

Influence of Information and Communication Technologies on Decentralization of Organizational Structure

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Abstract. This paper presents research on influence of information and communication technologies on decentralization of organizational structure. An empirical research was conducted, in which decentralization was described by dominant management style was compared to the level of composite index of ICT adoption. Also, consulting experience in four major Serbian companies was used to further elaborate and explain the results in the context of modern literature and practice. Conclusions were that ICT adoption is more frequently expressed in decentralized companies, empirically described by dominant liberal style of management, although ICT adoption can also lead to centralization in some cases, depending on other factors in the organization.

Keywords: Decentralization, Organizational structure, ICT; Information and communication technology, ICT adoption, Management styles, Autocratic, Democratic, Liberal.

1. Introduction

The main idea of this paper is to describe the importance of influence that ICT have on organizational structure and main focus of the paper is on one indicator, decentralization of power in organization. We will discuss that topic in context of broader thesis that vast possibilities for application and utilization of improvements of ICT are today limited much more by organizational and social aspects than by technological boundaries. Inspiration for this work came from Tom Standage's studies that compare Internet and telegraph revolution. Similarities point to importance of adjusting organizations to new possibilities for the full utilization of results. In that context, we will analyze existing and potential implications of ICT on decentralization of organizational structure.

There were two main sources for this research besides literature analysis. First is consulting experience in four major Serbian enterprises and second is wider research in 72 companies of various size, industry and success.

Major research effort was not primarily aimed at organizations that were in cutting edge technologies, or perfect examples of business success, but instead to average organizations, in a country that is not among world technological leaders. Distinguished ICT specialists sometimes cannot see clearly from the ivory towers of progressive environment that common managers, clerks and workers down below in ordinary organizations do not utilize even the part of potentials provided by advancements in their fields. Such ordinary companies still form majority and have larger potential of improvement in application of ICT. Sometimes organizational culture, attitudes, ignorance and fear from the unknown play much more important role than the features of the technology itself. That is why we believe it is necessary to dedicate some research to illustrate the application of modern ICT and systems in organizations.

2. Research

For empirical confirmation of assumptions, research was conducted in 72 companies from Serbia. Each company was analyzed using existing documentation, interviews with management and interviews with employees. Result of analysis was written report for each company, averaging 16 A4pages per report, with following chapters:

1. Introduction
2. Company history
3. Strategic aspirations
4. Basic company data
5. Employee data
6. Information and communication technology
7. Business activities
8. Competitors analysis
9. Basic financial analysis
10. Organizational structure
11. Management data

2.1. Gathered data

Formal data gathered covers more than 40 indicators, which are presented in the appendix 1. This research was focused on data describing usage of ICT in the company and dominant management style. Companies were selected from various industries, and 11 companies were in ICT industries. Also, companies were of various sizes, ranging from 7 employees to 2894 employees. Of total 2880 quantitative entries, 92 were missing values (3,19% of total data). Main problems emerged with estimated values or misunderstanding of questions by interviewed personnel, so data like number of management staff was misinterpreted, e.g. staff that had job title of a

manager, but no subordinates were included in number of management staff. Presence of written reports was very valuable to the researcher, because inconsistencies in data could be detected by invalid text description in the report. Since a lot of indicators concerning adaptation of ICT are not totally tangible, attention was also directed toward interviews with managers, sometimes to “between the lines” messages and hidden attitudes.

Second part of the research was consulting experience in four major Serbian enterprises where authors had opportunity to work as consultants. Consulting period was in sum more than 4 years long, and covered leading enterprises in chemical, electro distribution, petrochemical and industrial building and maintenance industries. Empirical conclusions that came from interviews and data of 72 companies were compared with practice in large companies, during the restructuring processes.

2.2. Composite index of ICT adoption

In order to develop more powerful indicator of ICT adoption in the company, existing data was used and a composite index of ICT adoption was formed. Formula of the composite index is presented in following:

$$CI_ICT = \frac{NoC}{NoE} + \frac{NoCC}{NoE} + \sum_{i=1}^{i=8} Cf_i + \prod_{i=1}^{i=8} \left(\sqrt{\frac{NoCC}{NoE}} + Cf_i \right) + CDB + DBA \quad (1)$$

Where mentioned factors mean:

CI _{ICT}	=	Composite index of ICT adoption in company;
NoC	=	Number of computers in the company;
NoE	=	Number of employees in the company;
NoCC	=	Number of computers connected to internal network in the company;
Cf _i	=	Coverage of enterprise function by ICT, where for different values of i functions are: 1 - human resources, 2 – accountancy, 3 – financial, 4 – technical, 5 – commercial, 6 – administrative, 7 – legal, 8 – protection;
CDB	=	Existence of integrated company database (0=no, 1=yes)
DBA	=	Database administrator present (0=no, 1=yes)

This composite index was chosen because it depicts adoption of ICT in the organization much better than any single indicator, and it was estimated that interviewed employees would be too subjective in approximation of level of adoption of ICT in the company, indicator that would be approximate to the mentioned composite index. First addend in the formula of the composite index is ratio between number of computers and number of employees ranging between 0 and 2,2 (extreme value was in a company with educational

center that included computers for participants). Second addend was introduced to emphasize importance of intranets and effects that could be results of computer networks in a company, ranging between 0 and 1,641. Third addend is a simple sum of coverage of business function by information system, and with every part of the sum ranging between 0 and 1 it ranges between 0 and 8. Fourth addend has the role to emphasize importance of synergetic effect of ICT appliance in the company. If all major business functions are fully covered, ICT adoption cannot be just slightly better than in a company where one function is omitted or functions are not fully covered. So, a sum of square root of ratio between number of computers connected to the internal network and number of employees and coverage of enterprise function by ICT ensures that total product will not be 0 if one function is not covered, and product of all those sums ensures us that it will have synergetic growth. Fourth addend ranges between 0 and 322,15 (there are 7 outliers with values larger than 30), but while mean is 22,34 median is 3,36 because most values range between 0 and 10. Fifth addend is existence of integrated database (0 if there is no database and 1 if there is), and sixth represents existence of employee with database administrator duties, with 0 value if there is no such employee or 1 if there is at least one.

Three groups of enterprises were formed according to the dominant management style, enterprises with dominant autocratic management style, enterprises with dominant democratic management style and enterprises with dominant liberal management style. Differentiation between management styles was elaborated in the works of Tannenbaum and Schmidt (1973) where seven behavior points were suggested[1], in continuum of leadership behavior between boss-centered and subordinate-centered leadership. In development of that theory, three different styles of leadership were distinguished as major, same as mentioned at the beginning of paragraph. Autocratic or authoritarian style is most commonly defined as a style where most decisions are made by superordinate, democratic as a style where most decisions are made in group of managers and subordinates, and liberal, or laissez-faire as a style where subordinates make decisions on their own, with the support of management. Classes are wide and there are lots of intersections, but literature and practice dominantly use that classification.

3. Results

During the study, interviewed employees were presented with the simplified explanation of management styles as mentioned previously and asked to select what is in their opinion dominant style that managers in that organization apply.

Results can be graphically represented on the following figure 1.

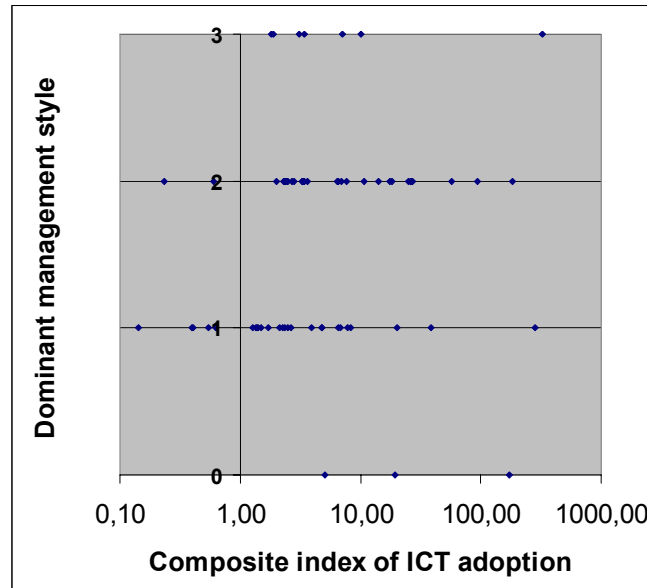


Fig. 1. Diagram of Composite index of ICT adoption and dominant management styles

After that we have run the analysis of variance for Composite ICT index using management style as an independent variable. Analysis of variance was used to test the hypothesis that means for all three groups are equal. First, descriptive statistics in table 1. suggest that there is difference between groups. After the elimination of 7 samples because of inadequate values, 27 enterprises created group with dominant autocratic style, 31 created group with dominant democratic style and there was a group of 7 enterprises with dominant liberal style. Means of Composite ICT index were, respectively 14,9922; 18,3071 and 49,9171. That suggests that ICT is more adopted in enterprises with dominant liberal style. However, we have expected more difference in mean of Composite index of ICT adoption between autocratic and democratic group. Rational explanation, confirmed after re-examination of written reports, was based on fact that democratic style is a wide category, and covers behavior between allowing employees to slightly modify the decision according to current circumstances, and participation of employees on equal basis of decision power with the manager. It is possible that companies were more open towards declaring democratic style as dominant and therefore estimated dominant style as democratic even if only slightest modifications of decisions were allowed.

Table 1. Descriptive statistics in analysis of correlation of Composite ICT adoption index

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Autokratic	27	14,9922	53,64	10,32	-6,23	36,21	,00	280,43
Demokracic	31	18,3071	36,28	6,52	5,00	31,62	,24	184,14
Liberal	7	49,9171	120,08	45,39	-61,14	160,97	1,83	322,15
Total	65	20,3343	56,99	7,07	6,21	34,45	,00	322,15

Next test was in homogeneity of variances, with hypothesis that variances of all three samples are equal, which is rejected with significance of 0,012, so since there is statistically significant difference between variances, so we can continue with the test.

Table 2. Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
4,718	2	62	,012

Next test, shown in table 3, did not confirm that there are statistically significant differences between groups, and hypothesis that groups are statistically different and that results are not probably due to chance cannot be accepted, but still cannot be rejected, either. After that, separate tests were run to check the difference between each of the studied groups.

Table 3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7023,929	2	3511,964	1,084	,344
Within Groups	200806,158	62	3238,809		
Total	207830,086	64			

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Table 4. T-test for equality of means of composite index of ICT adoption between companies with dominant autocratic and democratic styles

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Upper	Lower
Composite Index of ICT	Equal variances assumed	,026	,872	-,28	56	,781	-3,31487	11,89	-27,14	20,51
	Equal variances not assumed			-,27	44,70	,787	-3,31487	12,21	-27,91	21,28

However, when we run t-test for autocratic and liberal groups, F statistics had considerably high value, with level of significance below 0,05. That means that there are statistically significant differences between two observed groups of companies.

Table 5. T-test for equality of means of composite index of ICT adoption between companies with dominant autocratic and liberal styles

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Upper	Lower
Composite Index of ICT	Equal variances assumed	5,25	0,029	-1,16	32	0,25	-34,92	30,11	-96,26	26,41
	Equal variances not assumed			-0,75	6,63	0,48	-34,92	46,55	-146,2	76,38

Table 6. T-test for equality of means of composite index of ICT adoption between companies with dominant democratic and liberal styles

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Upper	Lower
Composite Index of ICT	Equal variances assumed	9,62	0,003	-1,28	36	0,21	-31,61	24,76	-81,83	18,60
	Equal variances not assumed			-0,69	6,25	0,52	-31,61	45,856	-142,7	79,51

Finally in table 6 were presented even higher values of F statistics (9,62) with significance of 0,003 when t-test was run in comparison of groups with dominant liberal and democratic styles suggesting that statistically significant difference can exist between those two groups in level of composite index of adoption of ICT.

4. Discussion

ICT emerge as source of strategic competence and driver of change for most enterprises during the end of the last century. At the beginning, companies that processed data as main business activity, then companies that had abundant data processing somewhere in Porter's value chain (Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales or Service) started to value and implement ICT. This enabled research of influence of ICT as important factor of organization and its structure. But long history of undervaluation of ICT role in an organization influences negatively on such trend.

The application of ICT is often regarded as something unorthodox and novel in organizational history. Contrary view is best expressed by citation of Tom Standage (1998) "The hype, skepticism, and bewilderment associated with the Internet – concerns about new forms of crime, adjustments in social mores, and redefinition of business practices – mirror the hopes, fears, and misunderstandings inspired by the telegraph. Indeed, they are only to be expected. They are the direct consequences of human nature, rather than technology." [2] Deeper analysis of telegraph application reveals interesting facts. It should be noted that telegraphy technology from its inception in 1840s had undergone "re-invention" where a user modified the innovation in the adoption and implementation process through out its diffusion period (Rogers, 1995). [3] That adoption is best illustrated by increase of number of telegrams handed daily to the main office of Western Union Company in New York. That number was 3,500 in the year 1871, then 35,000 telegrams per day in the year of 1875, and finally in the year 1917 approximately 200,000 telegrams daily were handled through this office. Most important improvements of telegraph in between were quadriplex which allowed eight simultaneous messages to travel through one wire (four in every direction) and automatic transmission which doubled output. That does not explain increase in level of application in everyday use and business practices. So it is reasonable to expect that major improvements in organization resulting from ICT are still to come, and that those improvements will not be enabled by technological breakthrough, but by better application of existing technologies.

In most companies that were not directly in information and communication industries, ICT were limited on support activities for decades. That created false image of lesser value and marginal influence on company's success. Authors of this article have had consulting experience in four major Serbian enterprises, each employing more than 2.000 employees. In all four

companies, managers of ICT activities were not present during top-management meetings. Companies also had very few things in common, and among short list was a derogatory nickname for ICT staff, "basementeers", applied in all four companies. In all companies ICT organizational unit was positioned in the least desirable part of company building. Main explanation of such trend is conflict between ICT representatives and managerial staff based on misunderstanding and feelings of jeopardized position due to the lack of knowledge or authority. Each side usually reacts to that by over-exercising its main source of power, ICT staff relied mainly on technical knowledge and managers relied on authority.

Nevertheless, modern literature recognizes important influence of ICT on organization and its design, such as in Daft (2004) who sees five main influences: decrease of staff in the organization, increasing decentralization, improving internal coordination, improving inter-organizational cooperation and better outsourcing.[4] Desanctis and Jackson present influence of ICT on coordination and decentralization[5], while Lars Groth describes important role of information on organizational communication, centralization and despecialization.[6] Mintzberg also mentions ICT as influence while describing specialization, centralization, departmentalization, coordination and control.

This paper gives contribution to the thesis that ICT have deep influence on characteristics of organizational structure, by examining influence of ICT on decentralization. One of the most important determinants of organization is distribution of power. Mintzberg uses term decentralization to mark three different processes in organization: dispersion of formal authority down through the chain of command, as vertical decentralization; dispersion of formal authority at the same hierarchical level in organization, where decision power is given to staff outside line chain of command, such as specialists and analysts, as horizontal decentralization; physical dispersion of the company, where company allocates its organizational units closer to customers.[7]

As it has been confirmed by analyzed data, there is significant difference in adoption of ICT between organizations with dominant liberal style of leadership applied by management, and organizations with either dominant autocratic or democratic style on the other side. Since there is no widely accepted measurement of level of decentralization in the company, dominant management style was applied instead because of very high correlation with decentralization in the company. Organizations with dominant autocratic style are by definition strongly centralized, both horizontally and vertically. Organizations with dominant democratic styles have amount of vertical and horizontal decentralization dependent on the size and structure of the group making the decisions, while organizations where liberal styles are dominant have very strong decentralization in both dimensions by definition.

The adoption of ICT is correlated to the flattening of hierarchical levels[8] which immensely leads to vertical decentralization. Moore's law decreases cost of information that was few years ago available at acceptable cost only to upper managers, and that creates decisional support basis for decentralization. Also, systems are being designed in such a way that people

do not need to be a computer specialist to benefit from computing power[9]. That opens possibilities for managers to distribute information needed for establishment of strong decentralization basis. Existence of basis for decentralization can logically lead to decentralization, but can also lead to conflict over power. The second option was much more present in large enterprises where authors had consulting arrangements. Existing potentials were not utilized, but instead created crisis in analyzed companies. Nevertheless, adoption of ICT is useful for the high level of decentralization in both dimensions, which was indicated by the highest level of Composite index of ICT adoption in group of enterprises with dominant liberal management styles in the research. However, it can be concluded due to the high variance of that indicator in the group that other factors influence decentralization as well.

Theoretically, ICT also open possibilities for centralization of decision power. View on information as a source of power has resulted in early predictions that information providers (usually in subordinate organizational positions) would lose power to information gatherers who tended to be in positions closer to the top of organizational hierarchies,[10] as stated in Gotlieb and Borodin(1973). Computers cannot transfer verbal message much faster or further than a telephone can, mostly due to restrictions of human perception. But capacity for data processing, availability of simultaneous quantitative information from different sources, user-friendly presentation renders modern ICT an effective tool for assuring good decision background. In some organizational milieus such background can enable vast centralization of decisions, to few or even one organizational nodes of power. That was proven during the research, where some organizations with dominant autocratic style had relatively large composite ICT index, and the whole group was characteristic by high variance. One banking company even had index of 280,43, and still strongly centralized organization with dominant autocratic management style.

Scholar example for that is SAGE computer system, anti-aircraft defense center where all information is focused to one node where all non-operative decisions are made. Also, case study that can illustrate dual nature of ICT is case of Benetton, where same information system opens possibilities for strict centralization or very loose decentralization. Subcontractors of Benetton produce non-colored clothes, and limited quantities of colored clothes are sent to stores at the beginning of the season. Information system collects all sales data regarding color of merchandise, data is then sent to central and synthesized, where system creates reports about total estimated demand for colors, and specific demands for each shop. Coloring and distribution of clothes is coordinated according to reports. Decision power can be easily centralized to top management, where all important data is available, or decentralized to shop managers without risks of large scale lack of coordination. Good example is also a design of Boeing 777, one of most successful design projects up to that time. Information system distributed information among thousands of engineers all across the world, so each engineer could change design of his/hers part and all other engineers could

see how that fits with their airplane parts. Coordination was dramatically simplified, and centralization/decentralization possibilities blossomed. Decisions could be made at single point, or distributed to each member. For that project decentralization was much better solution for bolstering creativity, which enlisted this project among best examples of design management.

However, it is very difficult to empirically measure influence of ICT on decentralization due to the influence of other factors: organization size, managerial style, history and culture of the organization, requests for service standardization, requests for independence, availability of managers, development of control techniques, territorial dispersion of activities, growth dynamics, time-span and span of consequences of decentralized decisions[11]. That means that researcher would have to choose companies similar by all eleven factors and different by appliance of ICT and measure correlation between estimated level of decentralization and appliance of ICT. Both values should even in a perfect research conditions be measured by expert estimation or composite formula because there are no globally accepted measurement standards, which additionally make matters worse.

Theoretical assumptions did not always pass in major Serbian companies where authors had consulting experience. Vertical decentralization should be enabled by management information system, existed in some form in every organization, but fragmented and burdened by different software solutions and standards. Management information systems were still functional at acceptable level, but its functionality was dependent on ICT staff. It was common practice for ICT staff involved in data processing to use information as source of power for improving their undervalued position. During interviews consultants sensed strong attitude that information is private ownership of an employee who created it, whenever such condition can be utilized. Unless there were clear regulations about sharing information that could not be overridden, it should be distributed only if reward is acceptable or punishment for non-distribution is viable. For common information it was very difficult to apply such malpractice, but aggregated reports, analysis of complex datasets, and most other MIS output that exceeded technical knowledge of management was delayed on basis of mostly made-up reasons until acceptable bargain was agreed. Managers also sometimes estimated incorrectly whether reason for unavailability of information was of technical nature or result of attitude.

Lack of formalization of information availability among lower management led to preservation of vertical decentralization in similar form and intensity as before introduction of management information system. Information available to lower level managers was not used for decision making, but instead presented to the upper level managers as a proof of loyalty and competence. That was due to sovereign view of power, criticized in works of Bloomfield and Cloombs, who stated different value of information in different contexts and clearly instructed that we should move our attention away from the form of computing to its content and from the location of ownership of information to its significance [12].

There were some examples that confirm modern theories, where technical information system in electro–distribution company decentralized all decisions concerning maintenance of electro-system, but centralized strategic decision regarding expansion of the electric network. Similar thing occurred during benchmarking of our leading company in petrochemical industry with benchmarking partner from Slovakia. Benchmarking partners had comparable capacities, but petrochemical complex in Slovakia had around 500 workers, while Serbian complex had 2818 employees. Same technology was used for production, except environment protection part and safety information system that was equipped with early warning systems, and fused with metric devices all through the production process flow. That centralized both decisions and support for safety in one command center and intervention team, while in Serbian complex there was one intervention team for each major component of the production system, in combination with the surveillance staff.

Regarding horizontal decentralization, most influences come from improvement of communication. Videoconferencing, shared databases and similar advances enabled business communication with quality much similar to face-to-face meeting, regardless of the location or number of participants, at acceptable costs. That enhances vertical decentralization, and also, as can be concluded from earlier Boeing 777 design case, horizontal decentralization. Despecialization of employees, on the other hand eliminates the need for gathering information from different nodes of single specialized employees, and directs organization toward horizontal centralization.

Territorial decentralization is mostly enhanced by two factors: improvement in inter-organizational communication and telecommuting. Definition of company is loosened, as importance of concentration in one location or under single ownership decreases. Alliances of different companies and individuals produce adequate results as concentrated single companies so it is possible to disperse territorially when environment demands proximity with customers or resources.

Regarding previous analysis, consulting experience and research reports a new set of additional decentralization factors can be added to those proposed by Koontz and Weihrich:

1. Development and level of dispersion of information system in organization
2. Conflict potential between ICT and managerial staff
3. Confidentiality of data in information system
4. Attitude of employees toward ICT
5. Segmentation of levels of access to information system

5. Conclusion

It can be concluded from observations and interviews in companies where authors have had consulting experience that decentralization is not a discrete, but continuous process, and that authority migrates slowly to organizational unit where information is concentrated. More than 70 years were needed to

utilize the potential of invention of Samuel Morse (and first practical telegraph system was invented fifty years before his invention, in the year 1794), and there is a rational concern that application of new ICT technologies may be faster, but still take few decades. When technology is discussed it is useful to remember that standards often evolve slower than people think (and wish) on the short term, but that their impact is often much deeper than expected in the long term[13]. Process of authority migration is often informal in nature at the beginning, superior still keeps right to sign formal decisions and documents, but lower-level employee with necessary information in fact makes the decision. That could be seen in banks, as authority for issuing smaller loans migrated toward desk clerks equipped with information system.

Also, one of the major conclusions is that ICT itself does not point organization toward more or less decentralization, but widens possibilities for adjusting level of decentralization to other internal or external parameters characteristic to the organization. Development of ICT leaves much more freedom to the designers and consultants to accommodate organizations to other influences, both internal and external. Such conclusion is backed by results of Ziadi and Koufie (2006) where managers in Tunisian companies were interviewed on impact of ICT introduction on decision making. In result 38,3% of interviewed managers indicated that there was a decentralization in decision-making against 26,8% of the executives who in contrary found that there is centralization in decision making instead[14]. It is however important catalyst for application for liberal management style, as decentralization factor.

This research might open more questions than we have given answers. Organizations are maybe yet to change its structural morphologies and other characteristics under the influence of new technologies, and maybe we are yet to develop structures that will utilize potentials of ICT breakthroughs. That assumption can be illustrated by description of one information system from the middle ages. In the fourteenth century AD Templar Knights organized banking and money transfer system, based essentially on writing, system of questions and passwords and messengers (all technologies existing for thousands of years). That organization could accept payment from a noble in England, and just few weeks afterwards pay it securely (without the need to physically transport the money) to the person he has chosen in the Middle East, in a world without telegraph, telephone, computers, fingerprints, photographs or even personal identification. It took thousands of years for organizations to adapt to full utilization of some technological advances. So it might be arrogant to assume that our organizations have adapted to the vast potentials of ICT, however the pace is quickened.

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APPENDIX 1: List of indicators gathered during research

This research has based on large set of gathered data. Only part of that set was used, leaving space for other conclusions. We are looking forward to eventual collaboration with colleagues in the field. Other researchers might have different ideas on usage of other data from wider set, and we will welcome any elaborated proposal sent on our given e-mail addresses. Wider set of data includes year of establishment, basic sector of business activity, total number of employees, total number of management staff, number of employees with graduation degree qualification, number of employees with bachelor degree qualification, number of employees with high school degree qualification, number of employees with elementary school degree qualification, number of employees with 5 or less than years of work experience, number of employees with 6-10 years of work experience, number of employees with 11-15 years of work experience, number of employees with 16-21 years of work experience, number of employees with 21-25 years of work experience, number of employees with more than 26 years of work experience, absolute change of number of employees during observed year, year previous to observed and two years previous to

observed, number of working computers in the company, existence of internal computer network, number of computers connected to the internal network, existence of integrated internal database, existence of database administrator, coverage of human resource functions with information system, coverage of accountancy functions with information system, coverage of financial functions with information system, coverage of technical functions with information system, coverage of commercial functions with information system, coverage of administrative functions with information system, coverage of legal functions with information system, coverage of protection functions with information system, total revenue in observed year, total expenses in observed year, profit in the observed year, total fixed assets in the observed year, total current assets in the observed year, estimated rivalry, number of hierarchical levels, number of external contracted cooperatives, percentage of value of final product generated in company, percentage of value of final product generated in network of cooperatives, dominant management style, concern for people (1-9) and concern for production (1-9, from Blake-Mouton Managerial Grid).

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