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The effect of relation-specific investments in the supply chain triad on innovation performance

Andrea Gelei
Corvinus University of Budapest, Department of Logistics and Supply Chain Management
e-mail: andrea.gelei@uni-corvinus.hu

Zsófia Kenesei*
Corvinus University of Budapest, Department of Marketing
Fővám tér 8., Budapest-1093, Hungary
Phone number: + 36 70 282 3773
e-mail: zsofia.kenesei@uni-corvinus.hu

Abstract

Using a comprehensive survey, this paper analyzes the effect of committed and heavy supply chain relationships characterized by high levels of relation-specific investments in innovation performance in Hungary, an emerging economy in Eastern Europe. For this research, we carry out a two-step analysis. First, we investigate the effect of Relation Specific Investments (RSI) on four different innovation-related performance dimensions of a focal firm. In contrast to previous research, we did not limit our analysis to the dyadic relationship level, but rather, we analyzed the triadic supply chain relationships. Uniquely, this paper conceptualizes and measures innovation performance in a complex way, both product and process, but also analyzes incremental and radical innovations. As a second step, the effect of internationalization on the focal firm is tested. Triad level RSI has a positive effect on all innovation related performance dimensions. A test of the moderation effect produced mixed results, indicating the need to treat innovation in a complex, sophisticated way in future research.

Key words: relation-specific investments, triadic supply chain relationship, innovation, emerging region, SEM model

* corresponding author

1. Introduction

Innovation seems to still be one of the distinguishing features of competitiveness in highly developed economies compared to emerging economies. Eastern Europe – including Hungary – was not able to catch up with their highly developed counterparts, and innovation related performance in this region is still lagging behind. Although Hungary's innovation performance has increased in recent years, the country, together with most countries in the region, is a moderate innovator. Their performance along the Summary Innovation Index (SII) slightly exceeds half of the EU 27 average (EIS, 2015). The reasons for this are diverse. From inappropriate and insufficient regional innovation systems (Radosevic, 2002) to firm specific aspects (Leskovar-Spacapan and Bastoc, 2007), which all may be contributors. Our paper focuses on the latter approach. Triadic supply chain relationships form our unit of analysis because the general understanding is that firms on their own are no longer capable of successful innovation. Cooperation with supply chain partners (Dodgson – Rothwell, ed., 1994; Sivadas and Dwyer, 2000) is a trigger for innovation. It is therefore especially disconcerting that Hungarian firms perform poorly with respect to cooperation with business partners in innovation related projects (EIS, 2015).

Eastern European firms have been through enormous changes related to business relationships. Twenty-five years ago, when the socialist–communist regime became a free market economy, established business relationships and complete supply chains dissolved and vanished. Most Hungarian firms lost their traditional partners and markets. Newly established companies strengthened their internal market positions, but it became more and more important for them to join international corporations that have established themselves in Hungary and the region. One of the most important and often cited reasons for this is the spillover effect. This effect was expected to guarantee that the institutional knowledge accumulated in these corporations would be acquired by less developed local firms. Twenty-five years have passed since this transition started and since firms reconfigured their supply chains. Newly developed business networks are no longer politically determined, but they still have crucial importance. In our global business network economy in general, supply chain relationships in particular are important sources of competitive advantages (Morgan – Hunt, 1994; Krause et al., 2007). Long-term, successful and committed business relationships have particular importance for innovation (Dyer, 1996; Fawcett et al., 2012).

The objective of this paper is to investigate the role and effect of supply chain relationships on innovation in the case of Hungary, an emerging economy in Eastern Europe. We carry out a two-steps analysis. First, we analyze the effect of relation-specific investments (RSI) that the focal firms have accumulated in their key supply chain networks as they relate to the innovation-related performance of these firms. Then, the moderating effect of the focal firm's international networking is examined. In contrast to previous research, we do not limit our analysis to the dyadic relationship level, but rather focus on triadic supply chain relationships. Although the limitations of the dyadic approach have become more and more apparent (Choi and Wu, 2009), the theoretical and empirical implications of a triadic approach are still limited. The triadic relationship focuses on the partnership of a focal firm with its most important customer and supplier. We also take the unique approach of conceptualizing and measuring innovation performance in a complex way, analyzing both product and process but also incremental and radical innovations. This article has the following sections: Section 2 presents the theory and hypotheses; Section 3 introduces the applied methods; and Section 4 presents the results. The manuscript closes with discussion and conclusions.

Literature review and development of the theoretical model

Our analysis is built on three interlinked theoretical areas: literature related to (1) RSI, (2) innovation performance and (3) internationalization. We close this section with a description of the theoretical model developed.

Relation-Specific Investments

Relation-specific (or idiosyncratic) investment is a key concept in business relationships and supply chain management literature. It represents those investments that have been made by cooperating actors and are sticky to the given relationship. These investments cannot be mobilized and transferred easily to other relationships (Williamson, 1985; Anderson and Weitz, 1992). The level of accumulated RSI is closely linked to several relational constructs. It is understood as an indicator for relationship heaviness (Håkansson and Ford; 2002), one of the two factors influencing relationship stability. However, RSI is also used as a proxy for relationship commitment, which is interpreted as a key predictor of the successful future development of relationships (Dyer and Singh, 1998). Both heaviness and commitment help the partners to sustain and competitively develop ongoing business relationships. Long lasting relationships tend to strengthen interaction, making relational bonds richer and supporting more complex and innovative types of cooperation (Zhao et al., 2014).

Our paper differs from previous research with respect to the scope of relationships involved in the analysis. RSI is originally a dyadic concept. During recent decades, the literature has produced a rich understanding of how buyers and suppliers interact in dyads and how this affects performance (Autry – Golicic, 2010). However, this dyadic perspective has severe limitations, especially when a firm's innovation performance is the object of research. Both customers (Hallen et al., 1991) and suppliers (Haffmans and van Weele, 2003) influence the capabilities of a focal firm and its innovation performance. A classic dyadic approach is not able to capture both of these influences. To overcome the limitations inherent in a dyadic approach, we extended the scope of analysis to a supply chain triad. This triad consists of (1) a focal firm, (2) its most important first tier supplier (3) and also its most important direct customer (S1 – FF – C1). This paper investigates a so-called open triad (Holm and Johanson, 1992) and applies the structural interpretation to triads (Vedel et al., 2012). Triadic research is underdeveloped in the literature. Näslund and Hulthen (2012) carried out an extensive literature review and found that only 12 articles applied a triadic approach to supply chain management issues, including only 5 that analyzed a S1 – FF – C1 triad; none of them quantitatively investigated RSI and its impact on performance.

The effect of RSI on innovation performance

Performance is a highly complex phenomenon. Our interpretation originated in b2b literature, suggesting that firm competitiveness is determined by its capability to generate value for its customers (Anderson et al., 2006). Customer value can be increased in two basic ways: (1) increasing the quality level of the product and service supplied; and/or (2) decreasing the associated cost of creating and using that product and service package.
On the other hand, customer value creation is driven by the expectations of the customers (Parasuraman et al., 1994). Mandják and Durrieu (2000) sorted these expectations into different groups: (I) expectations related to short-term transactions and (II) expectations related to long-term interactions between business partners. Transaction level customer expectations are those that are directly linked to buying and using a given product and service

package, especially for (i) the quality of the product/service and (ii) its associated cost. These are the same avenues through which customer value can be increased as interpreted by Anderson et al. (2006). Relational expectations can only be fulfilled by a company through long-term cooperation with a partner. According to Möller and Törrönen (2003) as well as Walter et al. (2001), these expectations are either radical (1) products/services or (2) process innovations.

Based on the time dimensions of possible customer expectations and the way customer value can be created, we identified four types of performance dimensions (see also Figure 1):

1. *Transaction level:*
    a. Changing/increasing the quality of a product and service package – that is incremental product innovation;
    b. Changing/increasing the productivity of the process of creating the product and service package – that is incremental process innovation;
2. *Relationship level:*
    a. Developing completely new products/services – that is radical product innovation;
    b. Developing completely new business processes – that is radical process innovation.

FIGURE 1 ABOUT HERE

Overall, the literature suggests that an increase in RSI is expected to positively influence performance (Parkhe, 1993; Enright, 1995; Dyer, 1996). In spite of numerous studies on performance, only limited research (Autry and Golici, 2010; Cao and Zhang, 2010) uses innovation as an outcome, and we have not found any that systematically classified and used these outcomes along with the specific types of innovations.

In our research, we empirically examine the effect of the focal firm's RSI that was accumulated in its supply chain triad through four types of innovation performance outcomes. We hypothesize that reconfiguration of the supply chains over the last 25 years in Hungary has led to the formation of heavy, committed relationships that are measured by the level of RSI; furthermore, this positively influences not only incremental types of innovation (both product and process innovations) but radical innovations too.

Using data gained with an extensive survey, we tested the following hypotheses:

> ***H1a:*** Supply triad level RSI of the focal firm positively influences the focal firm's incremental product (or/and service) innovation performance.
>
> ***H1b:*** Supply triad level RSI of the focal firm positively influences the focal firm's incremental process innovation performance.

H2a: Supply triad level RSI of the focal firm positively influences the focal firm's radical product (and/or service) innovation performance.

H2b: Supply triad level RSI of the focal firm positively influences the focal firm's radical process innovation performance.

Internationalization

Developing committed and strong ties with supply chain partners may lead to a competitive edge because firms can leverage their complementary resources (Wernerfelt, 1984; Barney, 1991; Grant, 2002); this would be expected to yield increased innovation capabilities. On the other hand, the internalization of firms is also expected to yield a competitive edge through intensified innovation (Kotabe et al., 2002). One of the rationales for this is the increased pool of resources available through a wider network of cooperating partners (Kafouros et al., 2008; Kumar et al., 2013). However, widening the net of cooperating firms means increasing the number of partners that might lose ties with existing ones. Consequently, the two streams of research seem to have contradicting results. Therefore, in the second step of our analysis we tested the effect of internationalization of the focal firm on the relationship between the supply triad level RSI and the focal firm's innovation performance. We hypothesize as follows:

H3: The degree of internationalization of the focal firm moderates the relationship between supply triad RSI and innovation performance.

Based on our literature review, we formulated the above hypotheses, which are summarized in our theoretical model (Figure 2). Control variables were included in the model to check for the effect of company size, company age and ownership (Hsieh and Hsieh, 2015).

FIGURE 2 ABOUT HERE

Method

Sample

Three-hundred Hungarian companies were presented with a questionnaire in the form of a comprehensive survey developed by the Hungarian Competitiveness Research Center at the Corvinus University of Budapest. Data collection was carried out by a professional market research company. The survey consisted of four linked questionnaires. The questionnaire that was filled out by the head of operations was used in our analysis. From the 300 responses, we had 175 usable questionnaires with data on our focal constructs (related to the RSI).

We checked for non-response bias and did not find any differences. The sample is characterized in Table 1.

TABLE 1 ABOUT HERE

Measures

To observe the constructs, the actual survey incorporated multiple items for each of the five constructs in the model. The items for each construct were developed or adopted from available supply chain management and relationship marketing literature.

Relation-specific investments are not easy to measure. They are usually not recorded in company records; therefore, it is acceptable to measure them through the perceptions of key informants. These investments are also very diverse and are generated by different transactions, episodes and interactions that occur between partners over the life cycle of the business relationship (Ford et al., 2003). Otto and Obermaier (2009) argue that the AAR model developed by Håkansson and Johanson (1992) is appropriate for capturing the investments generated and accumulated in business relationships. The model identifies three building blocks of any business relationship: actor bonds (Yu et al., 2006), activity links (Batonda and Perry, 2003) and resource ties (Ford et al., 2003).

The development of actor bonds, activity links and resource ties is parallel. The overall level of RSI in a given relationship is consequently determined by the sum of RSIs generated by the three AAR constructs over time between partners. Based on the AAR model, the level of RSI between a focal firm and its most important customer and supplier was operationalized as follows: (1) the perceived level of RSI in actor bonds/social capital; (2) tied up in operational routines, activities; and (3a) in current but also (3b) long-term assets. These four items were measured in both relationships in the triad on a five point Likert-scale.

On the basis of the literature review and the matrix shown in Figure 1, incremental product innovation was operationalized through increases in the quality level of the product and/or service of the focal company. Following Knemeyer et al. (2003), the quality of products/services was measured with a four-item scale where respondents assessed improvements compared to three years ago in several key areas: (1) the level of customization of products/services; (2) the quality of products/services; (3) the level of timeliness of orders; and (4) the level of specialized services. Incremental process innovation was operationalized by measuring the increase in the productivity of the process of creating the product and service package on a three-item scale. The respondents compared, on a five point Likert-scale, the level of operational efficiency of their company compared to three years ago. Based on Nyaga et al. (2010), three items were used to assess the constructs: improvement in (1) efficiency of the workforce; (2) efficiency of operations; and (3) efficiency of capacity utilization. Both product/service quality and productivity of process are traditional operational performance measures. Because none of these can be increased without incremental innovation, they prove the presence of incremental innovation of the focal firm.

Radical product innovation was measured with a single-item dichotomous question (based on Koberg et al., 2003) (“Were there any new products or services launched in the company within the last three years?”), whereas process innovation was measured with four items based on Koberg et al. (2003), asking respondents if there were any radically new (1) knowledge management systems, (2) production processes, (3) distribution systems or (4) logistics systems launched within the past three years.

Analysis of the measurement model

The data were analyzed using a "two-step approach" to structural equation modeling. The measurement model was found to fit the data at a satisfactory level ($\chi 2/df=1.58$, $p<.001$, CFI=0.95, IFI=0.95, TLI=0.93, RMSEA=0.041). The reliability of the four scales was then assessed: Cronbach's Alpha coefficients were above the threshold level of 0.7, except for the radical process innovation scale (Table 2). The value could have been increased by leaving only two items in the scale, but from a theoretical point of view we retained the four-item scale with a 0.69 value. Our decision was reinforced by the composite reliability values because all were above the threshold level of 0.7. Convergent validity was confirmed for all scales where all variables were shown to have significant weighting (factor loadings were all significant and greater than 0.50). AVE values were all above the 0.5 threshold level (Bagozzi and Yi, 1988).
Lastly, an assessment of discriminant validity was conducted by comparing the shared variances between factors with the AVE of the individual factors (Fornell and Larcker, 1981). Table 2 provides the inter-construct correlations and the square roots of the AVEs. It shows that the square root of the AVE was higher than their shared variances. Table 2 indicates that there is acceptable discriminant validity for each construct in this study.

TABLE 2 ABOUT HERE

Results

To test the basic model, SEM was used to simultaneously measure the hypothesized relationships between constructs (with IBM SPSS AMOS 20.0). The model indicated an acceptable fit.

TABLE 3 ABOUT HERE

The results indicate that all of our hypothesized relationships are significant and positive. This means that higher levels of accumulated RSI in the supply chain triad were positively related to incremental product and process innovations, thus confirming H1a and H1b. In addition, the results showed that the RSI in the triad were also positively correlated to the level of radical product and process innovations, thus confirming H2a and H2b.
We checked for the control variables (size, age, ownership), but none of them had a significant influence on the dependent variables.

Testing the moderation effects

After confirming the influence of the four postulated main effects, we tested for moderator effects. Specifically, we conducted a Chi-square difference test for all four possible moderator

effects in which we compared restricted and non-restricted models. To investigate the moderating effects of integration in the global supply chain, the sample was divided into high and low groups, and a multi-group moderation analysis was performed (Baron and Kenny, 1986). To measure the level of internationalization, we analyzed two questions (on a 1-5 Likert-scale): "What is the level of your effort to increase (1) the level of global supply and (2) the level of global sales". The high and low groups were formulated. Companies that had neither supplies nor sales from/to global partners (answering 1 to any of the questions) belonged to the "local supply chain group" (N=78) and those that had either supplies or sales from/to global partners were members of the "global supply chain group" (N=84). The results of the moderation analysis are summarized in Table 4.

Based on a chi-square difference test, the relationship between triad level RSI and incremental product innovation was weaker in companies that are part of the global supply chain (have international partners), but stronger in local supply-chain member companies (have only national partners). In the case of incremental process innovation, the situation was similar, but the significant difference was only at the 0.1 level, indicating that there is no real difference between the two groups in this respect.

TABLE 4 ABOUT HERE

The link between triad level RSI and radical product innovation is stronger for companies that are part of a global supply chain, though at a non-significant level. Finally, the link between triad level RSI and radical process innovation is significantly stronger for global supply chain members than for companies operating with local supply chain partners.

Discussion

Our results support previous knowledge but have added value from both a theoretical and practical perspective. This research was unique from a theoretical perspective because a triadic set of supply chain relationships, rather than a dyadic set, formed the unit of analysis. The complex way we conceptualized and measured innovation performance is also unique in empirical research. The triadic level analysis supported all of the hypotheses related to the basic model investigating the relationship between triad level RSI and the focal firm's innovation performance. Although the level of RSI accumulated in the triad for all four items and in both key supply chain relationships were quite low. None of these RSIs exceeded a value of 2.87. Still, this relatively low level of RSI was sufficient to leverage successful innovations of all types in the focal company.

The Innovation Union Scoreboard in 2015 (also in previous innovation related studies from the EU) noted that Eastern European firms in general, but Hungarian firms in particular, are weak in mobilizing their business networks and leveraging the skills and capabilities of their partners. The 2015 study indicated, for example, that only 54% of SMEs collaborate with others to successfully innovate (page 61) (let us note that 80% of our companies in the sample belong to SMEs, see Table 1.) This EU analysis indicated that only 54% of all SMEs were involved in any type of close partnerships, which indicates that the ratio of firms intensively cooperating with supply chain partners must be even lower. This means that building

committed relationships is an important untapped opportunity for Hungarian SMEs to promote further development and increased performance, especially innovation performance. This is an important practical result of the analysis and has direct relevance, not only for firms but also for policy makers. It should be a primary objective of the latter to help overcome the obstacles hindering the development of committed, heavy relationships. One of the most important issues here is trust. Hungary's economic actors are reported to have low levels of trust (Chikán et al. 2012). This might be partly explained by the immense changes that took place in the last 25 years, which have not favored the creation of trusting, committed and innovative business relationships.

These results are especially interesting when considering the moderating effect of internationalization. The effect of triad level RSI on incremental product innovation was negatively moderated by internationalization, as expected. Incremental product innovation is usually triggered by the requirements of a key customer(s). Internalization of firms, in our analysis, seems to weaken the effect of these key actors, probably due to internalization resulting in increasing numbers of customers, thereby lowering the level of dedication to key customers. On the other hand, the effect of triad level RSI on radical process innovation was positively moderated by internationalization. We think this is probably because operation at an international scale with increased numbers of supply chain partners cannot be managed effectively without intensely and radically innovative processes. We obtained significant results in only these two concrete innovation performance dimensions. However, the level of internationalization seems to generally weaken the positive effect of supply level RSI on incremental innovation and strengthens it in the case of radical innovations. The fact that different types of innovation performance dimensions behave differently in our analysis is an important theoretical contribution of this paper because previous studies have treated innovation as one general phenomenon. Future research should overcome the problem of simplification in this respect and treat innovation performance systematically in a more sophisticated way.

This study does have certain limitations. The cross-sectional nature limits longitudinal analysis of the influence of relation-specific investments. Self-reported data may lead to subjective evaluation of RSI. The results of this study are limited to Hungary, thus the generalizability of the results have limits. This study generated data about relation-specific investments that provides only one aspect of relationships; other characteristics, such as commitment, power and trust, were not measured. Future studies may incorporate these variables and link them to the different innovation dimensions.

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Tables:

Size	%	**Main owner**	%	**Sector**	%
Small	13.7	State	7.4	Agriculture	6.9
Medium	70.3	Private/Hungarian	72.0	Energy industry	5.1
Large	16.0	Private/Non-Hungarian	20.6	Processing industry	47.4
				Construction industry	7.4
				Retailing	17.1
				Services	16.0

Table 1: Demographic data for the sample

	Cr. α	**CR**	**AVE**	*Supply triad level RSI*	*Incremental process innovation*	*Incremental product innovation*	*Radical process innovation*	*Radical product innovation*
Supply triad level RSI	0.90	0.91	0.555	0.745				
Incremental process innovation	0.81	0.83	0.555	0.280**	0.745			
Incremental product innovation	0.82	0.83	0.635	0.303**	0.326**	0.797		
Radical process innovation	0.69	0.71	0.553	-0.338**	-0.331**	-0.317**	0.744	
Radical product innovation		-	-	-0.206**	-0.231**	-0.208**	0.539**	-

Cr. α = Cronbach's Alpha, CR= composite reliability, AVE=average variance extracted, Correlation matrix (Note: Diagonal elements are square roots of the AVE values of the constructs; **p < .01)

Table 2: Reliability and validity analysis

Hypothesized relationships Basic model	*Estimated coefficients (std)*	*St.error*	*t-values*	***Results***
Supply triad level RSI => Incremental product innovation	0.307**	0.10	3.03	***Ha1 is supported***
Supply triad level RSI => Incremental process innovation	0.169*	0.68	2.50	***H1b is supported***
Supply triad level RSI => Radical product innovation	0.302**	0.09	3.83	***H2a is supported***
Supply triad level RSI => Radical process innovation	0.173**	0.045	3.84	***H2b is supported***

** *p <0.01; *p<0.05;* (χ2(285)=526; χ2/df=1.85, p<0.001; RMSEA=0.0649 CFI=0.92, IFI=0.92, TLI=0.90)

Table 3: Results for the main effects

Hypothesized relationships Moderating effects				***Results***
	Global supply chain	*Local supply chain*	X2 difference (df=2)	
Supply triad level RSI => Incremental product innovation	0.158	0.316	*6.05***	***Internationalization weakens the relationship***
Supply triad level RSI => Incremental process innovation	0.162	0.231	4.69*	***No significant difference***
Supply triad level RSI => Radical product Innovation	0.310	0.266	1.31	***No significant difference***
Supply triad level RSI => Radical process innovation	0.268	0.06	7.1**	***Internationalization strengthens the relationship***

Table 4: Results of the moderation analysis (** p<0.05; * p<0.1)

Figures:

Figure 1: Innovation-related performance dimensions in the empirical analysis

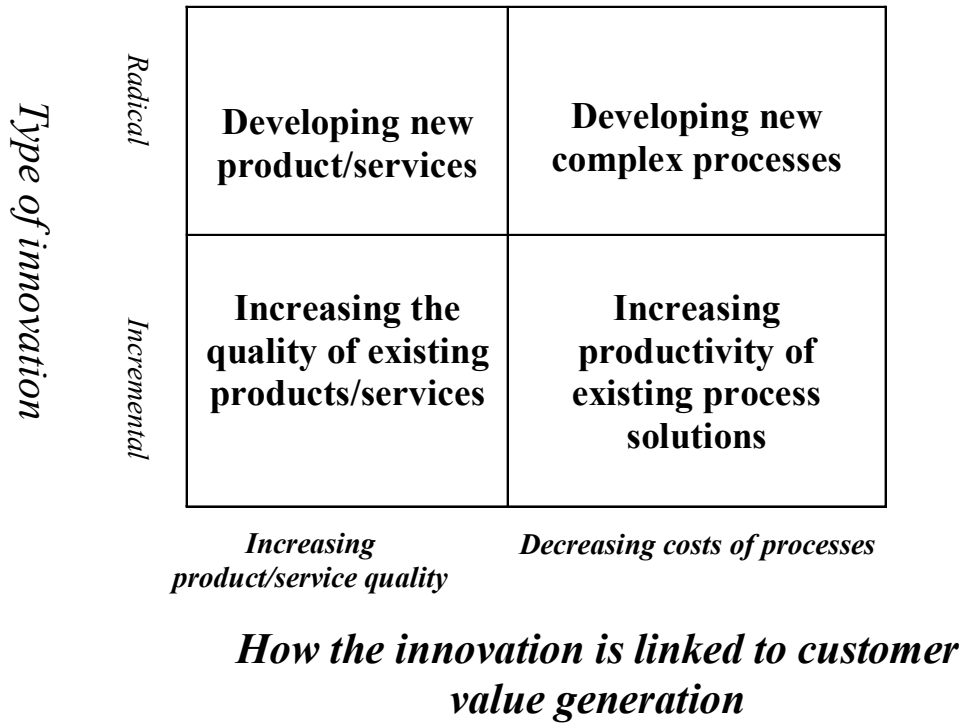

Figure 2: The theoretical model