

RETHINKING BUSINESS PROCESS MAINTENANCE RELATED TO CORPORATE CULTURE

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Abstract

Nowadays disciplines of maintenance management are widely applicable in other fields of science as well. This paper shows the possible uses of maintenance strategies in connection with inter-corporate cooperation by determining the relations between procurer and supplier. The objective of the paper is to support the CEOs in describing the business processes maintenance system and its attributes in the company. The research is based on a survey attended by the CEOs of more than 260 companies from different operational fields in Hungary. The basic theory of the research is that the inner operations of a company are driven by the principles of some sort of maintenance strategies or a combination of those. Based on this theory the research answers the question of whether these companies can be integrated into clusters and how they can conclude the expectation systems of the members of a certain cluster towards the suppliers. The paper also shows which corporate culture types are more or less resistant to different failure types of the business processes such as misuse fault, manufacturing fault, systematic fault, etc.

Key words: *business process maintenance, maintenance strategy, failure type, corporate culture.*

Introduction

Note that due to the strengthening economic competition, the reliable corporation operations are more and more important. For example in the automobile industry a few hours of breakdown could cost a fortune. According to Handy (2003) it is becoming a trend that large and medium-sized enterprises – so called “elephants” – are served by small companies – “fleas” – formed into a supply chain. The question is what kind of behavior the “elephants” should choose if they wish to organize their own processes and supply chain – that consists of the “ants” – in a reliable way.

The Maintenance Related Aspects of the Research

Through the research it is crucial to define reliability. The definition of reliability is still developing. The appearance of newer and newer technologies is leading scholars to rethink and redefine reliability. In the beginning reliability was “working without flaws”, but this explanation went through some major transformations since that time (Mobley & Higgins & Wickoff, 2008).

According to Kovács (2001) maintenance is the supporter of business processes. Thus one possible definition: maintenance is the sum of activities connected to a corporations’ physical wealth that allows the successful completion of business processes. It is practical to add the moral wealth to Kovács’s definition as well, since moral values (such as “good-will”) contribute to the success of business processes as well.

Maintenance-organization from a reliability theory approach must be based on the consideration of risks (technological, economical and human). Thus maintenance strategy belongs to the category of a leaders’ decision.

The idea of maintenance strategy should be defined on a decision-theory basis (Gaál & Kovács, 2002). According to Gaál and Kovács (2002) maintenance strategy is the chain of decisions made in order to reach a given goal. Based on this there are four possible strategies:

- Breakdown maintenance (BM) (The starting point of the decision chain is breakdown.)
- Time-based maintenance (TBM) (The basis of the decision chain is a prescheduled repair strategy that can be developed in solid or flexible system as well.)
- Condition-based maintenance (CBM) (The basis of the decision chain is observation, measurement evaluation and a comparison of these with the desired state.)
- Total productive maintenance (TPM) (This strategy recognizes the importance of reliability, maintenance and the economic efficiency of plant design. In order to avoid breakdown teamwork, involvement and authorization of employees, and continuous perfecting is used. Maintenance is defined as an activity that must be done by everyone.)

Breakdown maintenance waits for breakdown to occur while the other three are preventive maintenance strategies (Lewitt, 2003). Breakdown maintenance is the least developed strategy and total productive maintenance is the most developed one.

In case of a corporation these four strategies can be used in parallel, since there are machines and processes that require only breakdown maintenance, while others work better with one of the preventive strategies. Therefore a selective strategy can be developed. The applicable strategy depends on the risk taken in case of a breakdown.

The definition of reliability, maintenance and possible fault types that can occur in a system are defined in the IEC 50(191):1990 standard. According to this standard, reliability is a collective concept, which is used to describe usability and its influential factors such as flawlessness, maintainability and maintenance support performance. These definitions can also be interpreted during maintaining the whole business process maintenance system as well.

The Corporate Culture Related Aspects of the Research

Since the '80s organizational scholars have been paying serious attention to the concept of organizational culture. Although scholars usually document, describe and model the achievements of practical work done by managers, culture has been an area in which conceptual work and scholarship have provided guidance for managers to improve effectiveness (Cameron & Quinn, 2006).

When considering culture there are many kinds of levels. The broadest one is a global level, which is about cultural differences between world religions, or the Far East and the Western World. Narrowing down the scale, the level of organizations, and its sublevels such as departments, groups, teams appear. It is important to keep in mind that all of the sublevels of a company also contain the core elements of the entire organization's culture in addition to their unique elements (Alpert & Whetten, 1985).

Cameron and Quinn (2006) developed a method to diagnose and change organizational culture. The diagnostic part of this method begins with answering six questions. Each question consists of four statements. One is asked to rate the current situation of their organization by distributing 100 points between the four statements according to their typicality. The six questions are about the following topics: dominant characteristics, organizational leadership, management of employees, organizational glue, strategic emphases, criteria of success. The method of Cameron and Quinn is one of the most widely cited, it is applied to many researches because it is easily accessible and linkable to other kinds of research (Berthon & Pitt & Ewing, 2003; Chin-Loy & Mujtaba, 2007; Wells & Thelen & Ruark, 2007; Teo & Ahmad & Rodwell,

2003).

Campbell, Brownas, Peterson and Dunnette (1974) created a list of thirty-nine indicators that describe the culture in any organization. In the work of Cameron and Quinn (2006) these thirty nine indicators are narrowed down by indentifying two dimensions. As Figure 1 shows, together these two dimensions form four quadrants, each representing a distinct set of organizational effectiveness indicators. The dimensions are the following: flexibility and discretion versus stability and control, and internal focus and integration versus external focus and differentiation.

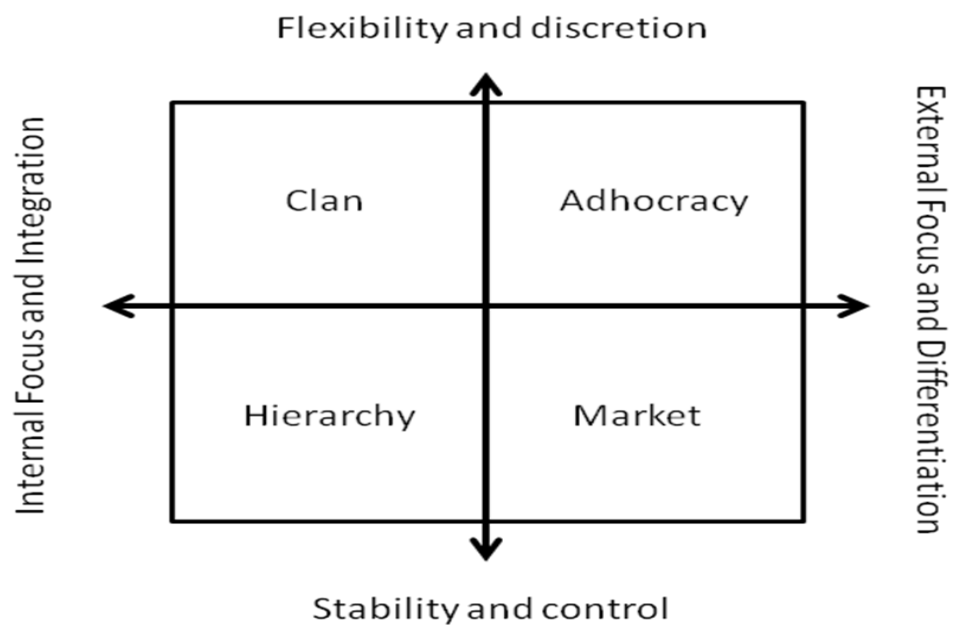


Figure 1: The competing values framework (Cameron & Quinn, 2006).

Each quadrant was given a name that distinguishes its most notable characteristics: Clan, Adhocracy, Hierarchy and Market.

The orientation of an organization with clan culture is collaborative. The leaders belong to the facilitator, mentor or team builder type. The organization values are commitment, communication and human development, while the basic theory for success is that human development and participation produces effectiveness.

Organizations with adhocracy culture tend to orientate to creative solutions. The leader exemplifies innovation, entrepreneurship and encourages visionary behavior. Values are innovative outputs, transformation and agility. According to this culture type the best way to increase effectiveness is through innovativeness, vision and new resources.

The basic concept of hierarchical organizations is controlling. The leaders' main roles are coordinating, monitoring and organizing. Main values are efficiency, timeliness, consistency and uniformity. Hierarchical organizations believe that control and efficiency with capable processes produce effectiveness.

The market culture type believes in competition. Managers belong to the hard driver, competitor and producer type. These organization values are market share, global achievements and profitability. In this context aggressive competition and customer focus produces effectiveness.

Research Focus

The research focuses on the description and characterization of company business process maintenance through maintenance strategies, without neglecting the intricate web of corporate culture relations that pervades the whole organization. According to reliability theory, the reliable operation of an organization's on business processes depends on whether supplier business processes operate in a reliable way or not. For instance, if a supplier does not send the ordered carriage to the procurer on time, it can cause disorders in the procurer's business processes.

Based on the above, one of the basic questions of the research is whether a connection between the maintenance strategy of business processes applied by the procurer and by the supplier exists or not. A related question: if the connection exists, what is its nature and strength? Knowing an organization's business process maintenance strategy, it is worth observing whether conclusions can be drawn about the supplier's maintenance strategy. Considering that the corporate culture is different with the given companies, it is an interesting question whether various corporate culture types can be ordered in a hierarchy according to the extent of their resistance to fault types occurring in the given business processes.

Methodology of Research*General Background and Sample of Research*

The research started in 2008 and was built on a quantitative survey. For data collection questionnaires were addressed to the CEOs of more than 2700 companies in Hungary from different operational fields. More than 260 CEOs filled in the questionnaire. The data collection was carried out between 2009 and 2010.

In the selection of target audience the most important criterion was that CEO should have had an at least one-year work experience at the current organization because this period is sufficient for identifying well the dominant company peculiarities. Considering the research focus, CEOs were the most relevant people in the company to answer the questionnaire because only they had the right perspective to see through the entire business process system and corporate culture as well.

For measuring the internal consistency of the relevant variable groups of the questionnaire Cronbach-alpha is an appropriate instrument. For each relevant variable group the Cronbach-alpha has higher than 0.7 value.

For later analyses, it is important to show how the different culture types share the research sample. Table 1 shows the distribution of the examined corporations by culture type identified by the CEOs.

Table 1. Distribution of companies by culture types.

Culture type	Number of cases
Hierarchy	81
Market	81
Clan	76
Adhocracy	8

The adhocracy culture type is absolutely underrepresented in this sample, therefore this culture type should be excluded from further examinations. In 16 cases there were no data.

Instrument, Procedures and Data Analysis

According to the definition of maintenance and maintenance strategies discussed previously, if the maintenance method of a corporations' business processes are definable and the method goes according to one or a combination of the maintenance strategies, then the maintenance strategy profile of a corporations' business processes can be given.

The research assumes that the dominant party in inter-corporation relationships is the procurer, and so the procurer has influence over the strategy of suppliers. The research also assumes that a developed maintenance strategy cuts out the less developed maintenance strategy.

From a CEO's perspective the general question is how typical each of the previously discussed four maintenance strategy type is in the organization. Using this theory in the research model, the maintenance type of the inner operational processes of a corporation and the business processes of the suppliers can be interpreted on a high level measurement scale. If the current maintenance strategy is absolutely not typical, CEO should mark point 1, if the maintenance strategy is absolutely typical, point 7 should be marked.

In order to answer the question, whether a connection between the maintenance strategy of business processes used by the procurer and by the supplier exists or not, the relevant method is path analysis, since the simple regression analysis is unavailable due to the obvious correlation between the independent and dependent variables. For example, if the most developed maintenance strategy type is absolutely typical, the less developed maintenance strategy type cannot be absolutely typical but should be absolutely not typical; otherwise why did the organization make efforts to develop a better system?

When starting the path analysis there are no expectations, all the elements are related to one another on and through the dependent and independent side. The number of relations can be reduced by identifying those variables which correlate to each other at a certain significant level. Based on these correlations path analysis can be executed.

When analyzing the relations between variables only those correlations stayed in the model, which were significant at the 0.01 level. This strict decision was brought about because the research focuses only on the most relevant relations between the variables revealing the "core relations". Through the path analysis only those relations stayed in the model whose explaining ability was significant at the 0.05 level.

It is another important point that it is possible to group the organizations depending on what kind of maintenance strategy combination is used to maintain the organizational business processes. If the different clusters exist it would be beneficial to ask whether the fact that the procurer belongs to a certain cluster predicts which supplier clusters' member the procurer will choose or not.

For grouping the organizations by the applied maintenance strategy cluster analysis seems practical. As soon as clusters are identified – which means the measurement of the companies are transformed to a nominal scale – with correspondence analysis the uncertainty can be decreased in the classification of maintenance strategy of the supplier, with reference to the maintenance strategy of the procurer.

To analyze the possible clusters on the side of procurer and supplier, hierarchical cluster analysis was used. The strength of the correlations was assigned to be the distance function. Euclidean distance could not be used because the variables correlated.

Applying the competing values framework previously discussed, the corporate culture type can be identified and described. After that it can be examined whether there is a connec-

tion between the assigned culture type (as an independent variable measured on nominal scale) and the possible failure types (defined by IEC 50(191):1990) of the procurers' and suppliers' business processes (such as misuse failure, manufacturing failure, critical failure, etc.) and the failure type's nature. For the analysis of failure reasons, CEOs were required to rate on a scale, to what extent the failure of a business process can be originated from certain failure types. The bigger the number, the stronger the relevance of the failure type (1 if origination is not relevant, 7 if the origination is absolutely relevant). Answering the question variance analysis is the practical method.

Results of Research

Figure 2 shows the result of path analysis. The grey numbers on or next to the arrows indicate the value of the beta parameter of connections and the black numbers indicate the strength of correlations. One asterisk next to the number indicates that the value is significant at the 0.05 level, two asterisks indicate that the value is significant at the 0.01 level.

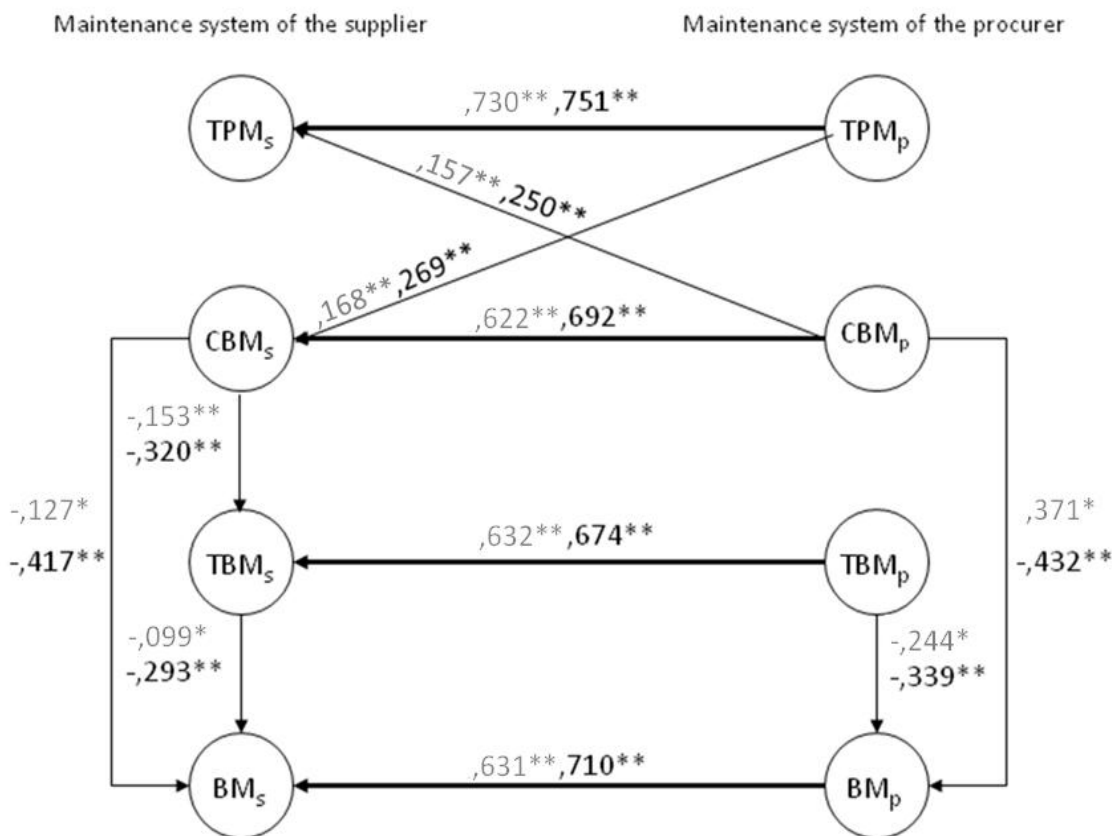


Figure 2: Result of path analysis.

All the prerequisites of each linear regression in the path model are realized. The explaining ability (R^2 or adjusted R^2 , depending on the numbers of independent variables) of each linear regression is high, the smallest value of the explaining ability is 0.470 and significant at 0.01 level, the highest is above 0.7 and also significant at 0.01 level.

As it is visible in Figure 2, the connections between the elements of the maintenance

strategy system of the procurer and supplier are much stronger and much more effective than connections between elements in the own maintenance strategy system of the procurer and supplier.

After grouping the corporations into clusters depending on their dominant maintenance strategy, the properties of the two theoretical maintenance strategies can be examined during cluster-interpretation. The first cluster includes companies that primarily use breakdown maintenance (BM) therefore the other three strategies are not typical. The other clusters' members use mainly preventive strategies (Time-based maintenance - TBM, Condition-based maintenance - CBM, and Total productive maintenance - TPM) where the occurrence of breakdown maintenance is low.

The results of the cluster analysis concerning the operation of maintenance on the procurers' side are discussed below.

Table 2. Final cluster centres on procurers' side.

Final cluster centres on procurers' side		
Cluster number	1.	2.
BM	6	2
TBM	3	5
CBM	3	5
TPM	3	4
Number of cases	148	109

It can easily be read in Table 2 that the two theoretical categories (breakdown maintenance and preventive maintenance) are clearly separated.

Table 3 shows the cluster centres concerning the maintenance of the supplier sides' operations, where the two theoretical categories are distinct as well.

Table 3. Final cluster centres on suppliers' side.

Final cluster centres on suppliers' side		
Cluster number	1.	2.
BM	6	3
TBM	3	5
CBM	3	5
TPM	3	4
Number of cases	132	122

Knowing that the corporations can be categorized into one of the previously mentioned two clusters, it is advisable to ask whether the fact that the procurer belongs to a certain cluster predicts which supplier clusters' member the procurer will choose or not.

Belonging to a cluster is a measurable phenomenon on a nominal scale, thus it was practical to use correspondence analysis to get the answer.

After finishing the correspondence analysis, the following indicators turned up as results:

- PRE indicator: the value of this indicator is 0.59 which means that knowing an or-

ganizations’ operational processes of its maintenance strategy significantly decreases the uncertainty in the classification of maintenance strategy operational processes of suppliers.

- Cramer indicator: the value of this indicator is 0.66 which means that there is a close connection between the maintenance strategy of organizational operations and the maintenance strategy of supplier operations.

- In 83% of all cases we get the same (breakdown maintenance - breakdown maintenance; preventive maintenance– preventive maintenance) cluster pairs.

Based on these indicators it can be stated that the cluster membership of the procurer predicts that the supplier will be the member of the same type of cluster.

After using variance analysis, the extent of how failure types represent failures of business processes in each culture type was identified.

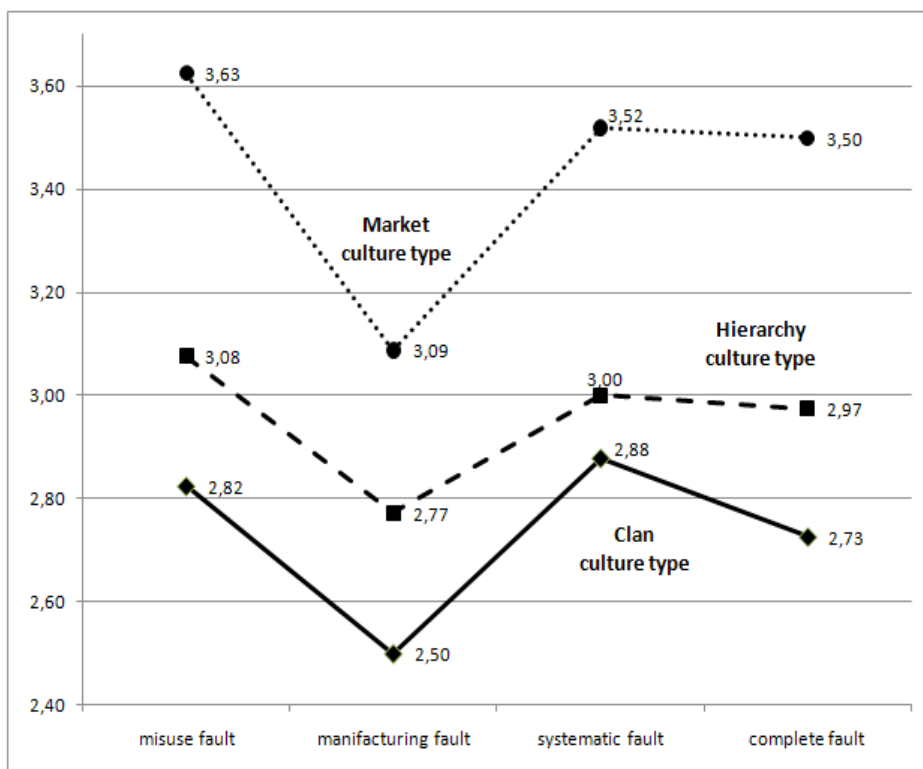


Figure 3: Result of variance analysis.

A connection between the culture type and the reason of failure was revealed at the 0.05 significance level in four cases. The reasons in these cases are the following: misuse fault, manufacturing fault, systematic fault, complete fault, as it is visible in Figure 3.

Discussion

It can be determined that during the organizational cooperation the maintenance strategy of business processes at the supplier becomes similar to that of the procurers because - as it can be seen in Figure 2 - the connections between the maintenance strategy system elements of the procurer and supplier are much more stronger and have much greater explaining ability than

connections between elements have in the maintenance strategy system of the supplier.

As the result of the cluster analysis, two theoretical maintenance strategy categories (breakdown maintenance and preventive maintenance) appear on both the procurer and supplier sides. Thus a corporation can be categorized clearly into a cluster regardless of whether it is a procurer, a supplier or both at the same time – as it is usual in reality. The results also show that the cluster membership of the procurer predicts that the supplier will be the member of the same type of cluster.

The cultural consequent is an obvious trend which shows that corporations following the clan culture are less affected by failures caused by the four reasons above. The hierarchy culture is less immune than the clan culture but not as sensitive as the market culture.

Conclusions

It can be concluded that considering maintenance strategies can help in the identification of the nature of inter-corporate relationships between procurer and supplier. The maintenance strategy of the procurers' business processes is an important factor in the maintenance strategy of the suppliers' business processes. If a procurer belongs to a certain cluster (breakdown or preventive maintenance), there is a great chance that the procurer will choose the suppliers who maintain their business processes the same way. The message of this paper is that if a company would like to become or remain a supplier for another company, it is highly recommended to know the expectations of the procurer towards itself and its suppliers.

There is a demonstrable connection between the culture type of a corporation and the reasons of failures in business processes. The clan culture type is the least and the market culture type is the most sensitive to the mentioned failure types (misuse fault, manufacturing fault, systematic fault, complete fault). In the organizations, in which these kinds of faults often appear, the CEOs should think twice to change the organizational culture into the clan culture type.

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