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Impact of Risk Managementon Software Projectsin Nigeria Using Linear Programming

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ABSTRACT: *The globalresearch on software indicates that the success rate of software projects worldwide is currently very low, and has been low for several decades.However, the application of risk management has improved the success rate of software projects in the developed world.This research study is conducted to know if the success rate of software projects in Nigerian is also low, and whether risk management might also improve these success rates. The research results indicate that the average success rate in Nigerian is extremely low and often experience the same risks as the institutions in the developed world. We also observedfrom our research resultsthat where risk management is applied, software projects produce better results than software projects with no risk management.Quantitative research methodology was deployed for data collections and all simulations were performed in Matlab and Excel.*
Keywords: *Risk Management, Developed World, Software Projects, Success Rate, Nigeria*

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I. INTRODUCTION

In the last few decades especially the end of 20th century and the beginning of 21st century, people have shown a great interest in automation of different activities which are specifically software control in operation. However, the complexity of software development has significantly increased over the years due to its demand in almost every aspect of life. Surprisingly many software industries are faced with regular software project failures thereby decreasing projects success rate.Avizienis et al. (2004)identified two levels of project failures according to its degree of severity. (a) Partial failure and (b) Complete failure. Partial failure: is a kind of project failure that resulted when the system has been delivered to the user, but some of the users' expectations or success criteria are not satisfied. The criteria could be either the budget exceeding the original cost in the plan, or schedule overrun.Complete failure: is occurred when the system is delivered on time and within budget, but the expected quality, performance or function has been strongly reduced.Risk management is viewed as series of steps taken to identify, address, and eliminate software risk items before they manifest as threats to successful software operation (Boehm (1989) cited in William (2004)).Schwalbe (2003) cited in Abdelrafe (2014)defined risk management as the process of identifying, analyzing and controlling risk throughout the life of a project, to meet the project objectives.This research paper is aimed at measuring the effectiveness of risk management within the context of software projects in Nigeria. Dikmen et al (2004) defined risk management as the objective functions to represent the expected outcomes of a project, measuring the probability of achieving objectives by generating different risk occurrence scenarios and development of risk response strategies to ensure meeting the preset objectives. Visser (2013) described software risk management as an ingredient to project success rate.The Standish Group (2014) reported the overall, success, challenged and projects failed as depicted in Table 1.

Table 1. Classification for All Projects

YEAR	1994	2009	2010	2011	2012	2013
SUCCESSFUL	31%	36%	38%	37%	41%	36%
CHALLENGED	53%	44%	40%	46%	40%	48%
FAILED	16%	20%	20%	17%	19%	16%

II. MATERIAL AND METHOD

1.1 Material

a) Matlab 2013 and Microsoft Excel 2013 for results simulations and analysis
b) Questionnaires for data collections

1.2 Method

Linear Programming (LP) approach wasused in evaluating the impact of risk management on software projects in Nigeria.

1.3 Questionnaire

A questionnaire with twelve questions was used to evaluate the respondents' opinion on the aspects of risk management in software projects in Nigeria. The twelve questions were designed to understand the importance of risk management application on software projects. In total 448 questionnaires were sent to tertiary institutions in Nigeria that offercourses such as computer engineering, computer science, information management technology and cyber security. A total of 256 questionnaire were returned, 26 were completed by students who do not study any of the above courses.The rest of the questionnaires were filled by students of the desired courses. Figure 3 showed the distribution of the positions held by the respondents' with respect tosoftware projects.

2.4 Research Hypotheses

The following hypotheses were postulated for this paper

2.4.1 Nature of Risks

H0: Software Project Risk (R_{sp}) faced by tertiary institutions in Nigeria are not the same as those in the developed world.
H1: Software Project Risk (R_{sp}) faced by tertiary institutions in Nigeria are the same as those in the developed world.

2.4.2 Impact of Risk Assessment on Project Success

H0: Risk Assessment (R_A) has no impact on project success
H1: Risk Management (R_M) increases the probability of project success

Table 1: Respondents' Information

Institutions	Departments	Number of Students	Year	Failed Projects [%]	Successful Projects [%]
MOUAU	Computer Engineering/ Science	223	2013 - 2017	80	20
FUTO	Information Management Technology	180	2013 - 2017	85	15
FUNAAB	Computer Science	108	2013 - 2017	78	22
UNIUYO	Electrical Electronics Engineering	143	2013 -2017	87	13

III. THE CONCEPTUAL FRAMEWORK FOR RESEARCH INVESTIGATION

In Figure 1below the acronyms B, S, Q and X_p stand for Budget, Schedule, Quality and Convergence of B, S, & Q. The Software Risk Assessment Decision Framework principle shows that when planned budget and schedule are subtracted from the project success the result is a failed project.

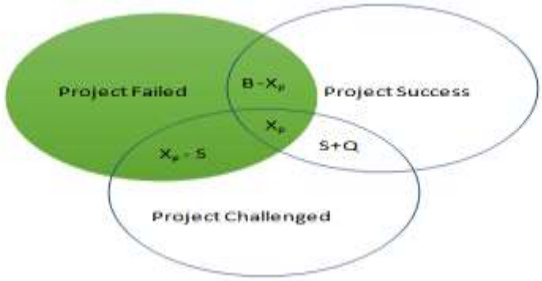

Figure 1: Software Risk Assessment Decision Framework

In this paper, projects were classified into three ways as shown in Figure 1:

- **Project Success:** The project is completed on-time and on-budget, with all the features and functions as initially specified
- **Project Challenged:** The project is completed and operational but over-budget, over- time estimate, and offers fewer features and functions than originally specified.
- **Project Failed:** The project is cancelled at some point during the development cycle.

If (Software Project is achieved within Budget & Schedule with right Quality)

Print Successful Project

Else If (Software Project is achieved within Schedule at Budget overrun with desired Quality)

Print Challenged Project

Else

Print Failed Project

Figure 2: Algorithm for Software Risk Decision Framework

1.4 Primary Data Collection

The principle of the algorithm is that when the three decision variables budget, schedule and quality are achieved as planned, the project is considered to be successful, also when either one, two or three of the decision variables is/are failed to be achieved as planned then the project is seen as challenged / failed project as depicted in Figure 1. Where Xp represents the convergence of the three variables "Budget, Schedule and Quality". Xp in the software risk assessment decision framework shown in Figure 1, simply implies that the project will be achieved within budget, schedule with the desired quality.

In order to better understand the nature of risk with respect to either project will succeed or fail, we formulated software project risks' equation at a constant risk factors as follows:

$$\text{Software Project Risks } (R_{sp}) \propto \frac{1}{\text{Software Project Success } (S_{sp})} \quad 1.1$$

$$\text{Software Prject Risks } (R_{sp}) \propto \text{Software Project Failure } (F_{sp}) \quad 1.2$$

The combination of equation (1.1) and (1.2) gave birth to the general risk equation stated thus:

$$\text{Software Project Risk } (R_{sp}) \propto \frac{\text{Software Project Failure } (F_{sp})}{\text{Software Prject Success } (S_{sp})} \quad 1.3$$

$$R_{sp} = \frac{\pi F_{sp}}{S_{sp}} \quad 1.4$$

Where π is the risk factor's constant

3.1 Risk Resolution with LP

$$\text{Optimize (Max. or Min.) } Z = \sum_{j=1}^{n} C_{j\,X_j} \quad 1.5$$

Where $Z = R_{sp}$ and $C_{j\,X_j} = \frac{\pi F_{sp}}{S_{sp}}$

Therefore, the formulated equation used to analyze the impact of risk management on software projects is stated thus:

$$(\text{Min}) R_{sp} = \sum_{j=1}^{n} \frac{\pi F_{sp}}{S_{sp}} \quad 1.6$$

Subject to the linear constraints

$$\sum_{j=1}^{n} B_{ij} X_j \ (\leq, =, \geq) Q_i \quad 1.7$$

$$\text{where } i = 1, 2, \dots, m; \text{ and}$$

$$X_j \geq 0; j = 1,2, \dots, n \quad 1.8$$

Where B and Q in equation 1.7 represent the budget and quality of the software projects in any case.

IV. RESULTS AND DISCUSSION

4.1 Data Analysis from Questionnaires

The respondents' information on Table 1 was analyzed in Figure 3. It can be seen from Figure 3 that the number of failed projects were greater than successful projects because risk management was not applied to the software projects. This showed that the software projects risk faced by tertiary institutions in Nigeria are the same as those in the developed world. In Figure 3 the meaning of Fp, Sp and Std is described as follows: Fp is failed projects, Sp is successful projects while Std is number of students involved.

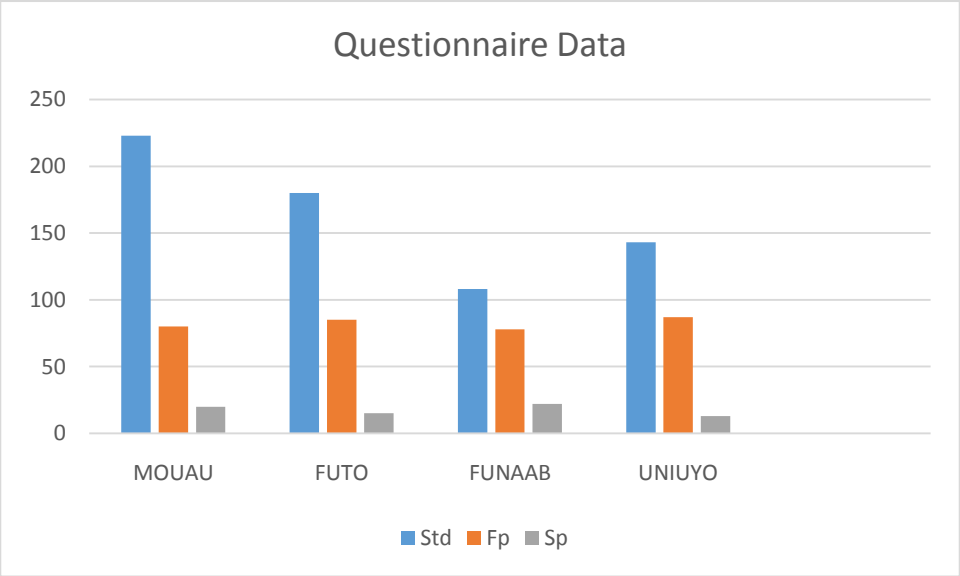

Figure 3: Projects Success and Failure when RM is not Applied

4.1.1 Impact of Risk Management on Software projects

With the introduction of risk management in the software projects of the specified years. The projects' success rate were improved at a very prominent percentage values shown in Table 3 compared with the Standish Group(2014) represented in Table 1. Although the percentage values realized from risk managements' application differ from the Standish group values, the difference was not statistically significant for the test of Figure3. Therefore, the success rate of software projects in Nigeria is therefore roughly the same as in the developed world.

Table 3: Risk Resolution via Risk Management

YEAR	2013	2014	2015	2016	2017	2018
SUCCESSFUL	41%	56%	68%	57%	61%	76%
CHALLENGED	33%	24%	20%	36%	23%	18%
FAILED	16%	20%	18%	17%	19%	16%

4.2 Software Risk Factors

The following three factors are taken to be the most risky in Nigeria with respect to software development.

- Unrealistic schedules and budgets
- Continuing requirements changes
- Less functionality than required

If the actual mean realized from the successful projects of Table 3 is 96.5 percent. A one-sample T-Test was applied to responses that produced the result of Table 3 to test whether a sampled meanof 96.5 percent is statistically significant, being higher than the hypothetical mean of 70 percent. Table 4 below summarizes the result of the T-Test.

Table 4: T-Test Result

Actual Mean	Target Mean	P-value
96.5 %	70%	0.0058

In Table 4 the result of T-Test produced a P-value of 0.0058, which is statistically significant as it is greater than the target of 70 percent. The null hypothesis (H0) can thus be rejected and the research hypothesis (H1) accepted. The results therefore indicates that software development projects in Nigeria face the same risks as the software projects in the developed world.

Table 5: Risk Breakdown Structure (RBS)

ZONE	RBS CODE						INSTITUTIONS	STUDENT's ASSESSMENT		RISK VALUE	YEAR
								Total Project	Number Utilized		
E	0	0	0	0	0	0	Michael Okpara	430	8	High	2013
	0	1	-	P	M	B	University of	380	5	High	2014
			7	2	6	7	Agriculture,	520	3	High	2015
							Umudike	618	12	High	2016
							(MOUAU)	545	9	High	2017
							Abia State				
W	0	0	0	0	0	0	Federal	330	6	High	2013
	1	0	-	P	M	B	University	252	4	High	2014
			2	2	4	0	of Agriculture,	290	2	High	2015
							Abeokuta	248	1	High	2016
							(FUNAAB)	305	5	High	2017
							Ogun State				
S	0	0	0	0	0	0	University of	289	10	High	2013
	1	1	-	P	M	B	Uyo (UNIUYO)	301	4	High	2014
			1	0	1	7	Akwa Ibom	369	13	High	2015
							State	422	8	High	2016
								508	6	High	2017
E	0	0	0	0	0	1	Federal	180	0	High	2013
	0	0	-	P	M	B	University of	228	7	High	2014
			1	5	2	6	Technology	254	4	High	2015
							Owerri (FUTO)	215	6	High	2015
							Imo State	280	11	High	2017

V. CONCLUSIONS

The following conclusions can be made in line with this research study

- The success rate of software projects in Nigeria is low, as it is in the rest of the world. The need to investigate the impact of risk management on project success rates can thus be substantiated.
- The application of risk management procedures increases the rate of successfully executing software projects in Nigeria.
- The risks that face software projects in the developed world is generally the same as in Nigeria

REFRENCES

[1]. Abdelrafe E.R and Roy (2014)"Software Risk Assessment and Evaluation Process (SRAEP) using Model Based Approach", International Conference on Networking and Information Technology, IEEE, pp 171-177.

[2]. Avizienis B.N, Esteves, J. & Rodriguez, N. (2004) Implementing and improving the SEI risk management method in a university software project. IEEE Latin American Transactions, 3, (1), pp. 90-97.

[3]. B. W. Bohem and Williams (2004), "Software Risk Management: Principles and Practices,"IEEE Software, vol. 8, pp. 32-41, 1991

[4]. Dikmen, I., Birgonul, M. T. and Arikan, A. E., (2004) "A critical review of risk management support tools", 20th Annual Conference of Association of Researchers in Construction Management (ARCOM), 1-3 September, Vol (1), 1145-1154.

[5]. J.K. Visser and B. de Wet (2013) "An evaluation of software project management in South Africa." South African Journal of Industrial Engineering May 2013 Vol 24(1), pp 14-28

[6]. Schwalbe (2003)Risk management for software projects, IEEE Software **11** (3) pp. 59-67.

[7]. Standish Group (2009)Standish chaos report. www.projectsmart.co.uk/docs/ chaos- report.pdf [Accessed on November 11, 2010].

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