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EMPIRICAL STUDY ON KNOWLEDGE SOURCES IN PROJECT-INTENSIVE ORGANISATIONS

1. Introduction

In today's globalised world, knowledge management is becoming increasingly important. Although the history of knowledge management dates back to ancient Greece and Rome[383], it was only in the 90's of the XXth century when the concept of Knowledge Economy emerged. According to the OECD definition, KE is the economy based on the production, distribution and use of knowledge and information[384]. As the importance of tangible assets declines, the business success is increasingly determined by the degree of effectiveness of the use of knowledge and innovation[385].

According to the current state of theory and practice knowledge is seen as an effective use of information in action[386], as a mean to resolve problems and issues[387], a thorough cognition of a phenomenon through experience, education, observation or research[388].

Study by M. Polyani presents knowledge that can be tacit (unwritten, unspoken, based on one's emotions, experiences, intuition, insights observations, integral to the entirety of a person's consciousness) or explicit (structured, written and stored in form of documents, procedures and knowledge systems)[389]. According to I. Nonaka

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[383] A. Jashapara, *Zarządzanie wiedzą*, PWE, Warsaw 2006, p. 38.

[384] OECD, *The Knowledge-Based Economy,* Paris 1996.

[385] I. Brinkley, *Defining the Knowledge Economy*, The Work Foundation, London 2006.

[386] P. Drucker, *Społeczeństwo pokapitalistyczne*, PWN, Warsaw 1999, p. 43.

[387] W. Applehans, A. Globe, G. Laugero, *Managing Knowledge. A practical web-based approach*, Addison-Wesley 1999, p. 18.

[388] Project Management Institute, *A Guide to the Project Management Body of Knowledge*, 5th edition, PMI 2013.

[389] M. Polanyi, *The Tacit Dimension*, Routledge & Kegan Paul, London 1966.

knowledge develops by constant transformation from one kind to another in process of socialisation, combination, externalisation and internalisation[390].

Knowledge as a new kind of organisation resource has particular features: is not subject to wear, multiplies if shared[391], its value rises when used[392]. Organisation knowledge assets form its intellectual capital, which is reflected in business model, the organisational procedures and documentation, in the design of the main and auxiliary business processes, in employees, managers at every level, cooperating experts, information systems and planning and many more[393]. Knowledge and knowledge management mechanisms have become unquestionably a source of competitive advantage of the organisation[394].

Special interests in knowledge, both scientific and business, led to the development of knowledge management systems combined from best practices, solutions related to organisational culture[395], defined roles and organisational structures[396], IT systems[397] and established processes and tools[398].

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[391] J.J. Brdulak, *Zarządzanie wiedzą, a proces innowacji produktu*, Oficyna Wydawnicza SGH, Warsaw 2005, p. 14.

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[397] G. Green, L. Liu, B. Qi, *Knowledge-based Management Information Systems for the Effective Business Performance of SMEs*, "Journal of International Technology and Information Management" 2009, vol. 18, no. 2, p. 201–222; B. Iyer, G. Shankaranarayanan, G. Wyner, *Process coordination requirements: implications for the design of knowledge management systems*, "The Journal of Computer Information Systems" 2006, vol. 46, no. 5, p. 1–13; J.S. Edwards, D. Shaw, P.M. Collier, *Knowledge management systems: finding a way with technology*, "Journal of Knowledge Management" 2005, vol. 9, no. 1, p. 113–125.

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Projects stand for a particular subset of activities of organisation. Projects are temporary, complex endeavours undertaken to deliver unique products or services. Uniqueness of their goal and conditions, as well as a temporary nature of project organisation hinder organisation learning processes, gathering lessons learned and development of organisational, project knowledge. In result new knowledge is kept from application in projects, project teams reinvent the wheel and keep making same mistakes. Proper use of knowledge management practices allows to lower project risk level, improves quality of planning, as well as allows saving project costs[399].

As knowledge has been recognised as a valuable resource, a company tries to leverage it by transferring the existing knowledge within the company itself as well as from external sources[400]. This implies an issue of reaching for useful knowledge from within and outside management boundaries of organisations. Project knowledge has been a subject to many scientific studies and papers[401]. However just a few of them have raised an issue of sources of project knowledge and their value in the eyes of project management specialists.[402]The aim of this paper is to fill the gap and present the recent findings of the research on preferences of project teams towards use of project knowledge management sources.

2. Research Methodology

The study adopted survey method for data collection and examined hypotheses by applying statistical tests to evaluate the significance of differences between sample groups. Questionnaires were distributed among postgraduate students of the Warsaw School of Economics and members of PMI Poland Chapter. The survey sample consisted of 631 people –project management specialists of diverse business sectors

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[401] P. Wyrozębski, *Praktyki zarządzania wiedzą projektową w polskich organizacjach – wyniki badań*, „E-mentor" 2011, no. 5(42); J. Schwaab, *Knowledge management for project managers and other decision--makers – Learning from experience*, Deutsche Gesellschaft fur TechnischeZusammenarbeit, Eschborn 2009; M. Haddad, V. Ribiere, *The use of knowledge management in software acquisition*, "The Journal of Information and Knowledge Management" 2007, vol. 37 no. 3, 2007, p. 295–313; K.G. Cooper, J.N. Lyneis, *Learning to learn from past to future*, "International Journal of Project Management" 2002, vol. 20, no. 3, p. 213–219; B. Horner Reich, S. Yong Wee, *Searching for knowledge in the PMBoK Guide*, "Project Management Journal" 2006, vol. 37, no. 2, p. 11; S. Faraj, L. Sproull, *Coordination expertise in software development teams*, "Management Science" 2000, vol. 46, no. 12, p. 1554–1568; A. Tiwana, A. Bharadwaj, V. Sambamurthy, *Antecedents of IS capability*, Proceedings of 24th. International Conference on IT Systems, Seattle 2003, p. 246–258; T. Kotnour, *A learning Framework for Knowledge Management*, "Project Management Journal" 1999, vol. 30, no. 2, p. 23–38.

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and positions. The sample included representatives of the major areas traditionally pursuing their activities in the form of projects. The most numerous were: construction industry, the development and implementation of software, followed by a public administration, manufacturing and technology and finance (Table 1).

Table 1. Sectors Represented by the Survey Participants

	Responses		Percent of people surveyed
	N	%	
Construction	100	13,9%	18,0%
IT (software)	89	12,4%	16,0%
Public administration	70	9,7%	12,6%
Production/technology	64	8,9%	11,5%
Finance and banking	59	8,2%	10,6%
Telecommunications	49	6,8%	8,8%
Power engineering	36	5,0%	6,5%
Advisory/ consulting	35	4,9%	6,3%
Media/ advertising	34	4,7%	6,1%
IT(infrastructure)	30	4,2%	5,4%
Commerce	28	3,9%	5,0%
Insurance	22	3,1%	4,0%
Logistics	16	2,2%	2,9%
Education	13	1,8%	2,3%
NGO	11	1,5%	2,0%
Tourist services and sports	5	,7%	,9%
Agriculture	2	,3%	,4%
Municipal services	2	,3%	,4%
Other	53	7,4%	9,5%
Total	718	100,0%	129,1%

Source: Own research.

The working position of people surveyed ranged from top executives to staff in various functional areas. The most of research sample were project managers (161/29.4%). The second most numerous groups were project team members (156/28.5% of respondents). Every fifth respondent (19.9%) was a member of the project management team, and almost one out of 10 (9.5%) worked on projects in an informal way. Twenty-one respondents were employed in the project management offices (PMO), which represents 3.8% of the sample. The category of "other" positions occupied by the respondents (8/1.5%) included i.e.: the head of the portfolio of projects, HR manager and business analyst. Position of 84 respondents (13.3%) was not declared.

In the survey respondents answered the question "Which source of knowledge would you recommend to the other project manager in one's organisation? Respondents were given the choice of seventeen sources of knowledge identified in the course of preliminary research. Multiple answers were possible.

Project archives. Analysis of project documentation enables the assessment of the project in terms of fulfilment of initial requirements and compliance with project plans. Information and experience contained in project plans, logs and reports are an important source of knowledge for subsequent projects[403].

Corporate project management methodology. Project management methodology is a set of rules and guidelines that describe the project management process and tools agreed to use in a particular organisation. Development of a corporate methodology typically involves adapting one of the universal or industry methodologies to the specific requirements of organisation. The employment of such methods is limited to the organisation in which they were created.

Contact with PMO. Project management office (PMO) is a separate, permanent unit within the organisation devoted to advancement of project management capabilities within organisation. PMO staff provides a standardisation of project management processes, leading to an increase in their quality and efficiency. One of the key tasks of the PMO is a project knowledge management. This is done through the collection, preservation and transfer of information and experience gained in the implementation of previous projects. Consultants are also involved in carrying out further training and raising qualifications of project personnel[404].

Contact with other project managers inside (or outside) the organisation. The experience of other project managers gives a great opportunity for acquisition of rare and valuable tacit project knowledge. Contacting the PM within the organisation allows obtaining useful knowledge in line with the corporate practices, whereas contact with managers from outside the organisation gives a chance to look at the problem from a new perspective.

Internal training. Training programs provide the opportunity for gaining skills, knowledge and other competencies in process of teaching and learning. Training is primarily concerned with the acquisition of competences that relates to the specific requirements of a post held by an employee. Internal training is usually conducted by a supervisor or other employees. Increasingly, organisations are also creating special training platforms through which employees can take e-learning courses.

Participation in the project summary meetings. Meetings summarising the project (lessons learned meetings) is a method to analyse the work on the project

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[403] M. Wirkus, H. Roszkowski, E. Dostatni, W. Gierulski, *Zarządzanie Projektem*, ZIP, Warsaw 2014, p. 176–181.

[404] P. Wyrozębski, *Biuro Projektów*, Biblioteka Project Managera, Warsaw 2009, p. 8–19.

through the prism of experience of the project team. The first step in this technique is the preparation for the meeting, which involves the selection of meeting facilitator and conducting preliminary analysis of project documentation. The second step is to hold the meeting. The third phase is the preparation of the summary and project lessons learned report[405].

The organisational knowledge base. One of the operational goals of knowledge management is the collection, selection and preservation of information. Individual experience of the employees and knowledge artefacts are codified and stored in the organisational knowledge bases. Different types of information are stored in structured way and are subject to regular review in order to eliminate the unusable knowledge[406].

The internal coaching program. Coaching is an interactive process which helps people or organisations in accelerating their professional development and achieving better performance[407]. Manager works with a coach (internal or external) to solve the problems associated with the results achieved, as well as to develop individual abilities, skills in organisation and acquisition of knowledge[408]. The benefits of individual development programs are manifold: improved performance, increased employee satisfaction, improved relationships, greater commitment to the company. B. Redshaw also indicates an increase the capability of learning and knowledge acquisition by employees[409].

Internal publications and guides. The most of organisations issue publications, brochures or manuals for the internal use by their employees. Information contained therein is the form of codified knowledge. It may relate to current events, articles on business topics or manuals and guides to organisational processes. These brochures can be printed or transmitted electronically in the form of a newsletter.

Membership in project management associations. The leading, global non-profit organisations whose purpose is to develop and promote project management include Project Management Institute, and International Project Management Association. Membership in these organisations provides access to society of professionals, varied knowledge resources, communities of practice, expertise, career development as well as people networking opportunities.

Books and magazines. Since Gutenberg books and magazines have been traditionally used as a prime source of codified knowledge. The catalogue of the Polish

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[405] P. Wyrozębski, *Zarządzanie wiedzą projektową – techniki gromadzenia doświadczeń projektowych*, "E-mentor" 2008, no. 3(25).

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[408] M. Sook Choi, *A case study of an action learning program: Can action learning be an approach to enhance a manager's coaching skills?*, The George Washington University, 2005, p. 24.

[409] B. Redshaw, *Do we really understand coaching? How can we make it work better?* "Industrial and Commercial Training" 2000, vol. 32, no. 3, p. 106–108.

National Library consists of 301 items under the keyword of "project management", whereas Amazon.com – 86, 857. The last number shows the massive amount of knowledge held in form of paper and e-books.

Internet portals, blogs and discussion forums. The Internet has become a great tool for knowledge sharing and acquisition. It helps finding info on any kind of knowledge just by typing a key word in search engine and clicking the right link. The Internet is a source of countless specialist sites where one can speak to the experts in their fields. It allows access to wikis, specialist journals, books, expert blogs, videos, social media and many more. Access to the Internet resources is usually free and if fee is required, the materials are made available immediately after the payment. Immense amount of knowledge and information stored in the Internet requires ability to assess its credibility, usefulness and quality of the information provided.

Postgraduate programs. Postgraduate studies in project management are offered by many Polish universities. Their goal is to provide theoretical and practical knowledge in the field of project management. In contrast to training, postgraduate communicate knowledge in a comprehensive manner. Frequently employers, who want to increase the skills of their employees, provide funds for covering their participation fee.

External training. External training is provided by independent training companies and usually takes place outside the workplace. Such training may take the form of seminars, conferences, case studies, lectures or simulation games. The main advantage of external training is the ability to contact experts from outside of the organisation and therefore gives the opportunity to acquire completely new knowledge, take a fresh look at the matter. On the other hand, the disadvantage of such training is the risk of a mismatch of content to the needs of the organisation.

Universal PM standards. Project management standards consist of bodies of knowledge, methodologies, competency baselines and norms published by leading project management organisations. They provide common language and set of recognised best practices, methods and processes. Their universal nature means that standards are applicable to most of projects, most of time and most of industries, however generality of recommendations requires their careful tailoring and implementation into the particular organisation.
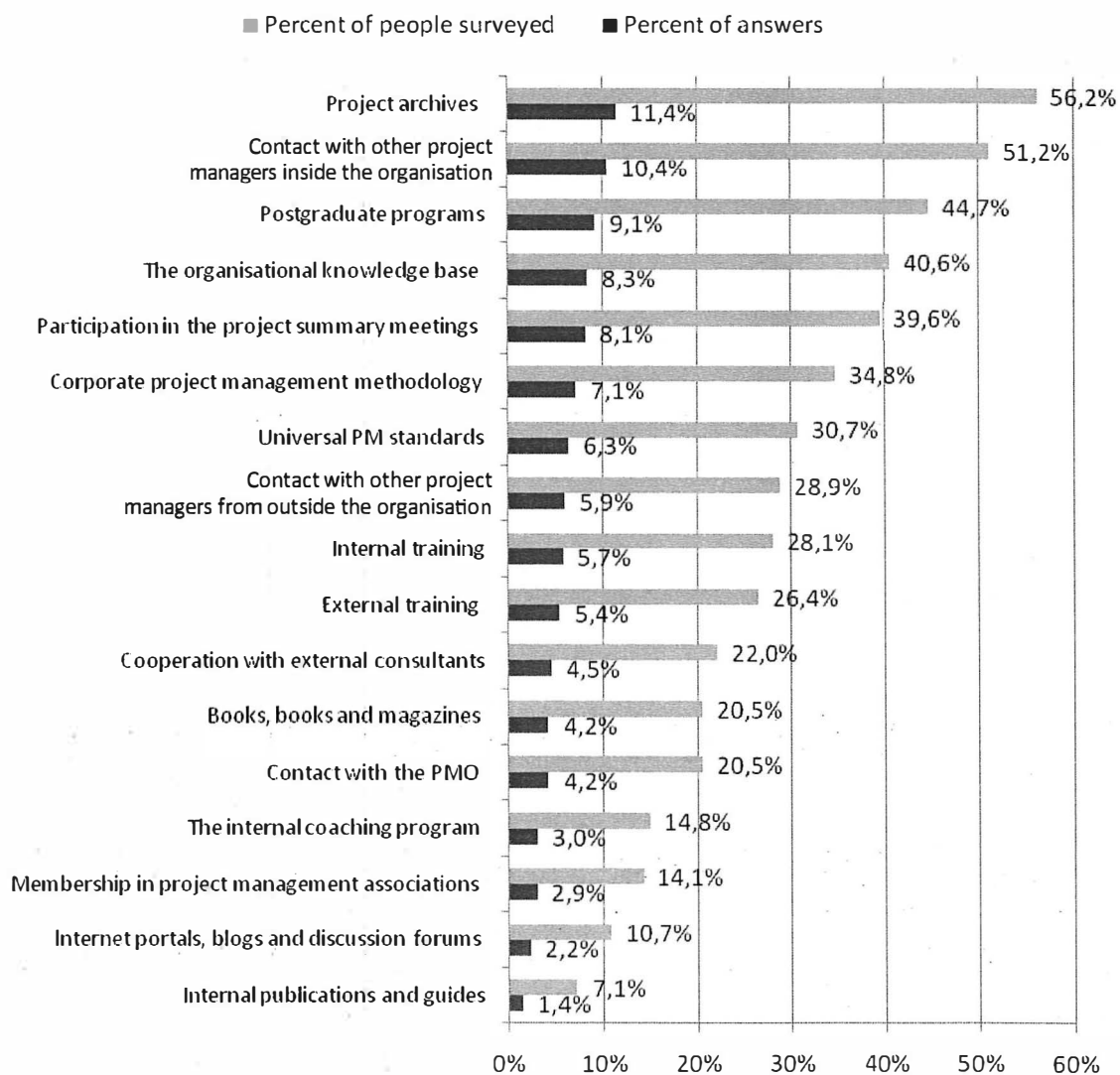
Cooperation with external consultants. Currently on the market there are many consulting firms that offer broad consulting and advisory services. Consultants, or people engaged in professional consulting are highly qualified to offer a wide range of services. The consultants support companies at various stages of managing the project like planning, managing risk and controlling the project progress.

3. Results

The survey showed that the most frequently recommended source of project knowledge were project archives, chosen by 56.2% of respondents. Contact with other project managers inside the organisation ranked second (51.2%). Postgraduate studies were chosen by 44.7% of people surveyed, followed by participation in the project summary meetings (39.6%), and corporate project management methodology (34.8%). It's clear that except for post-graduate studies the ranking lead consists of internal sources of knowledge, both codified (documentation) and personalised (other project managers). The most recommended sources of knowledge are therefore closely linked to the specifics of project work done in the organisation and are meant to resolve that kind of problems – see Figure 1.

Figure 1. Sources of Project Knowledge Recommended by Project Personnel

Source: Own research.

Internal and external training are recommended respectively, by the third and every fourth respondent. Cooperation with external consultants, books and other publications, as well as contact with the PMO are an important source of knowledge for every fifth interviewee. The least popular sources were recommended by less than every seventh respondent and were: internal coaching programs, membership in professional associations, portals and discussion forums, and, interestingly, internal publications and guides.

In order to identify the specific preferences of subsets of sample the further analysis was to verify the hypotheses concerning the differentiation of these preferences with respect to the distinguished characteristics of the respondents and the organisations they represent.

H1: Preferences of sources of project knowledge vary depending on the business of the sector.

Partial hypotheses concerned diversity of preferences with respect to each sector (15 sectors, due to the insufficient quantity omitted: agriculture, municipal services, travel services and other), and each category of sources of project knowledge (17 types of sources). The test statistics used Pearson Chi2 for 2x2 and the phi coefficient, with $p < 0.05$. Summarised results of the analysis are presented in Table 2.

The analysis revealed relatively week (phi<|0.2|) relationships between variables. IT infrastructure companies were more likely than others to ask PMO staff for help. Similarly, a strong preference in favour of the PMO characterises the representatives of finance and banking as well as insurance, telecommunications and education. The construction industry, on the contrary, rarely recommended contact with this unit.

Another interesting observation concerns the preference for online sources of knowledge (portals, blogs and discussion forums). While its cored last but one rank in the overall ranking, it was relatively more frequently recommended by representatives of companies involved in software development and implementation. Representatives of IT companies were also relatively more likely to recommended membership in professional associations.

Quite interesting results appear to the public administration sector, as its representatives relatively more often than others recommended external sources of knowledge, especially cooperation with external consultants, external training and contact with project managers from outside their organisations.

The opposite trend applies to the telecommunications, which recommended less frequently cooperation with external consultants and external project managers. On the other hand, telecommunications more often pointed to the value that comes from the company's project management methodology, contact with the PMO and other managers within the organisation, as well as participation in internal trainings.

H2: Preferences of sources of project knowledge vary depending on the importance (intensity) of projects in the organisation.

Table 2. Differences between Represented Sectors on Recommended Sources of Project Knowledge

M – more likely / L – less likely / (xxx) – phi coefficient / p<0.05	Sector														
	Public administration	Construction	Advisory/consulting	Power engineering	Finance and banking	Commerce	IT (infrastructure)	IT (software)	Media/advertising	NGO	Production/technology	Logistics	Insurance	Telecommunications	Education
Project archives															
Corporate project management methodology					M (0,083)			M (0,097)						M (0,082)	
Contact with PMO		L (−0,150)			M (0,154)		M (0,188)						M (0,079)	M (0,093)	M (0,096)
Contact with other project managers from inside the organization								M (0,100)	M (0,087)				M (0,106)	M (0,080)	
Internal training										M (0,082)				M (0,090)	M (0,087)
Participation in the project summary meetings		M (0,079)													
The organisational knowledge base															
The internal coaching program					M (0,103)								M (0,120)		
Internal publications and guides				M (0,123)					M (0,103)						
Membership in project management associations							M (0,128)	M (0,104)				M (0,083)			
Contact with other project managers from outside the organisation	M (0,095)													L (−0,088)	
Books, books and magazines							M (0,094)				M (0,96)				
Internet portals, blogs and discussion forums								M (0,132)							
Postgraduate programs															
External training	M (0,106)														
Universal standards for PM		L (−0,082)			M (0,090)										
Cooperation with external consultants	M (0,125)													L (−0,078)	

Source: Own research.

The next hypothesis investigated significant differences in the recommended sources of knowledge between organisations that implement projects occasionally, and those for which it is the primary area of business. The test statistics used Mann-Whitney U test (also known as Wilcoxon Mann-Whitney test). The following figure shows the summary of results of a series of tests with level of significance at $p < 0.05$.

The results show that organisations with lower intensity of project activities are not able or had not yet produced their own internal sources of knowledge, therefore, tend to rely on external sources- hence the postgraduate studies and contacts with external experts. That is the opposite to the project oriented organisations, which have already accumulated significant amount of proprietary project knowledge produced independently or acquired previously from the environment. Their knowledge resources are stored in the form of professional publications, documentation of the processes and procedures, staff experience and formal training programs. Such organisations do not have to seek out for external knowledge – see Figure 2.

Figure 2. Ranking of Recommended Sources of Project Knowledge with respect to the Importance (Intensity) of Projects in the Organisation

		Value
Sources of knowledge recommended in organisations with a higher project intensity level	Internal publications and guides*	72,19
	Corporate project management methodology*	55,49
	Contact with other project managers inside the organisation*	40,55
	Internal training*	31,88
	The internal coaching program	27,65
	The organisational knowledge base	10,5
	External training	3,62
	Participation in the project summary meetings	2,83
Sources of knowledge recommended in organisations with a lower project intensity level	Contact with the PMO	-2,65
	Universal standards for PM	-10,98
	Internet portals, blogs and discussion forums	-14,19
	Project archives	-14,42
	Books, books and magazines	-23,84
	Contact with other project managers from outside the organisation	-24,32
	Postgraduate programs*	-30,73
	Membership in project management associations	-31,94
	Cooperation with external consultants*	-44,23

* significant at p<0.05

Source: Own research.

H3: Preferences of sources of project knowledge vary depending on size of the organisation.

The last hypothesis concerned the diversity of recommended sources of knowledge due to the size of the organisation (measured by the number of employee). Do large organisations differ from small ones in terms of recommended sources of knowledge project? The test statistics used Mann-Whitney U test. Figure 3 shows the summary of results of a series of tests with level of significance at p <0.05.

Figure 3. Ranking of Recommended Sources of Project Knowledge with respect to the size of the organisation

Sources of knowledge recommended in large organisations	Contact with other project managers inside the organisation*		55,02
	Corporate project management methodology*		43,72
	The internal coaching program*		37,57
	Internal publications and guides		32,94
	Contact with the PMO		25,01
	The organisational knowledge base		20,66
	External training		18,48
	Universal PM standards		12,1
	Internal training		5,64
	Participation in the project summary meetings		1,18
Sources of knowledge recommended in small organisations	Books, books and magazines		-4,48
	Postgraduate programs		-14,82
	Membership in project management associations		-15,64
	Cooperation with external consultants		-17,93
	Project archives		-20,38
	Contact with other project managers from outside the organisation		-21,79
	Internet portals, blogs and discussion forums		-32,57

* significant at p<0.05

Source: Own research.

In this case, only three sources of project knowledge significantly differentiate organisations in terms of their size. They are: contact with other project managers within the organisation, corporate project management methodology and an internal coaching program. These three sources were selected by representatives of organisations with significantly greater number of employees. In other cases, diversity, even if

occurred, cannot be regarded as statistically significant. Still, it is worth noting that Internet sources of knowledge were generally chosen by small organisations.

4. Conclusions

This study advances current state of knowledge by highlighting perceived value of different knowledge sources for project managers and other members of project personnel. It fills the gap which results from lack of research concerning this issue.

Empirical results gave the opportunity to create overall ranking of project knowledge sources with regard to the origin of knowledge (internal and external sources), and the way of storing it (codified source, personalised andmixed) – see Table 3.

Table 3. Ranking of Project Knowledge Sources

		How is it stored?						
		codified		mixed		personalised		
Where does it come from?	internal	Project archives	1	Internal training	9	Contact with other project managers inside the organisation	2	
		The organisationalknowledge base	4			Participation in theprojectsummary meetings	5	
		Corporate project managementmethodology	6			Contact with PMO	12	
		Internalpublications andguides	17			The internalcoaching program	14	
	external	Universal PM standards	7	Postgraduate programs	3	Contact with other project managers outside the organisation	8	
		Books,booksand magazines	12	Externaltraining	10	Cooperation with externalconsultants	11	
		Internet portals, blogs and discussion forums	16			Membershipin project management associations	15	

Source: Own research.

The ranking demonstrates the need for development and sustaining internal knowledge sources. Project oriented organisations should pay special attention to project archives which should be properly collected, stored and shared. If to treat the management as a range of organisational structures[410], the organisations eager to make best use of knowledge must reach both the knowledge of an internal nature, lying within its boundaries, as well as the external knowledge-beyond them. The results showed that the most project organisations acquire internal knowledge-rarely reach-

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[410] D.B. Van, *Redrawing boundaries*, "Executive Excellence" February 1999, vol. 16, no. 2, p. 3–4.

ing beyond its borders. According to T. Allan people are five times more willing to acquire knowledge from their colleagues then from other knowledge sources (data base, archives etc.)[411]. This study seems to confirm his findings, as contact with other project managers within organisation ranked second in the overall list.

The results of this study also indicate that the perceived value of knowledge sources is different for those organisations which are project intense and those which undertake projects occasionally. The differences can be also observed in terms of size of the companies.

Those differences should be followed up by the management, which should use different tactics to enhance knowledge acquisition according to the characteristics of a company. This should be considered as starting point for the future research.

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Amit R., Schoemaker P.J.H., *The competitive Dynamics of capabilities: Developing strategic assets for multiple features*, in: *Wharton on Dynamics competitive strategy*, (ed.) G.S. Day, D.J. Reibstein, R.E. Gunther, John Wiley & Sons Inc., New York 1997.

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