The moderating role of environmental unpredictability on building network relationships and network performance results

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WIP paper

Introduction

This paper presents a part of a major study which empirically supported a business-to-business relationship building model, which treated information and social exchanges as antecedents, or building blocks of business relationships, on the one hand, and adaptability, adaptation and cooperation, as business network relationships outcomes on the other.
Om the whole, the relationship between information and social exchanges and the network outcomes, in the sense of adaptability, adaptation or cooperation, has been extensively supported in the marketing literature(Williams and Attaway 1996; Jaworski and Kohli 1993; Saxe and Weitz 1982; Moorman and Rust, 1999; Gadde, Huemer and Hakansson 2003; Boyle, Dwyer, Robicheaux and Simpson 1992; Heide and John 1988; Frazier and Antia 1995; Karayanni, 2004). In this study, we specifically discuss the moderating role of the environment upon the aforementioned relationships.
The paper evolves as follows. First, we present the theoretical background and develop the research hypotheses. The next session deals with methodology issues. Finally, we discuss the findings and implications derived from the research results.

Theoretical Background

Environmental Unpredictability

This is defined as "the inability to forecast accurately the volume requirements in a relationship" (Walker and Weber, 1984). The more uncertain the environment is, the more intensive the need for continuous gathering and processing of non-routine and novel information, which is crucial for decision making (Spekman and Stern 1979). Environmental unpredictability encompasses high levels of business risk which is interpreted as great difficulty in making accurate predictions about future supplies, production and sales. The expansion of business relationships to a wide range of alternative market actors (suppliers, customers or partners) is a way of spanning such risk, thus minimizing the negative consequences of a possible pessimistic market scenario (Heide 1994; Varadarajan and Cunningham 1995; Arndt 1979; Pheffer and Salancik 1978).As a matter of course, unpredictability may be an influencing environmental factor on business relationshipsbuilding, as discussed along the hypotheses session.

Inter and Intra-organizational Information Exchanges

We build upon network theory which considers product, finance, information and social exchanges as the building blocks of business relationships (Hakansson, 1992). Whilst product and financial exchanges should be normally contingent upon specific factors, such as the type

of industry and nature of the product, information and social exchanges constitute the core of business relationships, regardless of the product nuances, the nature of transaction (straight rebuy, modified rebuy, new task), and the type or sector of industry (services or goods companies). Along similar lines, Benson (1975) postulates that in order to understand the configuration of any particular network, the flows of power (i.e., the social exchanges) and information are more important than those of money and utilities (i.e., financial and product exchanges). In this spirit, we selected these two types of exchanges as antecedent variables of business relationships.

As far as the information exchanges are concerned, these, together with the extent of operational linkages, may discriminate between closer and more distant types of relationships and determine the intensity of ties which is built among the partners (Cannon and Perreault 1996, Morris, Bruynee and Page 1998). Under this perspective, the bilateral information activities of acquisition and integration, which were discussed earlier in this chapter, become subsets of network information exchanges.

Specifically, inter-organizational or network information exchanges serve to tie activities together and to transfer knowledge among network actors. Speaking of network information exchanges, the need to define their frame of reference (i.e., operationalization) emerges. Gadde and Hakansson (1993) identify three dimensions in network information exchange, namely, technical, commercial and administrative. Technical, administrative, as well as a large part of commercial information which aim to coordination of operations (e.g., re-orders, inquires, bills of sale, choice of technical characteristics, stock replenishment rate and stock volumes) may be highly codified, thus processed effectively through standardized computer-based communication (i.e., mechanistic information exchanges). Nevertheless, commercial and technical information with more complex content, that is, related to transfer of knowledge and strategy formation (e.g., monitoring trends on supplier markets, initiating and participating in supplier relationships and development of projects) is not susceptible to standardization (i.e., unable to be computerized) and may be processed only through personal and rich communication means (i.e., relational communication strategies). Although that network literature stresses the need for substantial standardization of information exchange that may be codified, for increased coordination and efficiency, interpersonal communication and strategic information exchange is, and is likely to remain, most important in networks (Gadde and Hakansson 1993).

Indeed, many researchers argue that network organizations (relationships) are primarily strategic relationships (Arndt 1979; Walker 1997; Achrol 1997; Morris, Bruynee and Page. 1998; Jarillo 1988). Drawing on the pertinent literature, the motives that characterize the strategic intent of relationships are related to: a) promoting present product offerings in present served markets, b) developing new markets for present products, c) developing new products for present served markets, and d) entering new product-market domains that are either related or unrelated to present product-market domain (Ansoff, Varadarajan and Rajaratnam 1987).

Similarly, other researchers support that the primary purpose of strategic relationships is to obtain strategic advantage through differentiation or cost leadership and propose such motives as access to new markets and / or technical information, enhanced product value, acquiring of superior skills or superior resources (Spekman and Sawhney 1990; Day and Wensley 1988; Porter 1980, 1985). Indeed, as firms move towards more relational structures, information which is communicated among the parties is concerned with issues of long-term forecasting, proprietary and structural planning information, including future product design information, production planning schedules, tool development and product design, value analysis and cost targeting, design of quality control and delivery systems and so on (Noordewier John and Nevin 1990; Heide and John 1990; Palay 1984; Drozdowski 1986; Dowst 1988;

Treleven1987; Spekman 1988). Thus, the above motives define the frame of reference of network information exchanges.
Consequently, the organizations which develop network relationships should exchange information with a context related to the aforementioned motives. This kind of information may only be exchanged through relational communication strategies, thus implying the need for appropriate organizational forms that are compatible to relational communication strategies.

Network Social Exchanges

As it has already been discussed earlier in this dissertation, social exchanges refer to the interpersonal relationships which are established and evolve among interacting members of a network. They are considered to be critical in the establishment of close, long-term relationships between the buyers and the sellers (Metcalf, Frear and Krishman 1996). Additionally, they facilitate problem solving, and they are particularly important in overcoming barriers to communication. Furthermore they have the potential to lead to higher levels of commitment to relationships (Wilson and Jantrania 1993). Thus, as Cunningham and Tynan (1993) sustain, the importance of social exchanges is at least as important as the technical, product, and financial exchanges.

Network Relationships Outcomes

Drawing on relationship marketing and network theory literatures, we select three variables to operationalize network relationship outcomes, namely, adaptability, adaptation and cooperation. In the following, we briefly discuss each one of them.

Adaptability

It is the ability to respond to market change by either expanding niches or finding new niches (Boulding 1978; Huber 1984). It is necessary for the survival in the long-run (McKee, Varadarajan and Pride 1989; Weick 1979). This element of business relationships is clearly rooted to the responsiveness element of the intrusiveness concept (Narasimham 1997) and to the response element of the marketing concept (Kohli and Jaworski 1990). The role of the information networking capability "implies the instantaneous sharing of information between organizations with shared interests, thus increasing the speed and economy of coordinated response to market changes" (Johnston and Lawrence 1988). Indeed, adaptability (i.e., ability to respond to market niches by either expanding niches or finding new niches) is one motive and advantage of network relationships (Varadarajan and Cunningham 1995; Daft 1994; Tully 1993). Indeed, strategic networks proactively seek to change conditions through strategic thrusts, allowing the development of distinctive competencies, i.e., flexibility and adaptability (Jarillo 1988). Thus, we anticipate that the variable under discussion should be affected by the information and social exchanges examined in this study.

Adaptation

Adaptation refers to smooth alterations in practices, policies, roles and functions by trading partners in light of unforeseen or changing conditions (Boyle, Dwyer, Robicheaux and Simpson 1992; Macneil 1980). Adaptations tend to bond the buyer and the seller in a tighter relationship and create barriers to entry to competing suppliers, thus reflecting closer network relationships (Hallen, Seyed-Mohamed and Johanson 1988; Wilson 1995). Network information exchanges should be positively related to adaptation. This is because marketing orientation (i.e., the intraorganizational information exchanges examined in this study) reflects

an organizational culture which fosters information sharing, needs discovery and cooperation, in order to adapt to customer specific needs and wands. In this sense, it reflects the organization's adaptation, i.e., willingness to accommodate specific customer requirements. As a matter of fact, the ability of the Internet Communication Strategies to predict this variable should be examined within this conceptual framework.

Cooperation

Cooperation has been defined as "similar or complementary coordinated actions taken by firms in interdependent relationships to achieve mutual outcomes or singular outcomes with expected reciprocation over time" (Anderson and Narus, 1990). As the extent and scope of joint activities' increase, interacting firms effectively become partners in an alliance (Heide and John 1990). In this sense, cooperation defines the level of integration among network members (Robicheaux and Coleman 1994). Cooperation is closely linked to information sharing among network members. Continuous exchange episodes (i.e., information and social exchanges) nurture co-operative behavior between the buyer and the seller (Anderson, Hakansson and Johnansson 1994). In a sense, information sharing on strategic network issues (i.e., the network information exchanges examined here), pre-supposes mutual willingness for cooperation. More specifically, in the initial stages of the relationship development, information exchange among network members should target to acquaintance, creation of a positive atmosphere and uncovering opportunities of mutual interest for cooperation. Information exchanges on more critical and strategic issues reflecting cooperation, either in market or in product development field (i.e., the information exchanges examined here), would develop in later stages of the relationship (Dwyer, Shurr and Oh 1990; Wilson 1995; Anderson 1995).

Hypotheses

High volume unpredictability (i.e., environmental unpredictability) requires the development of mechanisms of adaptation to change, which is more readily carried out when there are strong expectations of relationship continuity, which are the result of network long-term relationships (i.e., the key variables of the study) (Williamson 1985; Heide and John 1990). This is because enlarging the shadow of the future makes it easier for parties to cooperate and to cope with unanticipated changes (Alexrod 1984). Indeed, Han, Wilson and Dant (1993) found that long term relationships result in price/production stability (i.e., due to reliability of reorder and the resulting improved production schedules) and optimal capacity planning (i.e., due to the ability of accurate forecast variations in demand). Thus, when environmental unpredictability is high, information exchanges among interacting firms, not only on market-related issues, but also on issues related to technical cooperation, long-term joint planning and product development (i.e., the network information exchanges on strategic market and product-related issues that are examined here) would aim to stabilize long term business relationships and, therefore to minimize business risk and fluctuations on business performance (Hide and John 1990; Mohr and Nevin 1990; Boyle, Dwyer, Robicheaux and Simpson 1992; Business Marketing 1986; Han, Wilson and Dant 1993; Palay 1984; Noordewier, John and Nevin 1990). On the contrary, when environmental unpredictability is low, organizations have less to gain by the development of relational communication strategies, since their contribution to minimization of business risk, stemming from demand and supply fluctuations would be less exigent. Indeed, Noordewier, John and Nevin (1990) found that increasing relational governance improves buyer purchasing performance when the level of volume unpredictability is high, whereas it has no effect on lower levels of volume unpredictability.

Similarly, when environmental unpredictability is high, there is greater need for adaptation, i.e., ability of prompt adjustment to unforeseen environmental changes. Because the relational communication exchanges create an atmosphere of flexibility (adaptation), by sharingenvironmental scanning datawith its members and by ensuring that its members are given every opportunity to participate and share in the benefits of changes, or adaptations proposed, these should be more valuable when environmental unpredictability is high rather, than low.

In the same vein, Heide and John (1990) proclaim that unpredictability requires a firm to develop mechanisms for adaptation (thus implying that the impact of the information and social exchanges on adaptation and business performance would be stronger when unpredictability is rather high, than vise-versa). Furthermore, in such environmental conditions there is a greater need for organizations to control their environment. The development of close network relationships with other functionally disaggregated firms in their network of organizations, is the alternative means to hierarchical formation, for gaining such a control over the environment (i.e., when environmental unpredictability prevails) (Jarillo 1988; Williamson 1975; Ouchi 1983).

In corollary, organizations have less to gain by the development of costly and time-consuming relational communication strategies when environmental unpredictability is low, since the perceived business risk (i.e., related to fluctuations in demand or supply) which might destabilize business performance, is, by definition, low, or nonexistent. Thus, there is less need for mutual adaptations, alterations in business practices and cooperation, in order to facilitate productivity and efficiency.

Thus, we hypothesize that:

H1: The greater the environmental unpredictability, the stronger the relationship between, theintra-organizational information exchanges (i.e., information acquisition, bilateral information exchanges with customers and information integration) and the network relationships outcomes (i.e., adaptability, adaptation and cooperation).

H2: The greater the environmental unpredictability, the stronger the relationship between, the inter-organizational (i.e., network) information exchanges (i.e., market-related information exchanges and product-development related information exchanges) and the network relationships outcomes (i.e., adaptability, adaptation and cooperation).

H3: The greater the environmental unpredictability, the stronger the relationship between, theinter-organizational (i.e., network) social exchanges and the network relationships outcomes (i.e., adaptability, adaptation and cooperation).

Methodology

Our research involved primary data selected via e-mail. The quantitative research instrument was based on extensive marketing literature review and was filled in by 150 highly-ranked executives,representing uniquely respective business-to-business organizations, world-wide. As research frame we used the Yahoo industrial supplies Web subdirectory. The produced response rate was24.9%, which was quite acceptable, as it compared favorably with response rates obtained in similar large-scale e-mail surveys from executives and managers (Karayanni, 2004).

Measures[1]

Environmental Unpredictability was measured by a four-item scale, which was developed in order to assess the perceived inability to make forecasts in regard to sales volume demand and

[1]The variable list of items may be kindly provided upon request.

future prices. We used items from Noordewier, John and Nevin's (1990) scale, and Walker and Weber's (1984) scale.

Inter and inter-organizational exchanges. The intra-organizational communication construct was measured using eleven items from the Kohli and Jaworski's (1990) scale, indicating the extent to which the research participants were exchanging information with their customers on current and future customer needs, and disseminating information within their organizational colleagues, regarding customers, competitors and market trends.
The inter-organizational information exchanges scale comprised eleven items that were developed to agree with existing theory on information interactions among network actors. These involve such motives as access to new markets and technical information, enhanced product value and acquiring of superior skills and/or superior resources (Noordewier et al., 1990; Palay 1984).

Social exchanges. These were tapped by four items selected to agree with the description used by Wilson (1995) to identify social bonding.

Adaptability. A five-item scale was developed to tap adaptability, i.e. organizational responsiveness and implementation of plans in response to market information selection (regarding needs and preferences of customers and market trends), as put forward by Kohli and Jaworski (1993).

Adaptation. A five-item scale was used to measure organizational adaptation and adjustments in accordance to changes stemming from network partners (i.e. customers, competitors and other organizations). The items were adapted from the IMP Group's (1982) scale for adaptation, Boyle, Dwyer, Robicheaux and Simpson's (1992) scale for flexibility, and Noordewier, John and Nevin's (1990) scale for supplier flexibility.

Cooperation. Finally, a five-item scale was used to measure the joint efforts among organizations in their business network. The items were adapted from Heide and John's (1990) scale used for joint action, whereas other were operationalized in order to be consistent with Varadarajan and Cunningham's (1995) theoretical work, which defines functional areas for developing strategic alliances.

Reliability of scales

This was assessed through both reliability analysis and confirmatory factor analysis. All constructs had coefficient alphas that range between 0.60 and 0.90, indicating acceptable levels of reliability (Nunally, 1978). Additionally we performed a series of confirmatory factor analyses, involving a single factor representation of each set of co-generic items (Gerbing and Anderson, 1988). The confirmatory construct reliabilities are reported in Table 1 below. Several fit statistics were utilized to evaluate the acceptability of each one of the factor models. As recommended by Bentler and Bonnet (1980), the normed fit index (NFI) was utilized, and deemed acceptable if above the recommended value of 0.90. Additionally, the comparative fit index (CFI) was also utilized which demonstrates an acceptable model fit when it is over 0.90, as well. Furthermore, we produced the statistics goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI), which are acceptable when they are higher than 0.90 and 0.80, respectively. Finally, the root mean square error of approximation (RMSEA), was also provided, which incorporates no penalty for model complexity and is acceptable when it is no greater than 0.1 (Steiger and Lind, 1980; Browne and Cudeck, 1993). As a next step, we performed a series of regression analyses, by regressing the independent variable constructs, i.e., intra-organizational information exchanges, inter-organizational information exchanges and social exchanges upon each one of the dependent variables, i.e., adaptability, adaptation and cooperation. Then, we performed the Chow test, in order to

determine the moderating effects of environmental unpredictability upon the aforementioned relationships between independent and dependent variables. Specifically, the moderating effects of environmental unpredictability were tested by using subgroup analysis, as put forward by Kohli (1988) and Arnold (1982). First, the sample was sorted in ascending order for the hypothesized moderator. Next, following standard econometric conventions, the upper top (consisting of 35% of the cases) and the lower bottom (consisting of another 35% of the cases) were selected (Goldfeld and Quandt, 1965). The purpose of this selection procedure was to create two subgroups in order to reflect low and high scores on the moderator variable (Johnston, 1985).

Then each one of the dependent variables (i.e. adaptability) was regressed against the information and social exchanges respectively, using all the cases in the two subgroups (restricted run), one at a time, to obtain the restricted residual sum of squares. Next, in order to obtain the unrestricted residual sum of squares, separate regressions were performed for the low and high subgroups and then the sum of these residual sum of squares was taken (unrestricted run). The difference in the sums of squared residuals from the restricted and unrestricted runs was incorporated in the Chow test (Chow 1968). The purpose of this test was to assess the statistical significance of the differences in the regression coefficients of the antecedent variables across the low and high subgroups. Results from these analyses are reported on Tables 2.Next, we present a more detailed discussion of these findings.

Analysis and Results

Overall, the findings provided partial support upon the “fit”, or contingency arguments advanced in this study, i.e. that the environmental unpredictability would affect the impact of the information and social exchanges upon the network relationships outcomes.

Specifically, when adaptability is the dependent variable, the regression coefficients across the two subgroups reflecting low and high level of environmental unpredictability is statistically significant ($F= 1.91$, $p<.1$). Further, intra-organizational information acquisition ($\beta=.29$ $p<.05$), intra-organizationalinformation integration ($\beta=.28$ $p<.05$)and inter-organizational market-related information exchanges ($\beta=.25$ $p<.05$) are related to adaptability, when environmental unpredictability is low, but they are not related to the aforementioned dependent variable, when unpredictability is high. Inversely, social exchanges are positively related to adaptability in high levels of unpredictability ($\beta=.42$, $p<.001$), though they proved to be unrelated in low levels.

In respect to adaptation, regarded as the dependent variable, the difference in the regression coefficients across the low and high subgroups was statistically significant ($F=1.83$, $p<.1$). The regression coefficients associated with the intra-organizational information integration ($\beta=25$, $p<.05$) was significant in the group of organizations that perceived a high level of environmental unpredictability, but it was not significant for low levels. Moreover, social exchanges were positively related to adaptation in high unpredictability, though unrelated to adaptation in low levels of the same moderate variable.

As far as adaptability is concerned, the above findings imply that information exchange on marketing issues, either within the organization (i.e. information integration), or among organizations (i.e. strategic market-related information exchanges) is more beneficial, when future market conditions are perceived as predictable, to some extent. Nevertheless, when unpredictability becomes high, then the exchange of information among cooperating marketing actors becomes of little valueand may refer only to a short time horizon.

As far as adaptation is concerned, the findings regarding inter-organizational information exchanges are similar to the case of adaptability. However, contrary to the results for adaptability, intra-organizational information integration appears to be more beneficial to

adaptation, in high rather than low levels of environmental unpredictability. This finding implies that the members of an organization should feel more keen the need to exchange views in order to promptly cope with the appropriateadjustments and absorb fluctuations of the market.

On the contrary, social exchanges would have a greater impact upon both adaptability and adaptation, on high rather, than low environmental unpredictability. It appears that in high uncertainty, social exchanges are more beneficial than information exchanges, since they would contribute to the building of strong long-term social bonds among marketing actors, thus resulting in stabilization of future market fluctuations, in higher predictability of future market trends, in expansion of predictions' time horizons, all of which facilitate both adaptability and adaptation.

In corollary, when environmental conditions are not easily predictable, then network information exchanges are less effective than social exchanges.This may be due to the fact that social bonds, stemming from social exchanges may guarantee more stable business relationships, thus acting as a counterbalance to unpredictability. In this sense, social exchanges may result in more predictable marketing figures (i.e., in terms of demand or supply.

In corollary, environmental unpredictability regarded as a contingent variable may moderate the relationship of the information and social exchangewiththe network relationships outcomes of adaptability and adaptation. Finally, in regard to cooperation, the research results provided no significant evidence, thus implying that this variable reflects an advanced level of relationship building which may be not contingent on market volatility. Indeed, cooperation reflects strategic proactive planning which should have considered many more types of calculated risk than mere environmental uncertainty.

Table 1.

Confirmatory Factor Analysis of Model Constructs

Construct	No of Constructs	No of Items	GFI	AGFI	NFI	CFI	RMSEA
Environmental Unpredictability	1	3	.99	.97	.99	.99	.04
-Intra-organizational information exchanges	3	11	.87	.81	.85	.89	.10
Information Acquisition	1	2	-	-	-	-	-
Bilateral Information exchanges with customers	1	5	.95	.85	.94	.95	.1
Information Integration	1	4	.98	.91	.98	.98	.1
-Inter-organizational information exchanges	3	15	.83	.79	.82	.86	.10
Strategic market-related inform. exchanges	1	7	.93	.86	.92	.94	.11
Strategic product-related inform. exchanges	1	4	.97	.83	.95	.95	.12
Social exchanges		4	.99	.94	.99	.99	.08
Network Relationships Outcomes							
Adaptability	1	5	.94	.80	.94	.95	.16
Adaptation	1	5	.93	.87	.92	.94	.12
Cooperation	1	5	.98	.94	.98	.98	.00

Statistic	Suggested
Goodness of Fit Index (Joreskog and Sorbom, 1978)	>=0.90
Adjusted Goodness of Fit Index (Joreskog and Sorbom, 1978)	>=0.80
Delta 1 (NFI) (Bentler and Bonnet, 1980	>=0.90
Comparative Fit Index (Bentler, 1990)	>=0.90
RMSEA (Browne and Cudeck, 1993)	<=0.10

Table 2.

Standardized Regression Coefficients Across Low and High Levels of Environmental Unpredictability

				Independent Variables							
Dependent Variable	Moderator Level	R^2	Inform. Acquis.	Bilateral Inf. exch. with Customers	Inform. Integr.	Market-related Inf. exchang.	Prod.Devel-related Inf. exchang.	Social exchang.	n	Chow Test
Network Relationships' Outcomes										
Adaptability	Low		.29***	-.19*	.28**	.25**				
	High	.40***	.25**					.42***	149	1.91*
Adaptation	Low					.49***				
	High	.47***			.25**			.21*	147	1.83*
Cooperation	Low					.37***	.33**			
	High	.44***	.17*				.37***	.25**	147	.93

*** p<.1, **p<.05, ***p<.025, ****p<.001**

References

To be provided upon request.