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An Appropriate Framework in the Area of Organization Knowledge Management of Civil Projects Using a Dynamic Model

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Abstract. The world economic image has been changing. It has been a long time since the sole important resources of an organization were financial and physical. In the newly-emerged global economy, knowledge and information are accounted as the

most significant resources in order to produce value. Obviously, as the demand for knowledge to reach success is increasing day by day, maintenance and enhancement of an organizations' inner knowledge possesses a high degree of importance. This knowledge is used by the individuals inside the organizations. In other words, human resource plays a vital role in an organization's knowledge management. Additionally, due to the complexity of working conditions and advent of fierce competitions, a sheer number of organizations have moved towards project-oriented activities in an attempt to detract from the costs and to boost flexibility. Accomplishment of project-oriented activities is met in the form of a matrix organizational structure and therefor, upon completing any project, the human resource will immediately become involved in the next project or are even likely to leave the organization. Hence, maintenance of their knowledge and experience and transferring them to the next projects tend to be a matter of discussion.

Keywords: Project Management; System Dynamism; Knowledge Management Process; Civil Projects

1. Introduction

Over the past years, the number of activities which are done in the form of projects inside an organization has been increasing with a fast pace and project-orientation forms the basis of activities in many companies because the main features of project organizations indicate the fundamental factors of organizations' overall success (high flexibility, departmental work, innovation appraisal)(Disterer,2012). While torrents of achievements have been gained in the area of technology, programming tools, planning and management methods, the civil projects have still widely brought about disappointment. In addition, projects include different beneficiaries with fundamentally different approaches to the world, who must cooperate to achieve a new viewpoint of working processes, values, processes and methods. Westle refers to "constant tendency of failure in information systems" and the necessity to establish new organizational principles for projects, principles which arise from other doctrines like management science. Standish report which was presented in 2007 states that in information systems projects,

28% of projects were successful, 23% faced failure and the remaining 49% are still in progress (Standish, cited Jakso2007). Also, based on another research carried out in Norway, a mere 25% of information projects achieve their pre-planned targets about the estimated timeline and budget. The aim of this research is to identify effective factors and assessment indexes in knowledge management (maintenance and sharing) and introduce measures to invigorate knowledge management process in projects. Studying the research literature as well as evaluation of experts, it will be clear what methods are appropriate for knowledge management in projects and effective factors on knowledge management in projects will be determined. Thereafter, using system dynamism, all these factors are put together and their effectiveness on one another will be clarified. Then, comparing these methods and using system dynamism, a final framework for maintaining and sharing knowledge with Mandegar Structures Q.C. & Inspections Company which is engaged in conducting project activities has been formulated. The identified factors are modeled and also using system dynamism, the interactive effects of factors are assessed. Sustainability of model will be evaluated using special system dynamism methods. In addition, using system dynamism and its particular software's, various scenarios for knowledge management in projects have been investigated and the best scenario will be produced and presented based on the suggested framework for knowledge management in civil projects.

2. Literature review

Nisar and his colleagues are concentrating on knowledge management tools in a research titled "the merits of social media information, knowledge management and smart organizations" in 2019 since they believe that the staff is provided with the opportunity to strategically commit to different individual groups in their society and participate in communication and information exchange. Using the content analysis method, two mediocre information mechanisms (informal communication and information affluence) are investigated that discussion groups in social media management are theorized in order to contribute to and measure their impacts on work productivity and possession return. Their findings positively present evidence of organizational performance

through embedded information and social communication from knowledge management discussion group. Abubakr and et al on a research in 2017 titled "knowledge management, decision-making style and organizational performance " suggested a framework which presents the relation between capable knowledge management factors (for instance, organizational cooperation, T-shape skills, learning and supporting IT) and organizational compatibility and intermediary effect of knowledge generation process. This research also suggests that decision-making style (namely visual or rational) balances relations between knowledge generation process and organizational performance. Chin Fu Ho and et al on a research in 2014 titled "facilities and procedures of effective knowledge management realized that all aspects of organizational culture structure positively influence knowledge circulation processes (KCP). Nonetheless, formal organizational structure appears to have a positive impact on information process procedure while independent organizational structure is not so. This study also demonstrates that information process procedure has positive influence on the results of both work and contextual job performance. Salehi Taleshi and et al on a research in 2017 titled "identification and assessment of infrastructures in knowledge management projects in project-oriented organizations of Iran's oil and gas upstream industries have embarked on observation of knowledge management projects using a quantitative research approach and a measurement strategy. Based on their findings, among knowledge-management infrastructures, two components namely organizational culture and human resource have had the highest and structure has had the lowest level.

3. Method

To investigate knowledge management status in projects, a methodology and standard questionnaire called KMAT which exists for this purpose has been used and has been used in Mandegar Structures Q.C. & Inspections Company which is active in accomplishing civil projects. Also, interview and other research methodology tools have been used. To design and develop knowledge management framework for completing projects, system dynamism principles have been used. The mentioned system presents indexes as to assess the sustainability of a system and

that the suggested framework has also been evaluated in the same format. The statistical population consists of experts and project managers employed in the civil department. They were a number of 36 individuals who were all given questionnaires and 28 questionnaires were gathered at the end. The academic qualification of this group of experts was bachelor and master and among them, there was only one participant with an associate's degree. Additionally, they had all more than a year of experience and majority of them were senior engineers with over 10 years of engagement in the career. Prior to using systems dynamism modeling,, interviews were conducted for compatibility of model with the organization structure. Afterward, to ensure the suitability of system dynamism model, questionnaire and organization statistical study were used. Additionally, KMAT questionnaire was used to determine the current state of knowledge management in the organization.

4. Findings

After designing the primary model, it is turn to simulate it using Vensim software. In fact, all procedures of gathering information, interview and model design for accomplishing this stage have been completed. As this stage provides valuable aid to management for probing the current state and future trends and as a result making decisions. In this simulation, by altering different variables, their effectiveness on the system will be observed and based on this effectiveness, sensitive points and spots where knowledge transfer should have more attention can be recognized. Given the model discussed above, several variables could be counted as important, these variables are as follow:

- Amount of alteration in the first plan by the employer
- Delay in activities due to executive problems
- Rate of doing activities

To investigate each of the above-mentioned factor's influence on the system, other factors are virtually held fixed and the result of making alteration to the probed variable is collected. It is obvious that in real conditions, all these variables as well as other variables which have not been observed here yet will be effective on the system. But the aim of simulation is to investigate each variable separately and in the lab in

order to achieve a more accurate investigation on the system's behavior. The main employer is the Mandegar Structures Q.C. & Inspections Company. But the main problem is that the different units of Mandegar Structures Q.C. & Inspections Company define different projects to the organization. Entrance of a project leads to inconsistency of different units and departments with each other. This inconsistency causes that the units are not able to use each other's experiences. This matter then results in the fact that units sometimes are unaware of plan's executive challenges or any alteration made as a consequence. As a result of this unawareness, plan faces change by the employer several times during execution. This will increase project timeline and induces extra costs to the project. According to all of the experts interviewed by Sustainable Structures Control Company, if the experiences are transferred to the design and construction parts, it can have a significant effect on not changing plans during execution. Here, by changing plan alteration parameters during execution, different measures are looked into using simulation in an attempt to figure out the effect of this factor on delays in projects. To probe the extent and the quality of the influence of changes in plan, the remaining measures of the model have been assumed to be fixed and plan alteration was thought to be between 10% to 50% to be able to see its effect on the model. This matter has been solely considered as a way to simplify everything because experts believe that no pattern could be suggested for these changes and since they appear in a particular way for a project and do not have any certain time.

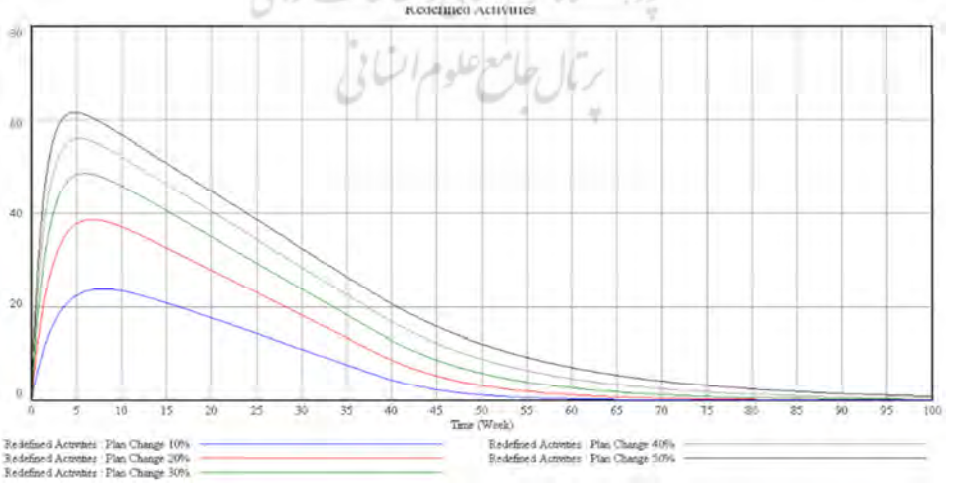

Figure 1. Redefined activities

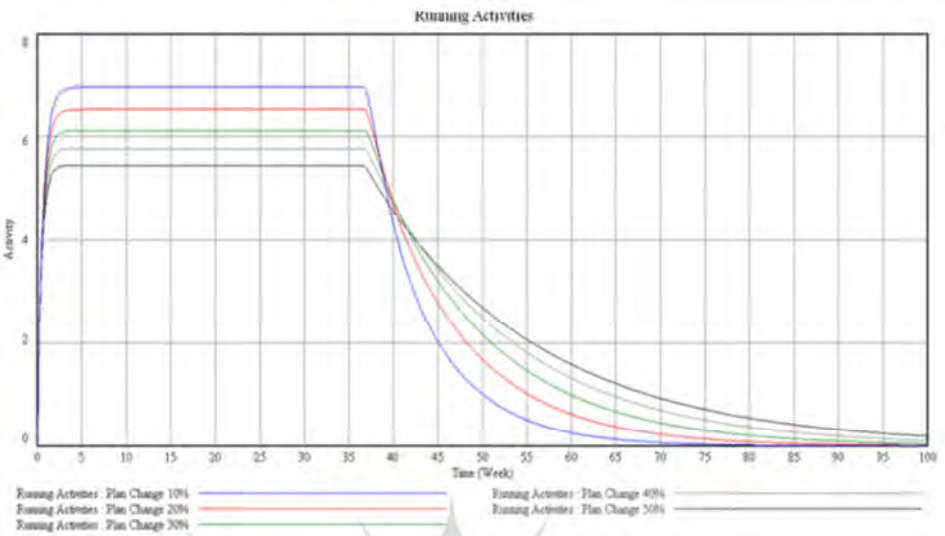

Figure 2. Running activities

These figures are all meaningful when the whole delay made in project is due to alteration in the primary plan. But project activities themselves may have delay too. This delay could have various causes like delay in payments, mistake in estimation of delivery by the suppliers, mistake in the primary plan and unnoticed mistakes in primary design. Based on the control project data of the new civil design projects unit, and experts' comments based on the project kind, delay percentage varies between 10% to 40%. Assuming there is no delay due to changes in the primary plan, simulation of the flow of a project activities was done using Vensim tool. After an activity faces delay, to avoid delay in the whole project, this activity stays in the waiting list to be executed after its problem has been resolved or after project activities decrease. At this stage, the path of those activities which have encountered delay is separated from those which are still running according to the plan because these projects often have delay due to problems which are not related to the projects main unit. Therefore, project's next activities are put in execution state, and delayed activities also are in execution status but their improvement speed is much less than other normal activities. Based on the statistics provided by the control project unit of the Mandegar Structures Q.C. & Inspections Company, the average finishing time of the delayed activities is 2.5 times more than other activities

which have been completed in line with the predicted timeline. In other words, if the average finishing time o the normal activities is 3 weeks, this time for the delayed ones reaches 7.5 weeks. In Mandegar Structures Q.C. & Inspections Company, those activities which have faced problems in the execution phase are crossed out of the project's main activities line until their problem has been resolved. In most projects, after elimination of an activity from the main line, their execution will not begin until the total number of finished activities or the delayed ones does not reach over a certain extent. Since the planning of a project forms in a way where the hardest, most time-consuming and complicated ones enter into execution phase, when 60% of the activities are finished or delayed, the remaining 40% are light activities, hence the project team can spend more time on solving the issues of the delayed activities. The main reason of increase in the overall time of an activity is that the process of resolving the problems is time-consuming. The more knowledge and experience the project team has, the less the finishing time will be. The following figure is the result gained from the simulation of execution process of a project when the whole delay made is due to delay in doing activities and no new planning is made because of map modification by the employer. For 4 different percentages of the delayed activities, different figures for the delayed activities and also the figure for finished activities which demonstrates project finishing time have been illustrated below.

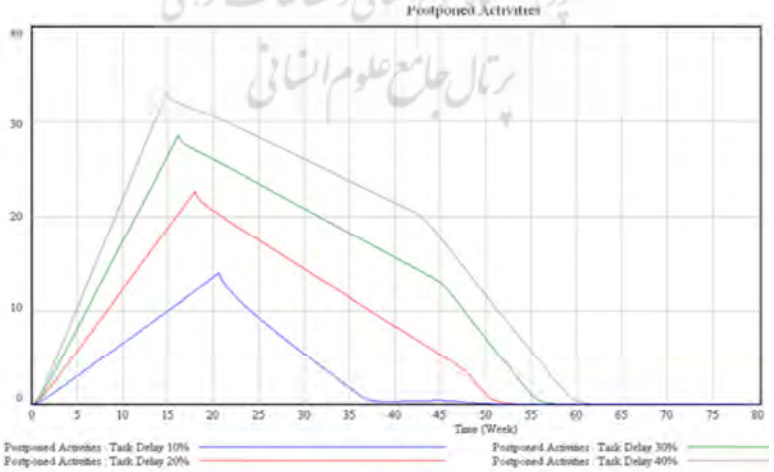

Figure 3. Postponed activities due to execution problems

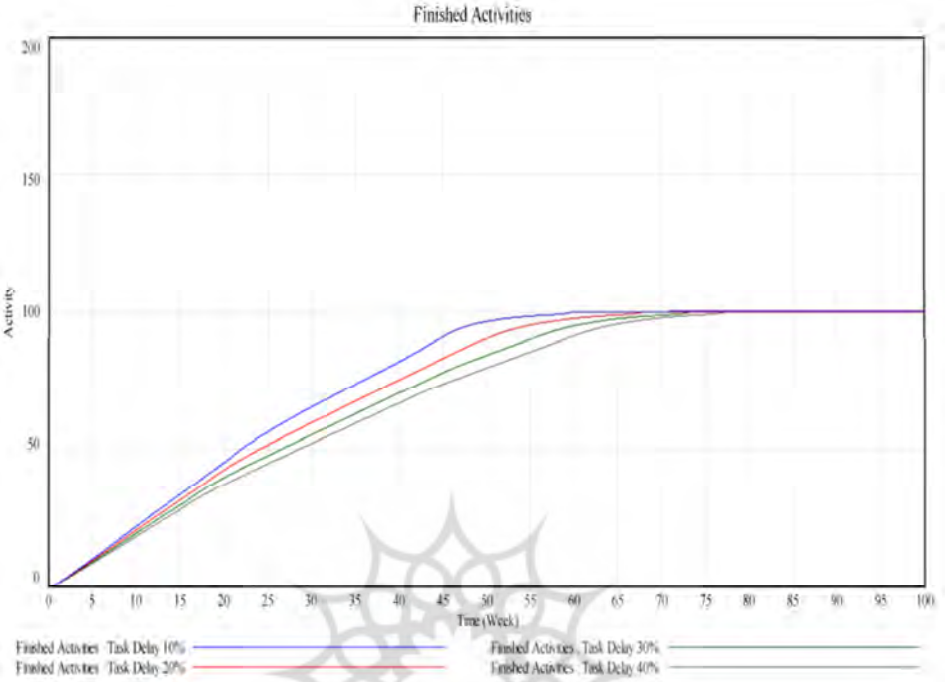

Figure 4. Finished activities

In the previous two conditions discussed above, attention was only given to parts where one of the two main factors causing delay in projects of Mandegar Structures Q.C. & Inspections Company played a role in its emergence but in fact, when executing a project, we face both of these delays. These two main causes of delay take place together during the project but the way to address them is different from the perspective of knowledge management. The delay in the project is due to coincidence of these two factors. It is obvious that the minimum delay takes place when each of the mentioned factors is in its minimum amount and vice versa is true for the maximum delay. But the ideal state which if not impossible to reach is very hard and rare is the time when both delay factors are zero. Figure 5 shows these conditions.

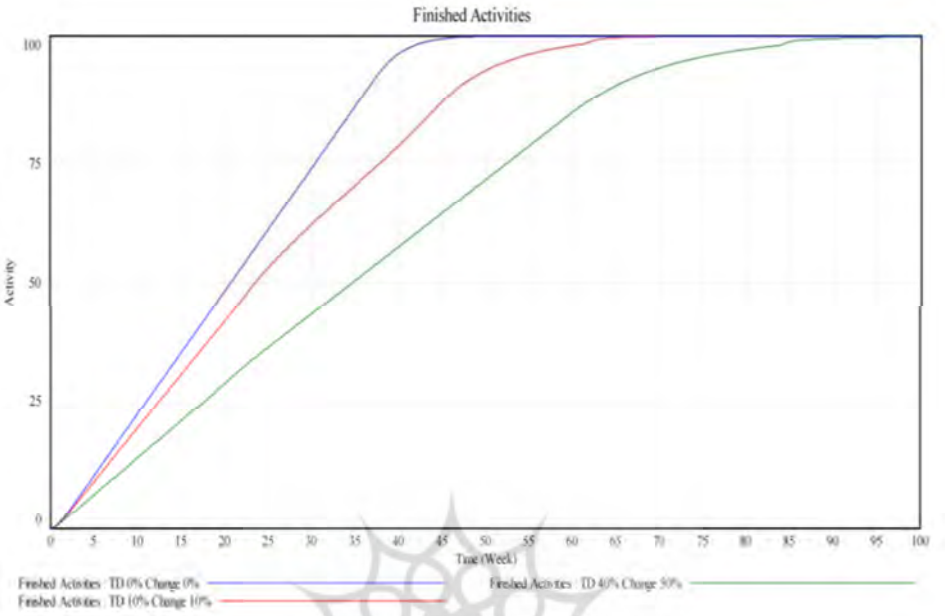

Figure 5. The best, the worst and the ideal way of project execution

5. Discussion and Conclusions

Since projects have an onward movement from the preliminary studies phase to execution stage and ending, it can be concluded that the knowledge flow must be a backward trend which means that the knowledge flow in the organization essentially has a feedback system.

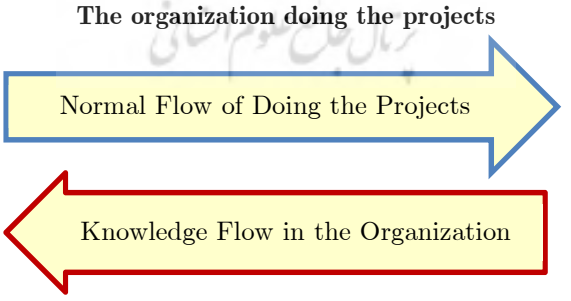

Figure 6. Knowledge feedback flow in the organization doing the project

Thus knowledge feedback in the projects organization aids with the transfer of the knowledge and experience from the previous projects to

the future ones. But this trend was not properly chased in Mandegar Structures Q.C. & Inspections Company. Knowledge management processes were weak in the company (it was mentioned earlier that most statistical tests about company's status were not confirmed). For final application of the proposed framework, existence of an appropriate culture for knowledge management is essential because having knowledge is one of the keys to success in doing the project. So that it is regarded as a source of power. Conditions for a simple method of sharing information and knowledge in the organization shall be prepared through cultural works and creation of suitable orders in the working environment. It is important for the juniors and fresh graduates to obtain the required knowledge and skills as soon as possible and hence learning chances in doing each activity shall be increased.

References

Abubakara A. M., Elrehailb H., Alatailatc M. A., Elci A. (2017). Knowledge management, decision-making style and organizational performance, Journal of Innovation & Knowledge, pp. 1–15.

April, K. A. (2002) Guidelines for developing a K-strategy. Journal of Knowledge Management, 6, 445-456.

El-Sayed Abou-Zeid (2008), Knowledge Management and Business Strategies: Theoretical Frameworks and Empirical Research, IGI Global.

Ha S.T., LoM.Ch., WangY.Ch., (2016). Relationship between Knowledge Management and Organizational Performance: A Test on SMEs in Malaysia, Procedia - Social and Behavioral Sciences, 224, pp.184 – 189.

Ho C.F., Hsieh P.H., Hung W. H., (2014). Enablers and Processes for Effective Knowledge Management, Industrial Management & Data Systems, Vol. 114, Issue 5, pp. 734 – 754.

Jackson, P. & Klobas, J. (2007) Building knowledge in projects: A practical application of social constructivism to information systems development. International Journal of Project Management, doi10.1016// j.ijproman.2007.05.011, 9.

Mailer, R. (2007) Knowledge Management Systems, Springer.

Meir Russ (2010), Knowledge Management Strategies for Business Development, IGI Global.

Nisar T. M., Prabhakar G., Strakova L., (2019). Social media information benefits, knowledge management and smart organizations, Journal of Business Research, 94, pp. 264–272.

Nonaka, I. (1991) Knowledge Creating Company. Harvard Business Review.

PMBOK (Ed.) (2018) a Guide to the Project Management Body of Knowledge, Project Management Institute(PMI).

Powell, J. H. & Swart, J. (2005) This is what the fuss is about a systemic modeling for organizational knowing. Journal of Knowledge Management, 9, 45-58.

Salehitaleshi,J. Hosseinalipoor, Mojtabaei, Aryaee, Hani,(1396), identification and evaluation of projects' knowledge management infrastructures in project-oriented organizations of Iran's oil and gas up-stream industries, The scientific and research journal of human resource management in oil industry, 8th year, no 32, page 177-203. (In Persian)

Shadrokh,S, Sadeghi,Yakhani, Rajaeddin,(1390), optimization of project management foundation in the organization using PSO algorithm, the 7th conference on project management, Tehran, Iran's association of project management.

Smits, M. T. & Moor, D. (2005) An Indicator Wizard for the knowledge Governance Framework.

WU, W. & Lee, Y.-T. (2007) Selecting knowledge management strategies by using the analytic network process. Expert System with application, 32, 841-847.