Comparing network pictures of learning and non learning supply chains
Working Paper[1]

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The purpose of the paper is to contribute to a deeper understanding of learning networks. The research conducted has two phases applying different research methodologies. *First*, an *empirical analysis* of learning relationships has been carried out using a theoretical framework derived from the theory of learning organizations and a database of a comprehensive survey. This analysis revealed the existence of companies active in learning and another operating in non learning supply chains. The first is called learning and the second non learning supply chain. In the *second step* of the research *two case study analyses* will be conducted. These case studies aim at mapping and comparing network pictures of a company belonging to learning supply chain and that of another firm representing the non learning cluster.

In the first step of the research program we aim at developing and testing a conceptual framework for learning relationships and learning supply chains and test it empirically. The framework proposed is based on Garvin's work (2008) describing basic features of a learning organization. In the paper we looked for supply chain relationships having a supportive learning environment in its relationships, a systematic knowledge management between cooperating parties and where the focal company has a behavior that reinforces learning between cooperating parties. Those triadic supply chains were interpreted as learning supply chain, which possessed two learning relationships of the same focal company, one on the focal firm's supply and another on its customer side. Methodology: The research was part of a comprehensive research program called "In global competition – competitiveness of the Hungarian enterprise sector" at the Competitiveness Research Centre of Corvinus University of Budapest and was carried out at the Competitiveness Research Center in 2009. We gathered our filled questionnaire from 317 companies (13% response rate). The database developed using this questionnaire was investigated through multivariate statistical analyses using SPSS 14.0.

Keywords: learning relationship, learning network, network picture

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Introduction

The purpose of the paper is to contribute to a deeper understanding of learning networks. The research carried out has two phases applying different research methodologies. *First*, an *empirical analysis* of learning relationships has been carried out using a theoretical framework derived from the theory of learning organizations and a database of a comprehensive survey. This analysis revealed the existence of companies active in learning and another operating in non learning supply chains. In the *second step* of the research *two case study analyses* will be conducted. These case studies aim at mapping and comparing network pictures of a company belonging to learning supply chain and that of another firm representing the non learning cluster.
This working paper summarizes the first research step, identifying learning relationships and supply chains in the Hungarian economy. This is the basis for the second research step that has just started in April. Results of this second research step can be presented at the 2011 IMP conference in September.

Learning supply chains (Dyer − Nebeoka, 2000; Spekman et al., 2002; Landoli et al., 2004; Maqsood et al., 2007; Bessant et al., 2003) is an actual research issue. Because dyadic business relationships are basic building blocks of any supply chain or business network, we think understanding learning relationship must be the first step toward understand learning chains. Therefore we narrow down our attention to these relationships. Analyzing learning relationships has also been studied mainly from an industrial marketing (Peppers et al., 1999; Sellness − Salis, 2003) and much less from a strategic management (Larsson et al., 1998) or supply chain management perspective (Dunne, 2007).

The purpose of this paper is therefore to propose a conceptual framework for learning relationships and learning supply chains and test it empirically. In the first step of the research program we aim at developing and testing a conceptual framework for learning relationships and learning supply chains and test it empirically. The framework proposed is based on Garvin's work (2008) describing basic features of a learning organization. In the paper we looked for supply chain relationships having a supportive learning environment in its relationships, a systematic knowledge management between cooperating parties and where the focal company has a behavior that reinforces learning between cooperating parties. Those triadic supply chains were interpreted as learning supply chain, which possessed two learning

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relationships of the same focal company, one on the focal firm's supply and another on its customer side. This analysis is the basis for the second step of our research: to analyse similarities and differences between the network pictures of companies active in learning and non learning supply chains.

Literature review

Resource dependence theory states that companies on their own are not capable to create complex product and service offerings suitable to create customer value. Therefore companies continually attempt to build interorganizational ties, business relationships in order to acquire specific resources and capabilities. Linking these resources and capabilities to the internal ones and using these interorganizational bundles of resources and capabilities are basis for competitiveness (Pfeffer - Nowak, 1976; Pfeffer - Salancik, 1978; Dyer - Singh, 1998; Ford et al., 2003). Interfirm relationships are a company's most important assets. Developing and managing these relationships influences competiveness directly on both company and supply chain level.

Theory of learning organization goes back to the behavioral theory of the firm looking at the routines companies learn (March – Simon, 1958; Huber, 1991). Here learning is basically interpreted as an effective problem solving, which assumes to have supportive learning atmosphere that helps to increase openness, risk taking behavior and psychological safety (Argyris – Schön, 1978; 1996). As Senge (1990) have pointed out leaders have a central role in creating and maintaining this supportive atmosphere. Senge was the first who applied a normative approach to the problem of organizational learning and tried to summarize the basic building blocks of a learning organization. He defined the learning organizations as, "an organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continuously learning to see the whole together" (page 3). As the definition points out system thinking, systematically managing the knowledge base of a company is crucial for any learning organization.

Following Senge's work a number of books and articles tried to identify the building blocks of a learning organization and presented diagnostic tools for it (Pedler et al., 1991; Pace, 2002; Watkins – Marsick, 2003; Garvin 1993). Although these tools point out several dimensions of different numbers, they tend to converge to three comprehensive components: supportive learning environment, systematic knowledge management and leadership behavior that reinforce learning (Garvin et al., 2008).

These characteristics have also been explained as building blocks of an effective and efficient supply chain in general but a comprehensive analysis of learning supply chain relations along these dimensions is still missing.
Trust and commitment are for example interpreted as basic influencing elements of the relationship environment (or atmosphere) in which cooperating parties operate (Håkansson ed., 1982) and are seen as necessary conditions to strategic supply chain management (Kumar, 1996; Das – Teng, 1998; Dyer et al., 1998; Zaheer et al., 1998 Dyer – Chu, 2003). Systematic information sharing, joint planning and problem solving are supply chain specific means of an effective knowledge management and has been subject of studies too (deVries – Brijder, 2000; Gattora, ed., 2003; Maqsood – Walker, 2007). And last but not least leadership behavior influencing atmosphere in relationships is researched under the umbrella of power

the focal company in the supply chain has (Hingley, 2005; Zhao, 2006; Ireland – Webb, 2007; Crook - Combs, 2007).

We suggest applying the characteristics of learning organization given by Garvin et al. (2008) to supply chain and its building blocks, relationships and capturing learning relationships and supply chains along the three components: (i) supportive learning atmosphere, (ii) systematic knowledge management between cooperating parties and (iii) appropriate leadership behavior of the focal company that reinforce learning.

In a comprehensive questionnaire we asked companies, treated as focal companies, to evaluate one of their important suppliers and an important customer along the previously introduced operational characteristics. In this way we could gather information about two business relationships within the same supply chain and analyze to what extent these supply chain relationships and consequently the triadic supply chain can be interpreted as learning relationships and learning supply chain.

Research methodology and the characteristics of the sample

One of the basic objectives of our analysis was to detect learning relationships and learning supply chains in the Hungarian economy, relationships and supply chains the operational characteristics of which back learning between cooperating parties along the supply chain.
The research was part of a comprehensive research program called "In global competition – competitiveness of the Hungarian enterprise sector" at the Competitiveness Research Centre of Corvinus University of Budapest and was carried out at the Competitiveness Research Center in 2009. We gathered our filled questionnaire from 317 companies (13% response rate). The sample focused on small and medium sized companies (88% of the sample) big companies are still overrepresented in the sample (categorization is based on the number of employees). 4.2% of the sample was active in agriculture, 42.4% are manufacturing firms, 1.9% are from the energy sector, 8.4 % from constructions, 19.1% from trade, 23% from service and 1% from communal service industry segment.

Based on the work of Garvin (2008) describing basic features of a learning organization we looked for supply chain relationships having a supportive learning environment in its relationships, a systematic knowledge management between cooperating parties and where the focal company has a behavior that reinforces learning between cooperating parties.

(1) Supporting learning environment:
Commitment is interpreted as basic influencing element of the relationship environment (or atmosphere) in which cooperating parties operate (Håkansson ed., 1982). Real commitment is indicated by the amount of relation-specific investments accumulated in the given relationship (Ford et al., 1986). We measured the level of relation-specific investments and interpreted it as an indicator for a supportive learning environment. The higher the level of relation-specific investments in the relationship is, the more committed cooperating parties are and consequently the more supportive the environment within the relationship is. Relation-specific investments were measured using a 5 points Likert scale, where 1 indicated very low level, 3 medium level and 5 very high level of relation-specific investment. In case of supplier relationship of the focal company we used question T35 of the questionnaire for measuring how supportive the environment of the relationship is. In case of a customer relationship question T36 was used. See Appendix for details.

(2) Systematic knowledge management:

Systematic information sharing, joint planning and problem solving are supply chain specific means of an effective knowledge management and has been subject of studies too (deVries – Brijder, 2000; Gattora, ed., 2003; Maqsood – Walker, 2007). In the questionnaire we measured to what extent these knowledge management techniques are applied in relationships along the supply chain using again a 5 point Likert scale. In case of supplier relationship of the focal company we used question T31 for measuring how systematic knowledge management in the relationship is. In case of a customer relationship question T32 was used. See Appendix for details.

(3) Leadership behavior that reinforces learning:

Positive leadership behavior that reinforces learning in business relationships was captured by the way the focal company of the supply chain looks at their suppliers and customers and the type of its expectations toward them. Actually we measured to what extent the focal company expects long term, innovation related type of gains from their supplier and customer relationships. The more this focal company could have been characterized having these type of long term oriented expectations towards cooperating parties in the supply chain, the more its leadership behavior was interpreted as being reinforcing learning in the supply chain. Here we used a 5 point Likert scale too. In case of supplier relationship of the focal company we used question K14 for measuring how reinforcing leadership behavior of the focal company. In case of a customer relationship question K11 was used. See Appendix for details.

The database developed using this questionnaire was investigated through multivariate statistical analyses using SPSS 14.0.

Table 1: Testing the variables used in order to capture specific dimensions of a learning relationship

Supplier relationship	Values of Cronbach alpha	Characteristics of a learning relationship in a supply chain	Customer relationship	Values of Cronbach alpha
Three variables in question T35	0.902	Supporting learning environment	Three variables in question T36	0.918
Three variables in question T31	0.871	Systematic knowledge management between cooperating parties	Three variables in question T32	0.870
Three variables in question K14	0.740	Leadership behavior that reinforces learning	Three variables in question K11	0.818

First step of the statistical analysis aimed at testing the stochastic relations among the variables used for capturing the different characteristics of learning relationships and a learning supply chain. We looked at Cronbach alpha between variables capturing the three specific operational characteristics mentioned (supporting learning environment, systematic knowledge management, and leadership behavior) and also carried out factor analysis (Principal component analysis, PCA) to test whether variables chosen really describe the dimensions referred to and are applicable for further analysis. Both the analysis of Cronbach alpha and the results of the PCA analysis confirmed that the nine variables used in the case of both the supplier and the customer relationships describe three different types of operational characteristics of that relationship (See Table 1 for concrete alpha values.)

The specific characteristics of a leaning relationship are complex; therefore we used three different variables in case of each characteristic. In order to condense information of the different concrete variables used to describe a given characteristic or dimension we created indexes Babbie (1989). We tried to detect both learning supplier and learning customer relationship of the focal company, consequently we developed six indexes. Three for learning supplier relationship and three for learning customer relationships:

1. *LEC indicates the index for Learning Environment with **Customer***
2. *KMC indicates the index for Knowledge Management with **Customer***
3. *LBC indicates Leadership Behavior in relationship with **Customer***

4. *LES indicates the index for Learning Environment with **Supplier***
5. *KMS indicates the index for Knowledge Management with **Supplier***
6. *LBS indicates Leadership Behavior in relationship with **Supplier***

All variables used were measured on a 5 point Likert scale and all the indexes were created with taking the simple average of their included variable. For example, the supportive learning environment in its supplier relationship of the focal company X was evaluated to have the values of 4 (in case of dedicated special tools and devices, see questions T35 in the Appendix), 2 (in case of dedicated warehouse) and 5 (in case of dedicated human resource). Consequently the LES index for this relationship will be (4+2+5)/3, that is 3.67. In case of customer relationship we had information concerning 154 relationships; in case of supplier relationship we had data about 153 relationships.

After creating indexes suitable for capturing the three relevant dimensions of a learning supplier and learning customer relationship we used these indexes to create clusters. In case of both types of relationship in the supply chain we looked for clusters of relationships characterized with high and with significantly lower level of learning capabilities. We carried out the k-means clustering method with a cluster number of two. In order to see how reliable our clusters are we also carried out a Hierarchical cluster analysis (between-groups linkage method). In case of customer relationship 87.02 % while in case of supplier relationship 85% of the relationships were assigned by the statistical analysis to the same cluster.

In order to increase consistency of our database the inconsistently clustered relationships were left out from the subsequent analysis. This means we were able to analyze 134 customer relationships and 130 supplier relationships.

Table 2: Differences between learning and non learning supplier relationship in our sample (on a 5 point Likert scale)

Values of specific dimensions	Supportive learning environment	Systematic knowledge management	Leadership behavior	Number of relationships in the cluster
Clusters				
Cluster of learning relationships	3.2240	3.541	3.7865	64
Cluster of non learning relationships	1.2828	2.0455	3.4899	66
Level of significance	.000	.000	0.5	-

The differences between learning and non learning relationship clusters are given in Table 2 indicates the differences between learning and non learning supplier relationships, while Table 3 shows the same but for learning customer relationships. It can be seen that in both relationship positions the two clusters are significantly different along all the three characteristics: supportive learning environment, systematic knowledge management and leadership behavior of the focal company reinforcing learning.

Table 3: Differences between learning and non learning customer relationship in our sample (on a 5 point Likert scale)

Values of specific dimensions	Supportive learning environment	Systematic knowledge management	Leadership behavior	Number of relationships in the cluster
Clusters				
Cluster of learning relationships	3.4203	3.5507	3.8744	69
Cluster of non learning relationships	1.3744	1.9949	3.0718	65
Level of significance	.000	.000	.000	-

Based on the result of cluster analysis we could identify separate clusters of learning supplier and customer relationships. As a next step we sorted out those focal companies in the sample, which worked with learning relationships on both sides of their supply chain, had learning relationships with both their important supplier and customer. Those triadic supply chains were interpreted as learning supply chain, which possessed two learning relationships of the same focal company, one on the focal firm's supply and another on its customer side. We could have revealed 36 learning and 38 non learning supply chains in our sample.

We have also investigated to what extent do the performance of companies operating in learning relationships (both with customers and suppliers) and in supply chains differ from those with supplier and customer relationships that can not be interpreted as learning counterparts? Financial, market oriented, innovation related and operational performance measures of the focal companies were asked to be evaluated in the questionnaire.

Although the mean values of both the analyzed dimensions of learning relationships (and supply chains) and the performance measures are in most of the cases relatively low, we could detect significant differences between the performance of focal companies working in learning type of business relationships both with their suppliers and their customers. Interestingly the difference between learning and non learning supply chains was found to be the most extended. The triadic learning supply chains in our sample proved to be significantly different as far as satisfaction, knowledge base of its human resources is concerned. Focal companies operating in a learning supply chain seem to understand customer requirements significantly better than those with non learning supplier and customer relationships. Interestingly quality is a key differentiating factor in case of both the dyadic relationships and on the supply chain level.

Conclusion and further research

This paper had the objective to investigate learning business relationships and learning supply chains empirically. In the second phase of the research network pictures of two companies in the sample will be mapped: one surrounded with rich business relationships (that is a member of a learning supply chain) and one other, with no learning relationships. Ford et al. (2006) interpreted network pictures as "a conceptualization by the observer of the network views of the participants, [...] a representational technique that aims to capture or illustrate views that specific actors have of the networked environment within which they operate". These network pictures, consciously or unconsciously, form the basis of network analysis and actions taken in order to influence cooperating counterparts and subsequently the overall network (Ford et al., 2002; Ford et al. 2003).

They work as 'sense making' devices and shape managerial decisions and actions (Henneberg et al., 2006). Network pictures are necessarily subjective, because they are the managers' mental representations of the relevant business environment. This subjectivity raises several problems, but network pictures still are seen to be useful analytical instrument. Ramos et al. (2009) presented a structure allowing capturing network pictures. This structure has twenty-one network picture dimensions divided into four groups: focus, weight, consistency and specificity (Table 7). Network pictures in our case study research phase will apply this structure. Results of our second research phase will be presented at the 2011 IMP Conference in September.

Table 5: Network pictures dimensions (Ramos – Ford, 2009)

Groups	Dimensions
Dimensional Group 1. : FOCUS	1.1. ACTORS
	1.2. PROCESSES
	1.3. ACTORS/PROCESSES
	1.4. ACTORS' FEATURES
	1.5. TIME SPAN
	1.6. FUNTIONS

Groups	Dimensions
Dimensional Group 2. : Weight	2.1. NORMATIVE
	2.2. MORAL
	2.3. KNOW WHAT IS GOING ON
	2.4. INTERNAL PROCEDURES
Dimensional Group 3. : SPECIFICITY/COHERENCY	3.1. COHERENCE WITH BOARD IDENTITY
	3.2. SITUATION SPECIFICITY
	3.3. AKCOR SPECIFICITY
Dimensional Group 4. : OVERALL VIEW	4.1. SZTEREOTYPE
	4.2. CONSISTENCY
	4.3. STRUCTUREDNESS
	4.4. STASIS
	4.5. BROADNESS
	4.6. COMPREHENSIVENESS
	4.7. CONFLICT/ COLLABORATION
	4.8. ACTORS AS PROVIDERS

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APPENDIX: QUESTIONS USED IN THE QUESTIONNAIRE
I. CUSTOMER RELATIONSHIP

T36: Please indicate the level of relation-specific investments in your customer relationship along all indicated investment types! (1 = very low level; 5 = very high level)

	Level of investments				
in case of special tools and devices	1	2	3	4	5
in case of dedicated warehouse	1	2	3	4	5
in case of human resource	1	2	3	4	5

T32: Please indicate to what extent you coordinate your decisions and processes with your customer! (1 = very low extent; 5 = very high extent)

	Extent of coordination				
Sharing inventory related information	1	2	3	4	5
Sharing demand related information	1	2	3	4	5
Harmonizing planning procedures	1	2	3	4	5

K11: Please indicate why you apply long term contract in your customer relationship! (1 = very low level; 5 = very high level)

	Level of importance				
Possibility of joint innovation	1	2	3	4	5
Possibility to form common strategic plans	1	2	3	4	5
Possibility of developing joint cost reduction programs	1	2	3	4	5

II. SUPPLIER RELATIONSHIP

T35: Please indicate the level of relation-specific investments in your supplier relationship along all indicated investment types! (1 = very low level; 5 = very high level)

	Level of investments				
in case of special tools and devices	1	2	3	4	5
in case of dedicated warehouse	1	2	3	4	5
in case of human resource	1	2	3	4	5

T31: Please indicate to what extent you coordinate your decisions and processes with your supplier! (1 = very low extent; 5 = very high extent)

	Extent of coordination				
Sharing inventory related information	1	2	3	4	5
Sharing demand related information	1	2	3	4	5
Harmonizing planning procedures	1	2	3	4	5

K14: Please indicate why you apply long term contract in your supplier relationship! (1 = very low level; 5 = very high level)

	Level of importance				
Possibility of joint innovation	1	2	3	4	5
Possibility to form common strategic plans	1	2	3	4	5
Possibility of developing joint cost reduction programs	1	2	3	4	5