

The Effect of Relation-Specific Investments in the Supply Chain Triad on Innovation Performance

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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 Central and 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

Introduction

Innovation seems to still be one of the distinguishing features of competitiveness in highly developed economies compared to emerging economies. Central and 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 (European Commission 2015). The reasons for this are diverse. From inappropriate and insufficient regional innovation systems (Radošević 2002) to firm specific aspects (Leskovar-Spacapan and Bastic 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 (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 (European Commission 2015).

Central and 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 are important sources of competitive advantages (Krause, Handfield, and Tyler 2007). Successful and committed business relationships have particular importance for innovation (Dyer 1996; Fawcett, Jones, and Fawcett 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 Central and 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 paper 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. After discussing these, we close the 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 and Golicic 2010). However, this dyadic perspective has severe limitations, especially when a firm's innovation performance is the object of research. Both customers (Hallen, Johanson, and Seyed-Mohamed 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 and applies the structural interpretation to triads (Vedel, Geersbro, and Ritter 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, Narus, and van Rossum 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, Zeithaml, and Berry 1994). 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, Narus, and van Rossum (2006). Relational expectations can only be fulfilled by a company through tight cooperation with a partner. According to Möller and Törrönen (2003) these expectations are either radical (1) products/services or (2) process innovations. Based on the relationship dimensions of possible customer expectations and the way customer value can be created, we identified four types of performance dimensions (see also figure 1):

| | | How the innovation is linked to customer value generation | |
|--------------------|-------------|---|---|
| | | Increasing product/service quality | Decreasing costs of processes |
| Type of innovation | Radical | Developing new product/services | Developing new complex processes |
| | Incremental | Increasing the quality of existing products/services | Increasing productivity of existing process solutions |

FIGURE 1 Innovation-Related Performance Dimensions in the Empirical Analysis

1. Transaction level:

- Changing/increasing the quality of a product and service package – that is incremental product innovation;
- Changing/increasing the productivity of the process of creating the product and service package – that is incremental process innovation;

2. Relationship level:

- Developing completely new products/services – that is radical product innovation;
- Developing completely new business processes – that is radical process innovation.

The above interpretation and classification is line with Schumpeter’s (1939) widely accepted output oriented approach to innovation.

Overall, the literature suggests that an increase in rsi is expected to positively influence performance (Dyer 1996). In spite of numerous studies on performance, only limited research (Autry and Golicic 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.

Based on the theoretical considerations we developed 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 (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, Srinivasan, and Aulakh 2002). One of the rationales for this is the increased pool of resources available through a wider network of cooperating partners (Kumar, Mudambi, and Gray 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.*

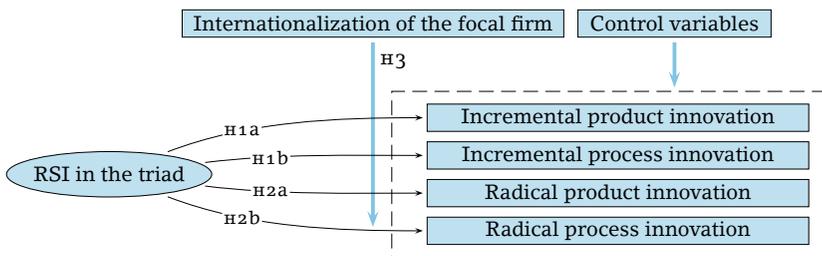


FIGURE 2 The Theoretical Model

Based on our hypothesis, we formulated 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).

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 method of administration was personal interview in the office of the respondents. The survey consisted of four linked questionnaires, filled in by different managers (CEO, head of sales, head of operations, CFO) of the company. 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.

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

TABLE 1 Demographic Data for the Sample (%)

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

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, Liao, and Lin 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, Corsi, and Murphy (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, Whipple, and Lynch (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, DeTienne, and Heppard 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, DeTienne, and Heppard (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 ($\chi^2/df = 1.58, p < 0.001, CFI = 0.95, IFI = 0.95, TLI = 0.93, RMSEA = 0.041$). 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

TABLE 2 Reliability and Validity Analysis

| | α | CR | AVE | (1) | (2) | (3) | (4) | (5) |
|-----|----------|------|-------|----------|----------|----------|---------|-----|
| (1) | 0.90 | 0.91 | 0.555 | 0.745 | | | | |
| (2) | 0.81 | 0.83 | 0.555 | 0.280** | 0.745 | | | |
| (3) | 0.82 | 0.83 | 0.635 | 0.303** | 0.326** | 0.797 | | |
| (4) | 0.69 | 0.71 | 0.553 | -0.338** | -0.331** | -0.317** | 0.744 | |
| (5) | - | - | - | -0.206** | -0.231** | -0.208** | 0.539** | - |

NOTES Column/rpw headings are as follows: α - Cronbach's Alpha, CR - composite reliability, AVE - average variance extracted, (1) supply triad level, (2) RSI incremental process innovation, (3) incremental product innovation, (4) radical process innovation, (5) radical product innovation. Diagonal elements are square roots of the AVE values of the constructs; ** $p < 0.01$.

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.

RESULTS

To test the basic model, SEM was used to simultaneously measure the hypothesized relationships between constructs (with IBM SPSS AMOS 20.0). AMOS provides a covariance-based structural equation modeling tool that uses maximum likelihood function to obtain parameter estimates. The model indicated an acceptable fit.

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

TABLE 3 Results for the Main Effects

| Hypothesized relationships, basic model | (1) | (2) | (3) | Results |
|---|---------|------|------|------------------|
| Supply triad level RSI → Incremental product innovation | 0.307** | 0.10 | 3.03 | H1a 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** | 0.04 | 3.84 | H2b is supported |

NOTES Column headings are as follows: (1) estimated coefficients (std.), (2) str. error, (3) *t*-values. ** $p < 0.01$; * $p < 0.05$; $(\chi^2(285) = 526; \chi^2/df = 1.85, p < 0.001; RMSEA = 0.0649 CFI = 0.92, IFI = 0.92, TLI = 0.90)$.

TABLE 4 Results of the Moderation Analysis

| Hypothesized relationships, moderating effects | (1) | (2) | (3) | Results |
|--|-------|-------|--------|--|
| Supply triad level RSI \Rightarrow Increment. product innovation | 0.158 | 0.316 | 6.05** | Internat. weakens the relationship |
| Supply triad level RSI \Rightarrow Increment. process innovation | 0.162 | 0.231 | 4.69* | No significant difference |
| Supply triad level RSI \Rightarrow Radical product innovation | 0.310 | 0.266 | 1.31 | No significant difference |
| Supply triad level RSI \Rightarrow Radical process innovation | 0.268 | 0.06 | 7.10** | Internat. strengthens the relationship |

NOTES Column headings are as follows: (1) global supply chain, (2) local supply chain, (3) χ^2 difference ($df = 2$). ** $p < 0.01$; * $p < 0.05$.

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.

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 Central and 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 SMEs to promote further development and increased performance, especially innovation performance. This is an important practical result of the analysis and has direct relevance for both firms and policy makers in Hungary but also in other Central and Eastern European countries with similar development path. Managers and policy makers should find the means of overcoming the obstacles hindering the development of committed, heavy relationships. This could help increase innovation performance and consequently the economic activity of the whole region.

Our 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.

Previous studies have treated innovation as one general phenomenon. The fact that different types of innovation performance dimensions behave differently in our analysis reflects the added value of our compound approach to innovation. It is significant to understand the way how certain management efforts – such as for example internationalization – effect the different types of innovation performance dimensions. We have pointed out previously that two contradictory theories on the link between internationalization and its effect on innovation are present in literature. Empirical results based on our multidimensional interpretation of innovation support both theories, internationalization of a company has various effects on different types of innovation. This is the main theoretical contribution of this paper to literature. Future research should overcome the practice 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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