Project Performance and Critical Success Factors in Nigerian Upstream Industry: Evidences based on SEM

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Abstract

In this study, the researchers investigated the nature and direction of influence running from critical success factors to project performance in Nigerian Upstream Oil and Gas industry using ADFE, MLE and GLS methods. We documented that the performance was inversely driven by the schedule of time. However, it was seen that estimated cost and quality control maintained a positive and significant relationship with project performance. Inclusively, "White Elephant Projects" and poorly performing projects are aftermaths of prolong project time schedule. Thus, we recommend that management should initiate effective planning process with periodic assessment to ensure that projects are executed within a record time.

1.Introduction

Project performance is a key factor in any industry or company. Primarily, projects are executed to provide benefits to their users. The benefits derived from projects are the indicators that such projects perform. When projects fail, it means that they are not performing and the net benefit is approximately zero. It has become a matter of concern that over the years, the Nigerian Oil and Gas industry is characterized with moribund projects that not just malfunctioning, but attract cost of maintenance. In the light of this, performance has become an essential phenomenon, to the extent that both professionals and scholars arguably discuss its link with the critical success factors or the so called iron triangle. The popular assertion on this debate is that project performance or project management performance is directly influenced by the critical success factors. Existing studies have shown this relationship and even confirmed that effective communication has a direct effect on project performance. According to Hussin et al (2016) good communication is paramount to all the participates in project implementation as it provides the needed networking for the success of the project, having knowledge of managerial ICT is required by senior project management team. Thus, communication is seen as exchanging of information from one point of the project to the other point in an efficient manner. While, Jen (2016) emphasized that communication in project management often begins to break down in the middle phases of a project, when team members are immersed in their work and liable to lose sight of what others are doing. Important details such as changes to a deadline might be communicated to only those team members who are directly affected, leaving others in the dark.

It is believed that top management support has a direct influence on project performance or success of an organization. In the study of Santos et al (2019), it was revealed that the variables that has more effect on project success is top management supports. Poveda-Bautista et al. (2018) believe that in order to address some specific complexities in project success the managers must acquire some specific competence development skills. Also, effective consultation with stakeholders influence the performance a project at each phase of the project life cycle. Thus there is need for adequate and regular consultation with clients and other stakeholders of the project. Team capacity is necessary to the success of a project. Considering that the project manager and the project team are ultimately responsible for the success and quality of projects, it stands to reason that competent personnel would be recruited and trained regularly. Training related to creativity, team building, documentation skills and problem solving had a positive impact on the overall project performance. Training for individuals or managers to understand their roles or new roles for performing knowledge oriented tasks might be needed. It is equally important for them to equip themselves with the skills to foster creativity, innovation, and knowledge sharing, all will enhance the performance of a project. Managers can also be trained in areas such as business development, strategic management and in ICT (Nolan & Garavan 2016).

However, due to the importance of projects, some researchers indicated the need for more research in the area of project management (Habibi et al., 2018; Ingason & Shepherd, 2014; Sridarran, Keraminiyage, & Herszon, 2017). In a narrower view, some researchers studied the phenomena of project failure and poor project performance and identified different causes, such as the misalignment between projects and business strategies (Catanio et al., 2013; Parker et al., 2015). Habibi et al. (2018), Ingason and Shepherd (2014), as well as Sridarran et al. (2017) indicated the need for more research in the field of project management in terms of success criteria, cost management, and time management. In view of this, we are motivated to contribute to these existing studies by identifying additional critical success factors that are peculiar to Oil and Gas Industry. we have extended the traditional iron triangle to include sustainable building factors such as human factor, project procedure, external issue and project management action. In this manner, our study is similar to Walker and Shen (2002). However, unlike Walker and Shen, whose study is based on correlational analysis, we utilize the structural equation modeling (SEM), which provide the framework of linking my construct variables together so that the bidirectional causation and the theoretical sign between critical success factors and project performance can be tested. The rest of the paper is structured as follows: literature review, data source and sample size, model specification, results, conclusion and recommendation.

2.Literature Review

Um and Kim' (2018) research aims to construct project uncertainty in NPD (New Product Development) projects and explore how it affects project performance through cooperation and opportunism. These relationships are investigated empirically in the context of Korean manufacturing companies that are now working on NPD initiatives with their major partner. SEM, meaning structural equation modeling, is used to demonstrate proposed ideas. The empirical results indicated that greater levels of project uncertainty promote

cooperation and opportunism, and that these two characteristics affect project performance in opposing ways: cooperation serves as a driver of project performance, whereas opportunism operates as a barrier to it.

Nareshkumar, Pranav and Qureshi (2017) studied the connectivity between critical success factors and performance indicator factors in automobile industry of Gujarat in India. The major goal of this study is to determine how lean manufacturing is being adopted along with a comparison of critical success factors and performance indicators. The result revealed that critical success factor and performance indicator are significantly related. This study also emphasizes the relationship between variations in lean manufacturing awareness and factors such as staff count, organizational age, organizational tier, product mix, and operation type. The results of the study show that all the factors are not found significant at 5 % level of significance; therefore, it can be concluded that there is significance difference in critical success factors and performance indicator factors between the different categories of operation type and tier of organization.

Ziadat (2019) explained that effective monitoring and control as a direct function with performance. He also stated that facts about the project should be obtained and detailed data investigation should be carried out. once weaknesses in the project plan are noticed, then necessary and preventative actions are certified to carry the project back into a pattern with the project plan. Time to time monitoring and control is useful in preventing incidents and in providing feedback. Furthermore, risk management in performance of a project is also important so as to meet up with the objectives of the project then minimizing or circumventing cost delays and overruns. However, the success of the project is premised on the plan and design of the project (Kassem, Khoiri & Hamzah, 2020).

Project managers are to arrange and allocate resources and make decisions which will enhance project's success and goals. Kauppi, et al., (2016) stated that a detailed risk management plan is essential to minimize project costs. Scheuchner (2017) said most projects experience poor project performance regarding time, cost, or scope that lead to organizational failure. He recognized that the iron triangle as one of the early project success has theoretical link with the performance, success, or failure of a project. It is generally observed that between 70% to 80% of IT projects fail because project management teams could not deliver the projects as per the plan (Mukerjee & Prasad, 2017). Fayaz, Kamal, Amin and Khan, (2017) established that project success/performance is driven by additional factors, namely the misalignment between the project and the business strategy, poor stakeholder management, and poor risk management.

Due to the importance of projects, some researchers indicated the need for more research in the area of project management (Habibi et al., 2018; Sridarran, Keraminiyage, & Herszon, 2017). In a narrower view, some researchers studied the phenomena of project failure and poor project performance and identified different causes, such as the misalignment between projects and business strategies (Caietti 2016; Carral et al. 2018). Habibi et al. (2018), as well as Sridarran et al. (2017) indicated the need for more research in the field of project management in terms of success criteria, cost management, and time management. I am motivated to contribute to these existing studies by identifying additional critical success factors that are peculiar to Oil and Gas Industry. I have extended the traditional iron triangle to include sustainable building factors such as human

factor, project procedure, external issue and project management action. In this manner, my study is similar to Jitpaiboon, Smith and Gu (2019). However, unlike Jitpaiboon, Smith and Gu, whose study is based on explorative factor analysis, I utilize the regression analysis model, which provide the framework of linking my construct variables together so that the bidirectional causation and the theoretical sign between critical success factors and project performance can be tested.

In Pakistan, the impact of project management skills on project success was assessed by Irfan, Hassan, and Hassan in 2019. Their study's major goal is to look into how project management maturity (PMM) and its components affect project success in the setting of Pakistan. To present and validate a research model that takes PMM and project success into account is the authors' goal. The research model is evaluated using structural equation modeling with partial least squares (PLS-SEM). Based on a sample of 425 respondents from Pakistani project-based organizations, the proposed hypotheses were tested. According to the study's conclusions, PMM and project success are positively linked. Additionally, it was deduced from the findings that various PMM components, including resource project management, process management, and knowledge management transfer, may directly affect project success. This study also found that the usage of software, continuous improvement, and training had no substantial impact on project success in Pakistan

The study of Hasan and Al-Hashimi (2019) was based on the impact of project management methodologies (PMMs) on project success in Bahrain oil and gas sector. The various project techniques were also examined, along with their advantages and disadvantages The results of this study showed that while augmented PMMs have an insignificant link with project success, comprehensive and applied PMMs have a significant influence on project success. In the light of the aforementioned studies, it seems there is a potential caveat that needs to be addressed, since no single study that has augmented the triangular factors to include human variables in explaining project performance. Thus, this current study is designed to provide additional information on the forces that drive project performance.

3.1 Data Types and Sources

The study employs primary data on the set of latent/construct variables identified in this study. These are project performance, top management action and satisfaction, time schedule, estimated cost, quality control, environment, health and safety, use of resources and scope & specification Structured questionnaire that reflects the basic characteristics of these variables is administered to the respondents who are typically employees of the selected oil and gas local industry. The raw information is therefore processed by the researcher to obtain coefficients for each of the constructs.

3.2 Population of the Study

The study is conducted within the domain of the oil and gas sector of Nigeria with a spread of companies majorly in four states of the countries, Warry, Port Harcourt, Abuja and Lagos. The target population is the upstream industry, where project developments of different types are concentrated. However, we only focus on the local companies in the upstream, excluding the international ones from this population, because our desire is to explain project performance in the domestic country. To be precise, 30 companies are involved with their teeming population size for employees and employers.

3.3 Sample of the Study

Three of the largest companies in the local upstream industry, namely Nigerian National Petroleum Corporation (NNPC), Niger Delta Petroleum Resources and Nigerian Petroleum Development Company (NPDC) selected for this study. Thus, the sample size comprises the employees and employers of these companies, who are the accessible respondents for the study. The estimated number of these respondents is approximately 1000 members from rank/file to managerial level. Out of this number, a sample of 300 respondents are employed. Therefore, to reduce human error to beeriest minimum, we limit the study to a sample of 300 respondents.

3.4 Construct Equations/Structural Equations

In the spirit of Wyngaard, Pretorius and Pretorius (2012), with modification, the econometric model that captures the conceptual framework of the study is defined as follows.

$$pp_i = \alpha_0 + \alpha_1 ts_i + \alpha_2 ec_i + \alpha_3 qc_i + w_{i1} \quad \textbf{1}$$

Measurement Equations

$$pp_i = \sum_{i=1}^{n} ppinstrm_i + e_{i1} \quad \textbf{2}$$

$$ts_i = \sum_{i=1}^{n} tsinstrm_i + e_{i3} \quad \textbf{3}$$

$$ec_i = \sum_{i=1}^{n} ecinstrm_i + e_{i4} \quad \textbf{4}$$

$$qc_i = \sum_{i=1}^{n} qcinstrm_i + e_{i5} \quad \textbf{5}$$

Definition of Variables

pp-project performance, ts-time schedule, ec-estimated cost, qc-quality control, ppinstrm-instrument relating to project performance, tsinstrm- instrument relating to time schedule, ecinstrm- instrument relating to estimated cost, qcinstrm- instrument relating to quality control, and n is the number of instruments in each case.

4 Results

The results of this study are classified to three, namely pre-estimation, estimation and post-estimation results respectively. The pre-estimation results are based on validity and reliability tests, estimation results focus on the test of the hypotheses of the study and they are extracted from the SEM estimation outputs, lastly the post-estimation results are on the fitness and explanatory power of the SEM specification adopted in this study.

4.1 Validity Test Results

Validity refers to whether instruments measure or capture the underlying construct variable perfectly. We conducted content validity test based on factor loading. Table 1 presents the results of the validity test.

Table 1 Validity Test Results

Instrument	Initial	Extraction
PP1	1	0.59
PP2	1	0.50
PP3	1	0.59
PP4	1	0.64
TS1	1	0.60
TS2	1	0.66
TS3	1	0.41
EC1	1	0.69
EC2	1	0.67
EC3	1	0.054
QC1	1	0.75
QC2	1	0.544
QC3	1	0.51

Note that the acronyms or abbreviations are defined in the model specification section

About thirteen (13) instruments or manifest variables are proposed for the study. No of these instruments has loading score/coefficient that is less than 50 percent except TS3. This means that all the instruments are well loaded, and measure their respective construct variables well, except TS3. This instrument is not valid since it does not significantly measure the underlying construct variable (TS)

4.2 Reliability Test

The researcher conducts reliability test for each set of instruments. Reliability test is a test that reveals whether a set of indicators are consistent internally. Consistency means no change at all time. The Cronbach's Alpha is used for this purpose, and the coefficients of the Alpha are reported in table 2.

Table 2 Reliability Test Results

Construct	Acronym	Cronbach Alpha	No of Instruments
Project Performance	PP	0.76	4
Time Schedule	TS	0.62	2
Estimated Cost	EC	0.57	2
Quality Control	QC	0.70	3

Apparently, there are four construct variables for this study, which are project performance, time schedule, estimated cost and quality control. Two of these construct variables have Cronbach's value equal or greater than 70 percent. This implies that the instruments of these variables are internally consistent. All other construct variables have Cronbach's Alphas that are approximately close to 70 percent, and as such we consider the test appropriate for the study.

4.3 Estimated Result and Test of Hypothesis

In this study, the researcher employs three competitive estimation methods, MLE, GLS and Asymptotically Distributed Free Estimate (ADFE), to test the hypothesis that project performance is influenced significantly by critical success factors. The ADFE is used as the benchmark technique, while the MLE and GLS are used as robustness checks. The results of the ADFE method are presented in table 3.

Table 3 ADFE Results

	Estimate	S.E.	C.R.	P-Value
PP <---TS	-0.13	0.08	-1.70	0.09
PP <---EC	0.43	0.15	2.80	0.00
PP <---QC	0.24	0.11	2.16	0.03
X^2/DF	6.23			
RMSEA	0.12			
RMR	0.12			
GFI	0.90			

Note that the dependent variables are PP (Project Performance), while predictors are TS (Time Schedule), EC (Estimated Cost) and QC (Quality Control)

The ADFE results provide evidence that time schedule has a weak negative influence on project performance. Since the relationship is significant at 10 percent, we deduce that there is 90 percent confidence that the performance of a project in the Nigerian Upstream Oil and Gas Industry declines with increase in the schedule of time. We claim that a longer time schedule is detrimental to project performance in this Industry. Estimated cost maintains a positive and significant relationship with project performance. This suggests that performance of a projects increases with a rise in cost. A very low cost estimate leads to "White Elephant Project" particularly in the face of inflation. Most of the projects abandoned or neglected in the Nigerian Upstream Oil and Gas Industry has direct link with estimated costs that their monetary value has been eroded by inflation due to long executing time. Quality control as a critical success factor has a positive impact on project performance. Meaning that performance of project increase with a rise in the quality control. A poor quality control reduces the performance of projects. Thus, there is evidence that the lackadaisical attitude of project

operators in the Nigerian Upstream Oil and Gas Industry spurred poor quality control and consequently poor project performance. We observed a good fit of the model with GFI statistic.

4.3.1 Robustness Checks

We conduct robustness checks using MLE and GLS methods due to potential endogeneity problem. The results are reported in tables 4 and 5 respectively.

Table 4 MLE Results

	Estimate	S.E.	C.R.	P-Value
PP <---TS	-0.07	0.10	-0.66	0.51
PP <---EC	0.07	0.16	0.45	0.65
PP <---QC	0.61	0.11	5.23	0.00
X^2/DF	7.09			
RMSEA	0.13			
RMR	0.07			
GFI	0.90			

Note that the dependent variables are PP (Project Performance), while predictors are TS (Time Schedule), EC (Estimated Cost) and QC (Quality Control)

The MLE results confirms the negative relationship between project performance and time schedule. However, the relationship appears insignificant and weaker. Both estimated cost and quality control still have positive impact on project performance; but the results show that quality control is the most sensitive variable to project performance. To the contrary, ADFE affirms that estimated cost is the most sensitive factor. Based on the statistics of the GFI and RMR, the model has good fit.

Table 5 GLS Results

	Estimate	S.E.	C.R.	P-Value
PP <---TS	-0.13	0.12	-1.10	0.27
PP <---EC	0.33	0.19	1.74	0.08
PP <---QC	0.70	0.18	3.97	0.00
X^2/DF	5.0			
RMSEA	0.11			
RMR	0.11			
GFI	0.90			

Note that the dependent variables are PP (Project Performance), while predictors are TS (Time Schedule), EC (Estimated Cost) and QC (Quality Control)

There is strong evidence that time schedule maintains inverse relationship with project performance, and that quality control is the most sensitive factor to project performance in the Nigerian Upstream Oil and Gas Industry. The model has good fit based on the statistics of the chi-square-degree of freedom ratio and GFI. In view of these findings, the following conclusions and recommendations are made.

5.Conclusion and Recommendation

The three estimation methods applied in this study provide overwhelming, and unanimous evidence to claim that a long time schedule reduces project performance. This claim is in tandem with the study by Mukerjee and Prasad (2017). Furthermore, we conclude that estimated cost and quality control have positive impact on project performance. This finding is partly in consonant with the study of Ziadat (2019), who documented that effective control and monitoring have a direct link with project performance. Therefore, we recommend that

the management of the Nigerian Upstream Oil and Gas Industry should initiate effective planning process with periodic assessment to ensure that projects are executed within a record time. Also, in estimating the costs of projects, inflation and exchange rate factors should be incorporated. The costs of projects that will take longer periods to accomplish should be higher than those with shorter periods.

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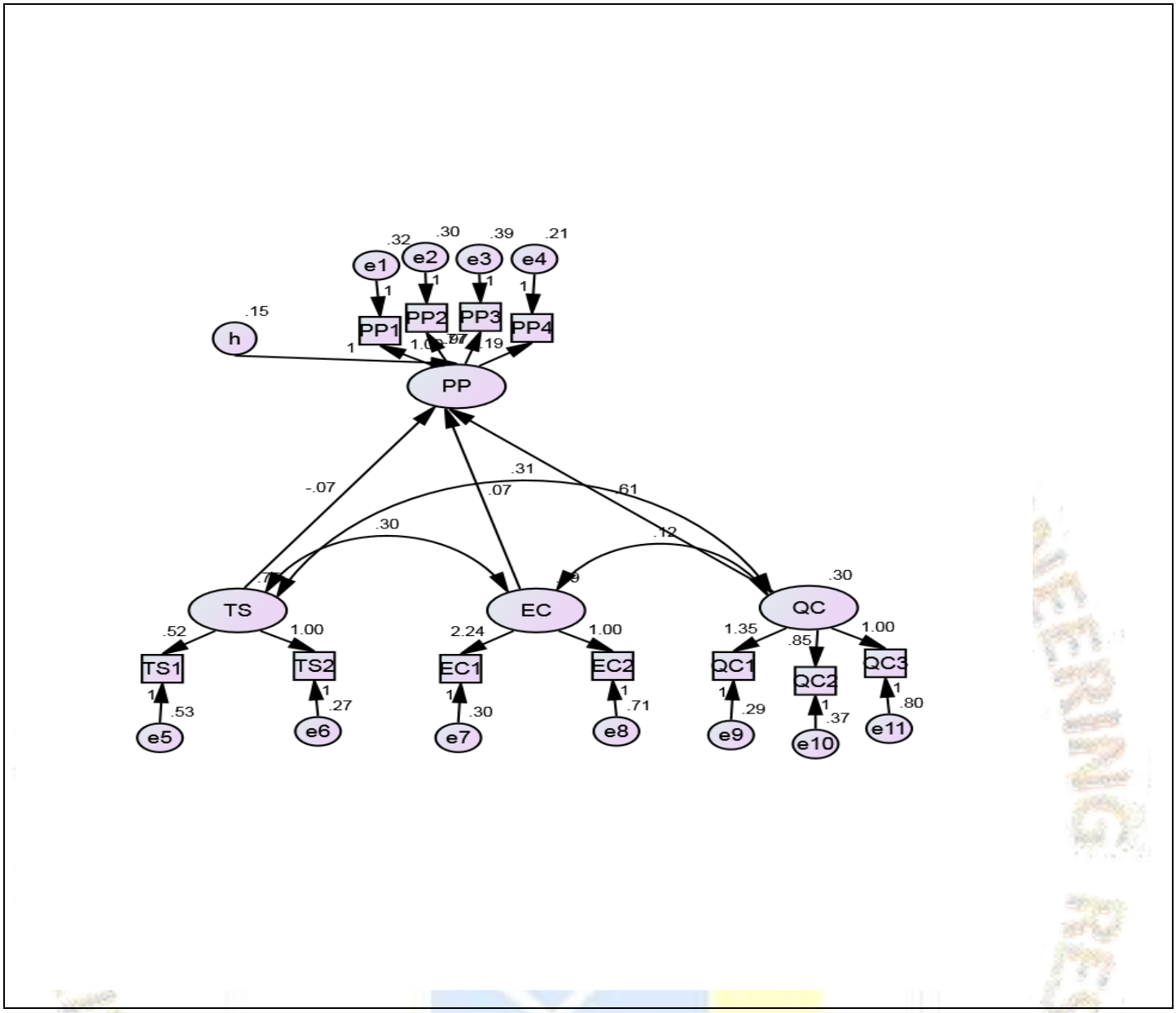
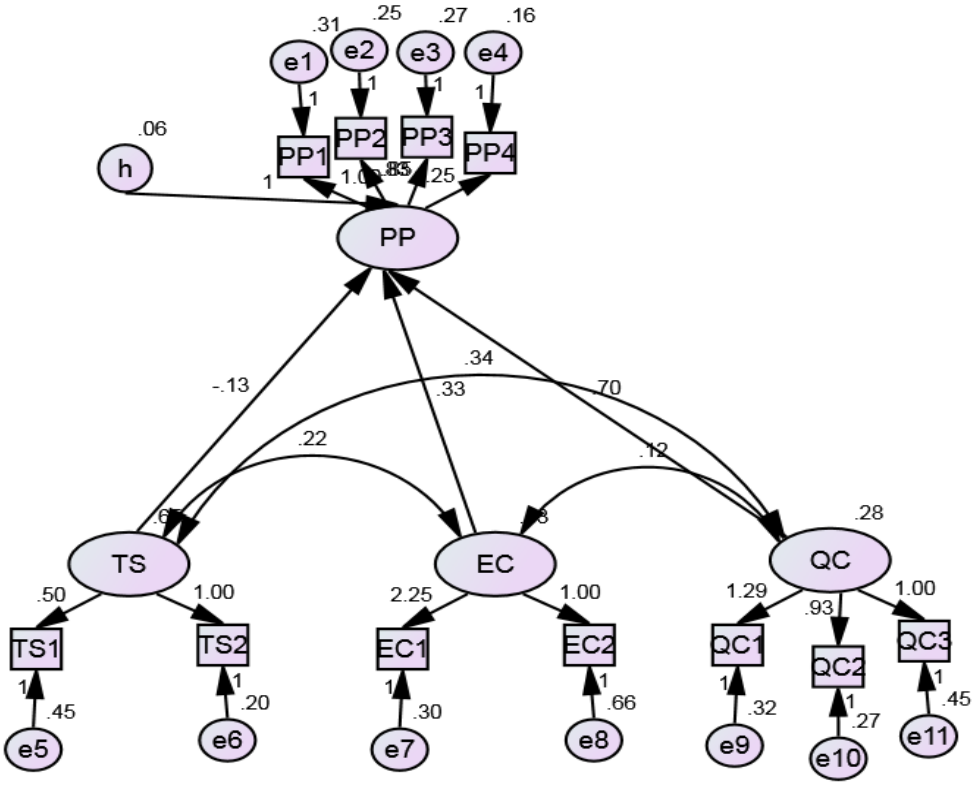
Appendix

MLE Results



GLS Results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ADFE Results