# ORGANIZATIONAL ELECTRONIC KNOWLEDGE REPOSITORY USE AND PROJECT SUCCESS IN SRI LANKAN SOFTWARE DEVELOPMENT ORGANIZATIONS

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**Abstract** - Electronic Knowledge Repository (EKR) is a type of Knowledge Management Systems which is widely used for the knowledge management activities in software organizations. It should be effective enough for the success of the software project and for the continuous use of it. However, it was poorly examined what factors affect to EKR use and how it affects to software project success in Sri Lankan software development organizations. The main objective of this research was to find out how codification effort, task interdependence and perceived task-technology fit affect to EKR use for software development activities and how EKR use affect to software project success in term of team performance and team members' success. An empirical study was conducted in the Sri Lankan software development organizations to test the validity of the conceptual model. The results show that even though codification effort has no significant relationship with EKR use and task interdependence, perceived task-technology fit has a significant positive relationship with it. EKR use has a significant positive relationship with team performance and team member success. The findings provide suggestions for Sri Lankan software development organizations for designing and implementing EKR in order to support organizational goals in term of software project success.

**Keywords-** Electronic Knowledge Repository, Software project success, Software development organizations.

## I. INTRODUCTION

Software development is a complex business which involves many professionals working in different phases and activities. New problems are solved, new knowledge is created every day and technology changes constantly within this industry. Since knowledge in software engineering is varied and its proportions, massive and growing day by day, keeping track of that knowledge, is a big organizational problem (Rus & Lindvall, 2002). Since software engineering is a human and knowledge intensive activity, there are different types of knowledge that required for software development activities. Information Technologies (IT) have become commonplace as efforts to improve the processes of capture, store, transfer and reuse of existing knowledge which is important for software development activities. Such technologies are often labelled knowledge management systems (KMSs) (Alavi & Leidner, 2001).

In the information systems literature, two models of knowledge Management Systems (KMS) have been identified. They are the repository model and the network model (Alavi & Leidner, 2001). A key technological component of this repository model is electronic knowledge repositories (EKRs). This study focuses on EKRs since they are fundamental to organizational

knowledge capture and dissemination. But the factors affecting EKR use are not well understood in software development industry (Markus, 2001). The effectiveness of the systems in facilitating knowledge management and project performance remains unclear (Wu & Wang, 2006).

Previous studies suggest that people will be motivated to perform an activity when they anticipate positive outcomes from doing so. Same applies to the EKR use also. Stakeholders of the EKR like management and employees of the organization expect positive outcomes from EKR if they intend to continue the use of EKR for knowledge management activities. Most of the software organizations are project based organizations. They measure their success by measuring the success of the projects they perform (Wieringa et al., 2005). Previous studies define project success in term of project team performance and team member success. So, people who use EKR expect an increase of team performance (achieving project goals such as time and cost) and team member success (work life satisfaction and learning) within the organization. However, little is known about how they reuse the information in order to enhance the team performance and team member success. Knowledge acquisition and storage play an important role in building organizational memory. But the process of knowledge retrieval, transfer, and application result in enhanced organizational performance as well as employee work life satisfaction.

## II. METHODOLOGY AND EXPERIMENTAL DESIGN

### *A. Hypotheses*

Through this study the relationship between these factors and the organizational use of EKR for software development activities of employees and the connection between the use of EKR and the success of the project of the Sri Lankan software organizations was tested. Hypotheses showed in Table 1, were investigated in order to answer the research questions.

**Table 1. Font sizes for this publication**

| | Hypothesis | Independent variable | Dependent variable |
|---|---|---|---|
| H1 | Codification effort is negatively related to EKR use for software development activities. | Codification effort | EKR use for software development |
| H2 | Task interdependence is positively related to EKR use for software development activities | Task interdependence | EKR use for software development |
| H3 | Perceived task technology fit is positively related to EKR use for software development activities. | Perceived task technology fit | EKR use for software development |
| H4 | EKR use is positively related to team performances | EKR use for software development | Team performances |
| H5 | EKR use is positively related to Team members' success | EKR use for software development | Team members' success |

### *B. Sampling procedure*

The quantitative research method was used to test the research model in order to establish the generalizability and has statistical power. The unit of analysis for the research model was individual employees from all kinds of software development organizations in Sri Lanka. A Survey questionnaire was developed as an electronic form (Google Form) since it is easy to distribute among the employees of software development organizations. The sample frame included software developers from ten software development organizations in Sri Lanka which use Electronic Knowledge Repositories as knowledge management system within the organization. The respondents were asked to respond to the questionnaire with respect to the EKR they used for knowledge seeking, contributing and reusing. Since the online form was programmed to request all the participants answering each measurement item, no missing values were found in the final result.

### *C. Operationalization of constructs*

Where available, constructs were measured using tested questions from prior studies or were modified to enhance content validity of the scales used. The questionnaire was designed in English with eight subsections based on the existing literature. Five-point Likert-type scale was introduced to capture respondents' self-reported attitudes. The questionnaire was pilot tested with eleven software developers and two doctoral personals contributing. Only 5% use it for knowledge contributing not for knowledge seeking.

## III. RESULTS

Data were collected during a 4-week period time. From 150 questionnaires that were sent out, 100 complete responses were received. The major reason for nonparticipation was mainly due to lack of time for them to complete the survey. Statistical Package for the Social Sciences (SPSS) were used to present statistics for comprehensive understanding of data collected from the questionnaire.

### *D. Demographic variables summary*

Demographic variables like gender, age, role, work setting, and work function were collected from each respondent. Nearly 74% of the participants are male. Most of the participants are in between 25-35 years old (72%) and nearly half of them were programmers. In terms of the role they perform in software development activities, most of the participants are team members (86%) and 73% of them work at their office with other team members. Most of the participants were programmers (48%). The survey included two questions regarding usage of the Electronic Knowledge Repositories (EKR) by the participants. When asked about the frequency of EKR use, 45% of the participants indicate that they use it daily and 20% of them indicate they use it more than once a week. In terms of the primary purpose for using EKR, 67% of them use it for both knowledge seeking and knowledge. This shows that all participants have a good experience in using EKR for software development activities.

### *E. Assessment of the measurement model*

1) Reliability and validity: To ensure the measures used are valid and that they adequately reflect the underlying theoretical constructs, a measurement model analysis was done. The test of the measurement model includes the estimation of internal consistency (reliability) and the validity. Reliability is assessed with both Cronbach's alpha. A value of at least 0.70 was used as the threshold to indicate adequate reliability (Nunnally, 1978). Table 2 displays the descriptive statistics and reliability for each variable. All of the constructs scored well above 0.70. Thus the reliability of the questionnaire is high and the internal consistency is good. Validity analysis was done with Kaiser–Meyer–Olkin (KMO) coefficient and Bartlett's test of sphericity (BTS). As Table 3 shows KMO value obtained is 0.89 and BTS also proved significantly on the strength of relationships. Thus, both tests provide a strong indication of the adequacy of the sample size for the analysis conducted.

**Table 2. Descriptive Statistics and Reliability**

| Construct | Number of Items | Mean | Standard Deviation | Cronbach's |
|---|---|---|---|---|
| Codification Effort | 5 | 2.768 | 0.7695 | 0.836 |
| Task Interdependence | 5 | 3.254 | 0.7584 | 0.752 |
| Perceived Task-Technology Fit | 5 | 3.508 | 0.8759 | 0.920 |
| Team Performance | 5 | 3.810 | 0.8473 | 0.926 |
| Team Member Success | 5 | 3.726 | 0.8916 | 0.926 |
| EKR Use | 5 | 3.552 | 0.8111 | 0.892 |

**Table 3. KMO and Bartlett's test**

| | | |
|---|---|---|
| Kaiser–Meyer–Olkin measure of sampling adequacy | | 0.864 |
| Bartlett's test of sphericity | | |
| | Approximately v2 | 337.159 |
| | Df | 15 |
| | Sig. | .000 |

2) Correlations: Table 4 presents correlations of the constructs. It was found that codification effort (CE) has significant correlation only with perceived task- technology fit (PTTF) but it has small effect on PTTF. Task interdependence (TI) was found to have positive correlation with and large effect on Electronic knowledge repository use (EKRU) ($r= 0.666, p<0.01$). Perceived task-technology fit (PTTF) was found to have positive correlation with and large effect on Electronic knowledge repository use (EKRU) ($r=0.663, p<0.01$). EKR use (EKRU) was found to have a positive correlation with and large effect on Team performance (TP) ($r=0.673, p<0.01$) and team members' success (TMS) ($r= 0.725, p<0.01$). Since all the correlations well below 0.9, there wasn't found any problem with multicollinearity.

### *F. Assessment of the measurement model*

Fig 1 and Table 5 shows the results of hypothesis test. Regression analysis method was used to test hypotheses. Research model was divided into three sub models for the convenience of the analysis.

Model 1 contains codification effort, task interdependence and perceived task-technology fit as independent variables and EKR use for software development activities as the dependent variable. Multiple regression analysis was done to this model and according to the results, codification effort ($\beta = -0.035$, t-value = -0.493, $p=0.623$, VIF=1.045) did not show a significant relationship with EKR use for software development activities. Therefore, hypothesis 1 wasn't supported since it was hypothesized as a negative relationship. Task interdependence ($\beta = 0.403$, t-value = 4.329,

$p=0.000$, VIF=1.781) and perceived task-technology fit ($\beta = 0.403$ t-value = 4.262, $p=0.000$, VIF=1.832) showed a significantly positive relationship with EKR use for software development activities. Therefore, hypothesis 2 and 3 were supported. Model 2 contains EKR use for software development activities as the independent variable and team performance as the dependent variable. Model 2 was analysed using simple linear regression. According to the results of model 2, EKR use ($\beta = 0.673$, t-value = 9.001, $p=0.000$) showed a

significant positive relationship with team performance. Hence hypothesis 4 was supported. Model 3 was analysed using simple linear regression and it contains EKR use for software development activities as the independent variable and team members' success as the dependent variable. According to the results of model 3, EKR use (β = 0.725, t-value = 10.430, p=0.000) showed a significant positive relationship with team members' success. Hence hypothesis 5 was supported. Figure 1 shows summary of the test results of research model.

**Table 5. Construct Correlations**

| Hypotheses | Coefficient | T-value | Result |
|---|---|---|---|
| H1: CF related to EKRU | -0.035 | -0.493 | Not Supported |
| H2: TI related to EKRU | 0.403 | 4.329 | Supported |
| H3: PTTF related to EKRU | 0.403 | 4.262 | Supported |
| H4: EKRU related to TP | 0.673 | 9.001 | Supported |
| H5a: EKRU related to TMS | 0.725 | 10.430 | Supported |

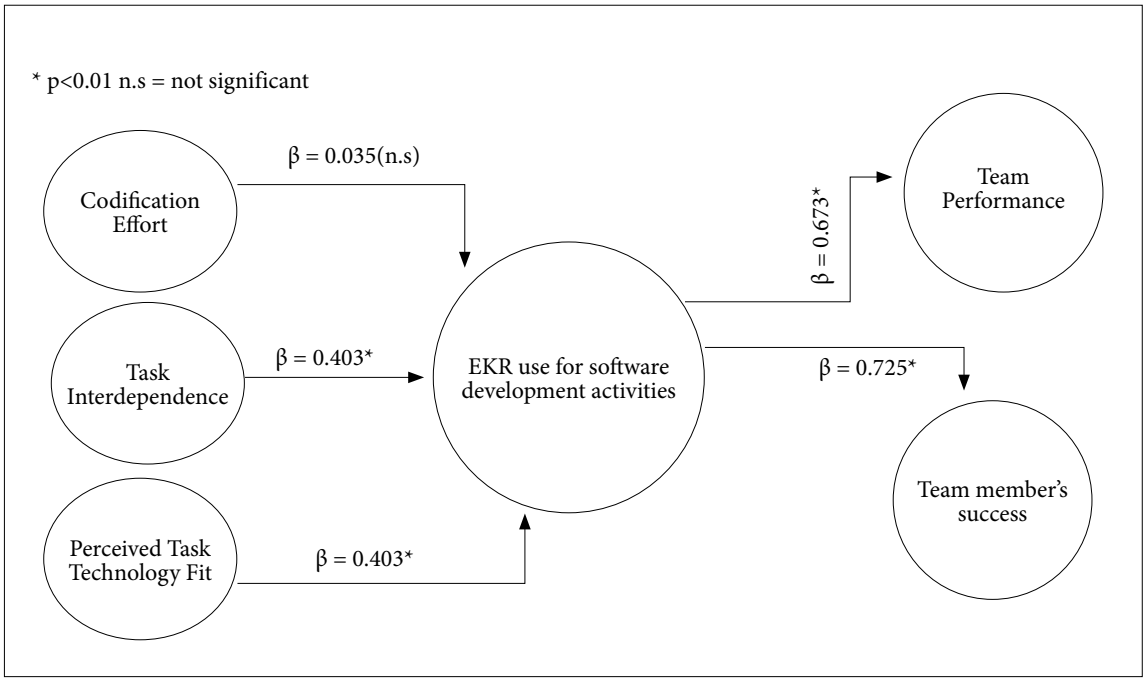
## IV. DISCUSSION AND CONCLUSION

The objective of this study is to examine the factors that affect Electronic Knowledge Repository (EKR) use and how EKR use affect to project success in software development organizations in Sri Lanka. The results provide empirical support for the proposed theoretical model and all the hypothesized relationships. Furthermore, the results indicate that codification effort has a negative relationship with EKR use for software development activities. Task interdependence and perceived task-technology fit has a significant positive relationship with EKR use for software development activities. These results agree with prior literature.

EKR use has a significant positive relationship with team performance and team members' success. Therefore, it can be identified that EKR use has a significant impact on software development project success in term of team performance and team member's success. The findings were discussed in detail as follows.

First this research tested the relationship between codification effort and EKR use for software development activities. It was found that there is not a significant relationship between those two constructs and that result is partly consistent with Kankanhalli's study, which found that codification effort had a significant negative relationship with EKR usage under conditions of weak generalized trust, but not under conditions of weak pro-sharing norms and weak identification (Kankanhalli et al., 2005b). In order to use EKRs for software development activities, there should be required knowledge, such as knowledge about the domain for which software is being developed, knowledge about constantly changing new technologies, Specific knowledge concerning the existing software base and local programming conventions in the organization. So employees need to contribute those knowledge in term of contracts, project plans, requirements and design specifications, source code, test plans and related documents. But if the amount of effort and time need to codify knowledge is high they don't tend to contribute knowledge, especially since software development is a time sensitive activity.

As a result of this research it was found that task interdependence positively relates to EKR use for software development activities. This result is consistent with findings of Wang et al. and Lin & Huang (Wang et al., 2014; Lin & Huang, 2008). But this result is inconsistent with Thomson & Bing's findings who investigated about knowledge repository use in Chinese firms (Teo & Men, 2008). The majority of the participants said that they must coordinate their efforts with others, and their performance depends on receiving accurate knowledge from others. Hence, it can be understood that most of the people who are involved in software development activities, have to perform interdependent tasks. As hypotheses testing results and participants' responses show, people who perform interdependent tasks tend to use EKRs regularly in order to obtain the required knowledge to perform intended tasks. For an example business analyst may need knowledge of finance




officer in order to perform a feasibility study, software architecture may need knowledge of business analyst to understand the requirements and programmer may need knowledge of software architecture to understand the design since it's very hard to perform individual tasks all by his/her own knowledge. Hence this finding is very important for decision makers of software development organizations, when making investing and designing decisions regarding EKR within the organization. As the results shows software developers expect to have necessary knowledge when they require it for software development activities. Therefore, managers of the software development organizations should understand the need of an organizational electronic knowledge repository. They need to understand the characteristics of tasks that are performed by their employees and increase the functionalities of EKR by integrating it with effective collaborative technologies such as real time discussion boards and Q and A sessions.

Perceived task- technology fit was found to have a significant positive relationship with EKR use. This result is consistent with Lin & Huang's findings, but not consistent with Thomson & Bing's findings, which found no significant relationship (Lin & Huang, 2008; Teo & Men, 2008). Participants were questioned about the functionalities of EKR in term of adequacy, appropriateness, helpfulness and compatibility with the tasks they perform. The majority of the participants mentioned that they were satisfied with the functionalities of EKRs they use in the organization. Because of that, they use EKRs for software development activities that they perform. Therefore, it can be understood that if the functionalities of the EKR adequately compatible with the tasks that are performed by the users, they tend to use it regularly for software development activities. This finding is important for designing decisions regarding EKR. Therefore, managers of the software development organizations need to rethink about the adequacy, capabilities of EKR and how compatible it with the tasks that perform by their employees in order to influence them to use it regularly and continuously.

According to the research findings, EKR use positively relate to the team performance in software development. This result is consistent with the Goodhue and Thompson's findings (Goodhue & Thompson, 1995). This research considered about team performance in term of achieving project goals such as time, cost and quality. As Mitchel and Seaman (2015) reveal that software engineers perceive that the removal or mitigation of project-level knowledge flow obstacles generally reduces the time to perform their

work, helps them to meet their deadlines, and improves their work quality, thus resulting in software process improvement (SPI). EKR can be identified as effective tool which remove knowledge sharing barriers. This research confirms that EKR can be effectively used for software development activities and it has a significant effect on achieving software project goals such as time, cost and quality. It was found that EKR use has a significant positive relationship with team members' success in term of increasing quality of work life, increasing efficiency in job performance and innovative ideas. This result is consistent with Sutanto et al.'s findings, but not with Teigland and Wasko's fingings (Sutanto et al., 2017; Teigland & Wasko, 2008). The majority of the participants said that EKR helped them to enhance their efficiency, job performance and quality of the work life. There can be several reasons for this finding. EKRs normally help employees to obtain assistance from other team members or any other colleague in an efficient and effective way when they have any problem performing their job and they can avoid mistakes that others have previously done. Therefore, from these findings it can be understood that EKR use have a significant positive impact on software project success in term of team performance and team member success. These findings are very important for managers when taking investing decisions regarding implementing an organizational electronic knowledge repository because this findings prove the positive impact of EKR on organization's ultimate goal, the software project success.

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## REFERENCES

Alavi, M., and Leidner, D. E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. MIS Quarterly, 25(1), pp. 107.

Bock, G., Mahmood, M., Sharma, S., and Kang, Y. J. (2010). The Impact of Information Overload and Contribution Overload on Continued Usage of Electronic Knowledge Repositories. Journal of Organizational Computing and Electronic Commerce, 20(3).

Chhim, P. P., Somers, T. M. and Chinnam, R. B. (2017). Knowledge reuse through electronic knowledge repositories: A multi theoretical study. Journal of Knowledge Management, 21(4), pp. 741-764.

Goodhue, D. L. and Thompson, R. L. (1995). Task–technology fit and individual performance. MIS Quarterly, 19(2), pp. 213–236.

Kankanhalli, A., Tan, B. C., and Wei, K. (2005a). Understanding seeking from electronic knowledge repositories: An empirical study. Journal of the American Society for Information Science and Technology, 56(11), pp. 1156-1166.

Kankanhalli, A., Tan, B., and Wei, K. (2005b). Contributing Knowledge to Electronic Knowledge Repositories: An Empirical Investigation. MIS Quarterly, 29(1), pp. 113.

Lin, T., and Huang, C. (2008). Understanding the determinants of EKR usage from social, technological and personal perspectives. Journal of Information Science, 35(2), pp. 165-179.

Lindsjørn, Y., Sjøberg, D. I., Dingsøyr, T., Bergersen, G. R., and Dybå, T. (2016). Teamwork quality and project success in software development: A survey of agile development teams. Journal of Systems and Software, 122, pp. 274-286.

Lindvall, M., Rus, I., and Sinha, S. S. (2003). Software systems support for knowledge management. Journal of Knowledge Management, 7(5), pp. 137-150.

Markus M. L. (2001). Toward a Theory of Knowledge Reuse: Types of Knowledge Reuse Situations and Factors in Reuse Success. Journal of Management Information Systems, 18(1), pp. 57-93.

Mitchell, S. M. and Seaman, C. B. (2016). Could removal of project-level knowledge flow obstacles contribute to software process improvement? A study of software engineer perceptions. Information and Software Technology, 72, pp. 151-170.

Rus, I., and Lindvall, M. (2002). Knowledge management in software engineering. IEEE Software, 19(3), pp. 26-38.

Sutanto, J., Liu, Y., Grigore, M., and Lemmik, R. (2018). Does knowledge retrieval improves work efficiency? An investigation under multiple systems use. International Journal of Information Management, 40, pp. 42-53.

Teo, T. S., and Men, B. (2008). Knowledge portals in Chinese consulting firms: A task–technology fit perspective. European Journal of Information Systems, 17(6), pp. 557-574.

Wang, Y., Gray, P. H., & Meister, D. B. (2014). Task-driven learning: The antecedents and outcomes of internal and external knowledge sourcing. Information & Management, 51(8), pp. 939-951.

Watson, S., and Hewett, K. (2006). A Multi-Theoretical Model of Knowledge Transfer in Organizations: Determinants of Knowledge Contribution and Knowledge Reuse*. Journal of Management Studies, 43(2), pp. 141-173.

Wu, J., and Wang, Y. (2006). Measuring KMS success: A respecification of the DeLone and McLeans model. Information & Management, 43(6), pp. 728-739.