

THE CONNECTIONS BETWEEN FIRMS' ORGANISATION QUALITY AND THEIR BUSINESS RESULTS

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Abstract

With classic statistical approaches and novel machine learning methods, we attempt to improve insight into the connections between the quality of an organisation of firms as a type of formal social unit and the business results of firms. The research used a data set with 72 extensive and very difficult-to-obtain assessments of the quality of an organisation (recorded only once 2007) and their business results, traced in four successive business years (2006–2009). We hypothesize that a causal relationship exists between the latter and the former. Only the final conclusions will be presented, together with some excerpts of the most interesting findings in the selected years of observation. A novel general explanation method from the computer science field of machine learning and data mining can be used to explain the influence of individual relevant organisational elements on the business results. Our findings confirm that traditional statistics and machine-learning approaches are successful at modelling this dependency relationship. Furthermore, the explanation of the influence of the organisational elements on the predicted business results provides insights that have meaningful scientific interpretations and proves the important meaning of good organisation for its firm.

Keywords: organisation; organisational relationship; quality of organisation; business results

1. INTRODUCTION

The work presented here strongly supports the idea of an important distinction between the concept of the formal social unit (FSU, e.g. firm) and its organisation (Mihelčič, 2012: 27–28). The commonly used phrase “a group of people” implies “a social unit”, which has formal and informal relationships between its members as key constituent elements of its organisation. The important distinction between the firm and its organisation logically leads to the key question what the real meaning of organisation for its firm is. The connections between organisational effects and business results are not sufficiently covered in the literature. It is mostly because there is no clear theoretical and/or practical borderline between the concept of the social unit on one side and the

concept of organisation on the other side. The concepts of the formal unit (firm) and its organisation are used interchangeably; consequently, there is a missing opportunity to clearly distinguish which (mostly intangible and hidden) organisational and (more tangible) business mechanisms can help to achieve better final results. Of course, there is a great deal of discussion about the importance of the quality of organisation for better business results; however, clear practical evidence is still missing. To further investigate this (non-trivial) question, we need sound theory (Rozman, 2012: 3), which we found on Lipovec's developed theory on organisation (Lipovec, 1987) and its further development by Rozman (1999) and Mihelčič (2008). We employ traditional statistical and novel data mining techniques to obtain additional and meaningful insight into the connections between the quality of an organisation

of firms and their business performance that can be seen as a continuation of research projects conducted by Mihelčič (1992b). Our starting point is Lipovec's definition of an organisation as a set of relationships among members of a formal social unit that are characteristics of the social unit and that ensure its existence, development, and rational achievement of the firm's goals (Lipovec, 1974, 1987). Lipovec is not alone in his view of organisation as a structure of relationships; for example, Morabito and co-authors also understand the organisation as a structure of relationships (Morabito, Sack & Bhate 1999). According to relationships' grounded Lipovec definition, there are organisational relationships at the core of an organisation: therefore, it is logically concluded that the very same relationships mostly determine the quality of the organisation. Different authors in different times repeatedly proved the importance of relationships. For example, Camén, Gottfridsson and Rundth in their study about contracts as cornerstones in external relationship building asserted that "contracts affect relationship building" (Camén et al, 2012). Some other authors, such as Blois, Liljander and Strandvik, are convinced that business relationships exists if there is a repeated business transaction and contract between the parties (Camén et al., 2012).

As the analysis of Mihelčič (1992b) argues, the most relevant goal-oriented relationships can be divided into five basic types (see also Mihelčič, 2012: 41):

- technical relationship: the determination of jobs and their logical connection in generating products and services;
- personnel relationship: the alignment of professional knowledge, personal traits and values of employees;
- coordinative relationship: the assignment of duty, responsibility and authority from the superiors and determination of the method, scope and strength of authorisation of subordinate employees;
- communicational relationship: the determination of contents, form of messages and channels of communication as links between numerous task holders;
- motivational relationship: the alignment of the range and meaning of motivational tools in the perspective of the mission and goals of the firm.

These relationships and their implementation should be evaluated, either directly through different aspects of the relationships' conditioned organisational life or indirectly through organisational contextual factors. Whichever approach is used, particular interdependent indicators as measures of quality of organisation can be derived. When such indicators of firms' organisation quality are determined, their connections with the firms' business results can be explored.

In this study (from 2006 to 2009), we explore the connections between the quality of organisation and business results on a sample of 72 assessments. The resulting data are suitable for intelligent data analysis, using traditional statistical and machine-learning methods, which we used to evaluate the extent to which business results can be predicted from indicators of quality of organisation. Although our findings reveal that the indicators of organisation quality have predictive power, the best performing model for a particular indicator of business performance is often complex and difficult to interpret. Therefore, we take advantage of a novel general explanation method (Štrumbelj & Kononenko, 2010).

2. ORGANISATIONAL OUTCOMES AND THEIR METRICS

A well-founded and sound theory on a particular subject must be able to predict the effects of its recommendations on the future state of its subject (Rozman, 2012: 3). An organisational theory approach is acceptable in practice if the use of its theoretical recommendations supports higher quality in relationships and, through increased internal efficiency, leads to better business performance of the firm as a type of formal social unit (Mihelčič, 2007). However, the rudimentary use of indicators of business performance in organisation theory, such as profitability, productivity, etc., is problematic. To establish organisation theory as an autonomous scientific field or some kind of "organisatiology", as Rozman proposed (2012: 3),

scholars must develop a new congruous system of measures and/or indicators. What then should we measure or assess in the theory of organisation (Pregeljc, 2004)? According to Lipovec's understanding of the concept of organisation, the most logical answer is the quality state of relationships.

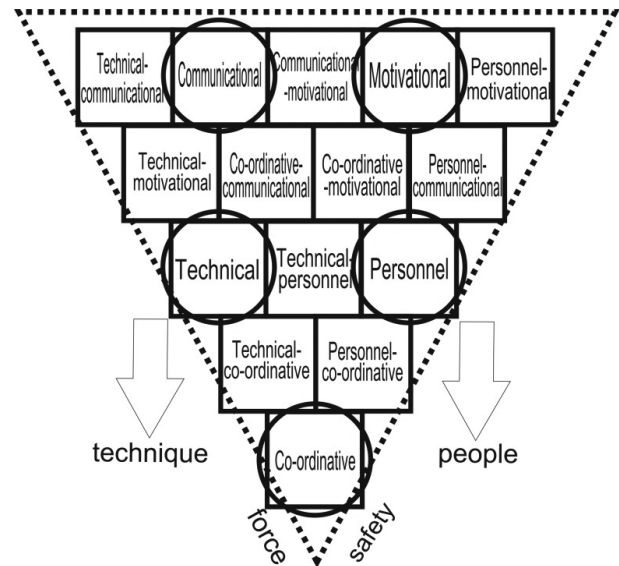
The next very important question is whether it is possible and/or necessary to distinguish between the financial or business results of an FSU and the outcomes of organising: the quality of the organisation? Lipovec (1987: 301–307) argues that “the universal result of organising is the organised formal social unit” and/or, that “the organisation is that which keeps the formal social unit together”. Consequently, he states that the results of organising are the satisfying of people's needs, productivity, compactness, cohesion or the integration of personnel into a formal social unit, the organisational climate and social power of the organised formal social unit or the ability of co-ordination. Some other possible results of organising include adaptability, organisational capital, lower transaction costs, congruency (Stimson, 1996: 105), redundancy of organisational processes, robustness, and results in the climate (McAuley, Duberley & Johnson, 2007: 93).

Measurement of the quality of relationships is a very challenging task. Traditionally, relationships are defined as a sequence of interactions between two people that involve some degree of mutuality, in that the behaviour of one participant takes some account of the behaviour of the other (Hinde, 1979; Dutton & Ragins, 2007: 9). Relationships are dynamic and fluid; interactions in the present are affected by past interactions and may themselves influence future interactions. Relationships do not reside in the individual but are recurring inter-connections that exist within the oscillating rhythm of interactions between two people (Berscheid, 1999; Dutton & Ragins, 2007: 9).

Observing the roles of members in a firm can lead to five fundamental relationships, defined as technical, personnel, coordinative, communicational and motivational, as already mentioned, which can be arranged in pairs of 15 relationships, as a cluster, a honeycomb or a wedge, or an inverted pyramid, as shown on Figure 1 (Mihelčič, 2008). The

form of triangle suggests both a suitable balanced (technical) striking force on one side and (people) safety on the other side.

Figure 1: Organisation as a structure of relationships



Source: Mihelčič, 2008

An original method of assessing the quality of organisation of a firm was developed, known as MUKOZ (Mihelčič et al, 1987, 1989), which stands for the methodology (*Metodologija* in Slovenian) of assessing (*Ugotavljanja* in Slovenian) quality (*Kakovosti* in Slovenian) of the organisation (*Organizacije* in Slovenian) of the formal social unit (*Združbe* in Slovenian). Within this method, through many years of research, an extensive list of aspects of relationships was developed as distinct expressions of organisational events, acts, and consequences of activities. For practical reasons, the list was narrowed down to the 10 most significant organisational aspects of each of 15 organisational relationships, i.e. to a total of 150 organisational aspects. For each organisational aspect, a scale of corresponding descriptions of six quality states or levels of these aspects from 0 to 5 was prepared, like later in an EFQM model from European Foundation for Quality Management. Level 0 denotes the worst state, where it is impossible to speak of the quality of the observed organisational aspect at all, while level 5 is the difficult-to-attain ideal state of the organisational aspect. An average mark from all of its “organisational relationship”

aspects reflects the full spectrum of organisation quality (Dutton & Ragins, 2007: 3).

Another way to calculate the grade of the quality of the organisational relationship is by estimating the quality of the contextual factors, which occur in relationship's aspects with different degrees of importance. The contextual factors of organisational relationships are particular elements or factors appearing within different organisational settings, which influence and define the type of organisational relationship in this particular classification of relationships. Thus far, the list of contextual factors in the aforementioned MUKOZ method contains 49 such factors (see Table 1). In research projects implemented thus far, it turned out (Pregeljč 2002, 2011) that the evaluation of the quality of organisation as structure of relationships, either through organisational aspects or through contextual factors, yield approximately the same final assessment of the quality of organisational relationships (deviations are in the range ± 0.01 in the absolute range from minimum 0 to maximum 5 and with the standard deviation of 0.4).

identification, the *organisational consistency* indicator and the *informational supply* or *information provision* indicator. The calculation of these is presented next, adopted from Mihelčič et al. 1988, 1989 and Mihelčič 2008.

2.1 The "organisation's value or worth" indicator

The calculation of an *organisation's value* (v) is based on the sum of the marks for the all fifteen relationships, using the following equation:

$$(1) \quad v = \left[\sqrt[4]{\left(\frac{n}{75}\right)^5} \right] \cdot 100,$$

where v stands for the "organisation's value" indicator (or worth) and n stands for the sum of the marks for all fifteen relationships. The maximum value possible is 100. Eq. (1) has the following background:

- Division by 75 normalizes the maximum value of 75 (in the case of an ideal organisation) to 100 as a generally accepted value of perfection.

Table 1. List of contextual factors of relationships

Contextual factors of relationships						
achievements (individual)	communication channels	customer	group work	managers	problems	tasks assignments
achievements (of group)	employees	databases	groups	means of production	receivers of messages	technology
authority	firm's goals	distribution and assembly of work	incentives	members' variety of skills (competence fields)	results	training
business process	control	disturbance (in the firm)	innovations	messages	sanctions	values
business process elements	co-operator	disturbance (in the environment)	interests	organizational levels	senders of messages	work stations
business results	creativity	environment	jobs	organisational rules	span of control	working conditions
changes in the environment	criteria	equality of employees	knowledge of staff	organisational units	tasks	working time

Source: Pregeljč, 2002

Assessing the quality of organisational relationships through organisational aspects or through contextual factors yields the six indicators of the quality of the organisation: the organisation's *value or worth* indicator, the organisation's *reliability* indicator, the organisation's *orientation* indicator, the *organisational commitment* indicator or *level of*

- The mathematical reason for the fifth power and the fourth root is the ratio of 100/75 (abbreviated to the 4/3) and then adding 1 in the numerator as well as in the denominator (a well-known approach from estimators in statistics).
- A power function deliberately emphasizes that in the beginning (from 0 onwards), the value

increases at a slower rate (compared to simple linear dependence), then faster (when closer to the ideal sum of 75). This is similar as resonance in physics, i.e. the organisation is gaining its acceleration (and hence value) when increasing amounts of its components are close to their optimal maximum. For more information see (Mihelčič, 2008).

The ideal organisation would have all fifteen relationship assessed with the mark 5 (or, to be precise, all organisational aspects of given relationship would reach the highest 5th level of excellence), therefore, 15 relationships multiplied by 5 yields 75, inserting this value as n in the Eq. 1 results in maximum value for indicator organisation's value $v=100$. To be more realistic, the firm whose organisation attains average relationships' marks of excellence of 2.5 would gather a total sum of all marks of $n=37.5$ and thus achieve its indicator organisation's value of $v=42,05$ (because we do not have a linear function, but an exponent one).

We may look at indicator organisation's value as an overall pointer, which try to capture all organisational problems in one single number, which is comparable in organisational health to the body's temperature as an overall indicator of human health. It is a quite daring attempt to express complex organisational phenomenon with just one numerical value on a scale from 0 to 100, but without regard to (more or less) grounded doubts about oversimplifications it has its strong own meaning. It allows comparing the values of this integral indicator between different firm's organisation or within the same firm's organisation in different points in time.

2.2 The "organisation's reliability" indicator

The calculation of organisation's reliability is based on the calculation of the standard deviation of the marks for individual relationships from the highest possible value ($M=5$):

$$(2) \quad or = \left[5 - \sqrt{\frac{1}{N} \cdot \sum (x - M)^2} \right] \cdot 20 .$$

In this calculation, N denotes the number of data ($N=15$ relationships).

The research shows that this indicator should be normalized for better comparison with other indicators. This normalizing patch is done with the following formula (Pekić, 1998):

$$(3) \quad or_{c(omparable)} = \sqrt[4]{\left(\frac{or}{100}\right)^5} \cdot 4 .$$

The ideal organisation, assessed with all the highest marks (5) of organisational excellence, would therefore obtain the value for indicator organisation's reliability $or=100$. An organisation with average relationships' marks of 2.5 would achieve the value for indicator organisation's reliability $or=50$, i.e. one half less than ideal organisation.

However, there exists another way to calculate an indicator of an *organisation's reliability*, which considers different basic types of relationships to a greater extent. It means that all grades for technical, communicational, co-ordinative, motivational and personnel relationships' must be totalled and then the deviation from maximum sum (25, because there are five relationships in each basic relationship types; all of these five could potentially reach the mark of 5 for their organisational excellence) should be calculated. This deviation is then again raised to the second power, and such squared grouping deviations should be totalled, divided with the number of data (5 because of five basic types of relationship) and finally included in Eq. 2. The reader can easily mathematically check whether the ideal organisation again reach the maximum value of indicator organisation's reliability $or=100$ and the "average" organisation value $or=50$.

What does the value of the indicator *organisation's reliability* tell us about the given organisation under consideration? To answer this question, let us assume two firms with their respective (more-or-less excellent) organisation both reach the same value of indicator organisation's value. Let us the say one of them has marks of relationships more equally distributed, while the other's marks of relationships oscillate: some are quite high and others quite low. In which one of these two firms would you prefer to be employed? Presupposing a natural wish for some kind of stability and safety, most people would choose the less deviant type of organisation, and these

deviations are exactly what the value of the *organisation's reliability* indicator expresses. In this sense, it in some way resumes Kaplan's methodology of balanced indicators (Kaplan & Norton, 1992).

2.3 The "organisation's orientation" indicator

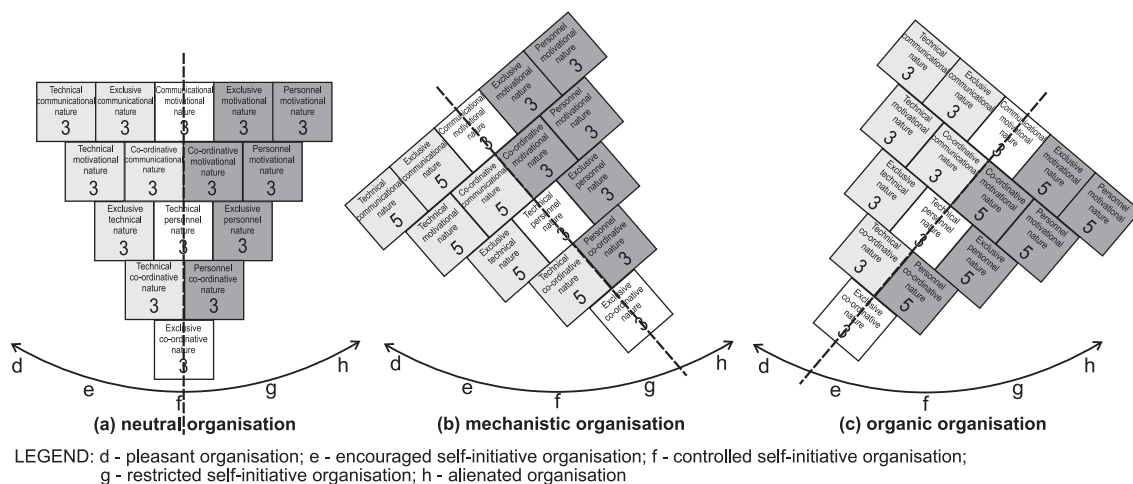
The calculation of the *organisation's orientation* indicator O is based on adding together all the marks of relationships, explicitly located on the left side of the cluster (emphasis on the technique and communication), and summing up all marks of relationships, explicitly located on the right side of the cluster (emphasis on employees and their motivation). Finally, both totals are included in the following formula:

$$(4) \quad O = 90 + \frac{(n_l - n_r) \cdot 180}{60},$$

where n_l denotes the sum of the marks of relationships from the left side of the cluster and n_r denotes the sum of the marks of relationships from the right side of the cluster. The range of possible values is between 45° and 135° , indicating possible range from pleasant organisation (d) through encouraged (e), controlled (f) and restricted self-initiative organisation (g) to the alienated organisation (h; see also Figure 2).

This indicator is concerned with different organisational emphasis on the technique or on the people. When discussing indicators thus far, we always look at ideal organisation with the highest relationships' marks and an average one with average marks of relationships. However, this indicator is somehow different. We cannot prescribe which organisational orientation is the best for the given formal social unit, because it depends on its environmental and strategic circumstances. Nevertheless, we could attempt to say that ideal organisation with highest relationship marks attains the indicator organisation's orientation-neutral value of 90° , described as controlled self-initiative organisation, because when balancing both sides of cluster ($n_l = n_r$), the same finding is valid for situations, where the relationships' marks are equal, as is visually depicted in Figure 2, case (a). A more interesting point is what happens if management deliberately focuses its attention on the relationships' improvement from the left or right side of the cluster, i.e. on the technique side or the people side. Both situations are presented in Figure 2, cases (b) and (c); hence, it follows that turning attention to relationships on the left side (technique) results in bending the cluster to the right of the neutral point and thus indicating a more mechanistic type of organisation, whereas drawing organisational attention to the right side of the cluster (people) turns the cluster to the left of the neutral point, thus a more organic type of organisation.

Figure 2: Different emphasizes on technique or people and their impact on organisation's orientation indicator



Source: Pregelj, 2004

2.4 The "organisational commitment" indicator or "level of identification"

To obtain the value of the *organisational commitment* indicator, all five marks for motivational relationships (exclusive motivational and combined with other four relationships) are added together, and this sum is patched (multiplied) with a normalization factor (3 because the total number of 15 relationships is three times more than five) and finally this value should be included as n in the basic Eq. (1); the maximum possible value for the *organisational commitment* indicator or *level of identification* is 100.

The second method relies on pondering particular types of relationships. With regard to this method, the main role for the indicator *organisational commitment* is played by the relationship of exclusive motivational nature and is therefore pondered with a maximum factor 5, a slightly less important role is played by relationships of a personnel-motivational nature and is thus considered with factor 4; still less considered is the relationship of a co-ordinative motivational nature with value 3; the relationship of a communicational-motivational nature is pondered with multiplier 2, and the relationship of technical-motivational nature is pondered with factor 1. In this way, we come to sum $\sum w_i \cdot g_i$, where w_i represents ponder (or weight of given organisational relationship) and g_i stands for the grade of respective relationship. This pondered sum is finally included as n in the original basic Eq 1.

The ideal organisation with just the highest ideal marks (5) would again reach the value of 100 for the indicator of *organisational commitment*. The organisation with a average relationships' marks of 2.5 would achieve the value of 42.04 (because of exponent dependencies in the original formula and not linear ones). The value of the indicator *organisational commitment* around 40 is a type of milestone, when we judge the motivational situation in any given firm. In an excellent organisation, these motivational issues cannot be ignored. Indeed, data gathered from the research projects implemented to date proves that this motivational indicator of *organisational commitment* usually reaches the lowest values, comparable with other indicators,

most probably because of the sensitivity of employees-assessors to motivational mechanisms in their organisations.

2.5 The organisational consistency indicator

To obtain the value of the *organisational consistency* indicator, the marks of all five co-ordinative relationships (exclusive coordinative and combined with other four relationships) are totalled, and the result is corrected (multiplied) with a normalization factor (3 in this case, because we again have five coordinative relationships, but fifteen in total) and finally this value should be inserted as n in the basic Eq. (1), the maximum possible value for the *organisational consistency* indicator is 100.

The second method is designed on different weighting individual types of co-ordinative relationships. Because the main importance for the indicator *organisational consistency* is the relationship of an exclusive co-ordinative nature, its mark is thus pondered with factor 5; somewhat less importance is held by the relationships of co-ordinative communicational and co-ordinative motivational natures; they are pondered with a factor of 3.5. The least pondered relationships for the indicator *organisational consistency* are the technical co-ordinative and personnel co-ordinative relationships, both with a factor of 1.5. These weights w_i are then used together with respective grades g_i of co-ordinative relationships in pondered sum $\sum w_i \cdot g_i$ and the value of this pondered sum is finally included as n in the original basic Eq 1.

The ideal organisation with exclusively the highest marks (5) would theoretically achieve the value of 100 for the indicator of *organisational consistency*. The organisation with average relationships' marks of 2.5 would reach the value of 42.04 (because of exponent dependencies in the formula and not linear ones). A value around 40 is a type of milestone for the organisation's indicator of *organisational consistency*. Because of the prevailing meaning of co-ordinative relationships in this indicator, it is an attempt to express how good the management in given organisation is, since the coordination is at the centre of management work. When improving the quality of organisation,

measures such as an indicator of organisational consistency can offer some insight on how good employees assess management work.

2.6 The informational supply or information provision indicator

The last indicator of the MUKOZ methodology is the *informational supply* or *information provision* indicator. The marks of all five communicational relationships (exclusive communicational and combined with the other four relationships) are totalled, and this is then corrected (multiplied) with a normalization factor (3, because besides the five communicational relationships there are a total of fifteen relationships, i.e. three times more). This corrected value is finally inserted as n in the basic Eq. (1). The maximum possible value for the *informational supply* or *information provision* indicator is 100.

Another way to calculate the indicator of *informational supply* or *information provision* makes a distinction between the importance of different communicational relationships in the overall estimation of communication quality in the organisation. The most important relationship of exclusive communicational nature is weighted with a factor of 5, co-ordinative communicational and technical-communicational with a factor of 3.5 and personnel-communicational and communicational-motivational relationships with a factor of 1.5. These weights w_i are then multiplied with respective marks g_i , and the resulting pondered sum $\sum w_i \cdot g_i$ is in the end inserted as n in the original basic Eq. (1).

The ideal organisation with the highest possible marks (5) obtains a value of 100 for the indicator of *informational supply* and the organisation with average relationships' marks of 2.5 obtains the value of 42.04 (again because of exponent dependencies in formulas and not linear ones). The value around 40 is a type of milestone when judging the quality of communicational situation in any given firm. The importance of good communication extends through all parts of organisational life: for example, coordination as a primary manager's task is done through effective communication, motivational tools and criteria are explained through honest communi-

cation as well dealing with personnel. Reaching organisational excellence would be impossible without strong communicational support and the indicator *informational supply* or *information provision* can be seen as a measure to indicate how close or how far we are from excellent organisation in the organisational perspective of good communication settings.

Other approaches also exist to measure the quality of organisation: for example, The Balanced Scorecard and the European Quality Award. All of these can be seen in the light of their usefulness in achieving business excellence (Rejc, 2001:152). In contrast, Dahlgaard-Park and Dahlgaard (1999) suggested a model of organisational excellence, called "the 4P" (people, partnership/teams, processes of work, products/services) model, in which the people dimension is recognized and emphasized as the primary enabler (Dahlgaard-Park & Dahlgaard, 2010:158). Such an approach provides a framework for building quality into the three levels: individual, team and organisational. The same authors claim that partnership is established in all people relationships.

3. EXPERIMENTAL RESULTS AND THEIR INTERPRETATION

3.1 Data description

The main research question is whether and how quality of organisation of firms is connected with their business results. These connections appeared in the reality in both directions: the quality of organisation affects the business results and vice-versa. For this purpose, data of 72 assessments of quality of organisation in Slovenian firms were collected in 2007 according to the MUKOZ methodology (Mihelčič, 1992b). Data about the quality of organisation was very difficult to obtain, because the corresponding questionnaire is very long: in its original full form, it consists of the descriptions of 150 organisational aspects, each of them with a detailed description of the six levels of quality. Nevertheless, the sample is large enough to sufficiently comply with statistical principles, which was tested with appropriate statistical tests. We also gathered publicly accessible economic indicators for

the 2006, 2007, 2008 and 2009 business years. In this sense, the research has a longitudinal character. The presence of a time shift should be noted, because publicly accessed economic data could not be acquired in the same one-month period as the observed states of quality of organisation.

Economic data for the assessed firms were collected through the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES). The following economic ratios were observed:

- total operating efficiency = total revenues / total costs in revenues;
- business operating efficiency = operating revenues / operating costs in revenues;
- capital profitability = net profit/loss / average owner's capital;
- net profitability of revenues = net profit/net loss / total revenues;
- profitability of operating revenues = operating profit/operating loss / total revenues;
- profitability of assets (net return on assets ROA) = net profit/loss / average total assets;
- value added per employee = (gross operating profit - cost of goods, material and services - other operating expenses) / average number of employees;
- proportion of fixed assets in assets = fixed assets / total assets;
- proportion of current assets in assets = current assets / total assets;
- proportion of investments in assets = (long-term investments + short-term investments) / total assets;
- average monthly wage per employee = salaries/numbers of months of operation / average number of employees.

Data about the quality of the organisation were obtained with the MUKOZ methodology through a survey in the form of a questionnaire. Due to timing reasons, the original questionnaire was halved, i.e. 75 organisational aspects (5 organisational aspects for each of the 15 organisational relationships) were measured instead of 150. In the research, 72 people assessed the quality of their organisation: 32

women and 40 men with an average 21 years of working experience (13 years of which in their present firm, which organisation they assessed) and with an average level of education of a bachelor's degree. In addition, the respondents assessed the quality of the organisation of their firms through the evaluation of 49 organisational factors in the form of the frequency of agreement for their firm (six levels from *never applies* to *always applies*). Estimations obtained from both sources were averaged and used to calculate the six previously described indicators of quality of organisation.

In the experiment, we used (separately) all three sets of input data: the six indicators of quality of organisation, the originally surveyed marks of 15 organisational relationships, and the marks of 49 organisational contextual factors. Target economic indicators were indexed with the average in the corresponding branch and discretized into three classes of equal frequency (low, medium, high).

3.2 Summary findings about the most exposed connections between quality of organisation and business results or other ratios

To achieve a high total operating efficiency across all four observed years, the importance of motivation is exposed, which is evidenced by the highlighted links to motivational relationships, motivational contextual factors of interests and incentives as well as the motivational indicator of organisational commitment. Occasionally personnel organisational elements are also joined (see Figure 3).

High *business operating efficiency* is mainly associated with highly assessed communicational organisational elements (organisational indicator of information provision, communicational organisational relationships with appropriate communicational contextual organisational factors such as databases and receivers of messages). These communicational elements are accompanied with corresponding coordination elements, and then suitable motivation elements also come to the forefront.

High *values of capital profitability* require adequate settled communicational elements, together with proper regulated coordination

elements. This finding can once again serve as experimental evidence for the theoretical origin about the importance of communicational support for good coordination.

To reach high *net profitability of revenues*, the importance of adequate motivational elements is emphasized along with communicational organisational elements.

High *profitability of operating revenues* primarily requires accordingly settled communicational elements (organisational indicator of information provision with the corresponding communicational relationship, within contextual factors particularly the quality of senders of messages); later motivation elements also become prominent.

High *profitability of assets* is initially bound to motivation elements (the indicator of organisational commitment with appropriate motivation organisational relationships and contextual factors such as incentives); it later also joined coordination elements with the organisational indicator of consistency and contextual factors such as span of control are joined to them.

High *value added per employee* is attainable in such organisational settings, which are suitably balanced within all organisational elements, such as the right (technical) and left (personnel) side of organisational cluster, which indicate the appro-

priately balanced indicator of the organisation's orientation and that it is adequately regulated with coordination relationships and elements.

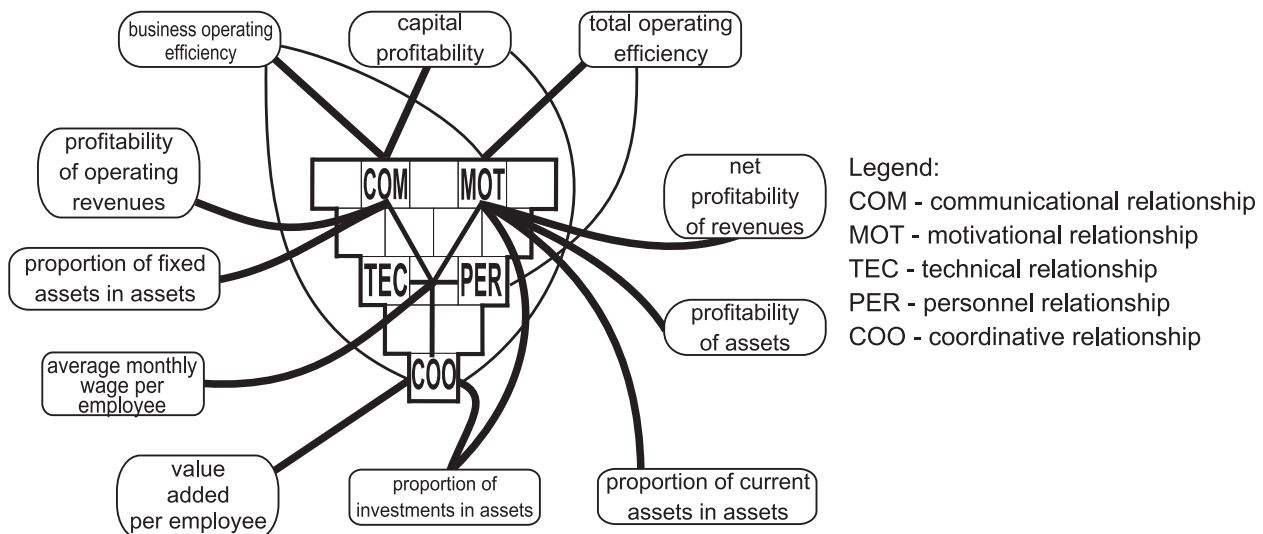
A higher *proportion of fixed assets in assets* in particular requires more excellent settled communicational elements, which means higher values of the organisational indicator of information provision together with the relevant communicational relationships and contextual factors such as communicational channels, messages, and the receivers of messages.

A higher *proportion of current assets in assets* expected good motivational elements, which means higher values of the motivational indicator of organisational commitment, appropriate motivational relationships and particularly exposed motivational contextual factors such as incentives.

A larger *proportion of investments in assets* is linked especially with coordination and motivation elements.

Higher *average monthly wage per employee* is linked with a balanced arrangement of all organisational issues; i.e., personnel, communicational, technical, coordination and motivation elements, as evidenced by the most exposed links with organisational indicators from MUKOZ methodology, which are based on the calculation of all organisational elements (value, reliability).

Figure 3: The connections between the quality of organisation and business results

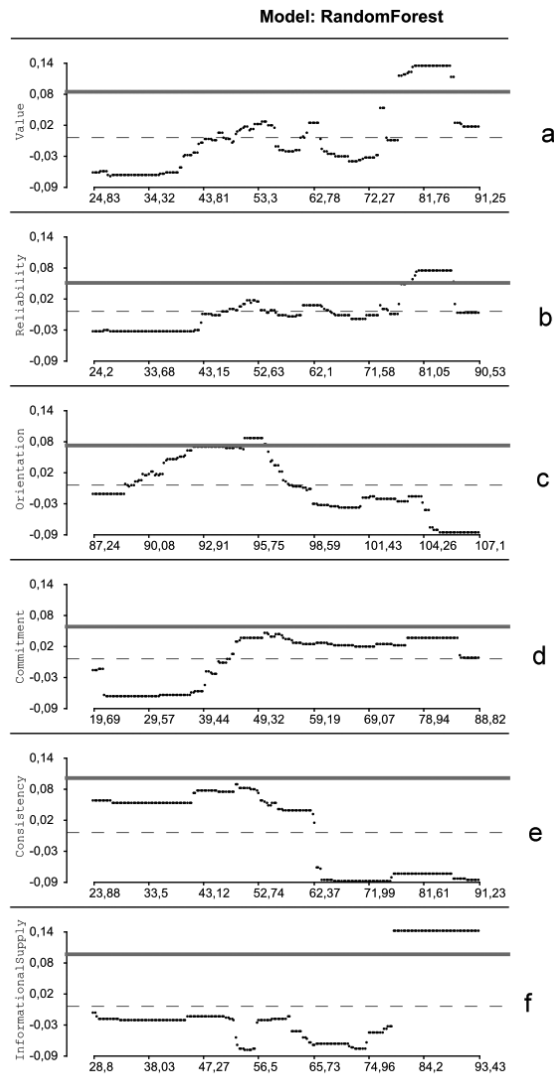


Source: Pregelj, 2011

3.3 Case study about the connections between the indicators of organisation quality and the indicator of economic profitability

The first set of examples is based on the data set with the indicators of quality of organisation as input data (features) and the indicator of economic profitability index for the years 2008 and 2009 as the target variable, because these combinations of connections are the most clearly exposed.

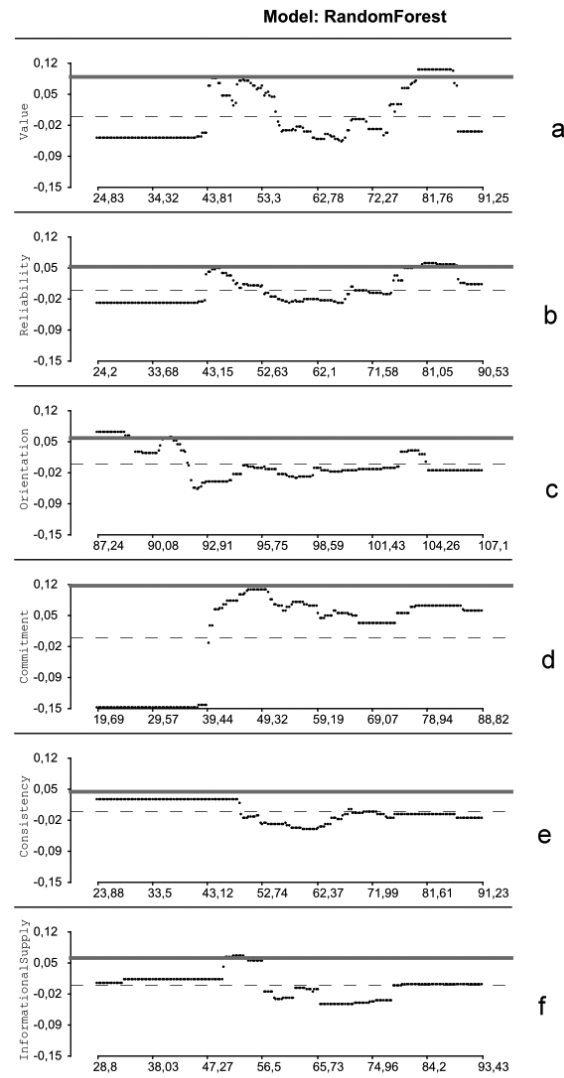
Figure 4: Visualization of how the predictions of economic profitability of operating revenues in 2008 were influenced by particular quality of organisation feature, assessed in 2007



Figures 4 and 5 illustrate the interpretation for the two consecutive years, how the indicators of quality of organisation of the firm: value (a), reliability (b), orientation (c), commitment (d), consistency (e) and information supply (f) affect the achievement of the (index) indicator of economic profitability of operating revenues.

The global contributions of each feature's values are plotted separately. The black points are

Figure 5: Visualization of how the predictions of economic profitability of operating revenues in 2009 were influenced by particular quality of organisation feature, assessed in 2007



Source: Pregeljč, Štrumbelj, Mihelčič & Kononenko, 2012

obtained by running the approximation algorithm for the corresponding feature and its value that corresponds to the value on the x-axis. The lighter lines correspond to the standard deviation of the samples across all values of that particular feature and can therefore be interpreted as the overall importance of the feature. The darker lines reveal the areas where features contribute towards/against the best class value.

A comparison between the interpretations of the findings of the model in both years yields the following conclusions about how the six organisational indicators influence the model's prediction for high economic profitability of operating revenues:

- An organisation's high value or worth contributes to high profitability in both years. The interpolated global trend is positively oriented. An organisation's low value or worth predicts relatively low profitability, whereas an organisation's high value or worth predicts comparatively higher profitability of operating revenues (Fig. 4a and 5a). That conclusion is more pronounced in the first year (Fig. 4) than in the other (Fig. 5), which logically reflects the decline in the expressive power of the organisation's state through time (we remind the reader again that the state of the quality of the organisation was recorded only once, then it was compared with the business results through several successive years).
- The indicator of the orientation exposes in the first year (Fig. 4c) the finding that for high profitability the most favourable orientation is around 95° (degrees), i.e. an organisation labelled as limited self-initiative with a focus more on technology and technique than on people. Later in the first year of the global financial crisis (2009) it moved to 90° (Fig. 5c), where personnel and technical relationships are balanced or even with a slight emphasis on human resources and motivational relationships (an organisation labelled as promoted self-initiative with more emphasis on people than on technique). That finding indicates the crucial importance of motivational mechanisms in crisis times, together with confidence in people.
- The importance of commitment increases in the crisis year of 2009 (Fig. 5d) with regard to the pre-

vious year (2008) (Fig. 4d). This again confirms, from a different perspective, the importance of motivational mechanisms for achieving a high profitability of operating revenues in crisis times and situations. When most other resources in crisis times are limited, the importance of people and their motivation increases.

- Greater consistency has a negative impact (Fig. 4e), which is reduced in the following year (Fig. 5e). A strict and consistent approach, perhaps even extremely bureaucratic, does not have a favourable effect towards high profitability. The collected data show that it is better to allow at least some creative disorder. In the following year (2009), the impact of consistency is reduced due to decreasing of expressive power of the once-recorded image of the quality of the organisation. Furthermore, in a crisis, the mix of many other external influences in environment correspondingly reduces the influence of such internal factors.
- High informational supply has a positive effect (Fig. 4f), which is reduced in the following year (Fig. 5f). The interpolated general trend is increasingly linearly positive. It is interesting to note that in order to achieve good business results, the worst approach is semi-efficient information. This is in accordance with the theory of communications: without proper confidence, which requires further verification of the correctness of information, we cause unnecessary system load and consequently worse outcomes.
- An organisation's higher reliability indicator has a positive impact in both years (Fig. 4b and Fig. 5b). An organisation's low reliability in general leads to lower profitability. An organisation's high reliability leads to higher profitability of operating revenues. In the organisation's reliability indicator, the congruent ordering of all organisational elements is composed (technical, personnel, communicational, coordinative and motivational). The calculation of an organisation's reliability indicator is based on the deviations between them. However, the curves of both years conclude with a warning that over-congruity (without deviations and accentuations) is not optimal, suggesting a slight decrease at the highest levels. This supports the theoretical basis of unfavour-

able “sleepy” non-responsive ‘perfect’ organisations in the case of over-harmony, which is especially critical for responsiveness in crisis times. This experimental result is in accordance with Herbert Simon’s theory about the inappropriateness of overemphasized perfectionism.

3.4 Case study about the connections between the organisational factors and the economic indicator of business operating efficiency

The second set of examples is based on the data set with 49 organisational contextual factors as input features (for details see Table 1) and the economic indicator of business operating efficiency index for 2009 as the target variable, because these combinations of connections are the most clearly exposed.

We used ReliefF (Robnik-Šikonja & Kononenko, 2003) to pre-process the data set for this experiment and select a subset of relevant features. Out of 49 organisational factors, the following four relevant input features were included (for details, see the description of approach to select the relevant elements in Robnik-Šikonja & Kononenko, 2003):

- Organisational Rules (see Fig. 6a),
- Technology (see Fig. 6b),
- Creativity (see Fig. 6c),
- Staff Knowledge (see Fig. 6d).

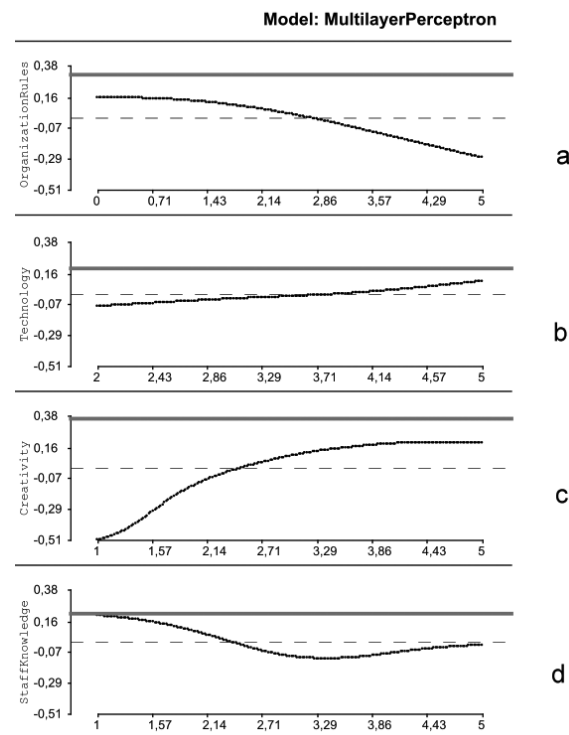
The following conclusions about the effect of individual input feature (organisational rules, technology, creativity and knowledge of staff) on the likelihood of greater business operating efficiency can be made:

- The predicted probability of high efficiency decreases with increasingly regularized organisational rules (Fig. 6a). Very strict organisational rules do not result in high efficiency, but have an opposite effect. Less strict organisational rules leave more space for creativity and initiative, so the potential for efficiency is higher.
- Business operating efficiency increases with improved technology equipment (Fig. 6b), i.e. better and more appropriate technological equipment leads to higher efficiency. This is an experimental confirmation of theoretical laws of the importance of starting technical relationships;

if (at its very beginning) the firm is not capable of producing a technically viable product with proper technology, all consecutive organisational upgrades will be fruitless.

- The business operating efficiency grows with creativity (Fig. 6c), which is the most important feature for both models. This is in accordance with the theoretical background of the importance of such organisational arrangements, which should not be too rigid, but should leave sufficient space for employees’ creative freedom.
- Business operating efficiency decreases with staff knowledge (Fig. 6d). This is a very surprising finding, which also has an interesting shape of the curve. A possible explanation would be that with a low (routine) knowledge of staff it is still possible to achieve high business operating efficiency (especially if the managers challenged with shortcomings in the personnel structure deliberately apply some other organisational mechanisms to successfully replace the shortfall reflected here).

Figure 6: Visualization of how the organisational factors affect the model’s prediction of business operating efficiency in 2009.



Source: Pregeljč, Štrumbelj, Mihelčič & Kononenko, 2012

However, in addition to staff knowledge, many other internal and external factors in a complex mixture might have some impact; therefore, more researches must be done.

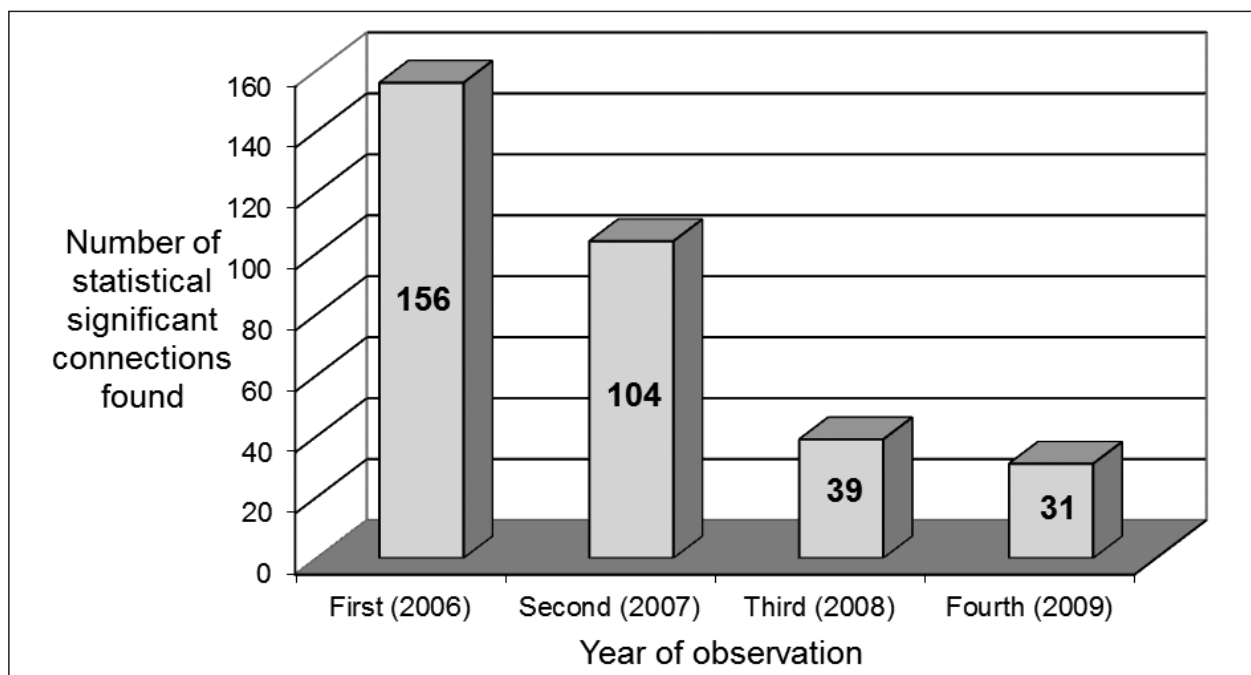
- It is more reasonable for business-operating efficiency to grow more at the beginning and then not so intensively (as interpreted by the neural network multilayer perceptron). This is related to the economic laws expressed in the form of a power functions. Creativity (Fig. 6c) starts with a highly enthusiastic impulse and later reaches the natural limits of its own growth, not increasing with the same starting intensity.
- With regard to the theoretical background, it makes more sense that the medium-high knowledge of the staff (Fig. 6d) has the most negative impact on a business' operating efficiency. The unusual form of the curve of the impact of knowledge of the staff on business operating efficiency can be explained with the fact that in extreme positions managers are more aware of the (limited) position of their personnel structure in terms of knowledge of staff and accordingly react with other organisational approaches. Staff knowledge at both extremes exerts influence upon

the achievement of high business operating efficiency. The most disadvantaged state is the intermediate state of the average knowledge of the staff, which in its unrecognized state does not allow breaking through to high business operating efficiency. Considering that the firms in the area of the average level of knowledge of staff are numerous, the competition in this domain obviously lowers economic performance.

4. CONCLUSION AND FUTURE RESEARCH DIRECTIONS

From an economic-research perspective, the explanation method and its visualizations have been a helpful tool for interpreting models, confirming known dependency relationships, and identifying new hypotheses. Our findings support the idea of the importance of quality of organisation for firms, in ensuring not only their long-term survival, but also growth and further development. Further research on the interdependencies between organisation quality and business results is required to cross-examine our findings. Because of the use of self-assessment techniques in evaluating various organi-

Graph 1: Connections between quality of organisation and business results



Source: Pregelj, 2011

sational aspects in firms, the active co-operation of top managers as estimators of organisation variables is inevitable. Therefore, to evaluate newly found hypotheses and to extend our work, additional experiments with more data should be performed: both quantitatively with more firms, and qualitatively with a higher share of top managers among the assessors. Nevertheless, our research found a great deal of statistically significant connections between the quality of organisation and business results. However, because the picture of the state of quality of the organisation was taken only once (with extended survey) and then the firms were tracked for four successive years, the impact through time had shown organisational inertia, on the one hand, and losing impact, on the other hand, which is depicted in Graph 1. In first observed year, the most statistical significant connections were found (156), then the number of statistical significant connection fell to 104, 39 and 31 in the successive observed years (see Graph 1).

The novel general method for the visualization and explanation of prediction models was successful in providing useful insight into the often complex connection between the quality of an organisation and the business results of firms. The interesting connections and successful predictions come mostly from complex models. Without proper visualization, these models are often discarded in favour of perhaps weaker, but more transparent models. As physics, chemistry and other science disciplines explore nature and attempt to explain natural principles by experimentally exposing elementary components of nature to different observations, the same is true also in "organisatiology". In our experiment, organisational basic elements (relationships) were exposed to different observations and experimental evidence confirms their significance for the performance of firms, in the sense of its survival and durable future development. This is what Lipovec's basic definition of organisation is about. With more profound and representative researches in the presented perspective, both organisational practice and theory could benefit, because managers in practice and academics studying the field can determine which organisational elements are relevant for business results and even direct the firm to business success or away from it.

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APPENDIX

Levels of excellence for the organisational aspect “the suitability of quality of message flows from the highest to the lowest organisational level”.

- Level 0: The firm does not give any attention to the quality of flow of messages, from the highest to the lowest organisational levels. The messages on the lowest organisational level frequently are not received or they are received with a deformed syntactic and/or semantic component and/or too late. The impact of the (un)suitability of communication channels on the flow of messages is of no concern.
- Level 1: The firm does not provide systematic development of the information system. Messages are not correctly designed. The receiver of messages on the lowest organisational level often faces distorted information. Only a few of employees are aware of importance of a suitable flow of messages has and use proper communication channels and ways of communicating.
- Level 2: The firm tries to establish an information system adapted to its demands, but it is too unsystematic. There are too many mistakes. More than one third of employees are aware of the importance of messages' flow quality. However, there are still many messages arriving to lower organisational levels too late and in poor form.
- Level 3: The firm's management strives to improve information culture by giving great attention to the establishment of concerted information system. Almost two thirds of employees are aware of the importance of messages' flow quality. However, there are still some unsuitably designed messages that reach a lower organisational level and too late.
- Level 4: A developed information system relies on systematic care for communication channels to assure a quality flow of messages, from the highest to the lowest organisational levels. The messages are properly designed and on time, and almost all employees use suitable communication channels. Only a few careless employees allow themselves to send messages through improper channels or do not control message through channels in accordance with the appropriate level of informational culture.
- Level 5: The management pays great attention to the regulation and the development of the information culture as one of basic features of the firm's information system. Almost all employees feel themselves to be accountable for the suitability of messages flowing from the highest to the lowest organisational levels. Often there are initiatives for improving the channels and/or removing disturbances in communicating.