

Evaluating Knowledge Management Practices in Software Development Organizations

Mauricio Seiji Cesar Rezende¹ João Bosco da Mota Alves¹

¹Universidade Federal da Santa Catarina, Brazil

Abstract

Software development is a knowledge-intensive and a complex activity. Due to increasing demands of the market, strategic management of knowledge assets is becoming indispensable for software development organizations. In software companies, as in other sectors, among the various categories of knowledge-related investments, knowledge management is one of the less known, both from a quantitative and a qualitative point of view. Thus, it is necessary to obtain a better understanding on the knowledge-based practices and on the current state of knowledge management as an organizational process within various kinds of companies and sectors. Aiming to help filling this gap, this paper presents the results of a knowledge management evaluation done in software development organizations in Florianópolis, Brazil. This research used the Organization for Economic Co-operation and Development questionnaire to evaluate knowledge management practices and the results obtained from these practices usage.

The goal of the article is to achieve an insight of the usage of knowledge management practices by local software companies and what results this usage has produced. Guided by this objective, the sample of this study was composed by 18 software developers from 14 different software organizations in Florianópolis, Brazil.

Respondents indicated that many results obtained through knowledge management practices are critical to their organizations. Particularly, 3 of these results seem to be critical for software development organizations:

- Improving skills and knowledge of workers;
- Improving worker efficiency and productivity;
- Increasing adaptation of products or services to client requirements.

keywords: knowledge management, knowledge management measurement, knowledge management practices, software development.

1 Introduction and study objectives

The current demands in software industry, such as short time-to-market, frequent introduction of new technologies, geographically distributed development teams, increasing application complexity, and increasing quality requirements, are among the toughest to be found among industry sectors (Althoff, Bomarius, & Tautz, 2000; Dingsøyr, 2002). (Avram, 2007) agrees and claims that software development has an intrinsic complexity, and that nowadays software development activities have increasingly become globally distributed.

According to (Dingsøyr, 2002), considering that software development is a very knowledge intensive task, both researchers and industry have turned their attention to knowledge management as a way to improve software development. In addition, considering that the

product of software development is knowledge itself, software industry is aware that usage of knowledge management practices is an important part of the software development process.

According to (OECD, 2004) there is a recognition of the need to understand and to measure the activity of knowledge management and the results obtained such practices,

Although there is a general understanding that software industry could benefit from knowledge management practices, the first step to approach the problem would be to access in what extend knowledge management practices are used by software companies and what results it has produced. However there is still little information about the current state of the application knowledge management practices usage and results not only in software development area, but also in other industry sectors.

Aiming to help achieve these objectives, (OECD, 2004) have set up a working group comprising representatives from the statistical offices of Canada, France, Italy, the Netherlands and Sweden and representatives from research bodies in Australia, Denmark, Germany and Ireland. The group created a questionnaire that surveys on the use of knowledge management practices and is complemented with questions on incentives for using knowledge management practices, results, responsibilities and investments on that area. The questionnaire was initially used by OECD in surveys carried out in Canada, Denmark, France and Germany and has later being used by other researches to evaluate knowledge management practices and results (Sá, 2011; Silva, 2011; Fonseca, Clemente, Oliveira, 2012).

In order to increase the understanding of the knowledge management practices in use on the software development industries and the results achieved by this use, this paper shows the results of a research were 18 software developers from 14 different software organizations in Florianópolis, Brazil were selected to respond the OECD questionnaire.

2 Theoretical basis

According to OECD (2004), knowledge management is “any intentional and systematic process or practice of acquiring, capturing, sharing and using productive knowledge, wherever it resides, to enhance learning and performance in organizations”.

Davenport e Prusak (1998) show the importance of knowledge management practices claiming that the only sustainable advantage that a company has is what it knows as an organization, how efficiently it uses what it knows, and how fast it acquires and uses new knowledge. Dalkir (2005), in accordance with this point of view, believes that “the ability to manage knowledge is becoming increasingly more crucial in today’s knowledge economy. The creation and diffusion of knowledge have become ever more important factors in competitiveness”.

In this context are the software companies, their current demands, such as short time-to-market, frequent introduction of new Technologies, geographically distributed development teams, increasing application complexity, and increasing quality requirements, are among the toughest to be found among industry sectors (Althoff, Bomarius, & Tautz, 2000; Dingsøyr, 2002).

Although knowledge management is clearly important to organizations, specially knowledge intensive organizations such as software companies, there is still a lack of understanding

about in what extend the knowledge management practices are actually been used by the organizations.

Aiming to help filling this gap, this article presents the results of a knowledge management practices evaluation held among software worker in Florianópolis, Brazil.

3 Methodology

According to Creswell (2010), the philosophical assumptions of the authors affect the research and must be clarified by them. Creswell (2010) defined such philosophical assumption as “a general orientation about the world and the nature of the research that a researcher holds”.

The present research was based on post-positivism as a philosophical assumption and has used a quantitative method to reach its objective. The approach of the research was collecting data from software developers that answered the OECD questionnaire and analyzing the results.

The goal of the article was to achieve an insight of the usage of knowledge management practices by local software companies and what results this usage has produced. Guided by this objective, the sample of this study was composed by 18 software developers from 14 different software organizations in Florianópolis, Brazil.

4 Results

Similarly to findings in the OECD survey (OECD, 2004) this study results showed that most respondents are familiar with the knowledge management concept, the conclusion is led by the fact that only 1 respondent has never heard of knowledge management before answering the questionnaire.

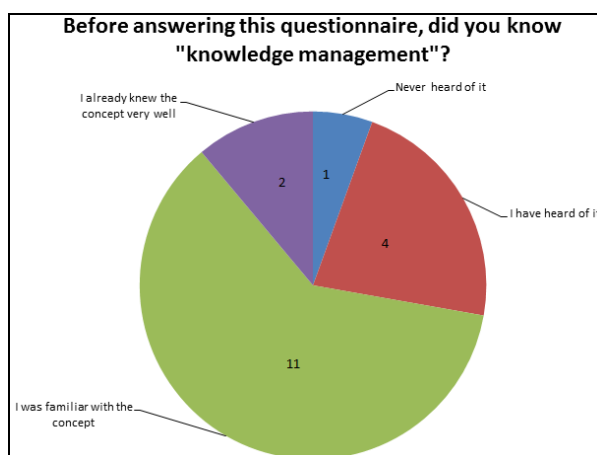


Figure 1: Respondents familiarity with knowledge management concept

The study also has shown that software developers participating on this study also clearly understood the questions. These could be verified through the option “Don’t understand the

question” added to every question. The results showed that only one respondent has chosen this option in only one of the questions.

Considering that the questions were understood by the respondents, the first part of the OECD questionnaire evaluates the usage of knowledge management practices in the organization. It is divided in 4 sections: communications, Training and Mentoring, Policies and Strategies and Knowledge capture and acquisition. This part offers the following alternatives as answers for each question:

- In use for more than 4 years
- In use for less than 4 years
- Plan to Use in the Next 24 Months
- Not in use / Not applicable
- Don't Know
- Don't understand the question

4.1 Communication

The communications section evaluates the usage of 3 practices and the results showed that most organizations surveyed regularly update databases of good work practices, lessons learned or listings of experts as well as prepare written documentation such as lessons learned, training manuals, good work practices, articles for publication, etc. (organizational memory).

In your firm or organization:

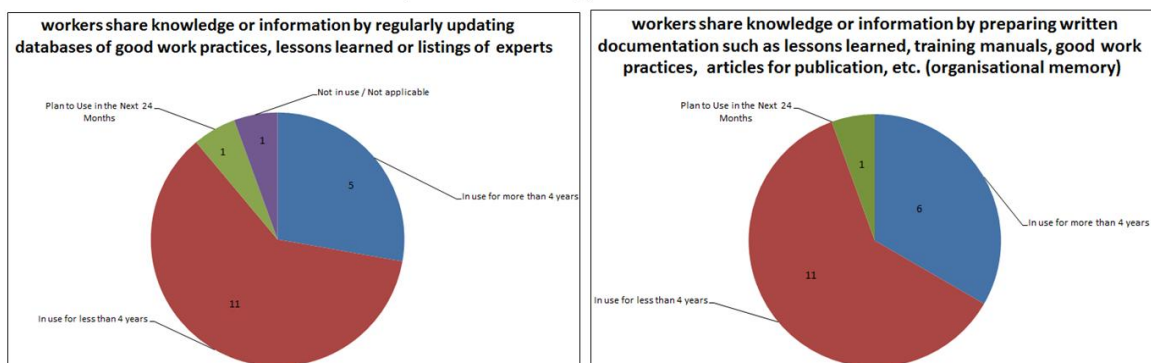


Figure 2: Results on knowledge communication

The last practice evaluated in the communication section was facilitating collaborative work by projects teams that are physically separated (“virtual teams”), although 10 out of 18 respondents said that their companies have this practice, 8 informed that this practice is not in use or is not applicable, showing that this practice is less used than the others.

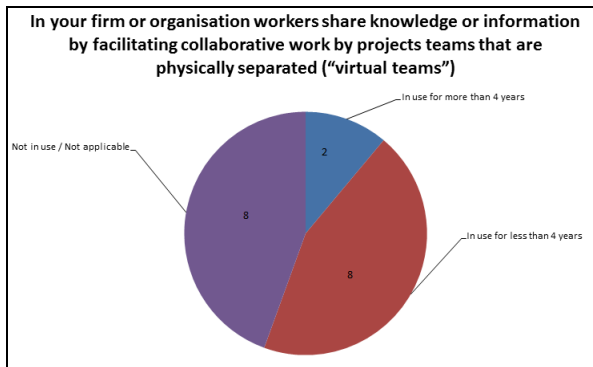


Figure 3: Results on facilitating collaborative work by projects teams that are physically separated

4.2 Training and mentoring

The second section of the OECD questionnaire evaluates the usage knowledge management practices related to training and mentoring. The results of this study indicate that these practices are being used by most software companies that were part of this research. The practices showed in figure 4 were all in use by the majority of the companies, especially encouraging workers to transfer their knowledge to new or less experienced workers, encouraging workers to continue their education by reimbursing tuition fees and providing informal training related to knowledge management practices.

Your firm or organization:

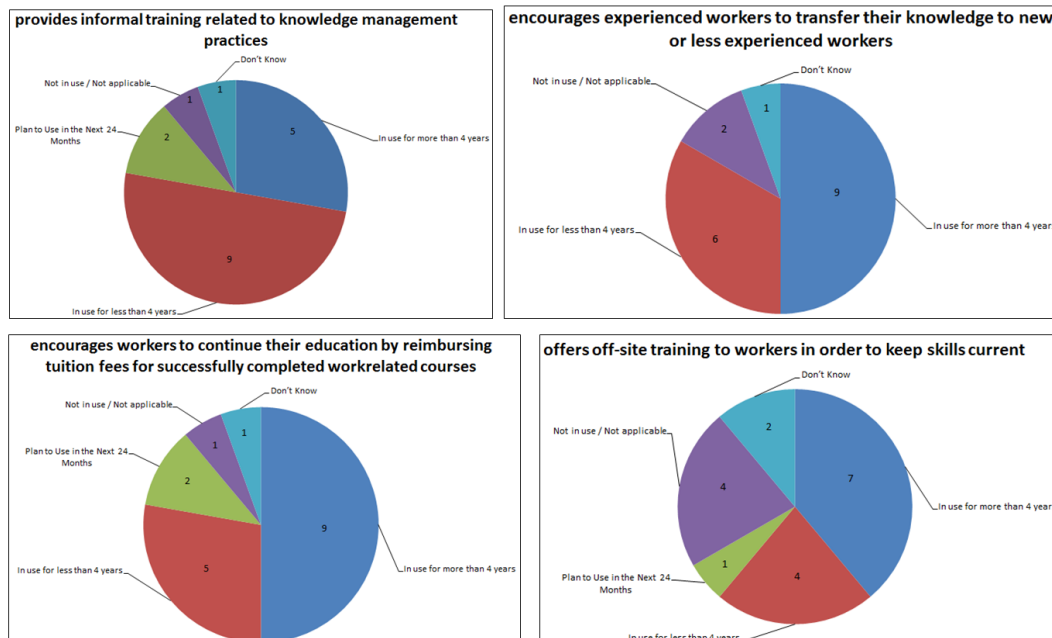


Figure 4: Results on training and mentoring for knowledge management

The training and mentoring practices that showed worst results, indicating that they are not being used as much as the others, were “providing formal training related to knowledge management practices” and “using formal mentoring practices, including apprenticeships”.

Although results indicate these practices are not as much in use as the others, still formal knowledge management training is in use or planned to be implemented by 12 out of 18 companies and formal mentoring, including apprenticeships, is in use or planned to be implemented by half of the software organizations that were part of the sample.

Your firm or organization:

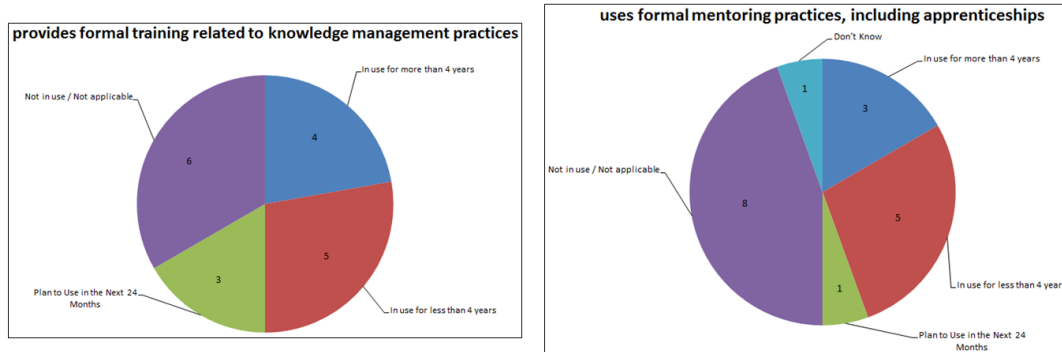


Figure 5: Results on training and mentoring for knowledge management

4.3 Policies and strategies

The third section of the OECD questionnaire evaluates the policies and strategies used by the organization. The results on this subject indicate that policies and strategies to improve knowledge management are practices not as adopted as other types.

Having a written knowledge management policy or strategy and using partnerships or strategic alliances to acquire knowledge, for example, are practices that only 9 out of 18 respondents believe their firms use.

Your firm or organization:

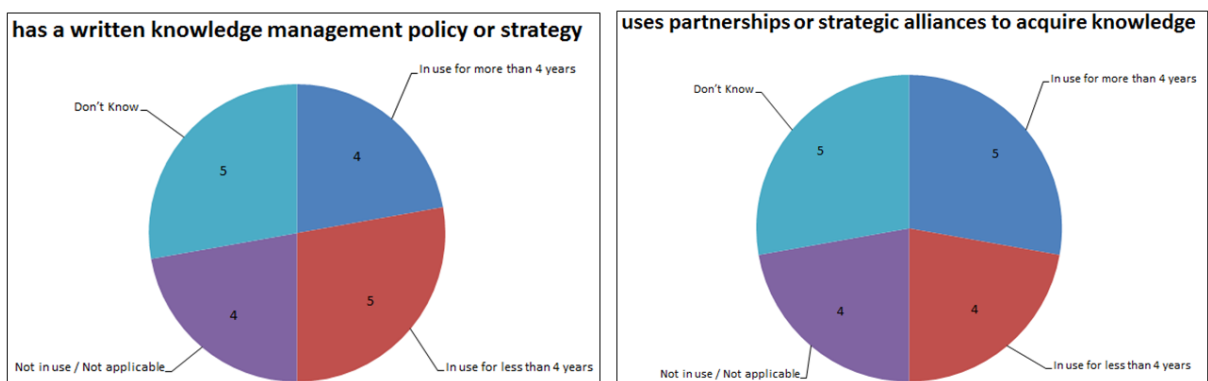


Figure 6: Results on policies and strategies for knowledge management

The evaluation of the fact that the organization has a values system or culture promoting knowledge sharing indicated that this is more common and is being done by most organizations as can be noticed in the figure below.



Figure 7: Results on having a values system or culture promoting knowledge sharing

4.4 Knowledge capture and acquisition

The last section of the first part of the OECD questionnaire (OECD, 2004) evaluates knowledge capture and acquisition on the organizations. Considering the popularization of internet, it was expected that its usage, as a source of knowledge for organizations, was very frequent. That was exactly what the results shown according to the figure below.

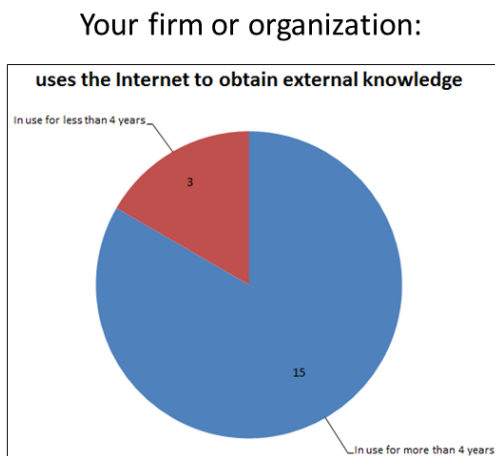


Figure 7: Results on using internet to obtain external knowledge

Other practices for knowledge capture and acquisition were not as used as internet, but other industry sources and external experts are also used in some extent. In addition, encouraging workers to participate in project teams with external experts as a mean of capturing knowledge seems to be a common practice since 8 of the 18 respondents said that it used by their organization.

Your firm or organization:

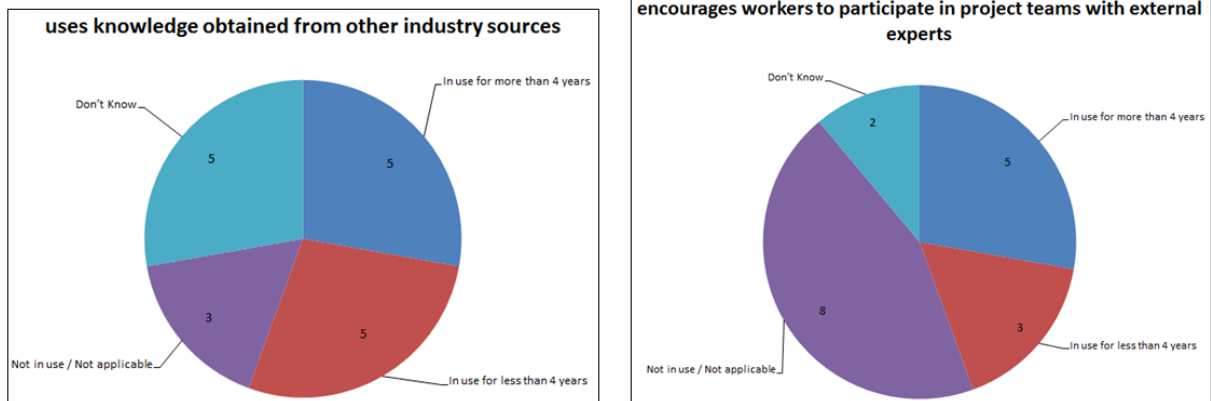


Figure 8: Results on knowledge capture and acquisition

Only 5 of the 18 respondents claimed that their companies used public research institutions as sources of knowledge, this suggests that this practice is the less used and one that could provide an opportunity for improvement, considering the important innovation produced by public research institutions.

Your firm or organization:

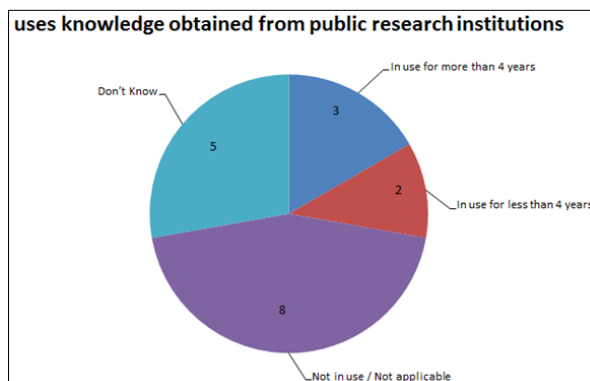


Figure 9: Results on knowledge capture and acquisition

Overall, most respondents claimed that their companies dedicate resources to obtaining external knowledge as presented in figure 10. This result may indicate the fact that software organizations are frequently looking for external knowledge to continue updated about the new software technology.

Your firm or organization:

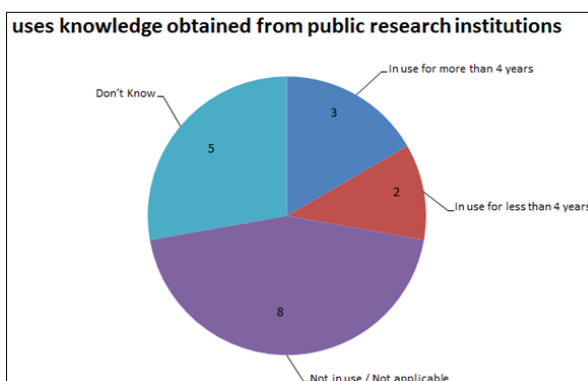


Figure 10: Results on dedicating resources to obtaining external knowledge

4.5 Results of using knowledge management practices

The second part of the questionnaire evaluated the results obtained by the usage of knowledge management practices. This part offered the following alternatives of answers for each question:

- + + + Critical
- + +
- +
- -
- - -
- - - - Not at all important
- Not applicable / Don't know
- Don't understand the question

Once again, the respondents showed very good understanding of knowledge management concepts, since no respondent chose the option “Don't understand the question” in this part of the questionnaire.

Software developers also found the results of knowledge management practices to be very effective in some aspects as improving skills and knowledge of workers, improving workers efficiency and productivity, and increasing firm's adaptation of products or services to client requirements.

Improving skills and knowledge of workers was critical from knowledge management practices according to 14 of the 18 respondents. Similarly, improving workers efficiency and productivity was a critical result of knowledge management practices for 13 of the 18 respondents and increasing firm's adaptation of products or services to client requirements was obtained from knowledge management practices for 13 of the 18 software developers that filled the questionnaire as shown in the figure below.

Using knowledge management practices:

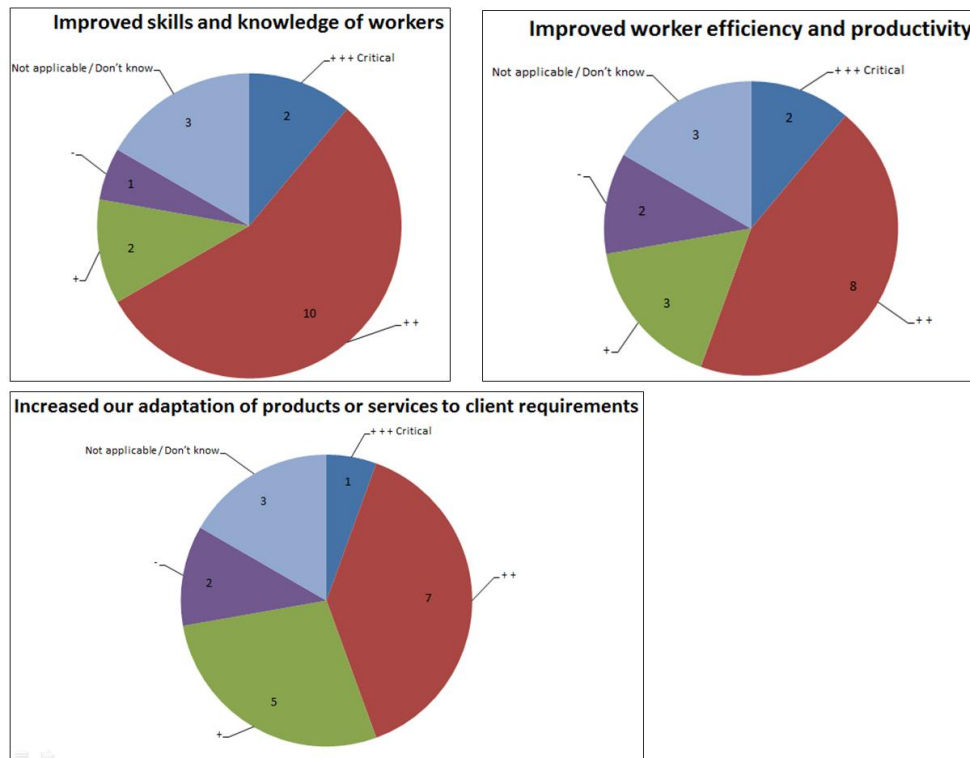


Figure 11: Results of using knowledge management practices

According to the results of the study, knowledge management practices also had positive effects on capturing knowledge from other businesses, adding new products and services to the organization's portfolio and reducing the impacts of workers departures.

The result of alleviating the impacts of workers departures was considered critical by 8 of the 18 software developers that participated on the study, while 11 of the 18 respondents noticed that knowledge management practices were critical to increase their ability to capture knowledge from other businesses and to help the firm to add new products and services to their portfolio.

Using knowledge management practices:

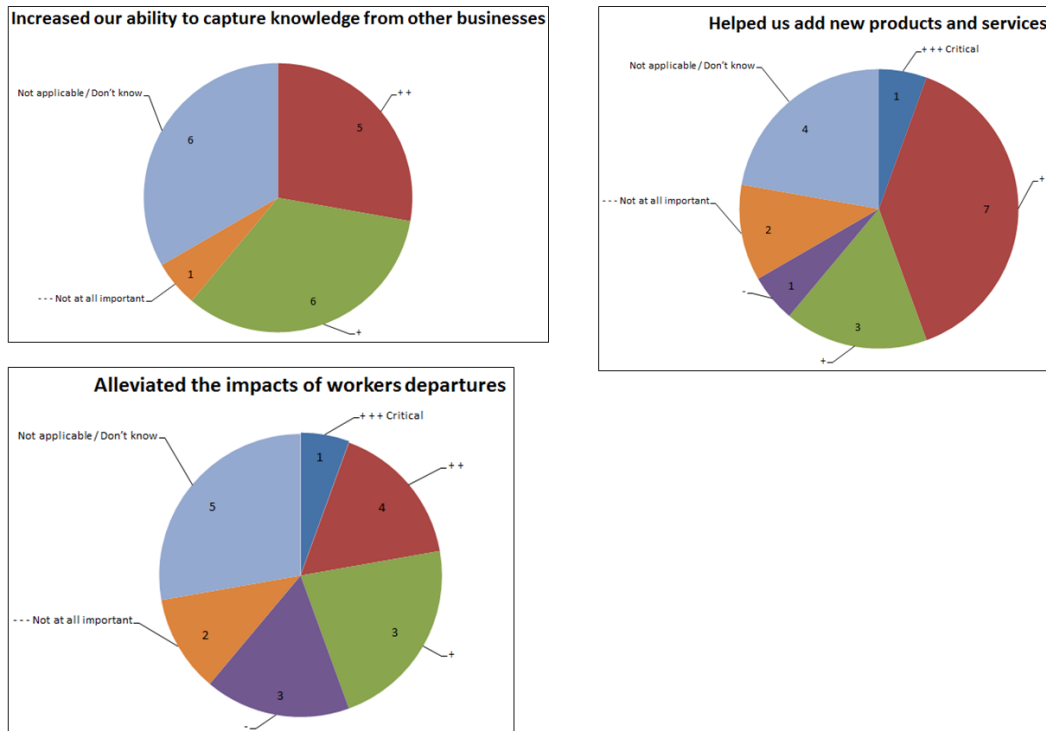


Figure 12: Results of using knowledge management practices

Finally, similarly to what was verified when most respondents pointed that their organizations usually do not capture knowledge from public research institutions, the results shown that most of them do not see as critical knowledge management practices increasing their ability to capture knowledge from public research institutions.

Using knowledge management practices:

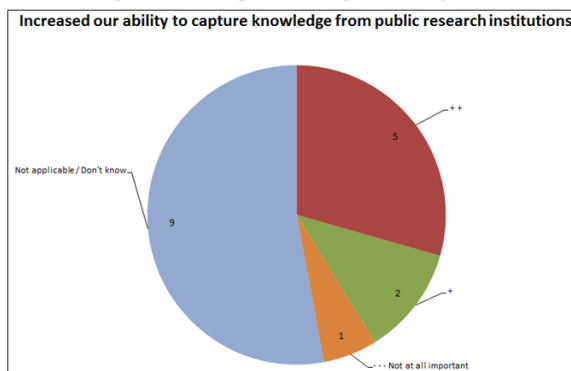


Figure 13: Results of using knowledge management practices

5 Conclusions

The purpose of this paper was to put some light into the usage of knowledge management practices by local software companies and what results this usage has produced. In order to do

that, a study was conducted were 18 software developers from 14 different software organizations in Florianópolis, Brazil were asked to answer the OECD questionnaire (OECD, 2004). This paper presents the results of the study.

The questionnaire results suggest that local software developers are familiar with knowledge management concepts and their organizations frequently use most knowledge management practices. These findings are consistent with the results originally obtained in the survey conducted by OECD in 2004.

Although most of the 17 practices evaluated by the questionnaire shown good usage among the respondents, some of them have shown special popularity, been used by a great majority of the companies:

- Creating updating databases of good work practices, lessons learned or listings of experts;
- Preparing written documentation such as lessons learned, training manuals, good work practices, articles for publication, etc. (organizational memory);
- Encouraging workers to continue their education by reimbursing tuition fees for successfully completed work related courses;
- Using the Internet to obtain external knowledge.

On the other hand, capturing knowledge from public research institutions seems to be a practice that is rarely conduct by local software companies, which may show an opportunity for improvement, since the software industry could take advantage of the knowledge produced by public research institutions.

In addition, respondents indicated that many results obtained through knowledge management practices are critical to their organizations. Particularly, 3 of these results seem to be critical for software development organizations:

- Improving skills and knowledge of workers;
- Improving worker efficiency and productivity;
- Increasing adaptation of products or services to client requirements.

Overall, this study indicates that knowledge management is a well-established concept among local software development companies and its practices are generally in use and bringing critical results to this particular industry.

6 References

ALTHOFF, K.-D.; BOMARIUS, F.; TAUTZ, C. Knowledge Management for Building Learning Software Organizations. Information Systems Frontiers, Vol.2, p. 349-367, Springer Netherlands, 2000.

AVRAM, G. Knowledge Work Practices in Global Software Development. The Electronic Journal of Knowledge Management. Vol.5 Issue 4, pp. 347-356. 2007.

CRESWELL, John W.; CLARK, Vicki L. Plano. Designing and Conducting Mixed Methods Research. 2 ed. Los Angeles: SAGE, 2010.

DALKIR, K. Knowledge Management in Theory and Practice. Elsevier, Burlington, USA. 2005

DAVENPORT, T. H.; PRUSAK, L. Conhecimento Empresarial: como as organizações gerenciam o seu capital intelectual. Rio de Janeiro: Campus, 1998.

DINGSØYR, T. Knowledge management in medium-sized software consulting companies. Empirical Software Engineering, 7(4), p. 383– 386, Springer, 2002.

Fonseca, R. G. C.; Clemente, R. G; Oliveira, A. R. de. Avaliação de práticas de gestão do conhecimento adotadas em novos empreendimentos de base tecnológica. Revista de Gestão e Operações Produtivas. Vol.3 Issue 1, pp. 1-12. 2012.

OECD. Organisation for Economic Co-Operation and Development. Measuring Knowledge Management in the Business Sector: First Steps. Canada: OECD Publishing, 2004.

SÁ, Mohana Faria de. 2011. Avaliação de práticas de gestão do conhecimento de parques tecnológicos: uma proposta para apoio à gestão pública. Tese (Doutorado em Engenharia e Gestão do Conhecimento) – Programa de Pós-Graduação em Engenharia e Gestão do Conhecimento da Universidade Federal de Santa Catarina, Universidade Federal de Santa Catarina, Florianópolis, 2011.

SILVA, Arleide Rosa da. Análise da relação entre a gestão do conhecimento e o ambiente de inovação em uma instituição de ensino profissionalizante. Florianópolis, 2011. Tese. (Doutorado em Engenharia e Gestão do Conhecimento) - Programa de Pós-Graduação em Engenharia e Gestão do Conhecimento da Universidade Federal de Santa Catarina, Universidade Federal de Santa Catarina, Florianópolis, 2011.