The Correlation between OSS Project and Organizational Performance

Jong-Bae Kim, Hyungwoo Park

Abstract: ***The software industry, which is the key to the opening of the fourth industrial revolution, evolves into artificial intelligence, virtual reality, and big data, attracting attention as Korea's future food. On the other hand, due to the high reliance on foreign SW companies, low global SW market share, and lack of SW technologies, the SW industry is still considered to have low competitiveness. But recently, open source software is emerging as a solution for us to acquire foreign SW technology and secure SW competitiveness in a short period of time. OSS means SW that anyone can modify and redistribute source code of SW development stage. OSS has been perceived to be inferior in terms of security and completeness, but in recent years, companies and developers have been increasing their participation and expanding their adoption. OSS is playing a pivotal role in leading the SW industry innovation, especially in the new IT paradigm called ICBM (IoT, Cloud, Big data, Mobile). As the scope of OSS expands to various new SW industries (cloud, big data, security, virtual reality, etc.), global SW companies such as Apple and Microsoft and various small and medium sized SW companies open their SWs and support OSS related community. Particularly, the OSS virtuous circle ecosystem is built around the US, so participation in OSS activities is the driving force of SW innovation, which will lead to strengthening SW industry competitiveness. However, due to lack of awareness of OSS, rigid software development culture, and short-term performance, Korea's contribution to OSS is still insufficient. In addition, due to the absence of SW source technology, it is highly dependent on proprietary SW companies.***

Therefore, SW companies need to strategically utilize OSS with advantages such as internalization of latest SW technology and human resources, shortening of development time, and cost reduction. In order to encourage OSS utilization and participation of Korean companies, it is necessary to first misunderstand and change recognition of OSS, foster OSS experts, and open computing environment.

This study analyses whether participation in an enterprise's open source software development project can generate organizational performance, which will promote the intent to participate. Through this, we intend to draw policy directions that can improve the awareness of our companies' open source software and promote their utilization.

Index Terms: OSS, software industry, ICBM, Project, Correlation

I. INTRODUCTION

The adoption of open source software is based on the internal and external factors of personal factors (joy, fun, reputation and status), political / ideological factors (hacker culture, development of free S / Altruism, etc.), and technical environments and work styles (learning and skill development, cutting-edge technology sharing, realizing personal ideas, etc.) and the motivating factors of a company include the characteristics of processes and products (code suitable for the business model of the enterprise, high-quality code, etc.) and openness (user-based innovation, human asset enhancement, competitiveness, reputation, etc.). In this study, we focus on the motivation factors of the company. The hypothesis that the motivation of these firms will influence the persistent participation intention is a very challenging research. However, identifying how open source software project participation on the enterprise side specifically affects "what organizational outcomes, and how it will affect the intent to participate," is the real motivation for future enterprise motivation for open source software participation. It can be secured.

Among the existing studies, organizational performance theory is based on psychological indicators (job satisfaction, motivation, fraud, conflict and cohesiveness, flexibility and adaptability) and economic indicators (overall effectiveness, productivity, efficiency, profitability, quality), and management indicators (frequency of occurrence, absenteeism, turnover rate, control, planning and goal setting, role and norm conformity, manager's human relationship management ability, etc.).

However, even if there are detailed motives such as process / product and openness, participation in open source software projects on the enterprise side will only be short-term participation if it does not actually affect the organizational performance of the enterprise. The primary motivation for an enterprise to engage in process / product aspects is to obtain an efficient process for realistic high-quality or target-quality software. Openness as a secondary motivation to participate will observe the competitiveness of the other members of the participating project and will make efforts to increase their competitiveness and provide opportunities to apply the exemplary open source software model It is because.

It cannot be argued that the nature of simply observing and mimicking the advantages of an opponent with an efficient process in developing on the enterprise side is an incentive to participate in an open source software project. It is even more important whether these benefits can stimulate the organization and what it is capable of sustaining. If openness has a positive effect on the managerial indicators of organizational outcomes, it can be interpreted that the absence of absenteeism or turnover in the exemplary working attitude of the other side participating in the project can be interpreted. In addition, positive effects on psychological indicators mean that job satisfaction is enhanced, motivation is enhanced, and morale is increased.

Revised Manuscript Received on March 02, 2019.

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Therefore, the purpose of this study is to identify the following factors. First, is participation in open source software projects simply driven by a primary motivation that will lead to continued participation? Second, how will participation in open source software projects lead to continued participation through specific organizational outcomes? Third, we try to understand the overall causal relationship between the motivation of first and second companies to positively affect organizational performance and the positive influence of intention to participate.

II. RELATED WORKS

In general, it is true that many companies encounter various difficulties in the development process when they first develop open source software. For example, it is very difficult to find people who have specialized knowledge and skills within a company for software that is difficult to develop. In addition, it is difficult to evaluate the objective of software to maintain and manage the target quality of the software that is being developed unless companies participate in open source software projects. Especially, it is very difficult to manage the development process efficiently in order to reduce duplication effort. Existing research suggests that if companies join and participate in the open source software development community, they can create more efficient software development processes and higher quality products [1]. Open source software's project development method uses a very wide range of modularity and develops with systematic division of labor [2]. This means that a very efficient and systematic approach to the development process can improve the development process and ultimately produce good software products. In other words, participation in these open source software development projects makes it easier to identify the suitability factors such as code function, quality cost, license, and competition that fit the business model [3].

In the existing research, companies can gain commercial visibility and reputation by participating in open source software projects. For example, Sun, a part of Oracle, is open source to the Java platform and the Solaris operating system, demonstrating tremendous trust among the open source software community and developers.

In addition, participation in open source software projects creates opportunities for observing the competitiveness of the communities participating in the project, ie, other companies [4].

Open source software project openness allows for the adoption of open source software models and ideas that are exemplary, and the employees involved in the project see the talents and development attitudes of other community members Create an atmosphere to receive patterns.

In other words, it can promote Human Capital Improvement [5]. In addition, open-source software openness suggests that user-driven innovation can be pursued by creating user-contributed software [6]. In previous studies, psychological indicators of organizational outcomes can be evaluated by measures of job satisfaction, motivation, morale enhancement, conflict and cohesiveness, flexibility and adaptability, organizational members' consistency with organizational goals, and internalization of organizational goals [7]. The Psychological Indicators of Organizational Performance presented in this study is based on an efficient process for developing and participating in open source software project, high-quality software products, and employees who are shown by members of the community of other companies in the project participants, motivation, and other psychological indicators.

The economic benefits gained from participating in open source software projects can be assessed by measures of overall effectiveness, productivity, efficiency, profitability, quality, growth, environmental utilization, stakeholder assessment, human resource value, [7] [8]. In addition, in the previous research, it is said that financial performance is measured in terms of financial aptitude to measure economic indicators among organizational performance, and it is measured with sales growth, profitability, and return per share [9] [10]. The economic indicators presented in this study are improved software quality performance when using internally generated software products by participating in open source software projects and profits obtained when selling them externally.

Psychological and economic indicators of organizational performance refer to final performance indicators. However, managerial indicators are conditions or premise indicators for achieving this final performance. Because managerial indicators are the frequency of accidents, absenteeism, turnover rate, control, achievement of plan and goal, coincidence of role and norm, manager 's relationship management ability, manager' s task orientation, information management and communication, promptness, And the importance of training and development [11].

III. RESEARCH MODEL AND METHOD

In this study, we will analyze what motivates companies to participate in open source software development, and how these motivations specifically generate organizational performance and promote sustainability. We would like to find out whether participation in open source software development will positively affect only the final objective economic indicators of the firm, or whether it will influence the psychological and management indicators to achieve this, thereby creating the intention of continuous participation. If it affects not only economic indicators but also psychological indicators and management indicators, it can be said to have an effect of improving the working atmosphere of the organization itself. This is not the primary economic impact of the enterprise, but it is a condition that must be preempted to achieve it. In this study, we try to show whether participation in open source software projects will have a positive effect on the economic profit or a positive effect on the non-financial profit. Or, we want to show whether participation in open source software projects will positively affect both economic and non-financial organizational performance.

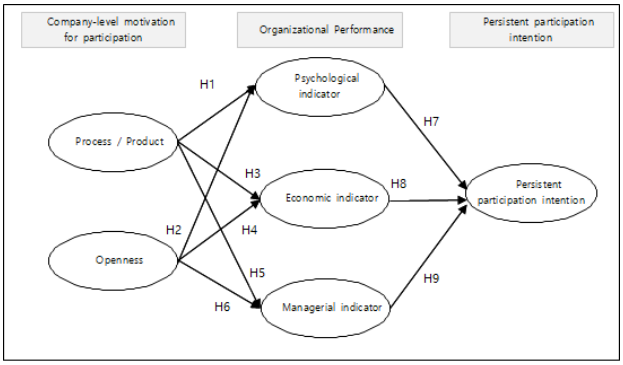

Fig 1 Conceptual Research Model

In this paper, we propose a method of maximizing organizational performance that is expected to be achieved by participating in open source software development in the future and affecting the positive (+) effect. You will have to find a way to do it. The following hypotheses are set to clarify this.

- *H1 (Hypothesis 1): Motivation for processes/products participating in enterprise open source software project development will positively affect psychological indicators.*
- *H2 (Hypothesis 2): Openness motivation to participate in enterprise open source software project development will positively affect psychological indicators.*
- *H3 (Hypothesis 3): Motivation for processes/products participating in enterprise open source software project development will positively affect economic indicators.*
- *H4 (Hypothesis 4): Openness motivation to participate in enterprise open source software project development will positively affect economic indicators.*
- *H5 (Hypothesis 5): Motivation for processes/products participating in enterprise open source software project development will positively impact management indicators.*
- *H6 (Hypothesis 6): Openness motivation to participate in enterprise open source software project development will positively affect management indicators.*
- *H7 (Hypothesis 7): Psychological indicators among organizational outcomes will affect positively (+) on the persistent participation intention.*
- *H8 (Hypothesis 8): Economic indicators among organizational performance will have a positive influence on the persistent participation intention.*
- *H9 (Hypothesis 9): The managerial indicator of organizational performance will have a positive effect on the persistent participation intention.*

The independent variables presented in this study set up the following motivational factors that represent the participation of open source software projects on the enterprise side. These main motives are based on theoretical studies, empirical researches, and surveys. As set in the conceptual research model, process/product, openness is the main motivation. There are many existing researches on the performance measurement of the organization. However, Campbell (1977), which has about 30 detailed metrics for psychological, economic, and managerial indicators, we want to measure. However, the measurement indices proposed by Daft (1998), Jones (1986), and Park, In-Seo (2006) are included in the measurement index used by Campbell. Two independent variables, three parameters, and one dependent variable are used to construct the measurement variables, and the motivation for enterprise open source software participation will be tested for validity and reliability by performing exploratory factor analysis using exogenous variables. In addition, we will confirm the reliability of factor analysis and response to psychological index, economic index, management index and persistent participation intention as endogenous variables. The reasons for dividing exogenous variables and endogenous variables in this way are dependent variables in the case of independent variables and parameters. In other words, if factor analysis is performed without separating the exogenous variables and the endogenous variables, the correlation becomes too high and the constitutional concepts are not correctly bound. In this study, we try to perform exploratory factor analysis by separating exogenous variables and endogenous variables for accurate analysis. The recall scale used was 5 points. Particularly, the organizational performance measurement part is derived from the concept defined in human resource management, and we intend to operationally redefine the measurement items based on the primary participation motivation presented in this study.

Table 1 Operational definitions of measured variables

Measuring factors	Operational definition	Related research
Process / Product	- Contributions from the open source software community - Modularization: Utilizing a wide range of modularity (improving product design and division of labor) - Code appropriate for the company's model:.	[1][2][3]
Psychological indicator	- Job satisfaction, motivation, morale enhancement, internalization of organizational goals such as conflict and cohesiveness, or degree of harmony of organizational members	[7][8]
Economic indicator	- Financial indicators such as productivity, efficiency, profitability, quality, growth potential, goal achievement	[7][8][9]

Managerial indicator	- Absenteeism, turnover, control, human relations management ability, information management and communication, promptness, stability, participation of decision making of organization members, training and development	[10][11]
Persistent participation intention	- Willingness to participate within the next six months and intention to continue participating in other community requests	[12]

In this study, 30 companies participating in open source software development were selected, and the participating communities, participation period and venture companies were surveyed. Three of the 30 companies were excluded from the analysis because they were unfaithful. The results of the survey were as follows. Twenty - seven companies are currently participating in a community that has been participating in the community for at least one month. The respondents were 18.5% of the respondents, the deputy, the deputy director, and the head of the department. The largest number of companies established in the year 2001 to 2010 was 66.7%. 40.7% of enterprises with sales less than 10,000 (one million won), and 40.7% with 50 to less than 100 employees. The size of companies participating in the project was 74.1% for medium-sized companies, 25.9% for small enterprises, and 85.2% for non-venture companies. Participating communities accounted for googlecode 48.1% and github 29.6%. Participation period was the highest (59.3%) in participation from one month to three months.

IV. HYPOTHESIS TESTING AND ANALYSIS RESULTS

In this study, we analyzed the exploratory factor analysis and reliability analysis based on Cronbach 'alpha (> = 0.7) to confirm the consistency and validity of the construct concept using SPSS 20. The reason for the difference between the exogenous variables and the endogenous variables before performing the exploratory factor analysis is that factor analysis cannot be done without dividing the exogenous variables and the endogenous variables in the dependency between the independent variables and the parameters. In order to confirm the validity of the measurement scale for each factor, it was confirmed that the Eigen value was 1 or more. As shown in Table 2, the eigenvalues for each factor of exogenous and endogenous variables exceed one. This can be said to be qualified as a factor. The construct validity of each potential variable, i.e., questionnaire item, for constructive concept was Varimax by principal component analysis in order to extract only factor loading value greater than 0.5. In addition, the cumulative variance was estimated to be 60.684% for exogenous variables and 82.604% for endogenous variables. Therefore, we can secure explanatory power about the factors of each construction concept. As a result of the exploratory factor analysis of the factors constituting the study, the Kaiser-Meyer-Olkin Measure of Adequacy (KMO), which measures the correlation between data items, is 0.714 for exogenous variables and 0.648 for endogenous variables. It is possible to say that it is qualified to do. As a result of examining Bartlett's sphere formation test to determine suitability against the number of factors, the exogenous variables are suitable as Chi-square = 90.768, df = 36, Sig =.000. The endogenous variables are also suitable as Chi-square = 299.536, df = 91, Sig =.000.

Table 2 Factor analysis and reliability analysis

Configuration concept		Metrics	Factor loading		Reliability
			1	2	
Exogenous variables	Process /Product	pp1	.669	.416	.811
		pp2	.832	.142	
		pp3	.842	-.074	
		pp4	.696	.167	
		pp5	.623	.275	.781
	Openness	op2	.106	.889	
		op3	.258	.840	
		op5	.053	.602	
		op7	.193	.680	
		Eigenvalue	2.840	2.622	
		Cumulative variance (%)	31.552	60.684	

Reliability : Cronbach's alpha, KMO and Bartlett's Test= 0.714, Bartlett's Test of Sphericity(Approx. Chi-square=90.768, df=36, Sig=.000

	Metrics	1	2	3	4	

Endogenous variables	Psychological indicator	ps2	.235	.422	-.119	.699	.738
		ps3	-.097	.424	.135	.772	
		ps5	.242	-.049	.405	.777	
	Economic indicator	ec3	.339	.666	.419	.349	.837
		ec4	.114	.899	.229	.066	
		ec5	.124	.915	.159	.149	
		ec6	.059	.802	-.264	.243	
	Managerial indicator	mg5	.290	.020	.776	.327	.881
	Persistent participation intention	co1	.856	.075	.181	.155	.893
		co2	.942	.014	.068	.049	
		co3	.849	.205	.236	.038	
		Eigenvalue	3.553	3.251	2.637	2.124	
		Cumulative variance (%)	25.3476	48.598	67.431	82.604	

Reliability : Cronbach's alpha, KMO and Bartlett's Test= 0.648, Bartlett's Test of Sphericity(Approx. Chi-square=299.536, df=91, Sig=.000

Correlation analysis was performed to confirm the validity of the concept. In general, the range of expression of the correlation is between 0 and 1. 0 means no correlation, 1 means that there is a correlation. This means that each constituent concept cannot be discriminated. In the correlation table, its own correlation is 1. Therefore, if each constitutional concept is 0.9 or more, it can be judged that there is a multi-collinearity problem as presented in the previous study. In addition, through the correlation analysis, we will determine whether the direction of hypothesis setting affects the positive (+) and negative (-) factors. If the correlation shows that a factor has a negative relationship, the hypotheses set at the beginning should be modified to negative (-) for the effect of positive.

Table 3 Correlation Between Configuration Concepts

Configuration concept	1	2	3	4	5	6
Process/ Product	1.000					
Openness	0.415*	1.000				
Psychological indicator	0.503**	0.437*	1.000			
Economic indicator	0.388*	0.688**	0.557**	1.000		
Managerial indicator	0.145	0.647**	0.449*	0.430*	1.000	
Persistent participation intention	0.178	0.586**	0.321	0.335	0.634**	1.000

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

This study suggests the following evaluation index for the evaluation of the fitness before the proposed research model test. We will look at the difference between the R squared value and the modified R squared value of how well independent variables describe dependent variables. The modified R-squared value is the value suggested because the R-squared value tends to increase unconditionally when the measured variable increases. The difference between the R squared values of Hypothesis 1, 2, Hypothesis 3, 4, Hypothesis 5, 6, and Hypothesis 7, 8, 9 and the modified R squared value is not large.

In order to evaluate the independence of the residuals, Durbin-Watson was in the range of 1 ~ 3. The results of the hypothesis test of this study show that all of them are within this range. In other words, there is no problem in the independence of residuals. In addition, the model fit was satisfactory when the significance value (Sig.) Of the F value presented as the result value after the regression analysis was small at the level of $p < 0.05$. In order to confirm the problem of multi - collinearity, we examined whether the VIF presented after regression analysis was less than 10, and all the hypotheses satisfied VIF. Adoption of the hypotheses set in the research model $| t | > = 2$, and $p < 0.05$, $p < 0.01$, $p < 0.001$. In Figure 2, the dotted line indicates rejection and the solid line indicates adoption. The path coefficient presented in the study model test is a standardized path coefficient, and it is a hypothesis describing the t value indicating the adoption. The main motivation of the enterprise to participate in open source software project development is set as software development process, product, and openness. In addition to the hypothesis that psychosocial, economic, and managerial organizational performance can be achieved in an organization by participating in off-source software, we would like to find out what organizational outcomes will affect the intent to participate in open-source software in the future.

Table 4 Hypothesis test results

Model				Non-standardized path coefficient		Standardized path coefficient	t	Sig.	Adoption	Multi-collinearity	
				B	Std. Error	Beta				Tolerance	VIF
Constant				1.454	.695		2.092	.047			
H1	Process/Product	→	Psychological indicator	.380	.182	.388	2.091	.047	Not Reject	.828	1.208
H2	Openness	→	Psychological indicator	.243	.163	.276	1.486	.150	Reject	.828	1.208
Model Fit				ANOVA: F=5.534, Sig.=0.001, R square =.316, Modified R square=.259, Durbin-Watson=2.262							
Constant				-.134	.842		-.159	.875			
H3	Process/Product	→	Economic indicator	.170	.220	.124	.774	.447	Reject	.828	1.208
H4	Openness	→	Economic indicator	.783	.198	.636	3.954	.001	Not Reject	.828	1.208
Model Fit				ANOVA: F=11.339, Sig.=0.000, R square =.486, Modified R square =.443, Durbin-Watson=1.985							
Constant				.336	.948		.355	.726			
H5	Process/Product	→	Managerial indicator	-.218	.248	-.149	-.882	.387	Reject	.828	1.208
H6	Openness	→	Managerial indicator	.937	.223	.708	4.204	.000	Not Reject	.828	1.208
Constant				1.893	.679		2.788	.010			
H7	Psychological indicator	→	Persistent participation intention	.014	.223	.013	.063	.950	Reject	.636	1.572
H8	Economic indicator	→	Persistent participation intention	.056	.158	.070	.353	.727	Reject	.650	1.539
H9	Managerial indicator	→	Persistent participation intention	.441	.136	.598	3.231	.004	Not Reject	.752	1.331
Model Fit				ANOVA: F=5.266, Sig.=0.007, R square =.407, Modified R square =.330 Durbin-Watson=2.046							

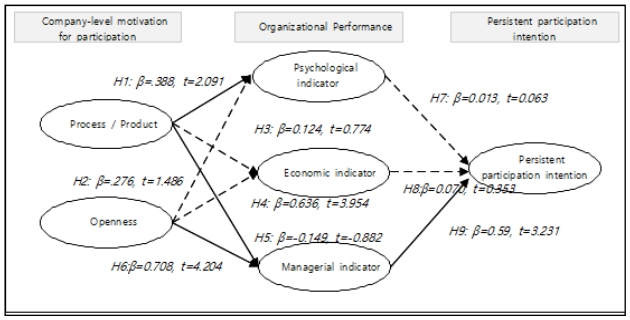

Fig 2 Model Test

The results of this study are as follows. It can be seen that the motivation to participate in process / product and openness has a positive (+) impact on the managerial indicator. The management indicator is a concept that can reduce the frequency of accidents in the organization, reduce absenteeism / turnover rate, improve communication efficiency, and improve managerial human relationship management ability. The Managerial Indicator was the only organizational outcome that led to the continued participation of open source software projects.

It can be seen that the motivation for participating in process / product and openness has a negative effect on economic indicators. Campbell defines economic indicators as corporate effectiveness, productivity, efficiency, profitability, quality, and growth potential. This indicates that motivation for open source software participation is not positively affected. In other words, it can be seen that it does not directly affect the company's ultimate goal of profit creation and corporate strategy management. Economic indicators have been shown to have a negative impact on the willingness to participate in open source software.

Psychological indicators showed that motivation, job satisfaction, conflict, flexibility, adaptability, and so on influenced only positive (+) motivation of process / product participation. In addition, as in the case of economic indicators, it affects the intention of continuous participation (-). Participation in open source software projects means that the organization is capable of psychological resolution but is not fully resolving. For example, conflict resolution and job satisfaction control are more difficult than administrative indicators. In other words, absentee / turnover rate has a system such as controllable compensation and promotion, but conflict and job satisfaction are systematic but difficult to control.

V. CONCLUSION

Continuous participation in open source software projects is not solely attributable to the acquisition of specialized and specialized development processes and high-quality software. Mutual sharing of software development technology and competitiveness Open-source software must be ensured by ensuring openness and a working environment based on mutual consideration that can be developed collaboratively. In addition, we need to find ways to positively influence not only managerial indicators but also psychological and economic indicators.

The following is an overview of the environment in which open source software will create an intent to participate. First, there should be a disciplined and specialized development process and a high quality and continuously upgradeable process and motivation to participate in the

development. Second, openness, mutual consideration, and openness to provide excellent software discovery should be provided to naturally observe the specialized technology and competitiveness of the software to be developed by our company. In addition, the factors that affect the positive intention of continuous participation in terms of organizational performance are management indicators. Although it does not affect economic and psychological indicators such as direct profit making, strategic operations, and job satisfaction and motivation, it does not affect the frequency of accidents related to in-house development in software development, reduces the number of absences / It can be seen that it influences the managerial index which improves communication efficiency and management ability of manager. In fact, managerial indicators are a very primary problem in achieving organizational performance. This is because direct management of absenteeism and turnover cannot guarantee direct profit creation, organizational conflict and even job satisfaction.

REFERENCES

1. Feller, Joseph, and Brian Fitzgerald. "A framework analysis of the open source software development paradigm." Proceedings of the twenty first international conference on Information systems. Association for Information Systems, pp.58-69, 2000.
2. Henkel, Joachim. "Selective revealing in open innovation processes: The case of embedded Linux." Research policy, Vol.35, No.7, pp.953-969, 2006.
3. Gruber, Marc, and Joachim Henkel. "New ventures based on open innovation–an empirical analysis of start-up firms in embedded Linux." International Journal of Technology Management, Vol.33, No.4, pp.356-372, 2006.
4. Lerner, Josh, and Jean Tirole. "The open source movement: Key research questions." European economic review, Vol.45, No.4, pp.819-826, 2001.
5. Bonaccorsi, Andrea, and Cristina Rossi. "Comparing motivations of individual programmers and firms to take part in the open source movement: From community to business." Knowledge, Technology & Policy, Vol.18, No.4, pp.40-64, 2006.
6. Hippel, Eric von, and Georg von Krogh. "Open source software and the "private-collective" innovation model: Issues for organization science." Organization science, Vol.14, No.2, pp.209-223, 2003.
7. Campbell. J. P., "On the Nature Organization Effectiveness," San Francisco, CA: Jossey-Bass. 1977.
8. Kamaruddin, Roslina, and Shamzaeffa Samsudin. "The sustainable livelihoods index: A tool to assess the ability and preparedness of the rural poor in receiving entrepreneurial project." Journal of Social Economic Research 1. 6 (2014): 108-117.
9. Suryanto, T., Haseeb, M., & Hartani, N. H. (2018). The Correlates of Developing Green Supply Chain Management Practices: Firms Level Analysis in Malaysia. Int. J Sup. Chain. Mgt Vol, 7(5), 316.
10. Musingafi, Maxwell Constantine Chando, and Christopher Chaden'anga. "Information and communication technology in classroom situations in rural and urban areas in Zimbabwe: A comparative study on the use of digital and projected media in teaching and learning at six secondary schools in Masvingo." Review of Information Engineering and Applications 1. 4 (2014): 77-92.
11. Sang-Wan Lee, Yong-Eon Cho, Kyu-Sub Lee. (2013). The Role of justice and organizational citizenship behaviour in the relation between measurement diversity and managerial performance. Journal of Digital Convergence, 11(11), 219-231.
12. Daft, Richard. Organization theory and design. Nelson Education, 2012.
13. Jin Oh Ju, Kyung Tae Hwang. (2016). A Study on Sustaining Knowledge Contribution Intention of Participants in the Open Source Software Development Communities. Information Systems Review, 18(3), 111-135.

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