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Managerial Competence for Optimization of Variations with Public Construction Projects: A Case of Selected Public Procuring Entities in Mbeya, Tanzania

Kaula Stephen

Faculty of Business Management, Open University of Tanzania, Mbeya, Tanzania

Email address:
kaula_stephen@yahoo.com

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Abstract: The study aimed at investigating on the effects of managerial competence towards optimization of project deliverable variations. The investigation was carried out following a number of cases reported over >75% of public projects not to be completed on time and if completed then they found not of the quality intended. There are number of factors which count for this dilemma such as budget constraints, technical incompetence, dishonest, force majeure and managerial incompetence. Managerial incompetence being one among other influencing factors was a point of focus contributing in fulfilling the gap. To explicitly reveal to what extent this managerial proficiencyover project follow-up, monitoring and evaluation lead to performance of the project to the standards expected then quantitative research approach, descriptive-survey design and simple random sampling were employed. The target population being technicians, engineers, contractors, architects in construction industry in Mbeya, Tanzania then reality was revealed. From 230 unit of inquiry while the facts collected using questionnaireand throughthe use of structural equation modeling (by applying the descriptive statistics, correlation, average variance explained and multiple regression) it was found that project follow up, monitoring and evaluation managerial competences contribute positively and statistical significant on optimization of variations ofend deliverables. It is from this positivism between variables revealed what this study recommends that the project managers have to ensure effective follow-up, monitoring and evaluation of the public construction projects in-order to optimize the variations over end deliverables effectively and most significantly.

Keywords: Project, Follow up, Monitoring, Evaluation, Project Deliverable Variations

1. Introduction

Optimization of variations over project deliverables has been the agenda of many of procurement firms Worldwide. It is with the minimized pitfalls what qualifies project deliverables to have met the expectations of the needy group or the client [33]. The minimized variations over the project deliverables is the indication of the extent to which the quality standards and guidelines are reached [22]. Metallurgical uncontrolled variations over the end deliverable is the burden which has revealed to distort efficient over project executed thus a value for money to be not sustained [35]. It is with this dilemma what calls for quality control and assurance to be effectively inacted [17].

Many other causes of project variations reported were budget difficulties, technical deficiencies, corruptions and more other dishonest acting committed by stakeholders involved in procurement undertakings [45] but this study has focused on managerial incompetence. The managerial incompetence was indeed specifically addressing on proficiency over follow up, monitoring and evaluation which proved advantageous in achieving quality construction deliverables in China [42].

Project follow up is the expediting process over the project in progress [29]. Follow up is aggressiveness over changes to happen regarding the project under execution [36]. Follow up ensures curbing the distortions before becoming great. This is then the ignition point for optimization over project

variations leading into un-expectations.

Monitoring is the assurances over the standards and guidelines to confirmation [39]. It is with a clear definition of demarcation or limit that is the content and context of the project expected to be seen as end deliverable [41]. Project monitoring help to minimize deviations from the formulated guidelines and limitations [25].

Project evaluation is the assessment over the extent to which the boundaries or scope is reached [43]. The scope entails the standards, guidelines in place, such as time duration of the project, quantified resources use, cost/budget line the technical and performance specifications defined in bill of quantity (BoQ) for construction projects [16]. Monitoring is also termed as intermediation juncture which ensure for rectification of the root cause of the deviations for both the project in progress and the completed one [34].

The adoption of the artificial intelligence worldwide especially with developed countries such as China has revealed to foster for all of these three managerial operations by >90% [21]. In developing countries inventions over the automated systems recently has shown a paved way though the discrepancy is still there over its ineffective implementations of the sosphiscated systems [44]. In Tanzania it was reported that for about >65% of the projects completed found with deviations such as non-durability, delay and more cost or resources being used contrarily from the expectations [27].

Despite of the significance of demonstrating managerial competence through effective project follow up, monitoring and evaluation but from the field area it was revealed that these managerial in-acting's were not proficiently executed to observe the variations being not optimized. It was found by >75% of the public projects completed had variations violating consumer/public expectations.

Either the study investigation was guided by three research objectives which were: to examine the effects of project follow up on optimization of variations, to assess the effects of project monitoring onoptimization of variations, and to analyze the effects of project evaluationon optimization of variations.

2. Literature Review

2.1. Theoretical Literature Review

The study adopted the Thermostat Model. This model is the cyberneticmodel of management control that consists of the following elements: there is a standardof performance; performance is measured at the output; the possible variance between thestandard and the measured value is used for correcting the process so that the standard can be reached [24].

This model is relevant indeed to the study under hand from the fact that usually project stakeholders, owners and beneficiaries would like to observe the expected outputs are realized. Thus to reveal whether a variation has been minimized or performance is attained then there should be defined standards called expected returns/benchmark/elements to be monitored [15]. Moreover there should the actual outputs which then require a project to be subjected into implementations [13]. The deviations between the expected results and actual (observed) outputs/returns are the said project variation [12]. To determine whether expectations are reached or not then comparative analysis between the expectations and actual results is to be conducted [14]. This therefore shows that achieving to expected results is a process what the thermostat model failed to speculates thus being the area of weakness this study under examination has addressed. To uncover this gap this study under discussion explicitly investigated on how effective project follow up, monitoring and evaluation lead to optimization of variations on the end deliverables.

2.2. Empirical Literature Review

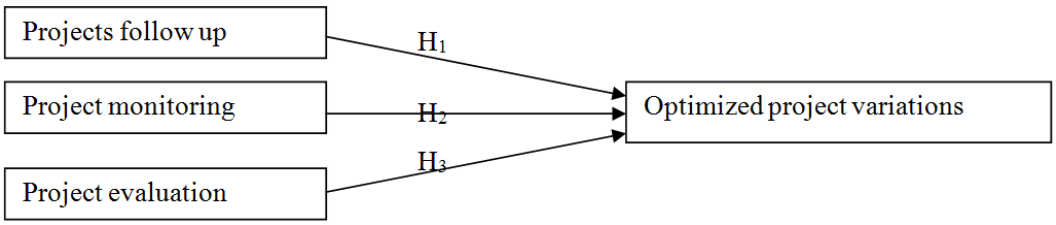
The impacts of managerial efficiency in relation to optimization of project variations were found with construction industry in South Africa. From the study titled "managerial competence and performance of construction contract" in South Africa it was revealed that managerial proficiency lead into performance sustainability of project [38]. With slight difference from the study underhand is that contribution of managerial competence focused on three issues i.e. the effective expediting/follow up, monitoring and evaluation towards reduction of the variations over the project deliverables. Moreover exploratory analysis which is the content data analysis tool was applied to reveal the facts over the study assessed [38]. Indeed the 25 sample of respondents was involved including the project managers and executors from public and private procuring entities [38] different from the study underhand which employed a descriptive-survey design while the tool of data analysis was structural equation modeling. Furthermore from 542 target population, 230 unit of inquiry including public project managers, experts in construction industry in Mbeya region were involved in the study under discussion.

In Kenya it was reported that effective project planning is necessary for quality deliverables [30]. This means that effective planning associated with formulation of vision is a good initiative towards minimization of variations and thus expected results being realized. It was moreover revealed that during planning targets, standards, quantified resources and activities are identified. But it should be noted that effectiveproject planning is not a sufficient factor for project variations to be optimized because there can be furnished plans but if there are no effective follow up, monitoring and evaluation variations are there to propound. More over the study conducted in Kenya applied mixed research approach, purposive sampling technique and semi-structured interview [30] while the study under discussion has applied quantitative research method, simple random sampling technique and questionnaires.

In Tanzania and from the study conducted assessing on the factors which lead to in-effective performance of public water projects [32] it was revealed that one of the factors counting

for the dilemma was managerial incompetence. Other factors revealed were budget deficit, the dishonest practices commitment by participants in construction industry. Moreover the study conducted assessing on factors hindering ineffective performance of public water projects in Tanzania was specifically carried out in Mkuranga, Pwani [32]. Furthermore the study [32] was broadly uncovering the factors leading to poor project performance different from the study under hand which was very specific while addressing how managerial competence in-terms of project follow–up, monitoring and evaluation lead into optimization of variations. While the study under discussion was conducted in Mbeya-Tanzania while that of [32] was carried out in Mkuranga, Pwani-Tanzania.

The Figure 1 below is conceptual framework guiding the study. From this model the project follow up, monitoring and evaluation were independent variables and optimization of project deliverables was a dependent variable.



Source: [24, 15, 13, 12, 14]

Figure 1. *Conceptual framework of the contributions of project follow up, monitoring and evaluation towards optimization of variations of project deliverables.*

3. Methodology

3.1. Research Philosophy

The study applied a positivistic philosophy. The positivism assumes for objectivity and the investigation focus on issue and not events [11]. More other positivistic tools applied to reveal the reality behind the scene over the study effects of project follow up, monitoring and evaluations on optimization of variations over end deliverable" were:-

1) Research approach: Quantitative;
2) Research method: Deductive;
3) Research design: Descriptive-Survey;
4) Sampling technique: Simple random sampling;
5) Data collection: Likert scale questions.

From 542 target population 230 respondents were obtained given the margin of error = 5%. The stated sample size was derived by using simple random sampling technique done throughthe useof couponslabeled'1' and '2'. Moreover the sample frame obtained was obtained from the User Departments, PMU and Tender Board. Specifically the facts were collected from the project managers, work forces/experts from TANROADs, TARURA and city level procuring entities in Mbeya rural and Mbeya City. This area was chosen as it is one of the researchareas where a number of cases are reported through mass media over the projects said to be completed but to find metallurgical variations differentfrom theclients' expectations.

3.2. Variables and Measurement

The main variables revealed were project follow up, monitoring, evaluation and the variations optimization. These variables were measured using likert scales. Use of (ab) likert scales (as it is to established dummy variables) helped to convert ordinal scales to interval scales (numerical, categorical and continuous data) scales [10]. The scales of measurement used were 5= strongly executed; 4= executed; 3=Undecided', 2=Not executed and 1= Not strongly executed. For instance despite of just asking ie part (a) of likert scale whether quality checks are adhered or executed but part (b) of the likert scale questionnaire was assessing the number quality checks which were in place (research area) (This was with the variable 'project monitoring'). Moreover despite of a questionnaire asking over whether project expediting is conducted in part (a) the part (b) of itwas asking on the number of frequencyin using a log book (This was with the variable 'project follow up'). Furthermore despite of asking the extent to which the project managers, experts are used to work plan, budget schedule but another question was asking on the number of disclosures of the filled/ executed budget plans and work plans in place (This was reflexive to the variable 'project evaluation').

3.3. Data Analysis

The study employed structural equation modelingguided by following equation model,

$$PV= \alpha_1\sum Y_1 + \beta_1\sum P_1 + \delta_1\sum Z_1;$$

where PV=Optimized project variations; α_1 =coefficient of follow up; β_1 = coefficient of monitoring; δ_1= coefficient of evaluation; Y_1 = Follow up P_1= Monitoring; Z_1 = Evaluation. From this SEM the causal –effect relationship, multivariate normalityand missing values were dealt with using the descriptive, correlation, (Average variance extracted or explained (AVE) and multiple linear regression detailed here below.

3.3.1. Causal-Effect Relationship

The strength of relationship between variables was determined from established recommended level say i) $5.00 \leq \bar{X} \leq 10.00$ [40]. Descriptive statistics was used to

reveal the strength of relationship between the variable project follow up and optimization of variations over deliverable ii) $0.10 \leq r \leq 1.0$ (correlation) used in testing the strength of relationshipbetween the variables project follow up and optimization of variationsiii) $0.35 \leq AVE \leq 0.7$ (Average Variance Expected) was applied in examining the strength of association between the project monitoringand optimization of variation of deliverablesandiv) $0.1 \leq R^2 \leq 1.00$ (Regression) employed in revealing the strength of relationship between the project evaluation and optimization of variations.

3.3.2. Hypothesis Statements

Three nullhypotheses developed included:-

H_1:PV = Y_1 ⟶ Project follow up positively and significantly influence on optimization ofvariations over end project deliverables

H_2:PV=P_1 ⟶ Project monitoring contribute positively and significantlytowards optimization of variations over end project deliverables

H_3:PV=Z_1 ⟶ Project evaluation contribute positively and significantly on optimization of variations over end project deliverables

Interpretation for the null hypothesis acceptance or rejections in favor of alternative hypothesis: i) Under correlation coefficient (r) and average variance expected analysis indeed to the study under hand the null hypothesis was accepted if $p>0.05$ in favor of the alternative hypothesis [9]. That means for $p<0.05$ for observed value then the alternative (H_a) hypothesis is rejectedii) Using multiple regression testing tool the null hypothesis is accepted in favor of alternative hypothesis if $p>0.01$ [8]. Therefore this means that if $p<0.01$ (for observed result) then alternative (Ha) hypothesis is rejected. The acceptance of null hypothesis in favor of alternative hypothesis shows a statistical significance to exist between variable though the significance can take a form of most, moderate or least. Rejection indicates non-statistical significance between variables.

3.3.3. Multivariate Normality Testing

Testing for normality aim at revealing the normal distributed results are obtained [7]. Usually the very right skewed or left skewed results indicates bias or non neutral results being attained for the audience or reader not rely on them [6]. With this study under discussion normality testing was dealt with through the use of: i) The –X-values ~ r-valuesii) the AVE-values ~0.7 and theiii) the standardized β-coefficient ~ t-valuesthat gave rise to $Z\alpha/2 = 0$.

3.3.4. Dealing with Missing Values

The multiple imputationswas applied in removing the missing values, errors and omissions. To reveal that the missing values are captured then non significance i.e. χ^2 – Non significant; p=0.00 is imputed [5]. Specifically with this study the p=0.00 was imputed over the correlation coefficient(r) and average variance expected (AVE). With the use of multiple linear regression analysis tool the omissions that could cause spreading effects of extreme data were captured through imputed 'standard error'.

4. Results and Discussion

4.1. Results

4.1.1. Project Follow up and Optimization of Variations

With this subtitle the study intended to examine the strength of relationship between project follow up and reduced level of variations. From this examination it was revealed that effective project follow up and optimization of variations are positively related though insignificantly executed. More facts obtained from the field were presented as shown in Table 1 and Figure 2 in appendix:-

Table 1. *Descriptive Statistics; Correlations.*

	Min	Max	$\bar{X}$	1	2	3	4	5
CA -------> PV	1.00	32.50	6.50	1				
RL --------->PV	1.00	37.00	7.40	0.50	1			
PMP ------>PV	1.00	41.00	8.20	0.45**	0.45	1		
OGP ------>PV	1.00	47.50	9.50	0.31	0.41**	0.52	1	
DSUE----->PV	1.00	48.05	9.61	0.49**	0.43**	0.49	0.50**	1

Key: *CA=Close attention to the project on progress; RL= Responsiveness and flexibility to the changes over the project in progress; PMP= Proactive managerial proficiency; OGP=optimize great distortions to occur; DSUE= Signs of unexpected events over the project in progress denoted earlier; PV= Optimization of project variations*

Note: **P<0.01; *P<0.05

Source: Researchers' Own Computations (2019).

With –X ≥5.00 and $0.1 \leq r \leq 1.00$ the recommended level, this then indicate that project follow up positively optimize the variations. These results were consistent with those over $p>0.01$ which meant that the project follow up and expediting wasstatistical significant to reveal thorough reduction of the variations over the project deliverable [19]. Thus this is then contrarily from the proposals which recommend the variables in associations to be statistically significance thus 'p-value' is

to be 0.01 [37].

4.1.2. Project Monitoring and Optimization of Variations

In here the study had a motive of determining the effects of project monitoring on optimization of the variations. The level of strength of effects over executing project monitoring in relation to optimization of variations was investigated through undertaking the divergent-confirmatory factor analysis. The reality from the field area was revealed and presented as shown in Table 2. Similar results have been shown using the structural model Figure 1 presented as appendix.

Table 2. *Average Variance Extracted.*

	1	2	3	4
QC ------>PV	0.7			
QA------->PV	0.49	0.7		
Spc------>PV	0.25**	0.51	0.7	
IPP-------->PV	0.45	0.40**	0.46	0.7

Key: *QC: Analysis of Quality control checks; QA: Analysis of quality assurance; Spc: Analysis of specification; IPP: Intermediation of the project in progress; PV=Optimization of project variations*

Note:**P<0.01; *P<0.05

Source: Researchers' Own Computations (2019).

With AVE values>0.35 i.e. 0.4, 0.51 and 0.36 showed that project monitoring have positive influence on minimizing variations. This positivistic over the association of the two variables was revealed to be consistent with its statistical significance given p>0.05 [23].

4.1.3. Project Evaluation and Optimization of Variations

The investigation over the impacts of undertaking project evaluation and reduction in variations was the intent of carrying out this test. Using multiple correlations the level of impacts of adhering to project evaluations and optimization of variations over the deliverable was revealed. The facts over the strength of relationship between these two variables were gathered and presented in Table 3.

Table 3. *Multiple Regression Analysis.*

	Unstandardized β coef.	Standard error	Standardized β coef.	t	p-value
Constant	0.840	-0.004	-	0.005	0.000
BA -------> PV	0.004	0.009	0.040	0.035	0.003
GCA ------>PV	0.000	0.006	0.060	0.059	0.001
EA -------> PV	0.001	0.010	0.070	0.068	0.002
PA--------->PV	0.070	0.070	0.080	0.075	0.003
SPSA-------->PV	0.00025	0.005	0.050	0.047	0.005

R^2 = 0.24; R^2-adj =0.25; Durban Watson = 1.02; F= 0.001

Key: *BA= Budget Analysis; GCA= Work plan/Ghant Chart analysis; EA= EOQ Analysis; PA= Analysis of plans/targets; SPSA= Analysis of specifications/BoQ; PV=Optimization of project variations*

Source: Researchers' Own Computations (2019).

With R^2 =0.24; R^2-adj =0.25 over project evaluation being the actual result which is then within the recommended or expected level of $0.10 \leq R^2 \leq 1.00$ is the indication of a positive relationship that exist between evaluation and optimization of variation. This either resembles the results over statistical significance shown by 'β' and 't' having (+) results while p<0.01 contrarily from what is said over employment of multiple regression [8].

4.2. Discussion

The positivity of the project follow up and optimization of variations as it has shown in Table 1 in subtitle 4.1 and summarized in Figure 1 is the indicator that project follow up is the important aspect that has to be taken into consideration by project managers and executors for realization of reduced variations. The positive association between the variables, project follow up and optimization of variations what was revealed from the field area was indicated by 5<=$\bar{X}$<=10 and 0.4<=r<=1.00 at p>0.01, statistical significant. Indeed from the field it was revealed that project follow up create a close attention to the project under progress, a function over minimization of variations given $\bar{X}$ = 6.50 and r= 0.49. It was moreover found that project follow up means being responsive and lean to the changes over the project under execution hence minimization ofvariations over the end deliverable shown by $\bar{X}$ = 7.40 and r = 0.41. Aggressiveness towards changes over the project in progress was revealed more valuable than waiting until the project is computed of burden happen when initiative is to taken out [26]. That means being preventive is more efficient than being proactive. Project follow up was indeed found to be proactive managerial proficiency proven through the computed $\bar{X}$=8.20 and r=0.45 instead of being reactive or simply waiting until the problem occur. Moreover from the field it was revealed that project follow up help to curb for the destructions before causing great distortions thus reducing variations indicated by $\bar{X}$=9.50 and r= 0.50. Furthermore project follow revealed toensure for the quick and earlier detection ofunexpected events /distortions /risks to occur in future given $\bar{X}$ = 9.61, r =0.43 [3].

It is with execution of follow up in which unexpected events are denoted (their signs are detected) before they cause great distortions/variations. This is to say exercising follow up is a camouflage over great loss not to occur and therefore optimization of variations [2]. The statistical significance revealed from computed p>0.01 is contrarily from what was revealed from the field area in which the project managers revealed not execute effective project follow up. From the field area such as Isyeye where one of the public health centre was in construction in 2019s found to be left with technicians several times with loose expediting from the project managers.

Monitoring involves analysis of the scope of the project which then help to avoid acting differently from the content and context of the expected output [20]. This fact was consistent with what was realized from the research area given AVE=0.49. Monitoring take up the plans of the project, the cost to be incurred, resources to be used to cause the project to come to an end quantified; and time of execution of which adherence to these demarcations help to overcome variations over the end deliverable shown from the computed AVE=0.51. Moreover monitoring accompany the specifications such that over bill of quantities, drawings and blue prints whichare made available to project executors to avoid deviations the same what was revealed from the field area given the derived AVE=0.46. Thus these are the said demarcations or standards which need to be monitored to realize variations being minimized [31]. It is by undertaking project monitoring (the found intermediation process), the variations over the end deliverables are minimized if not fully eliminated indicated by AVE=0.45. From the field, the positive relationship shown to exist between monitoring and optimization of project variations (shown in Table 2 (with AVE-values>=0.35 and <= 0.7) and Figure 1 (given p-values>0.05) is the proven fact of the vitalness why monitoring is to be train gully executed by project managers. Both a positive relationship and statistical significance found to exist between the variable, project monitoring and reduction over variations on the end deliverable is the fact to be taken into action by project managers indeed from the research area to realize expected outputs [18]. From the field area the scope (the specifications) or the demarcation said over the deliverable defined in terms of blue prints, drawings and bill of quantities reveled to be neglected a causal of variations cases reported. The variations mostly reported to be caused by ineffective monitoring were those pertaining constructions of ward community secondary schools (found none furnished and not durable) in the areas such as Umalila, Ntokela and Ikuti and more other rural areas of Mbeya region.

The positive association between the variables, project evaluation and optimized project variations revealed from the field showed the significance of undertaking evaluation of the project in progress (Refer Table 3 where R^2=0.24, Durbin Watson=1.02<2.00 and F=0.001<0.01). Evaluation is the analysis or assessment of the projects by comparing the standards and observed outputs in-order to determine the deviations [1]. It is during planning for the project where the said targets or standards are defined. In procurement management planning for the work (construction projects) is normally accompanied by preparing the procurement manual [28]. It is with this procurement manual where the budget plan, ghant chart/work plan/CPM, economic orders quantity (EOQ) vendor managed inventory (VMI) and more other guidelines are evaluated against the level expected to reveal the level of variations. Budgetary analysis which was found to be fostered through value for money (VfM) auditing found to be a strategic mechanism towards determining the deviations over resources used as it has shown with β=0.040, t=0.035 and p=0.003. Moreover analysis over work plan found to be significant towards the scheduling risk on why the project has not completed on time (the deviations created due to delay of the project) given the computed β=0.060, t=0.059 and p=0.001. With the results over β=0.070, t=0.068 and p=0.002, this is the indication that deviationsfrom the budgeted-optimal cost (evaluated through computation of EOQ value) of the project is sustained through evaluation. It is through operation auditing in which the policies, guidelines, objectives are evaluated to determine if there was adherence to these principles or not shown over β=0.080, t=0.0.075 and p=0.003. The same positive results were revealed over analysis of project specifications in relation to reduction in project variations given the β=0.050, t=0.047 and p=0.005. The results over positivistic and statistical significance revealed were contrarily from what was actually obtained from the field area in which it was found that most of rural infrastructures completed were below standards. This was found to be due to most of them being not subjected to effective continuous and perpetual evaluations. This either was revealed the same from the field area such that from Iyela II where water project which revealed to have completed but just in one month from its completion the project stopped discharging water. In here the project evaluations said could be in quarterly basis; midterm basis; semi-annual or annual basis [4] what was also revealed a discrepancy from field area such that from Sasya. It is from this field area in which the citizens (the beneficiaries of the projects) reported that road construction project which was to complete in 18 months delayed up to 3 years. Thus being a recommendation of this study is that evaluation should be a continuous and perpetual managerial operation which has found to deter the variations of such kind.

5. Conclusion & Recommendations

5.1. Conclusion

The variations over project in progress and that one completed havebeen the cases usually reported indeed over the public projects. Despite of many otherreasons which were after allnotthe focus of this study underhand such as budget constraints, dishonestpractices, technical incompetence but the dilemma was revealed by the studyto be caused by managerial incompetence. It was moreover revealed that most of projects by >75% completed found to be ofpoor quality different from client/community expectations. It was

furthermore found that delay of projects, more cost incurred, cases of a contractor paid indeed with re-mbursables but the project deliverable is not working were part of many project deliverables. Those deviations were found to be caused by insignificant / in-effective follow up, monitoring and evaluation managerial operations.

5.2. Recommendations for Action

From the revealed gap thus the study suggests the following:-

i). Project managers should be conducting continuous/perpetual project evaluation.
ii). The guidelines/principles are to be clearly defined during planning stage.
iii). The said demarcationsor limits are to be clearly confined to the specifications, bill of quantities (BoQ), blue prints and drawings.
iv). Project managers from TANROADS, TARURA and more other public and private procuring entities have to establish good relationship with the executors of the project.
v). During planning, the project management should also plan for a risk and find ways to mitigate.
vi). The project managers should expedit the progress.
vii). The project manager should be aggressive, responsive and act lenient for the project on progress against changes.
viii). The project managers and directors should effectively follow up a project.
ix). The project evaluation should be effective and concrete.

Appendix

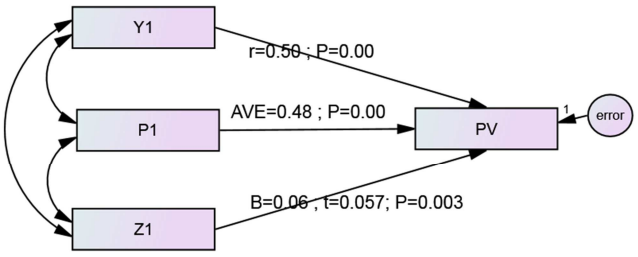


Figure 2. *Structural Model.*

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