# SUPPLY CHAIN MANAGEMENT TOOLS AS ACTIVITY TIES IN DYADIC PARTNERSHIPS

A work-in-progress paper

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**ABSTRACT**

Aim of the paper is to examine supply chain management tools as transaction-specific investments within dyadic partnerships.
Ford et al. (2003) indicate that transaction-specific investments origin in common activities, resource ties and social bonds between partners. These are closely related to each other and all of them are sources of relation-specific investments on their own way. Dyadic partnerships within a supply chain often use different tools for managing the value creating process. During my research I am focusing on distribution-side of the supply chain called demand chain (Van Goor, 2001) and the management tools used in supplying final goods to customers. There are several management tools applied for coordinating material and information flow between partners such as category management which helps to optimize product assortment; continuous replenishment program (CRP) and vendor managed inventory (VMI) a well as cross-docking which aim to develop and harmonize physical processes and EDI information sharing (related to demand forecast and inventory data) which makes possible the overall supply chain coordination (Bhutta et al., 2002; Harris-Swatman, 1997; Varma et al., 2006). My hypothesis is that the higher is the importance of transaction-specific investments at companies the higher the spread of application of different demand chain management tools.
Findings say that there is a link between operations and processes as transaction-specific investments and the diverse types of demand chain management tools, so companies, using these management tools are highly engaged to their partners and these are kinds of activity links between them.

***Keywords: relation specific investments, activity ties, supply chain***

## INTRODUCTION

Ford et al. (2003) indicate that transaction-specific investments origin in common activities, resource ties and social bonds between partners. These are closely related to each other and all of them are sources of relation-specific investments on their own way. Strengthening social bonds between cooperating partners needs time and efforts to make and consequently generates relation-specific investments. Enhancing the level and/or the extension of activities in the cooperation, adopting product and process technologies also leads to increased transaction-specific investments. Finally, extending the resource-dependency between partners also increases the level of inter-dependency.

Dyadic partnerships within a supply chain often use different tools for managing the value creating process. During my research I am focusing on distribution-side of the supply chain called demand chain (Van Goor, 2001) and the management tools used in supplying final goods to customers. There are several management tools applied for coordinating material and information flow between partners such as category management which helps to optimize product assortment; continuous replenishment program (CRP) and vendor managed inventory (VMI) as well as cross-docking which aim to develop and harmonize physical processes and EDI information sharing (related to demand forecast and inventory data) which makes possible the overall supply chain coordination (Bhutta et al., 2002; Harris-Swatman, 1997; Varma et al., 2006).

In my interpretation distribution-side supply chain management tools are types of transaction-specific investments and are a special form of activity links. A harmonized work cannot be expected without sharing sensitive information about actual inventory level or demand forecast and without these neither of the specific logistics management programs can be operated. For this reason a very deep and close relationship is needed between partners.

The focal hypothesis is that *the higher is the importance of transaction-specific investments at companies the higher the spread of application of different demand chain management tools*. While testing the hypothesis several additional research questions were indicated as well just like (1) how common the use of transaction specific investments in Hungarian company practice, (2) demand chain management tools are real activity ties or not, (3) how much are Hungarian companies familiar with the different demand chain management practices?

The theoretical contribution of the paper is that it has been hardly investigated that the management tools which are used to coordinate the activity of supply chain partners are transaction-specific investments. Focusing on the distribution side of the supply chain an additional contribution is that demand chain management tools have been classified along what they are supporting: either information or materials flow, maybe the cost and performance assessment.

Regarding the managerial application, the most important that the transaction-specific investment occur mainly in partnerships which are stable, working for a long time and partners trust each other. In such embedded relationships cooperating firms are likely to invest in transaction specific resources. Verifying that demand chain management tools are kinds of transaction-specific investments firms may consider to apply or invest not only in one individual tool, but create a toolkit, involving solutions to help not only the improvement of communication or information flow but materials flow and cost and assessment system as well.

## LITERATURE REVIEW

### Transaction-specific investments

Transaction-specific investments are realized by cooperating partners while establishing and operating a given relationship. Relation-specific investments are dedicated to a specific partner, can be used in that single partnership and cannot be transformed to other ones without significant losses.

We can differentiate many types of transaction-specific investments. One type of differentiation can be given along the specific types of relationship ties, which trigger these investments. Ford et al. [2003] distinguish three types of such ties: social bonds, activity links and resource ties. The richer social interactions among partners (1), the more intensive activities (2) and the deeper the resource commitments (3) between partners are the more relation-specific investments are triggered.

The level of transaction-specific investments generated by the different bonds identified by Ford et al. [2003] is increasing while a relationship goes through its life cycle. The specific life cycle stages of a relationship – according to the stages theory [Batonda-Perry, 2003] – are as follows: searching, starting, and improvement, sustaining and finally breaking up. Going through the relationship life cycle activity links are becoming more intensive between partners and the same time the resource links and human bonds are strengthened as well. Ford [1980] analyzes the product and *process* adaptation through supplier-buyer relationships' development stages, and emphasizes their role in decreasing social, technological, time etc. distances.

Activity links refer to the integrity of inter-firm processes and the existence and continuous realization of common coordination of procedures concerning the material flow. The level of integration in flows (material and related information) taking place within dyadic partnerships may differ consequently the strength of these activity links is also varying.

### Tools for managing demand chain

The literature lists plenty of different supply chain techniques which aim to make the finished goods distribution more effective in supply chains. These are Quick Response in fashion (textile) industry [Al-Zubaidi & Tyler, 2003; Birtwistle et al., 2003; Fernie & Azuma, 2004], ECR in FMCG industry [Bhutta et al., 2002; Harris & Swatman, 1997] and CPFR in various industries [Skjoett-Larsen et al., 2003; Fliedner, 2003]. All of these supply chain techniques consist of several, sometimes overlapping management tools, such as in Table 1.

| Appearance of technique | Tools of technique | Industry |
|---|---|---|
| QR | Electronic Data Interchange (EDI) | Fashion industry |
| Mid-1980s: USA | Common planning and forecasting | |
| | Vendor Managed Inventory (VMI) | |
| ECR | Category Management | FMCG |
| End of 1980s: USA | EDI | |
| | Continuous Replenishment Program (CRP) | |
| | Cross-docking | |
| | Computer Aided Ordering (CAO) | |
| | Activity Based Costing (ABC) | |
| CPFR | Common planning and forecasting | Textile industry |
| 1990s: USA | CRP | Commodities |

Table 1: Distribution side supply chain management techniques in literature

Because of this overlap I am intended to analyse the presence of the individual tools in demand chains rather techniques as a whole. For this reason I exclude the tools which are too industry specific such as category management in FMCG. In my opinion all the others can be adopted irrespectively of industry. After collecting the relevant tools I have categorized them into three groups according to their role in harmonizing different kind of processes of demand chain. The categorization is based on Lee (2000), Varma et al. (2006) and Van Goor (2001), and indicates the group of materials management, information management and performance and cost assessment tools, as Table 2 shows.

| Demand chain management toolset | General demand chain management tools |
|---|---|
| Information management tools | EDI (ERP, and other web-applications), CAO, common planning and forecasting |
| Materials management tools | VMI, CRP, Cross-docking |
| Performance and cost assessment tools | ABC, supplier assessment |

Table 2: Demand chain management toolset categories

**Demand chain management tools**

*EDI* or any kind of standardized information sharing application is elementary for harmonizing the information access in supply chains. Therefore its adaptation does not depend on the product characteristics. *Supplier assessment* is a widely-used methodology to evaluate the performance and give feedback about the value creating activity of suppliers. It is frequently used in dyadic partnerships however its role is important on supply chain level as well, as a basic tool for coordination.

In efficient supply chains delivering functional products to the market all tools are necessary which helps to match the supply to well-predictable demand. *Computer-aided ordering* as a

specific information sharing tool which – in case of low level of inventory – is automatically places an order request to partners. The material flow generated by CAO is realized by *continuous replenishment program*, so according to the automatic order received the requested amount of inventory is supplied. *Cross-docking* is responsible for keeping logistics and inventory-related costs low by avoiding stock and making materials flow non-fragmented. When delivering a highly innovative and complex product to a volatile market companies are keen to know the probable demand. For this reason a c*ommon planning and an effective demand forecast* system in cooperation with supply chain partners can decrease the likelihood of high market mediation costs. *VMI* helps to manage and customize material flow and making the supply chain able to react quickly to changes in demand. *Activity-based costing* is a good analytical and performance assessment tool for discovering non-value adding tasks in a system which aims to achieve low physical costs, and define the cost associated with activities, products or partners and helps sharing risks and benefits among partners.

## THE SAMPLE

My analysis is based on a survey database containing information about 60 firms. The sample was collected through an on-line survey in 2007-2008 which was distributed among logistics and sales managers of Hungarian companies. The on-line questionnaire was delivered to almost 200 companies and 70 valuable responds has received. The research is a part of the Hungarian Competitiveness Research Program carried out at Corvinus University of Budapest.

### Characteristics of the sample

The sample was gathered between 2007 July-2008 January. The on-line questionnaire was delivered to almost 200 companies (sales or logistics managers) and 70 valuable responds has come back.

Respondent companies are coming from mainly manufacturing industries, food industry takes 25%, one eighth of sample are service firms, agriculture is only 3 percent.

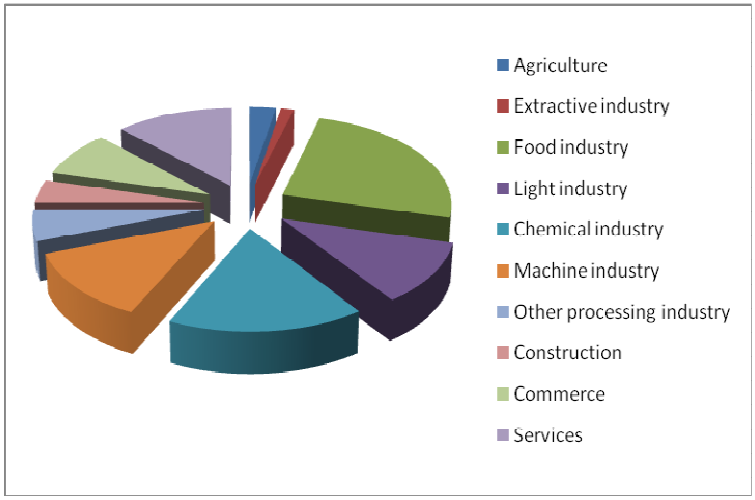


**Figure 1. Industry characteristics of sample**

Regarding the size of companies 54% is large company and the remaining are SME-s. That is very important from my point of view, because large companies are more likely to apply sophisticated management toolboxes and have power to coordinate their own supply chains.

Two third of the respondents are in international private ownership, 30% of firms have Hungarian private owners, and 3% of companies are in Hungarian state ownership.

### Analysis

The survey has explored what types of transaction-specific investments are applied by Hungarian companies. Four kinds of investments were differentiated in the questionnaire: dedicated human resource to a partner which captures social bonds, facilities and equipments representing resource ties, and common operations, procedures referring to activity links.

These latter investments will be the most important for me in the further analysis, because I suppose to regard demand chain management tools as activity links.
The overall spread of the transaction-specific investment types mentioned is to see in Table 3.

| *Transaction-specific investments* | *Spread (measured on 5-point Likert-scale, 1=not applied at all, 5=very much applied)* | |
|---|---|---|
| | | *standard deviation* |
| Transaction-specific investment: human resource | 3.32 | 1.019 |
| Transaction-specific investment: equipment | 3.04 | 1.183 |
| Transaction-specific investment: facility | 2.37 | 1.385 |
| Transaction-specific investment: operations, processes | 3.14 | 1.167 |

**Table 3. Spread of transaction-specific investments in Hungarian companies' practice**

As it seems in Table 3 that the level of application of different transaction-specific investments is not widespread or general in Hungarian dyadic partnerships, but the same time the standard deviation of the values are quite high. This raises the question what if there are companies which are operating very close relationship with intense use of different ties, and another group which is underdeveloped regarding the issue of relations-specific investments.
For testing this suspicion cluster analyses were carried out. Cluster analysis is an appropriate statistical method when the aim is to group the sample elements which are behaving similarly along several variables. In this case grouping variables were the different transaction-specific investment types, and aim is to differentiate companies which intensely invest in transaction-specific resources and which do not.

Two different methods were applied for classifying the sample companies along their transaction-specific investment practice. K-mean cluster analysis resulted two clusters, containing 29 ad 21 companies, Hierarchical cluster analysis using between-groups linkage and Euclidean distance added two clusters with 28 and 22 members from the sample. The results of the two cluster analyses were compared and the first cluster of the two methods contains 28, the second one 21 common companies. This high level of adequacy verify my suspicion that there is a group of companies in the sample behaving very similar to each other and very differently to an other group.
In case of the two clusters gained, the spread of transaction specific investments varies as followings in Table 4.

| *Transaction-specific investments* | *Spread (measured on 5-point Likert-scale, 1=not applied at all, 5=very much applied)* | |
|---|---|---|
| | *Cluster 1* | *Cluster 2* |
| Transaction-specific investment: human resource | 3.68 | 2.86 |
| Transaction-specific investment: equipment | 3.61 | 2.24 |
| Transaction-specific investment: facility | 3.29 | 1.10 |
| Transaction-specific investment: operations, processes | ***3.75*** | 2.29 |

**Table 4. Spread of transaction-specific investments in two clusters**

While testing the significance of different means in case of two clusters, a *t-probe* was applied which has verified a significant difference between two groups of companies.

The analysis carried out until now shows that in the sample containing data about Hungarian firms there is a group of companies investing significantly higher efforts into transaction-specific solutions than others. The Cluster 1 can be called as *companies with intense transaction-specific investments*, and Custer 2 as *companies with low transaction-specific investments*.

Regarding the characteristic of the two clusters, companies in Cluster 1 are in international ownership (71%) the remaining are in hands of Hungarian private owners. A large proportion of them is big company (57%) and mid-size firm (36%). Companies are mainly operating in food industry (25%), machine, chemical and light sector (18-18%). Companies with low transaction-specific investments are half part large companies and half part SME-s. Core industries they are operating in is food industry (28%) and all the others, structure is very fragmented. Almost half of them are in international ownership (57%), Hungarian private (38%) and state (5%) possession is present. So substantial difference between the two clusters cannot be found regarding the basic characteristics. Maybe there are some industries where the importance of transaction-specific investments is higher.

The following analyses are dealing with the spread of demand chain management tools.

According to the logic followed in first analysis I started with analysing the spread of demand chain management tool in the sample of 60 companies. Results say that the overall use of management tools is low but a high standard deviation is shown again in Table 5.

| *Demand chain management tools* | *Spread (measured on 5-point Likert-scale, 1=not applied at all, 5=very much applied)* | *standard deviation* |
|---|---|---|
| Electronic Data Interchange | 2.38 | 1.319 |
| Common planning and forecasting | 2.92 | 1.187 |
| Continuous Replenishment Program | 2.16 | 1.162 |
| Vendor-Managed Inventory | 2.04 | 1.133 |
| Computer-aided Ordering | 2.98 | 1.245 |
| Cross-docking | 2.07 | 1.041 |
| Supplier assessment | 3.67 | 1.248 |
| Activity-based costing | 2.37 | 1.244 |

**Table 5: Use of different demand chain management tools**

To discover the causes behind large standard deviation, cluster analyses were carried out. Two different methodologies were applied again, to get trustworthy classification. K-mean cluster analysis resulted two clusters with population of 29 and 24 companies. Hierarchical cluster analysis using within-groups linkage and squared Euclidean distance produced two clusters, containing 31 and 22 companies. The overlap of the different cluster analysis methods deliver 28 common companies in Cluster 1 and 22 in cluster 2.

After classifying the sample into two clusters, the level of application of demand chain management tools was tested again (Table 6).

| *Demand chain management tools* | *Spread (measured on 5-point Likert-scale, 1=not applied at all, 5=very much applied)* | |
|---|---|---|
| | *Cluster 1* | *Cluster 2* |
| Electronic Data Interchange | 3.21 | 1.50 |
| Common planning and forecasting | 3.36 | 2.32 |
| Continuous Replenishment Program | 2.61 | 1.55 |
| Vendor-Managed Inventory | 2.61 | 1.27 |
| Computer-aided Ordering | 3.61 | 1.95 |
| Cross-docking | 2.64 | 1.27 |
| Supplier assessment | 4.25 | 2.82 |
| Activity-based costing | 3.00 | 1.73 |

**Table 6. Use of demand chain management tools in clusters**

Except CAO and ABC, the difference of means in the comparison of two clusters is not significant. However I have got a cluster (No. 2.) applying demand chain management tools on a very low level, companies in Cluster 1 cannot be regarded as developed users of these management methods because the values are still at middling level.

Companies in Cluster 1 are dominantly large firms (71%) others are SMEs. 79% of them are international companies, remaining is in Hungarian private ownership. They are operating mainly in food (32%) and chemical (17%) industries, all the other cluster members are fragmented between other sectors. Companies in Cluster 2 are in 60% SMEs and 40% large firms. Half of the firms here are in international ownership, other half is in hands of Hungarian private owners (45%) and state (5%). Regarding the industries involved, the firms almost normally distribute between all possibilities given in the questionnaire, maybe the share of food and light industry is a little bit higher (18-18%). Along the basic characteristics no real difference can be found between two clusters.

## Cluster comparison

Continuing the analysis I compared the clusters resulted in first cluster analysis (along transaction-specific investments) to the clusters got in second analysis (along demand chain management tools). This way I have got a new Cluster 1 with intense use of transaction-specific investments and demand chain management tools (15 companies), and a new Cluster 2, which is engaged to neither transaction-specific investments nor demand chain management tools (13 companies).

Now I am intended to analyse the transaction-specific investments and demand chain management practices within these clusters and discover the correspondence between high level of activity ties and demand chain management tools.

First, level of transaction-specific investments is evaluated in case of two clusters created after cluster comparison. As Table 7 shows the level of different transaction-specific investments is quite different in case of the two clusters. The difference was analysed by a t-probe to be sure about significance. Student's t-probe says that means listed in Table 7 are significantly different ($p<0.05$).

| *Transaction-specific investments* | *Spread (measured on 5-point Likert-scale, 1=not applied at all, 5=very much applied)* | |
|---|---|---|
| | *New Cluster 1* | *New Cluster 2* |
| Transaction-specific investment: human resource | 3.93 | 3.00 |
| Transaction-specific investment: equipment | 3.73 | 2.08 |
| Transaction-specific investment: facility | 3.33 | 1.08 |
| Transaction-specific investment: operations, processes | ***3.73*** | 1.92 |

**Table 7. Comparing means of clusters in transaction-specific investments**

Going on with analysis, the demand chain management tools were examined, how the practice of the clusters differ. Results are shown in Table 8. Table suggest that the spread of different tools are almost double in cluster 1than cluster 2. Difference is significant in each case ($p<0.05$).

| *Demand chain management tools* | *Spread (measured on 5-point Likert-scale, 1=not applied at all, 5=very much applied)* | |
|---|---|---|
| | *New Cluster 1* | *New Cluster 2* |
| Electronic Data Interchange | 3.27 | 1.54 |
| Common planning and forecasting | 3.40 | 2.00 |
| Continuous Replenishment Program | 2.80 | 1.31 |
| Vendor-Managed Inventory | 2.73 | 1.08 |
| Computer-aided Ordering | 3.53 | 2.00 |
| Cross-docking | 2.67 | 1.15 |
| Supplier assessment | 4.33 | 2.77 |
| Activity-based costing | 2.80 | 1.46 |

**Table 8. Comparing means of clusters in demand chain management tools**

Tables tell that in cluster 1 where the level of transaction-specific investments is high the use of demand chain management tools is significantly more often than in cluster 2 which neglects relation-specific investments and specific management tools as well. This is a good way for verifying my original hypothesis and link activity ties and demand chain management tools.

| *Demand chain management tools* | *Transaction-specific investments: operations, processes as activity links* | *Significance level* |
|---|---|---|
| *Correlation* | | |
| Electronic Data Interchange | 0.513 | 0.01 |
| Common planning and forecasting | 0.544 | 0.01 |
| Continuous Replenishment Program | 0.528 | 0.01 |
| Vendor-Managed Inventory | 0.680 | 0.01 |
| Computer-aided Ordering | 0.459 | 0.05 |
| Cross-docking | 0.623 | 0.01 |
| Supplier assessment | 0.620 | 0.01 |
| Activity-based costing | 0.343 | not significant |

**Table 9. Correlation between demand chain management tools as transaction-specific investments**

Table 9 summarizes the final results of the study carried out in this paper. A middling or little bit stronger than medium but significant correlation was found between operations and processes as transaction-specific investments and different demand chain management tools. This finding opens up more questions than as many was answered. The size of the sample after several stages of cluster analyses and comparisons decreased to 28 which calls the attention to the limitations of results gained however interesting tendencies are highlighted and inspire researcher for further examinations.

## CONCLUSION

The aim of the paper was to test the hypothesis that demand chain management tools (Table 2) can be interpreted as activity links defined by Ford et al. [2003]. First I analyzed the spread of different kinds of transaction-specific investment in Hungarian company practice using a 60-firm survey database. Two groups of companies were differentiated, on with high level of such investments and on with low investments.

After that I analyzed the spread of demand chain management tools within Hungarian firms' management practice and two clusters were found, one which uses the tools on middling or high level, and one which uses a very poor toolkit.

After getting two-two clusters by using different variables the companies within clusters were compared, and I have found 15-13 common items. These firms are either investing a lot in transaction-specific assets and managing their demand chain very well (New Cluster 1) or both investment and demand chain management tools are at low level (New Cluster 2).

Then I was focusing on these firms consisting the two new clusters. Correlation was measured to find link between operations and processes as transaction-specific investments and the diverse types of demand chain management tools which is partly succeeded. In case of almost all tool a middling or little bit stronger and significant correspondence was found. This result says that companies, using these management tools are highly engaged to their partners and these are kinds of activity links between them.

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