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**The link between the quality of
knowledge management and
financial performance
– The case of Croatia**



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The link between the quality of knowledge management and financial performance – The case of Croatia

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Abstract

The paper investigates the link between the quality of knowledge management and financial performance of an organization, using the data from the research conducted in Croatia. The theoretical part of the paper presents the literature review on research concerning the link between knowledge management and financial performance. The empirical part of the paper investigates the before mentioned link using the quality of knowledge management success factors as a measure of knowledge management, and ROS and ROA as measures of organizational performance. Based on performed correlation tests, this research confirms that there is a link between knowledge management and financial performance.

Keywords

knowledge management, knowledge management success factors, measuring knowledge management success factors, financial performance, Croatia

JEL classification

M15, M20

1. Introduction

With knowledge being one of the most important resources today, traditional factors of production have become secondary (Reinhardt et al., 2001, pp. 794). As organizations became aware of the power of knowledge as the most valuable strategic resource in the knowledge economy, knowledge management became widely recognized as essential for the success or failure of organizations. Consequently, over the past 15 years, knowledge management has progressed from an emergent concept to an increasingly common function in business organizations (McKeen et al., 2006). According to one estimate, 81% of the leading organizations in Europe and the U.S. are utilizing some form of knowledge management (Beccera-Fernandez et al., 2004 from Grossman, 2006). Consequently, the key question today is no longer whether to manage knowledge, but how to manage it (Lee & Choi, 2003).

Distinctively, knowledge management today has two main features: (1) more and more organizations are integrating knowledge management into its business philosophy making it more common practice and therefore less differentiating factor of success, thus creating the need for knowledge management practice to become more and more superior, and (2) more and more knowledge is becoming available while at the same time knowledge itself is becoming more sophisticated, making knowledge management more complex. As a result, it seems as though businesses that could capture the knowledge embedded in their organization would own the future (Lee & Choi, 2003). In accordance, one of the most interesting activities both for organizations and for researchers became investigating the exact impact that knowledge management initiatives have on the overall organizational performance.

Consequently, as organizations expected evidence of knowledge management's contribution to organizational performance in terms of financial indicators, this contribution is being progressively examined. Still, despite the commonness of knowledge management in organizations, there is yet no standardized framework for measuring the contribution of knowledge management to organizational performance (Kim, 2006), and there are relatively few knowledge management texts dealing with explicit connection between knowledge and performance (Kalling, 2003, pp. 67). This can partially be explained by the fact that area of knowledge management is still in its early stages in terms of developing its theoretical base (Zaim et al., 2007, pp. 55), as well as by inadequately developed ways of measuring the knowledge management practice in organizations.

The link between knowledge management and organizational performance has been empirically explored, but rarely through assessing the state of knowledge management practice per se, and comparing it with direct indicators of financial performance. Namely, some empirical studies focus only on specific aspect of knowledge management, not the whole knowledge management system (for example Lee et al. (2005) were assessing the performance of an organization with respect to its knowledge, and Harlow (2008) was assessing the level of tacit knowledge within organizations and its effect on organizational performance). On the other hand, as Kalling (2003) annotates, the empirical studies that focus on the links between knowledge management and performance often stop with proxies of performance; not at profit, but at proxies of profit, such as productivity (for example Choi and Lee (2003) calculated corporate performance based on five items: overall success, market share, growth rate, profitability and innovativeness – four out of five of those items are proxies of profit, while Lin and Tseng (2005) calculated corporate performance using seven items: productivity, cost performance, competitiveness, sales growth, profitability, market share and innovativeness – out of which four are proxies of profit.).

Hence, this article investigates the link between knowledge management and organizational performance by looking at the link between knowledge management success factors and two financial indicators – ROS (return on sales) and ROA (return on assets). This link was investigated in Croatian environment, which is at the beginning of accepting a market-based economy and where majority of organizations are only beginning to integrate knowledge management into their business philosophy. Such environment is best suited to validate the concept that knowledge management can be a differentiating factor of organizational success and to prove that the most successful organizations understand the value of knowledge management concept for their success.

2. The link between knowledge management and organizational performance

Exploring the link between organizational performance and various activities organizations perform is frequent and accustomed way of exhibiting the importance of investing in those activities. When it comes to knowledge management, the attitude is no different. Even though some authors suggest that the link between knowledge and performance, which so frequently is taken for granted, might not always exist (for example Kalling, 2003), evidence of importance of investing into managing knowledge through linking knowledge management and organizational performance is a topic that interests many researchers, as well as practitioners. More to it, several studies have proposed the concept of “KM performance” to describe the performance improvement of the enterprise’s capability after embracing knowledge management (Tseng, 2008).

While knowledge management continues to gain popularity, the acceptance of standardized knowledge management assessment approaches has lagged (Grossman, 2006). When it comes to measuring knowledge management two different opinions can be noticed. One group of authors considers area of knowledge management insufficiently developed to properly quantify possible results of knowledge management and link those results directly to knowledge management activities such as knowledge generation, transfer and usage (for example Anantamula & Kanungo, 2006). On the other hand, an attitude that every activity an organization undertakes, especially the one demanding substantial financial investments, must have adequate financial indicators accompanying such investments that can confirm cost effectiveness of such activity, can also be recognized (for example O’Dell & Grayson, 1998). Nevertheless, Anantamula and Kanungo (2006) insist on importance of knowledge management measurement and cite three reasons for measuring success of a knowledge management system: (1) to provide a basis for valuation, (2) to stimulate management’s focus on what is important and (3) to justify investments.

Even though organizations should not expect to see a significant return on investment from knowledge management too quickly (Vestal, 2002, pp. 2), as organizations are turning to management of knowledge and skills their employees possess as a mean of survival and success in today’s knowledge economy, knowledge management can and should be recognized as a tool to gain competitive advantage, achieve long-term success on the market and consequently receive benefits in terms of financial performance. Specifically, full list of possible knowledge management results is presented in table 1. Unfortunately, there is no thorough way to quantify some of the basic advantages of knowledge management such as increased trust among employees, personal growth of employees, increased awareness of employees, value of new connections and relationships between employees or benefits from mentorship, and all the implications arising from those advantages. Therefore many authors (for example O’Dell and Grayson, 1998 and Vestal, 2002) suggest that organizations monitor and assess the value added from managing knowledge by recording and transferring stories, anecdotes and best practices confirming the importance of knowledge management, both those originating from the organization itself, as well as those from other organizations that are successfully managing their knowledge.

Table 1: Knowledge management results

Group of results	Results
<i>Employee performance</i>	Better decision making New or better ways of working Improved communication Improved employee skills Enhanced collaboration Sharing best practices
<i>Organizational performance</i>	Increased profits Reduced costs Increased empowerment of employees Better employee attraction/retention Improved productivity Return on investment of KM efforts Increased share price
<i>Business performance</i>	Faster response to key business issues Creation of new business opportunity Improved new product development Improved business processes
<i>Market performance</i>	Increased market size Increased market share Enhanced product or service quality Creation of more value to customers Entry to different market type Better customer handling
<i>Intellectual capital</i>	Enhanced intellectual capital Increased innovation Increased earning/adaptation capability

Source: Anantatmula, V. and Kanungo, S. (2006), pp. 29.

When it comes to measuring organizational performance it can be concluded that empirical researches usually accept one of the three possible approaches: (1) measuring general organizational performance (Jennex et al. (2008) define typical measures of knowledge management outcomes in terms of organizational performance as enhancement of: product and service quality, productivity, innovative ability and activity, competitive capacity and position in the market, proximity to customers and customer satisfaction, employee satisfaction, communication and knowledge sharing, and knowledge transparency and retention), (2) measuring financial performance of an organization (typically used are ROS, ROA, ROE (return on equity), profitability and Tobin's q) or (3) combining measures of general organizational performance and financial performance.

Even though researches that explored the link between knowledge management and organizational performance that did not confirm this link can be found, majority of those researches did confirm that link. Precisely, the list of authors that investigated the link between knowledge management and organizational performance, as well as focus of their study, main result and whether the link was confirmed, is presented in table 2.

Table 2: Researches that explored the link between knowledge management and organizational performance

Author(s)	Focus of the research	Main result of the research	Link confirmed
Bierly and Chakrabarti (1996)	Identifying groups of similar generic knowledge management strategies, determining how these strategies change over time, and comparing profit margins of the groups	Results assert that, in the pharmaceutical industry, organizations that have a more aggressive knowledge strategy have higher financial performance.	Yes
Wen Chong et al. (2000)	Identifying areas in which knowledge management adds value	Although only a very limited number of organizations have a mechanism to track the return on investment in knowledge-based competencies, meaning that the majority were not able to determine the business value of their investment, top three cited benefits gained by implementing informal or formal knowledge management plans are: (1) better client service, (2) enhanced communication flow and (3) shorter problem solving time.	Yes
Castillo (2003)	Empirically testing the link between organizational performance and the knowledge management initiatives of a sample of Fortune 500 organizations	Results show that there has been little payoff from organizational knowledge management efforts to date, in terms of financial measures and measures of efficiency, but there is payoff for some organizations and for some financial measures.	Yes
Kalling (2003)	Linking the quality of knowledge management with organizational performance	Results do not confirm the link between quality of knowledge management and organizational performance.	No
Lee and Choi (2003)	Interconnection of knowledge management factors such as enablers, processes and performance	Confirmed impact of trust on knowledge creation, impact of information technology on knowledge combination, impact of organizational creativity on improving performance.	Yes
Feng et al. (2004)	The study examines the impact of adopting knowledge management systems on organizational performance	Knowledge management systems improve organizational performance by significantly reducing administrative costs and improve productivity in the second year after adopting knowledge management system.	Yes
Tanriverdi (2005)	The study examines the link between organizational activities that utilize IT (knowledge management among others) and financial performance	Knowledge management is a critical organizational capability through which IT influences organizational performance, as the structural link from knowledge management capability to organizational performance is positive and significant.	Yes
McKeen et al. (2006)	Organizational impact of knowledge management	Knowledge management practices are directly related to organizational performance which, in turn, is directly related to financial performance.	Yes
Harlow (2008)	Assessing the level of tacit knowledge within organizations and its effect on organizational performance	Results indicate positive relationship between tacit knowledge index and innovation and financial outcomes, whereas use of tacit methods has a greater effect on innovation than on financial measures.	Yes

3. Research methodology

Measuring knowledge management can be performed in one of three possible ways: (1) through measuring knowledge management success factors,^[i] (2) through measuring results of knowledge management – knowledge management outcomes^[ii] or (3) through measuring perceived knowledge management effectiveness^[iii] (Clemmons Rumizen, 2002; Shih & Chiang, 2005; Anantatmula & Kanungo, 2006). In this research, knowledge management was measured using the first mentioned way, by measuring knowledge management success factors.

Many knowledge management enablers have been recognized as important for successful knowledge management in an organization, but there are five ones that are most commonly recognized as fundamental for knowledge management (listed in table 3), which are as well used in this research. Those five key knowledge management success factors are: knowledge management infrastructure,^[iv] knowledge management holders,^[v] knowledge culture – organizational culture that supports knowledge management,^[vi] information technology for managing knowledge^[vii] and measuring knowledge management.^[viii]

Table 3: Knowledge management success factors according to different authors

Authors	Knowledge management infrastructure	Knowledge management holders	Knowledge culture	Information technology for managing knowledge	Measuring knowledge management
O'Dell & Grayson (1998)	✓	✓	✓	✓	✓
Davenport & Prusak (2000)	✓	✓	✓	✓	✓
Gold et al. (2001)	✓		✓	✓	
Kululanga & McCaffer (2001)	✓	✓	✓	✓	
Moffett et al. (2003)			✓	✓	
Stewart (2003)	✓	✓	✓	✓	✓
Hasanali (2004)	✓	✓	✓	✓	✓
Metaxiotis et al. (2005)	✓	✓	✓	✓	
Anantatmula & Kanungo (2006)		✓	✓	✓	
Lee et al. (2006)		✓	✓	✓	
TOTAL	7	8	10	10	4

The link between knowledge management and financial performance in Croatia was assessed through correlation analysis between the numbered knowledge management success factors and return on assets (ROA) and return on sales (ROS), as the most frequently used financial indicators in researches that investigate the relationship between those concepts (table 4).

Table 4: Financial indicators used in the researches of the link between knowledge management and organizational performance

Author(s)	Indicators used
Bierly and Chakrabarti (1996)	ROS and ROA
Castillo (2003)	ROS, ROA, ROE
Feng et al. (2004)	ROA, ROS, asset turnover and operating income to assets
Tanriverdi (2005)	Tobin's q and ROA
McKeen et al. (2006)	ROA, ROE and profitability

The instrument used for data collection was a highly-structured questionnaire designed to assess organization's knowledge management practice in five before mentioned knowledge management success

factors. Questionnaires were fulfilled by the organization's representative that was either responsible for knowledge management or in a position to have the best insight into knowledge management practice.

The data collected was used to assign grades on a five point Likert-type scale (1 = not present/developed, 2 = minimally present/developed, 3 = moderately present/developed, 4 = present/developed and 5 = extremely present/developed) to each organization for the five key knowledge management success factors. Grades were assigned applying expert method in order to structurally process obtained information using the knowledge of an expert (which is one of the goals of estimation of experts according to Burinskienė & Rudtkienė, 2009). Precisely, each factor was assessed by the author of this paper, according to her insights into knowledge management theory, empirical findings in knowledge management literature, and knowledge about specific knowledge management practice in each organization from the sample. Assessment was based on the data provided by the organizations, varying from four to eleven indicators per factor, with distinct rules for assigning grades based on the number and/or combination of positive/negative indicators. In particular, grade for knowledge management infrastructure was based on eleven indicators, grade for knowledge management holders was based on ten indicators, grade for knowledge culture was based on nine indicators, grade for information technology for managing knowledge was based on nine indicators, and grade for measuring knowledge management was based on four indicators (exact indicators used to assign grades for each knowledge management success factors are listed in table 5. Financial indicators used (ROS and ROA) are taken from the special issue "The best 500" of journal Lider in 2007, which gave various financial indicators for the best 500 organizations in Croatia that year.

Table 5: Indicators used to assign grades for knowledge management success factors

Knowledge management success factor	Indicators used to assign grade
Knowledge management infrastructure	(1) Existence of a key knowledge list, (2) regularity of identifying the discrepancy between required and available knowledge, (3) percentage of additionally educated employees, (4) quality of a program for additional education of employees, (5) percentage of additionally educated employees that left the organization within the past twelve months, (6) percentage of employees engaged in knowledge management activities, (7) quality of selection process for new employees, (8) quality of organization's library, (9) existence of obligation for employees to formally share information and knowledge gained at conferences, workshops etc., (10) existence of practice of identifying lessons learned after completion of a project, and (11) quality of practice of identifying lessons learned after completion of a project.
Knowledge management holders	(1) Existence of a mission statement that includes knowledge, (2) existence of an employee responsible for managing knowledge, (3) appropriateness of organizational position of an employee responsible for managing knowledge, (4) appropriateness of organizational department in which an employee responsible for managing knowledge is positioned, (5) appropriateness of organizational title of an employee responsible for managing knowledge, (6) appropriateness of employee's performance appraisal with regards to involvement in knowledge management activities, (7) percentage of employees for which involvement in knowledge management activities is part of their performance appraisal, (8) quality of rewarding employees for their contribution to knowledge management, (9) existence of a mentorship program, and (10) percentage of employees participating in the mentorship program.
Knowledge culture	(1) Existence of a specific place intended for informal socialization of employees during working hours, and (2-9) perceptions of an employee that is either responsible for knowledge management or in a position to have the best insight into knowledge management practice about the level that an organization: has open communication among employees, nurtures trust among employees, is innovative, has employees that share knowledge, has employees that admit their lack of knowledge, has employees that initiate generation of new knowledge, has employees that regularly consult their colleagues, and has employees that dedicate their time to converse with colleagues.

Information technology for managing knowledge	(1) Existence of a software for knowledge management, (2) existence of a software specifically intended for: communicating information within organization, (3) document management, and (4) managing expert knowledge, (5) existence of yellow pages for employees, (6) percentage of employees included in yellow pages, (7) percentage of employees that should be included in yellow pages, (8) quality of updating information in the software for document management, and (9) percentage of employees that have access to internet and electronic mail.
Measuring knowledge management	(1) Existence of performance indicators that are connected to knowledge management, (2) percentage of organizational performance indicators connected to knowledge management, (3) quality of indicators of organizational performance connected to knowledge management that are used, and (4) existence of a practice to keep track of stories and anecdotes confirming the importance of knowledge management.

The population consisted of large Croatian organizations by number of employees (those with more than 1000 employees) since organizational size was found significant for quality of knowledge management practice (Davenport & Prusak, 2000; Singh et al., 2006). Out of 76 large organizations in Croatia in 2007 (according to the database of Croatian Chamber of Commerce), 34 organizations participated in the survey, which makes response rate of 44.7%. Characteristics of the organizations in the sample are given in table 6.

Table 6: Profile of organizations in the sample

Characteristic	Structure (%) of organizations
Size (measured by number of employees)	1000 to 1500 employees (29.5%), 1500 to 3000 employees (35.3%), 3000 to 5000 employees (17.6%), more than 5000 employees (17.6%)
Main activity	agriculture, forestry and fishing (5.9%), gas (2.9%), manufacturing (17.6%), construction (14.7%), wholesale and retail trade (8.8%), transport and storage (11.8%), hospitality and tourism industry (2.9%), information and communication technologies (11.8%), financial services and insurance (11.8%), other (11.8%)
Ownership structure	state- or mostly state-owned organizations (50.0%), mostly private Croatian-owned organizations (29.4%), mostly private foreign-owned organizations (20.6%)

All calculations and analysis were performed using Statistical Package for the Social Sciences – SPSS. The link between knowledge management success factors and performance indicators was assessed using Spearman's correlation coefficient as a measure commonly used when analyzing the correlation between ordinal and interval variables (Bryman & Cramer, 2005).^[ix]

4. Research results

Data from performed correlation tests by each knowledge management success factor, as well as descriptive statistics data including average grades and standard deviations are provided in table 7.

Table 7: Correlation tests between knowledge management success factors and performance indicators

KM success factor	n	Grade	σ	ROS		ROA	
KM infrastructure	34	3.26	1.24	Spearman's coefficient	0.157	Spearman's coefficient	0.098
				Significance	0.424	Significance	0.620
KM holders	34	2.56	0.99	Spearman's coefficient	0.306	Spearman's coefficient	0.108
				Significance	0.113	Significance	0.585
Knowledge culture	32	3.09	0.89	Spearman's coefficient	0.616	Spearman's coefficient	0.515
				Significance	0.001	Significance	0.006
IT for managing knowledge	32	3.31	1.47	Spearman's coefficient	0.123	Spearman's coefficient	-0.149
				Significance	0.542	Significance	0.459
Measuring KM	32	2.22	1.43	Spearman's coefficient	0.513	Spearman's coefficient	0.325
				Significance	0.006	Significance	0.098

For a more thorough analysis of these correlation tests, firstly the descriptive data will be briefly analyzed. As evident from the table 7, knowledge management success factor that has the highest grade is information technology for managing knowledge, meaning that on average the highest grades were assigned to Croatian organizations for knowledge management practice concerning utilization of information technology that supports knowledge management (average grade is 3.31). Second best knowledge management success factor is the knowledge management infrastructure (with average grade 3.26), followed by knowledge culture (average grade 3.09) and knowledge management holders (average grade 2.56). Finally, knowledge management success factor with the lowest grade is measuring knowledge management, which means that on average the lowest grades were assigned to Croatian organizations for development and usage of knowledge management measures (measures for assessing knowledge management practice's development, results and possible problems) (average grade for measuring knowledge management is 2.22). Another interesting aspect to address is the fact that even the highest average grade per knowledge management success factor (3.31 in case of information technology for managing knowledge) is still relatively insufficient to call that practice good or excellent – as needed for knowledge management to have a significant impact on an organization's performance.

Data from performed correlation tests presented in the table 7 exhibit that the link between knowledge management and financial indicators (ROS and ROA) was found in large Croatian organizations. Specifically, performed correlation tests imply that there is a link between: (1) the level of existence of knowledge culture and both ROS and ROA (the links between knowledge culture and both ROS and ROA are significant, positive and, according to the Guilford's correlation coefficient standard, values of Spearman's coefficient of 0.616/0.515 indicate a moderate correlation or substantial relationship), and (2) the level of practice of measuring knowledge management and ROS (the link is significant, positive and indicates a moderate correlation according to the value of Spearman's coefficient of 0.513). As for other knowledge management success factors, the link between them and the financial indicators was not confirmed as significant. In particular, when discussing knowledge management infrastructure, for both ROS and ROA, Spearman's coefficients indicate a slight, almost negligible relationship (values of the Spearman's coefficients are 0.157/0.098); for knowledge management holders, Spearman's coefficients indicate a slight, almost negligible relationship with ROA (value is 0.108), but indicate a low correlation and definite but small relationship with ROS (value is 0.306); and for information technology for managing knowledge Spearman's coefficient indicate also a slight, almost negligible relationship with ROS (value is 0.123) and a slight, almost negligible but negative relationship with ROA (value is -0.149).

5. Discussion and conclusion

Overall, the correlation analysis focused on five knowledge management success factors and two financial indicators, therefore investigating ten possible links, proved three out of ten links to be significant, two links to be insignificant although indicative of definite but small relationship, and five links to be insignificant with slight, almost negligible relationship. As this research confirmed the significant link between two out of five knowledge management success factors and financial indicators: (1) knowledge culture and financial indicators ROS and ROA, and (2) measuring knowledge management and financial indicator ROS, it supports the thesis of knowledge management being related to the financial performance of organizations.

Specifically, by confirming the significant link between knowledge management success factor “knowledge culture” and financial indicators (both ROS and ROA), this research proved the importance of knowledge culture for managing knowledge, which should not be a surprise since the presence of knowledge culture is considered to be the most important among critical success factors for knowledge management (Alavi & Leidner, 1999; Gold et al. 2001; Nahm et al. 2004; Lam, 2005; Walczak, 2005). Furthermore, this research found the significant link between knowledge management success factor “measuring knowledge management” and financial indicator ROS, which could be interpreted that measuring knowledge management is essentially the distinguishing factor between thoroughly developed knowledge management

system and a partial one, since measuring of knowledge management is the activity mainly performed in organizations with fully developed knowledge management system.

Based on the results of the correlation analysis, the relationship between knowledge management success factor “knowledge management infrastructure” and financial indicators is insignificant and slight, almost negligible, which is probably due to the fact that knowledge management infrastructure is a necessary precondition for knowledge management, and therefore it can not act as a differentiating factor between successful and poor knowledge management. Similar explanation can be provided for the result of the insignificant and slight, almost negligible relationship between financial indicators and knowledge management success factor “information technology for managing knowledge”, which is also perceived as a necessary precondition that is nowadays easily available and usually exploited by organizations no matter of the quality of their knowledge management. As for the knowledge management success factor “knowledge management holders”, the research results indicate an insignificant although definite but small relationship with the financial indicator ROS. This result suggests that knowledge management holders are important knowledge management success factor, and that they are connected with financial performance of the organization. The reason this research did not prove the significant link between those concepts perhaps lies in the relatively small sample of organizations participating in the research.

Overall, analyzing world-wide researches of the link between knowledge management and financial performance, the fact is that in general researches have had the tendency to conclude that there is the connection between knowledge management and financial performance. More to it, almost all of those researches found that some aspects of knowledge management are more important than others or that only some aspects of knowledge management are connected with financial indicators. Hence, it can be concluded that this research, implying that knowledge management is related to financial performance of an organization, presents findings which are in line with findings of the majority of such researches, as it also distinguishes which of the knowledge management success factors are the ones that are significantly related to financial indicators: knowledge culture and measuring knowledge management.

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^[i] By measuring knowledge management through measuring knowledge management success factors one assumes that efficient knowledge management system is going to lead to expected results, and based on development of those success factors concludes about the quality and development of total knowledge management system. This method of measuring knowledge management opens opportunity for identification of strengths and weaknesses of a knowledge management system, and thus is in accordance with Vestal's (2002, pp. 6) proposition that knowledge management measures should act as a dashboard to help you understand where to make changes in your knowledge management implementation. Negativity of this method is rooted in the fact that by measuring parts one can only hope that those parts combined reflect realistic picture of the quality of the entire knowledge management system.

^[ii] By measuring knowledge management through measuring its results, objective effects are being measured. The main disadvantage of this method lies in possibly incomplete results as some effects can not be easily quantified, some effects may not be noticed or some effects may not be solely result of a knowledge management initiative. Also, this method does not give insight into structure of a knowledge management system neither into its strengths or weaknesses.

^[iii] The third way of measuring knowledge management implies measuring perceived knowledge management effectiveness by measuring perceptions of employees either about knowledge management success factors, about overall practice of knowledge management and/or about knowledge management results. Although this approach is approved by the high correlation between objective and perceived measures in selected variables (Shih & Chiang, 2005, pp. 598), the negative side of this method lies in subjectivity of employees and the fact that their perceptions may, but do not necessarily reflect the actual state.

^[iv] One of the first steps while implementing knowledge management is providing knowledge management infrastructure, which includes installing adequate mechanisms focused on transferring knowledge and best practice within organization, whereas Stewart (2003) sees knowledge management infrastructure as one of the necessary prerequisites for successful knowledge management. Specifically, knowledge management infrastructure includes

systems and processes for capturing, structuring, transferring and using knowledge; roles and responsibilities needed for managing knowledge; and preparing a culture and style that promotes communication and sharing, including providing opportunities for communities of practice to define themselves (Corral, 1998). In particular, knowledge management infrastructure should provide an up-to-date list of knowledge and skills that employees in an organization, and therefore organization itself, possess. Such list can then be used to identify crucial knowledge that organization lacks and to define methods for employees to gain and transfer that knowledge. Minimizing the difference between needed and available knowledge in an organization has become an imperative for organizations to survive in a modern business world. Furthermore, knowledge management infrastructure demands adequate organizational structure as well as precise definition of employees' roles to ensure optimum conditions for knowledge transfer. Unfortunately, it is precisely the development of organizational structure and defining roles, relations and responsibilities of individuals in charge of knowledge management initiative that are most frequently ignored tasks while implementing knowledge management (Hasanali, 2004).

^[v] Knowledge management holders are embodied in three knowledge roles: (1) knowledge workers, (2) managers of knowledge projects, and (3) chief knowledge officers (CKOs) (Davenport & Prusak, 2000, pp. 109-114). One of the main characteristics of knowledge workers whose everyday job involves knowledge management activities, according to Drucker (2001, pp. 18) is the fact that they know more about their job than anybody else in the organization. Second category, managers of knowledge projects, form a specific group of project managers who should besides having insight into knowledge management concept, have expertise in project management, change management, and technology management. Chief knowledge officer, third category, is someone in a position with the highest responsibility for the entire knowledge management system, in other words he leads the knowledge management charge. Among variety of tasks CKOs perform, there are three particularly critical CKO responsibilities: (1) building a knowledge culture, (2) creating a knowledge management infrastructure, and (3) making it all pay off economically (Davenport & Prusak, 2000, pp. 115).

^[vi] In a knowledge era, where knowledge has been recognized as a crucial resource, the term knowledge culture has become very popular as it is a principal facilitator of managing knowledge. Davenport and Prusak (2000, pp. 153, 154) describe knowledge culture as "a positive orientation to knowledge: employees are bright and intellectually curious, are willing, and free to explore, and their knowledge-creating activities are given credence by executives". Knowledge culture can also be defined as "a way of organizational life that enables and motivates people to create, share and utilize knowledge for the benefit and enduring success of the organization" (Oliver & Kandadi, 2006, pp. 8), whereas this definition accentuates creating, sharing and utilizing knowledge as an ultimate objective of knowledge culture.

^[vii] Information technology is essential for initiating and carrying out knowledge management (Lee & Choi, 2003), although it is by no means sufficient for successful knowledge management. Precisely, information system that supports knowledge management implies the system based on computers which facilitates knowledge management activities such as acquisition, structuring, storing, distribution and usage of knowledge. The use of information technology makes possible the task of managing vast amounts of new knowledge being created on a daily basis. Still, many authors draw attention to the link between the type of knowledge and the benefits information technology provides for managing that knowledge. Namely, they conclude that the more complex the knowledge, the less appropriate the use of information technology (Gupta & Govindarajan, 1991, 2000; Simonin, 1999; Ciabuschi, 2005).

^[viii] Measuring knowledge management is about providing an assessment of the value that knowledge management systems and processes provide to an organization (Jennex et al., 2008). Area of measuring knowledge management, as one of the important knowledge management success factors, is the least developed area (O'Dell & Grayson, 1998; de Gooijer, 2000; Bose, 2004; Anantamula & Kanungo, 2006). As a key reason for underdevelopment of knowledge management measuring, Hasanali (2004, pp. 66) points that highly misunderstood and feared by most is the measurement factor, as most people fear measurement because they see it as being synonymous with ROI, and they are not sure how to link KM efforts to ROI. Or, as Grossman (2006, pp. 243) clarifies: "Measurement is perhaps the least developed aspect of knowledge management because of the inherent difficulty of measuring something that can not be seen or touched". However, regardless of the reasons, the fact still remains that while many organizations today are investing in knowledge management systems, they often have difficulty measuring its value (Brown et al., 2005).

^[ix] Pearson's *r* could also have been used as ordinal variables can be treated as "imperfect" or "weak" interval variables since they are generally described with statistical measures that assume continuous numerical scales (Leysens, 2004), however, Spearman's correlation coefficient is a more appropriate measure from the methodological perspective, and the usage of Pearson's *r* would be an empirical compromise.