transaction's uncertainty, may grow along with market dynamism. High uncertainties enable opportunistic partners to seek their own unilateral gains at the expense of others by breaching contracts or agreements, exercising private control, withholding or distorting information, withdrawing commitment, shirking obligation or grafting joint earnings (Cui et al., 2011; Luo, 2007). Transaction costs increase as firms find that they must employ a variety of control mechanisms to protect against partners' opportunism, such as choosing the right partners or signing legal contracts that specify the obligations of each party (Williamson, 1985). Existing studies have found that a partner's opportunism is positively correlated with environmental dynamism in emerging markets (e.g. Luo, 2007).

High levels of environmental dynamism may make cost forecasting inaccurate because they create causal ambiguity that blurs the links between cost responsibility and anticipated benefits, and many contingencies will distort cost structure and adversely affect performance (Sirmon et al., 2007). Consequently, it is difficult for a firm to foretell the cause-and-effect relationship between returns and costs or plan for the future through effective capital and cost control. Because accurate cost forecasting is difficult to achieve, partners have to identify and correct their forecasting problems by frequently re-estimating and re-allocating costs between them. Such frequent re-estimation and re-allocation not only make existing cost-sharing agreements non-binding, but also create enormous uncertainties for the future of ongoing cost-sharing programs.

Partners are exposed to higher risks when their performance substantially varies along with environmental dynamism (Das and Teng, 2001). Generally, they share risks only when they are confident that the risk-adjusted returns of a joint project will be positive. High levels of environmental dynamism may reduce or even damage confidence because risk forecasting and measurements become inaccurate in such environments. For example, managers are not able to determine the discount rate required to compute the present value of each period's net cash flow for a joint project because the discount rate should reflect the firm's cost of capital with an adjustment for the project's risk. The performance history of individual firms and industries can hardly be used to predict market and industry changes, and partners are unable to determine how vulnerable they are to the risks they share. Therefore,

> Hypothesis 2: In emerging markets, resource/cost/risk sharing between technology-based partners is negatively correlated with strategic alliances at high levels of environmental dynamism.

Method

Setting, sample, and data

This study uses international joint ventures (JVs) in China's technology industries as its research setting. This setting was chosen because many strategic alliances take the form of JVs and China has been the largest emerging economy in the world (Luo, 2007). Seven technology industries were selected based on three-digit SIC codes. They are: chemical & chemical products, electrical machinery & apparatus, electronics, office equipment, pharmaceuticals, semiconductors and transport equipment. These industries were selected not only because they are major technology industries that account for the majority of JVs in China, but also because they were likely to experience substantial environmental changes.

The initial conceptual framework was based on field studies that were carried out in two locations: Jiangsu and Shanghai. Two JVs in each location were selected as pilot case studies. An entry interview, using a semi-structured format, was conducted with the CEO regarding the firm's history, major changes in environments, rationales to form a JV, and contents of resource, cost and risk sharing. Variables were derived based on the JV rationales, sharing contents and environmental challenges that surfaced in the interviews. We erred on the side of being inclusive. If a factor was mentioned more than once, it was reflected in our variables. The measurements used for the main variables are also a result of the qualitative data collected in the interviews. Further refinements of the scales were conducted after the interviews through consultation with academic experts and consultants. Because the majority of Sino-foreign JVs in technology industries are concentrated in the large cities along the eastern coast, we targeted JVs located in four provinces (Guangdong, Jiangsu, Shangdong and Zhejiang) and two municipalities (Beijing and Shanghai) on the eastern seaboard. The names of the JVs were obtained from municipal economic and trade councils or departments. To be included in the sample, a firm had to employ at least ten people to differentiate it from "mom-and-pop" enterprises. Nine hundred and twenty JVs were selected and two waves of questionnaires were mailed to the chief executive officers (CEOs) or highest-ranking officers. The answers to all of the survey questions were rated on a seven-point Likert-type scale (ranging from 1 = strongly disagree to 7 = strongly agree). To provide a (more) detailed and accurate description of the major variables, we requested that the firm to give ratings to the first decimal place. Completed responses were received from 285 firms, yielding a response rate of 31%.

To assess non-response bias in the survey, early respondents are compared to late respondents, with the latter assumed to be similar to non-respondents (Armstrong & Overton, 1977). The sample is split into two categories on the basis of the survey return dates, with the first 65% classified as early respondents and the last 35% as late respondents, who were viewed as representative of the actual non-respondents. *T*-tests are used to compare the two groups on the two known attributes: age ($t = 1.12$, $p < 0.24$) and number of employees ($t = 0.97$, $p = 0.38$). The chi-square test is used to compare the two groups by location ($\chi^2 = 5.28$, df = 5). It was thus concluded that the sample represents the target population.

Measurement

In line with the qualitative data and previous studies (e.g., Goerzen, 2007; Lampel and Shamsie, 2000), we measure strategic alliances in terms of their number, turnover, duration, and importance relative to the industry average. That gives us a composite index of four items: more alliance agreements than major competitors in the industry, higher turnover of alliance agreements than major competitors in the industry, longer lifespan of alliance agreements than major competitors in the industry, and greater (perceived) effects of alliance agreements on a firm's operations than major competitors in the industry.

Two steps are taken to measure the sharing of resources, costs and risks. First, resources, costs and risks are defined as in previous studies (e.g., Borch et al., 1999; Gulati and Singh, 1998),[1] and each type of sharing is measured with a composite of index of three

[1] Resources include financial, technological, organizational and human (knowledge) resources. Costs included operation costs, information collection/processing costs and coordination costs. Risks included political and economic risks, operation risks and legal risks.

items: desire to share, volume shared and variety shared. Second, we calculate these types of sharing as the arithmetic average to obtain a single score and name it 'total' sharing.

The environmental dynamism measures developed and validated by Boyd and associates (1993) and Zahra and associates (1997) are combined and employed in this study. The participating executives were asked to evaluate the product obsolescence rate in the industry, the technology duplication/replacement rate in the industry, competitors' response rates in the industry, the entry and exit rate of competitors in the industry, the bankruptcy rate among firms in the industry, the rate of changes in consumer preferences in the industry and the uncertainty rate of industry growth.

Control variables

Following previous studies (e.g., Qian and Li, 2003; Zahra et al., 1997), we control for various firm- and industry-specific variables. (1) Firm size is measured by the log of a firm's total number of employees. (2) Firm age is measured by the number of years a firm has been operating. (3) Firm leverage is calculated as long-term debt divided by total capital. (4) R&D intensity is measured using annual R&D expenditure divided by total sales. (5) We compute the firm's average annual expenditure on advertising and divide it by average sales revenue to derive advertising intensity. Finally, dummy variables are used to represent the influence of the main operating industry. For econometric reasons, we omit one industry (transport equipment) so that the estimated coefficients should be interpreted as the difference in the dependent variable by the industry in question from the omitted group.

Measurement model assessment

Measurement model. The goodness-of-fit statistics, including the chi-square statistic, absolute fit indices, and incremental fit indices, all indicate that our measurement model fits the observed data well (see Table 1). In other words, the parameter estimation is robust and there is a low interpretational founding rate.

Construct reliability. Cronbach's alpha provides a reasonable estimate of internal consistency. Its values range from 0.74 to 0.81, with all values surpassing the recommended value of 0.70, indicating that the scale items measuring a construct are reliable.

Construct validity. All individual items load strongly (i.e., well above the recommended 0.50 limit) and significantly (t-value > 2.0) on their hypothesized constructs. In addition, the values of the average variance extracted (AVE) all meet or exceed the 0.50 threshold, suggesting that the amount of variance explained by the constructs is larger than the variance explained by measurement error. These statistics provide evidence of the adequate convergent validity of the constructs.

Discriminant validity. All three square roots of the AVE (see Table 1) are larger than the interconstruct correlations (off diagonals), indicating that each construct differs sufficiently from the other constructs. Modification index (MI) is also utilized to examine the robustness of the parameter estimates to small changes in the model. The largest MI of 0.93 is much smaller than the required level (at the 0.05 level). Hence, all of the constructs demonstrate adequate discriminant validity.

Analysis

This study takes both an 'overall' and an 'individual' approach to examining how partners' sharing of resources, costs and risks varies with different levels of environmental dynamism. In the former approach, environmental dynamism is treated as a continuous variable and regression analyses are performed using both of its linear and quadratic terms.[2] In the latter approach, environmental dynamism is treated as a discontinuous (or categorical) variable in which there are two different (firm) classification methods. One is to perform a mean split of environmental dynamism into two categories: low and high dynamic environments. The other is to group environmental dynamism into one of six categories, with each category representing an interval of 0.5 points along a scale of ‘below 4.5’ to ‘above 6.5’ answered by the firms in our questionnaires. ANOVA test and correspondence analysis (CA) are performed. In particular, CA determines which categorical variables are associated with one another through two dual displays of row and column points in biplot.[3] The categories (row and column points) located in the same area have more significant (or systematic) corresponding relations.

Table 1. Constructs and indicators

Variable name and items	Factor loading	*t*-value
Strategic alliances [α = 0.77]		
My firm has more alliances than major competitors in the industry	0.756	4.43
My firm’s strategic alliances have greater turnover than those of major competitors in the industry	0.681	3.97
The average duration of my firm’s alliances is longer than that of major competitors in the industry	0.654	3.75
My firms’ alliances have more significant impacts in comparison with those of major competitors	0.717	4.12
“Total” sharing [α = 0.74]		
My firm has a strong desire to share resources, costs and risks	0.772	4.58
My firm has a large volume of resource, cost and risk sharing	0.735	4.39
My firm a great variety of resource, cost and risk sharing	0.728	4.27
Environmental dynamism [α = 0.81]		
Product obsolescence rate in the industry is high	0.784	4.19
Technology duplication/replacement rate in the industry is high	0.801	4.31
Rate of responses between competitors in the industry is high	0.835	4.52
Entry and exit rate in the industry is high	0.873	4.91
Bankruptcy rate in the industry is high	0.844	4.73
Rate of changes in consumer preference in the industry is high	0.707	3.65
The uncertainty rate of industry growth is high	0.679	3.41
The goodness of fit measures		
χ^2 = 139.61, df = 77, GFI = 0.932, AGFI = 0.903, RMR = 0.023, RMSEA = 0.000, CFI = 0.937, NFI = 0.914, NNFI = 0.926, DELTA2 = 0.909		

[2] The terms represent the variable’s low/moderate and high levels, respectively.

[3] There is one display for the row data and one display for the column data. Both row and column, with comparable patterns of counts, will have points that are close together on the biplot, respectively.

Results

Descriptive statistics and intercorrelations of the quantitative variables were examined. The correlation coefficients among the variables are generally low. The highest variance-inflating factor VIF is 1.16 provide indicating that there is no significant multicollinearity problem.

Table 2 presents four models to test the hypotheses. Model 1 is the base model that includes the effects of all of the control variables. Models 2 and 3 test the two hypotheses (H1 and H2) using the two joint variables (i.e., strategic alliances and environmental dynamism), in which environmental dynamism takes both linear and quadratic terms, respectively. Interaction effects are also assessed. Finally, Model 4 is the full model that comprises all of the model variables.

Model 3 shows that the quadratic term of environmental dynamism is positive and significant
(β = 0.0801, p < .10). Thus, both H1 and H2 are supported partially. Meanwhile, it is important to note that the individual effect of strategic alliances is more highly significant (β = 0.1126, p < .01), while that of environmental dynamism is non-significant, although negative in sign. We ascertain from the above (individual and interaction) effects that environmental dynamism is the moderator (variable) because it reduces the direction of the relationship between them.[4]

Model 4 incorporates all variables. We find the signs and significance levels of our key variables to be consistent with those found in other models. The adjusted R^2 values for the models range from 0.100 (F = 3.774) to 0.134 (F = 3.677). The addition of the interaction terms into the base models increases the explanatory power of the model as shown in F change (ΔF) being significant at the 0.05, 0.001, and 0.001 levels, respectively.

In the next step, the relationship is further examined by directly observing the differences in 'total' sharing under different levels of environmental dynamism. As Part A of Table 3 shows, there is evidence of a difference between the mean 'total' sharing ratings of firms in low and high dynamic environments (F = 7.52, p < 0.01). Table 3, Part B presents the summary data from these classification efforts. Using ANOVA techniques, we find that the true mean 'total' sharing differs for at least two of the six categories of environmental dynamism (F = 4.27, p < 0.01). More specifically, the middle two categories (5.0-5.4 and 5.5-5.9) have, on average, higher means of 'total' sharing than the remaining four categories. The hypothesized direction of 'total' sharing between categories is thus confirmed: that is, the sharing of resources, costs and risks first increases from a low to a moderate level and then decreases from a moderate to a high level. In particular, sharing is the lowest when the level of environmental dynamism reaches the last interval.

Finally, based on the above categorical data (Table 3, Part B), a correspondence analysis is conducted to examine which categories of environmental dynamism (ED) and 'total' sharing (TS) are associated close together. Because the first two dimensions (or the first two characteristic roots of the covariance matrix) together explain 93% of the total inertia, a two dimensional solution appears satisfactory ED3 (the profile of the third ED scale) contributes substantially to the first dimension (0.393) and TS4 (the profile of the fourth TS scale) to the second dimension (0.439).

[4] We also checked whether environmental conditions have a mediating effect, but failed to find anything conclusive because the precondition did not exist: i.e., sharing had no bearing on environmental dynamism.

Table 2. Regression of sharing on strategic alliances under different environmental conditions[a]

Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Chemical & Chemical products	0.0465 (0.0323)	0.0441 (0.0312)	0.0454 (0.0318)	0.0428 (0.0305)
Electronics	0.0426 (0.0303)	0.0404 (0.0294)	0.0416 (0.0299)	0.0391 (0.0288)
Electrical machinery & apparatus	0.0509 (0.0339)	0.0487 (0.0331)	0.0499 (0.0336)	0.0476 (0.0326)
Office equipment	0.0983* (0.0417)	0.0958* (0.0412)	0.0969* (0.0414)	0.0948* (0.0409)
Pharmaceuticals	0.1013* (0.0424)	0.0992* (0.0419)	0.1003* (0.0422)	0.0980* (0.0416)
Semiconductors	0.1038* (0.0431)	0.1016* (0.0425)	0.1027* (0.0428)	0.1005* (0.0422)
Firm age	0.0537 (0.0355)	0.0514 (0.0345)	0.0526 (0.0350)	0.0504 (0.0341)
Firm size	-0.0746† (0.0433)	-0.0721† (0.0425)	-0.0733† (0.0428)	-0.0707† (0.0419)
Firm leverage	0.0329 (0.0254)	0.0307 (0.0241)	0.0319 (0.0248)	0.0296 (0.0236)
R&D intensity	0.0818† (0.0453)	0.0795† (0.0446)	0.0806† (0.0449)	0.0783† (0.0443)
Advertising intensity	-0.0285 (0.0229)	-0.0260 (0.0215)	-0.0272 (0.0221)	-0.0249 (0.0209)
Strategic alliances		0.1126** (0.0372)	0.0929* (0.0413)	0.1019* (0.0424)
Environmental dynamism		-0.0516 (0.0344)		-0.0502 (0.0340)
Environmental dynamism squared			-0.1116** (0.0376)	-0.1102** (0.0373)
Strategic alliances × Environmental dynamism		0.0801† (0.0450)		0.0788† (0.0446)
Strategic alliances × Environmental dynamism Squared			-0.0973* (0.0416)	-0.0958* (0.0413)
R^2	0.132	0.151	0.169	0.180
Adjusted R	0.100	0.110	0.129	0.134
F statistic	3.774***	3.430***	3.922***	3.677***
ΔF		2.014*	4.007***	3.138***
N	285	285	285	285

[a] The industry effects show those industries which were significantly different from that of the base industry (transport equipment).
Standard errors are in parentheses.
† *p* < .10; * *p* < .05; ** *p* < .01; *** *p* < .001

Table 3. The relationship between environmental dynamism and "total" sharing

A 'Total' sharing in high and low dynamic environments

Dependent Variable	Environmental dynamism: Low dynamic environment	Environmental dynamism: High dynamic environment
'Total' sharing	$\bar{x}$ = 5.59 n = 161	$\bar{x}$ = 4.72 n = 124

F = 7.52 (p < 0.01)

B. 'Total' sharing by level of environmental dynamism

Dependent Variable	Level of environmental dynamism (ED)					
	1 Below 4.5 (ED1)	2 4.5 - 4.9 (ED2)	3 5.0 - 5.4 (ED3)	4 5.5 - 5.9 (ED4)	5 6.0 - 6.4 (ED5)	6 above 6.5 (ED6)
'Total' sharing	$\bar{x}$ = 4.83 n = 34	$\bar{x}$ = 5.24 n = 48	$\bar{x}$ = 6.04 n = 57	$\bar{x}$ = 5.75 n = 75	$\bar{x}$ = 4.67 n = 40	$\bar{x}$ = 4.36 n = 31

F = 4.27 (p < 0.01)

$\bar{x}$ = Mean

The correspondence map is shown in Figure 1. There are four clusters of categories where row and column points are associated: ED1 and TS1 are located in Area 1; ED3, ED4, TS3 and TS4 in Area 2; ED2, ED5, TS2 and TS5 in Area 3 and ED6 and TS6 in Area 4. The structural relationships that are detected among the variable categories are consistent with what we found in Part B of Table 3.

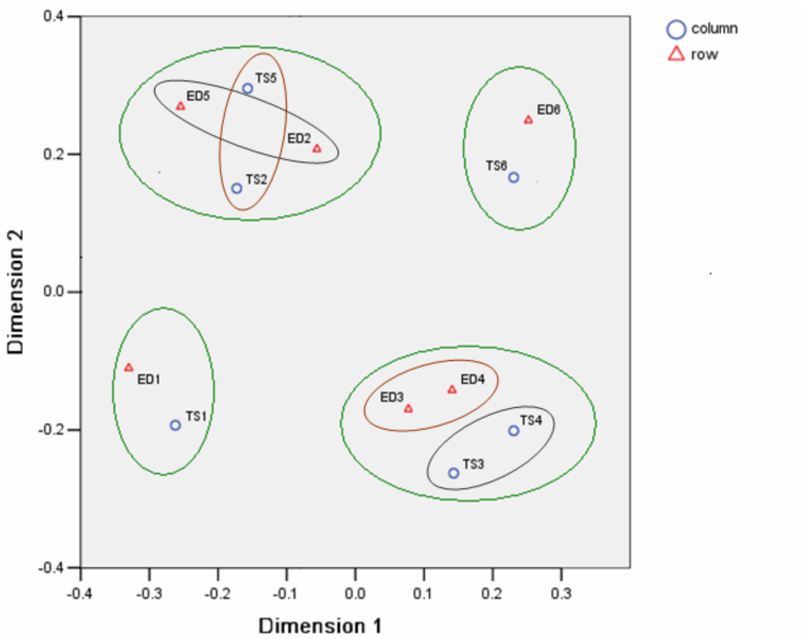

Figure 1. A correspondence map of environmental dynamism and total sharing

Discussion

This study explores how and to what degree environmental dynamism affects the sharing of resources/costs/risks between technology-based partners in emerging economies. Evidence collected from regression analyses indicates that the relationship between sharing and alliances is positive when the term of environmental dynamism is linear, but negative when it is quadratic. As such, environmental dynamism is a moderator that turns the relationship from positive to negative when it reaches a high level. Evidence collected from ANOVA tests shows that highly dynamic environments involve less sharing than low dynamic environments. It also shows that sharing increases as environmental dynamism grows from a low to a moderate level, but decreases as environmental dynamism increases further to its high level. Evidence collected from the correspondence analysis further supports the previous results because the four areas are located far from one another. Taken together, we conclude that in emerging markets, the effect of environmental dynamism on resource/cost/risk sharing between technology-based partners is inverted 'U' shaped; that is, sharing increases when environmental dynamism grows from a low to a moderate level and then diminishes if environmental dynamism continues to accrue. Figure 2 shows the changes in the relationships.

This inverted 'U' shaped relationship results from changes in benefits and costs provided by sharing when environmental dynamism fluctuates. Sharing resources/costs/risks between partners provides benefits and incurs costs. These benefits and costs are not constant, but rather vary along with environmental dynamism. When environmental dynamism is low, the costs of sharing are minimal and the benefits of sharing surpass the costs. When environmental dynamism increases from a low to a moderate level, the benefits decrease and the costs increase. Nevertheless, the benefits of sharing still outweigh the costs. When environmental dynamism grows further, from a medium to a high level, the benefits of sharing reduce additionally while the costs exaggerate substantially. The costs outpace the benefits of sharing, and sharing has negative impacts on firm performance. In emerging markets, technology-based partners adjust the capacity for sharing between them based on the changes of the benefits and costs.

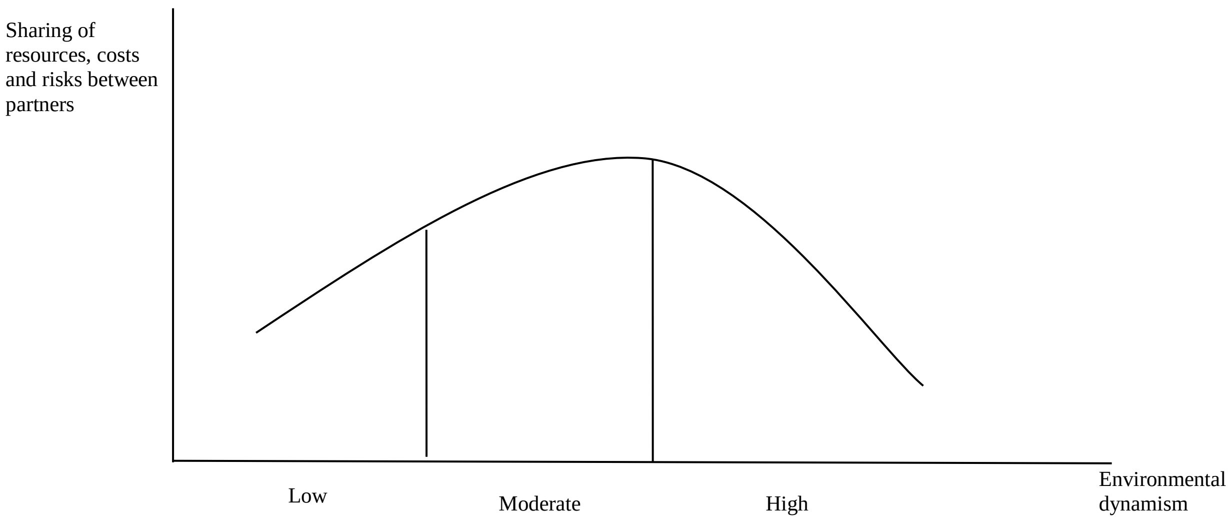

Figure 2. Relationship between sharing and environmental dynamism

The findings of this study make significant contributions to the existing strategic alliance literature by recognizing that the sharing of resources, costs and risks between partners depends, to a great extent, on environmental dynamism. Low environmental dynamism encourages sharing, and high environmental dynamism discourages sharing. High dynamism may even destroy the conditions for such sharing. This study also has methodological contributions, because it is the first attempt to employ both 'overall' and 'individual' approaches to exploring not only the causality that generally moves from environmental dynamism to partners' sharing, but also the corresponding relationships between different categories of the two variables. This method enables researchers to examine the essence of the variable relationships, enhancing the validity of the findings.

The findings of this study have important managerial implications as well. In technology industries, partners should share resources, costs and risks when they experience low or moderate levels of environmental dynamism. Such sharing improves partners' competitive advantage by offering access to external resources and spreading costs and risks. However, partners should reduce or even terminate such sharing when they observe rapid changes in the markets.

This study suffers a number of limitations that should be addressed in future studies. It explores sharing between technology-based partners in emerging markets – an extremely dynamic context because both the industries and the markets have been regarded in the existing literature as highly dynamic environments. It is not clear whether the findings apply to other industries and mature markets as well. In other industries and mature markets, firms may experience much less environmental dynamism. For example, firms in the Chinese textile industry and American technology-based firms may face much less environmental dynamism than the sample firms in this study. They may or may not go through the inverted 'U' shaped relationship identified in this study. Moreover, it is not clear why firms work as partners in highly dynamic contexts if they do not share resources, costs and risks. We expect that strategic alliances are mainly used to transfer or migrate environmental dynamism to partners in these settings. These issues should be explored in future studies.

Conclusion

This study challenges the mainstream belief in the traditional strategic management literature that the major motive of strategic alliances is to share resources, costs and risks. This study proposes that such sharing is possible in stable environments and may even increase when environmental dynamism increases moderately. However, when environments become highly dynamic, such sharing decreases. In the technology-based industries of emerging markets, environmental dynamism can be highly volatile. Therefore, in such a highly dynamic context, sharing resources/costs/risks between partners can be minimal. Data from 285 Sino-foreign joint ventures in technology industries confirm these hypotheses. Data collected in this study demonstrate that the relationship of sharing resources/costs/risks between technology-based partners is inverted 'U' shaped. Partners share resources, costs and risks at low levels of environmental dynamism, and such sharing increases within the intervals of low to moderate environmental dynamism. However, sharing decreases within the intervals of moderate to high environmental dynamism. As such, managers in stable environments should share more resources, costs and risks, but they should ensure that such sharing is minimal when their environments grow highly dynamic.

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