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Research Paper

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ABSTRACT

Over the last decade, information technology (IT) projects have continued to fail at an alarming rate. Project managers are still battling to manage and deliver successful IT projects in organizations. The conceptual information technology project management assurance framework developed consists of project assurance processes. The conceptual framework was validated through a survey of 121 IT project managers from organizations in seven African countries. The purpose of this paper is to present research findings on how well project assurance processes are implemented and their importance in achieving a successful IT project outcome in organizations. The findings indicate that most project assurance processes are implemented better in successful IT projects than in challenged and failed IT projects. The findings also indicate that in successful, challenged, and failed IT projects, project assurance processes were perceived to be important in achieving a successful IT project outcome. This paper contributes to the body of knowledge on project auditing and assurance. Practitioners and project managers can use the conceptual information technology project management assurance framework to deliver successful IT projects in organizations.

Keywords

Project management, project success, IT project auditing, project assurance, project governance.

INTRODUCTION

In the global business environment, organizations want to achieve greater efficiency, better value for money, and improved service delivery to customers and to create strategic business value to sustain competitive advantage in the market (Porter & Miller, 1985; Rayport & Jaworski, 2004;

Marnewick & Labuschagne, 2009; Jung, Valacich & Schneider, 2010; Almajed & Mayhew, 2014). This pressure has increased the adoption of project management as a discipline within different sectors and industries (Besner & Hobbs, 2006; Too & Weaver, 2014). Organizations continually align project activities with business strategy to achieve their strategic objectives and goals. Some of these initiatives are managed as information technology (IT) projects. For example, in 2018, the global IT spending is forecasted to total US$3.7 trillion (a 4.3% increase from 2017) focusing on artificial intelligence, cloud computing platforms, and digital business (Gartner Inc., 2017, 2018). Despite this growth in IT investments, IT projects still fail at an alarming rate (Standish Group, 2013, 2015). IT project managers are still battling to manage and deliver successful IT projects. Failed IT projects have resulted in organizations not achieving some of their strategic objectives, wasting vast amounts of money and not realizing a return on their IT investment. The global state of IT projects is shown in Table 1.

Table 1. Global state of IT projects (2011-2015)
(Standish Group, 2013, 2015)

Project type	2011	2012	2013	2014	2015
Successful IT projects	29%	27%	31%	28%	29%
Challenged IT projects	49%	56%	50%	55%	52%
Failed IT projects	22%	17%	19%	17%	19%

Some of the factors which contribute to the failure of IT projects include projects not delivered on time and within budget, cost overruns, poor communication between project team members, lack of correct auditing processes, project products not meeting customer requirements, as well as lack of skills in leading change in the organization (Shenhar, 2008; Marnewick, 2013; PMI Brazil survey, 2013; PMI India, 2014; Ramos & Mota, 2014; KPMG, 2017). Since project auditing plays a significant part in project success (McDonald, 2002; Simon, 2011; Marnewick & Erasmus, 2014), a framework is needed to ensure successful delivery by IT projects in organizations. The conceptual framework was developed and validated among IT project managers from organizations in seven African countries. Therefore, the main objective of this paper is to present research findings on how well the project assurance processes are implemented and their importance in achieving successful IT projects.

The paper is organized into five sections: the first section provides a literature review on project auditing, project success, as well as the relationship between IT project auditing and project success. The conceptual information technology project management assurance framework is discussed in the second section. The third section presents the research methodology. Results and analysis are discussed in the fourth section. The fifth section concludes the paper.

LITERATURE REVIEW

Project auditing

Project auditing examines the management of a project, collects and evaluates evidence to measure project results against a project work plan, determines whether the management of the project complies with best practice and standards, as well as communicates audit results to intended users (Ruskin & Estes, 1984; McDonald, 2002; IAPPM, 2008; Reusch, 2011; Hill, 2013). According to Hill (2013, p. 465), "audit within the project management environment measures results and identifies the contributing causes of those results."

Auditing of a project throughout the project life cycle helps to identify project risks earlier, trigger timely corrective actions and improve project performance, which increases the likelihood of successful completion of the project and the delivery of the product (Meredith & Mantel, 2009; Simon, 2011; Marnewick & Erasmus, 2014).

Project success

Project success has been perceived differently since its evolution. The evolution of project success started in the period 1960 to 1980, which focused on investigating success criteria for measuring project management success (Baker, Murphy & Fisher, 1983; De Wit, 1988). The traditional view of project management success was associated with meeting the time, cost, and quality criteria, referred to as the 'iron triangle' or 'triple constraints' or 'golden triangle' (Pinto & Slevin, 1988a; Atkinson, 1999; Belassi & Tukel, 1996).

In the period 1980 to 1990, the emphasis in project success was on developing critical success factors (Slevin & Pinto, 1986; Pinto & Prescott, 1988; Pinto & Slevin, 1987, 1988b, 1988c; Kerzner, 1987; Morris & Hough, 1987). According to Turner (2013, p. 74), project critical success factors can be influenced to increase the chances of achieving a successful project outcome.

In the period 1990 to 2000, project and product critical success factor frameworks emerged, and the project success factors were categorized into common themes (Shenhar, Levy & Dir, 1997; Pinto & Mantel, 1990; Baccarini, 1999; Wateridge, 1998; Atkinson, 1999). The view of project success included both project and product success (Davis, 2014).

In the period 2000 to date, the emphasis of project success has been on strategic project management. This emphasis moves the project success view from an organization's tactical level to the strategic level (Bannerman, 2009). Project success includes project management success, process success, project product (deliverables) success, organization's business success and strategic success, program success and portfolio success (Cooke-Davies, 2002; Turner, 2004; Misra, Kumar & Kumar, 2009; Bannerman, 2009; Müller & Jugdev, 2012; Marnewick, 2013; Standish Group, 2013; Almajed & Mayhew, 2013, 2014; Davis, 2014; Ahimbisibwe, Cavana & Daellenbach, 2015).

Relationship between IT project auditing and project success

As IT projects continue to fail at an alarming rate (Standish Group, 2013, 2015), organizations can turn to project auditing throughout the project life cycle (PWC, 2013). Project auditing improves the project management processes, provides lessons learned, and contributes to project success (Huemann, 2004). There are various studies which reveal that there is a positive relationship between IT project auditing and project success. For example, auditing of processes contributed to 50.2% of project success in South Africa (Sonnekus & Labuschagne, 2003). It was also confirmed by Marnewick and Labuschagne (2009) and Marnewick (2013) that auditing of processes in IT projects is among the factors influencing project outcomes in South Africa. Simon (2011) proposes three phases of project auditing to ensure IT project success: pre-audit, mid-audit, and post-audit. Pre-audit validates project readiness, mid-audit evaluates the progress of the execution of project activities against the project management plans, and post-audit confirms project readiness for closure. Auditing helps to identify project risks earlier, trigger timely corrective actions, and improve project performance.

Link between IT project auditing and assurance

As discussed, IT project auditing examines the management of the project, collects and evaluates evidence to measure project results against a project work plan, and determines whether the project management complies with best practices and standards. IT project assurance has a broader view than IT project auditing. Project assurance is when the project board objectively assesses a project's performance (Oakes, 2008; OGC, 2009: 273). This assessment helps the project board to understand what is happening across the project and to make the right decisions based on properly validated information. Thus, the project assurance team undertakes independent monitoring of the IT project's progress and outputs on behalf of the project board. Project assurance monitors project delivery performance throughout the project life cycle. Project assurance review is conducted within each phase of the IT project life cycle to improve the chances of successful project delivery and the realization of expected outcomes. According to Oakes (2008, p. 45), "*project assurance focuses on whether the IT project is likely to succeed, and what can be done to help it succeed. The main question asked during the IT project assurance review is 'will the IT project succeed given the current information?*".

Figure 1 indicates this relationship.

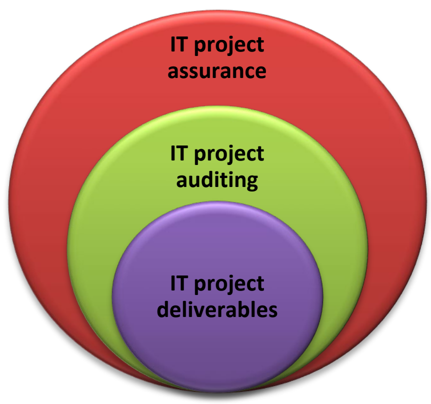

Figure 1. Link between IT Project Auditing and Assurance
(adapted from Mkoba & Marnewick, 2016)

Various studies reveal that the utilization of project assurance in IT projects can increase the rate of IT project success (Tilk, 2002; Berg, 2013; PWC, 2015). Thus, there is a growing need for an IT project management assurance framework that can be used to deliver successful IT projects in organizations.

The following section covers the research methodology used to validate the conceptual framework.

RESEARCH METHODOLOGY

The research used an exploratory research design and a quantitative research method through survey questionnaires. Data were collected by means of three structured questionnaires. The first questionnaire focused on successful IT projects and aimed at answering questions on the most recent successful IT project that was managed in the organization. The second questionnaire focused on challenged IT projects and aimed at answering questions on the most recent challenged IT project that was managed in the organization. The third questionnaire focused on failed IT projects and aimed at answering questions on the most recent failed IT project that was managed in the organization. These questionnaires were distributed via email to IT project managers from seven African countries.

Measures were developed from the literature review. Thirty-two items were identified and used in the questionnaires. The questionnaires used two types of Likert measurement scales, namely, a quality scale and an importance scale to measure all the items. The weights in the quality scale ranged from 1 Not implemented to 6 Excellent. The weights in the importance scale ranged from 1 Unimportant to 5 Critically important. The respondents used the quality scale to rank how well the project assurance processes had been implemented when a particular IT project outcome was achieved. The respondents used the importance scale to rank how important the project assurance processes were in achieving a successful IT project outcome.

Validity refers to appropriateness of the questionnaire to measure what it is intended to measure (Nunan, 1992; Byrne, 2002; Field, 2013). The types of validity that are commonly used to assess a survey questionnaire are face, content, criterion, and construct validity. This research used the content validity test. Content validity assesses the degree to which individual variables represent the construct being measured. The content validity test was conducted before the questionnaire was administered. Content validity was achieved through the following:

(i) Experts from the university's statistics consultancy services reviewed the survey instrument to ensure that the appropriate data were collected. The experts provided useful reviews which were incorporated in the final survey questionnaires.
(ii) Twelve questionnaires were pilot tested using IT project managers from financial and public sector organizations. The pre-test aimed to test the construct validity and reliability of the questionnaires to produce the same results under the same conditions. The results of the pilot test were reviewed, and a few changes were incorporated in the final questionnaires.

These questionnaires were distributed using convenience sampling, where samples were selected because of their convenient accessibility to the researcher. Data were collected from the 121 IT project managers. Data preparation was conducted before analyzing them which involved data coding and data cleaning. Data were then analyzed using SPSS 24.0.

Internal consistency was used to measure the questionnaire's reliability. Cronbach's alpha coefficient was used to test the reliability of the questionnaires (Cronbach, 1951; Cortina, 1993).

According to Field (2013), a Cronbach's alpha coefficient of 0.7 and above is accepted as representing good reliability. Cronbach's alpha coefficient was calculated for the project assurance processes in each phase of the IT project life cycle. The results in Table 2 indicate that there was internal consistency and good reliability.

Table 2. Cronbach's Alpha Reliability Test Result

IT project phases	No. of items	Cronbach's alpha coefficient
Initiation phase	10	0.781
Planning phase	12	0.847
Execution phase	24	0.902
Closing phase	8	0.801
Operations and maintenance phase	10	0.869

This result means that there was a consistency of measured items, the data collection instrument was reliable, and the data can be trusted.

A deductive content analysis was used to develop the components of a conceptual framework from the comprehensive literature review (Mayring, 2000). The steps used to identify the components of the conceptual framework were: (1) to refer research question and research problem; (2) to conduct a literature review to identify key concepts on project auditing, project life cycle, project governance, project success, project assurance, and project deliverables. The reliability of these concepts was linked back to the research question and problem statement as well as theoretical definitions (Mayring, 2000); (3) to create a relationship between the concepts, the concept mapping was used (Maxwell, 2005); (4) to identify components of the conceptual framework. The categories generated from content analysis were used as the main components of the conceptual framework.

An overview of the conceptual information technology project management assurance framework is given in the next section.

CONCEPTUAL INFORMATION TECHNOLOGY PROJECT MANAGEMENT ASSURANCE FRAMEWORK

This section presents the conceptual information technology project management framework which is comprised of various components. These components are discussed in detail in this section. The conceptual information technology project management assurance framework (as shown in Figure 2) was developed and validated.

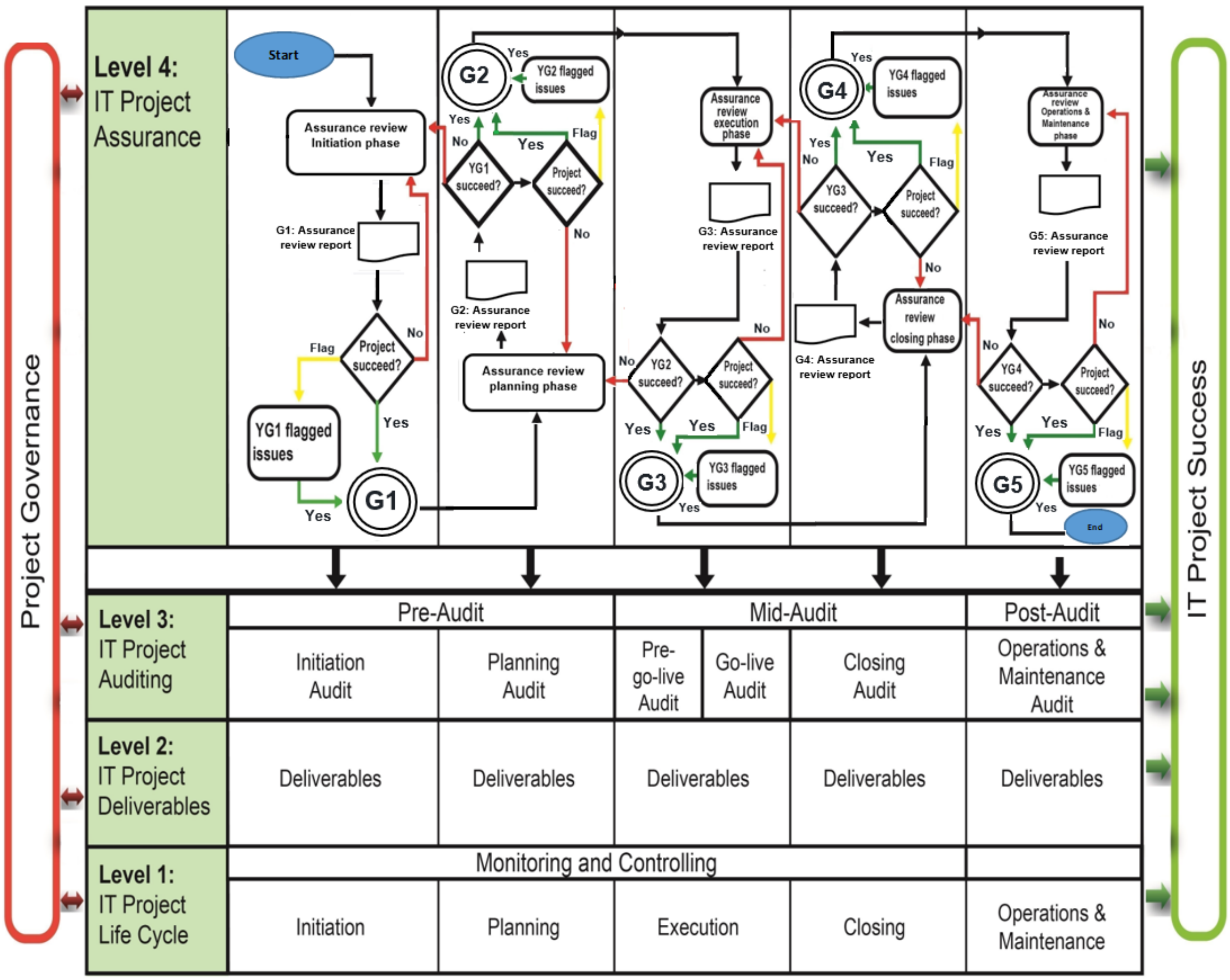

Figure 2. Conceptual Information Technology Project Management Assurance Framework
(Mkoba & Marnewick, 2016)

The conceptual information technology project management assurance framework consists of the following key components:

- *Level 1: IT Project Life Cycle:* Project life cycles differ depending on the nature of the project and the industry involved. The conceptual framework was built on the IT project life cycle, which was adapted from the Project Management Body of Knowledge (PMI, 2017), and the project operation and maintenance phase was adapted from Ohara (2005) and Kay (2014).
- *Level 2: IT Project Deliverables:* Project deliverables are measurable and tangible outcomes of a project according to the project management plans (PMI, 2017). The project deliverables in each phase of the project are audited during the implementation of the IT project.
- *Level 3: IT Project Auditing:* IT project auditing assesses whether the management of the project complies with the relevant policies and standards, as defined by the organization, its regulators, and other stakeholders (Oakes, 2008). Project auditing is categorized into pre-audit, mid-audit, and post-audit. Pre-audit examines the deliverables from the initiation and

planning phase. Mid-audit examines the deliverables from the execution and closing phase. Post-audit examines the deliverables from the operations and maintenance phase. The output of each audit category is used as input in the project assurance review process.

- *Level 4: IT Project Assurance:* Project assurance has a broader view than project audit because it focuses on project delivery performance (that is, whether the project is likely to succeed, and what can be done to help it succeed). The utilisation of project assurance can increase the success rate of IT projects (Tilk, 2002; Berg, 2013; PWC, 2015). In each project assurance review gate, there are project assurance processes that can be tailored to ensure successful delivery of an IT project. The interaction between the IT project assurance processes and the conceptual framework was represented by using a cross-functional flow chart. In Level 4, there are five IT project assurance review gates (G1, G2, G3, G4, G5) in the IT project lifecycle. In each assurance review gate, there are project assurance review areas. Each project review area has IT project assurance processes which aim at enhancing the prospect of the successful delivery of the IT project. These project assurance processes were generated from the literature review. Color coding in the lines as shown in Figure 2 are used by project governance for making decision. The color coding is described as: (a) *Red color* with the output branch named *"No"* indicates that major issues identified during the project assurance review have positive effect on the performance of the IT project, hence IT project cannot proceed to the next phase; (b) *Yellow color* with the output branch named *"Flag"* indicates that the IT project can proceed to the next phase. Minor issues are identified (denoted as the YG1, YG2, YG3, YG4, YG5 Flagged Issues) which need to be resolved, and will be reviewed at the next project assurance review gate; (c) *Green color* with the output branch named *"Yes"* indicates that no issues were identified during the project assurance review and the project can proceed to the next phase.
- *Project Governance:* Project governance is a critical success factor for the delivery of projects (HM Treasury, 2007; Garland, 2009; Müller, 2009; Biesenthal & Wilden, 2014). As shown in Figure 2, project governance cuts across all the levels to oversee project progress, provide project support and guidance, monitor project performance, control project implementation activities, and provide a framework for decision making throughout the IT project life cycle. Project governance also reviews and approves project assurance review reports (from project assurance review gates 1, 2, 3, 4 and 5) to determine whether or not to proceed to the next phase of the IT project life cycle. Thus, project governance enhances project success and enables the realization of organizational strategic objectives through projects.
- *IT Project Success:* IT project success is an outcome from the interaction of all the components of the conceptual framework. Project success includes project management success, process success, project deliverable success, business success, and strategic success of the organization.

RESULTS AND ANALYSIS

The survey results are presented in descriptive analysis and analysis of variance (ANOVA).

Descriptive analysis

A total of 121 complete responses were received from IT project managers in public and private sector organizations from seven African countries. A profile of the respondents indicated that

68% were male and 32% were female. Table 3 shows the profile of organization type against project type.

Table 3. Organization Type against Project Type

Organisation type	Project type			Total respondents
	Successful IT project	Challenged IT project	Failed IT project	
Public sector	18	23	17	**58**
Private sector	28	21	12	**61**
Other	1	0	1	**2**
Total	**47**	**44**	**30**	**121**

Data were analyzed using SPSS 24.0. The data analysis was conducted for the successful, challenged, and failed IT projects, and aimed at examining:

(i) how well the project assurance processes were implemented when a particular IT project outcome was achieved in the organization, and
(ii) how important the project assurance processes are in achieving a successful IT project outcome.

The results of the data analysis are discussed in each phase of the IT project life cycle in the sections that follow.

Initiation phase

The weighted percentage was calculated to examine how well the project assurance processes were implemented and their importance in achieving a successful IT project outcome in the organization. The results are illustrated in Figure 3.

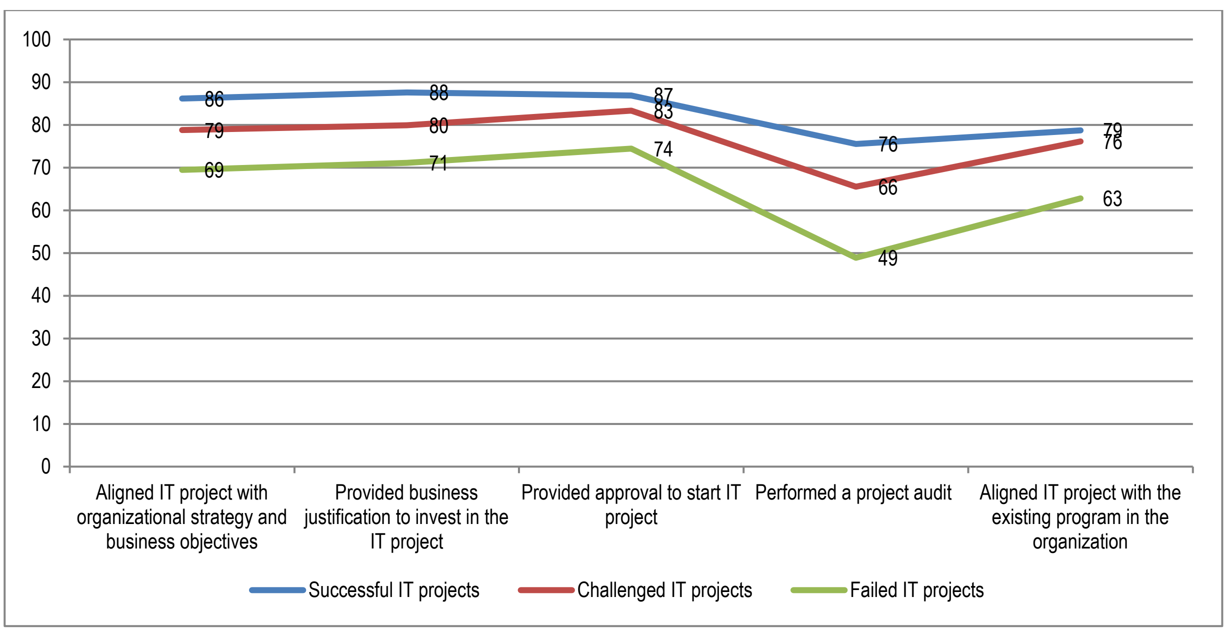

Figure 3. Weighted Percentage for Level of Quality Implementation of the Project Assurance Processes

The results in Figure 3 show that most of the project assurance processes were implemented well in successful and challenged IT projects. However, they were not well implemented in the failed IT projects. For example, 43% of the respondents indicated that failed IT projects were not audited during the initiation phase.

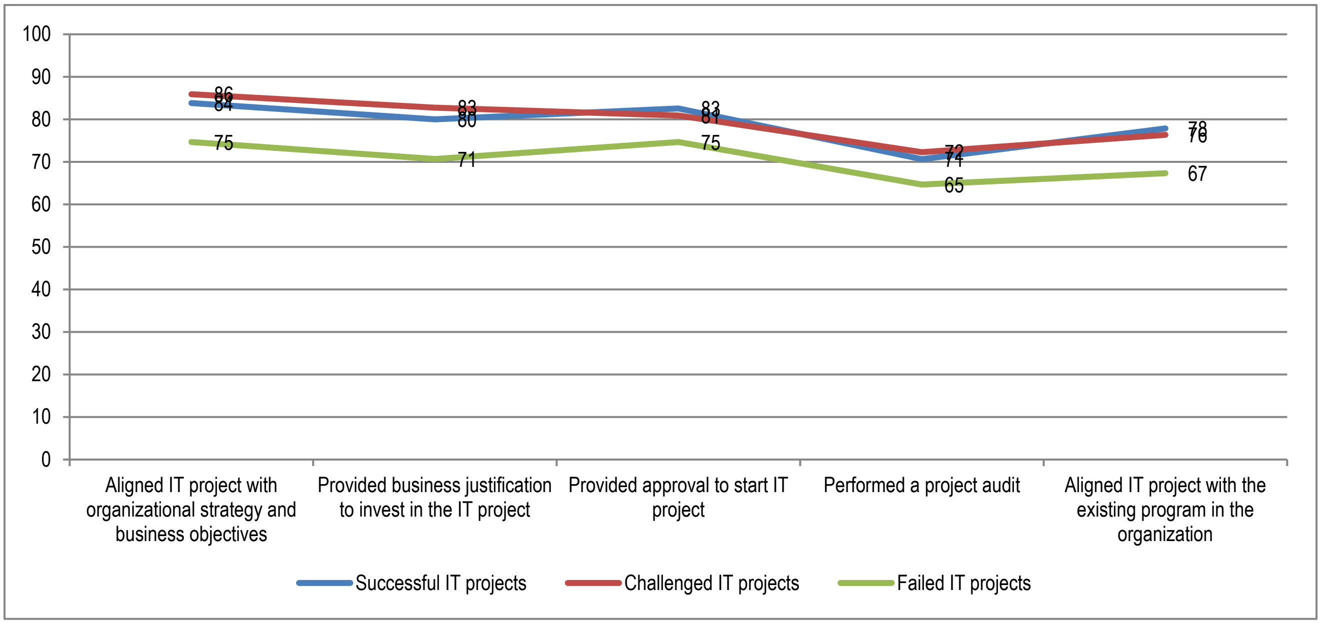

Figure 4. Weighted Percentage for Importance Level of the Project Assurance Processes

Figure 4 shows that the results of successful, challenged, and failed IT projects are clustered together. This implies that all the project assurance processes in the initiation phase were perceived as important across successful, challenged, and failed IT projects.

Planning phase

The weighted percentage was calculated to examine how well the project assurance processes were implemented and their importance in achieving a successful IT project outcome in the organization. The results are illustrated in Figure 5.

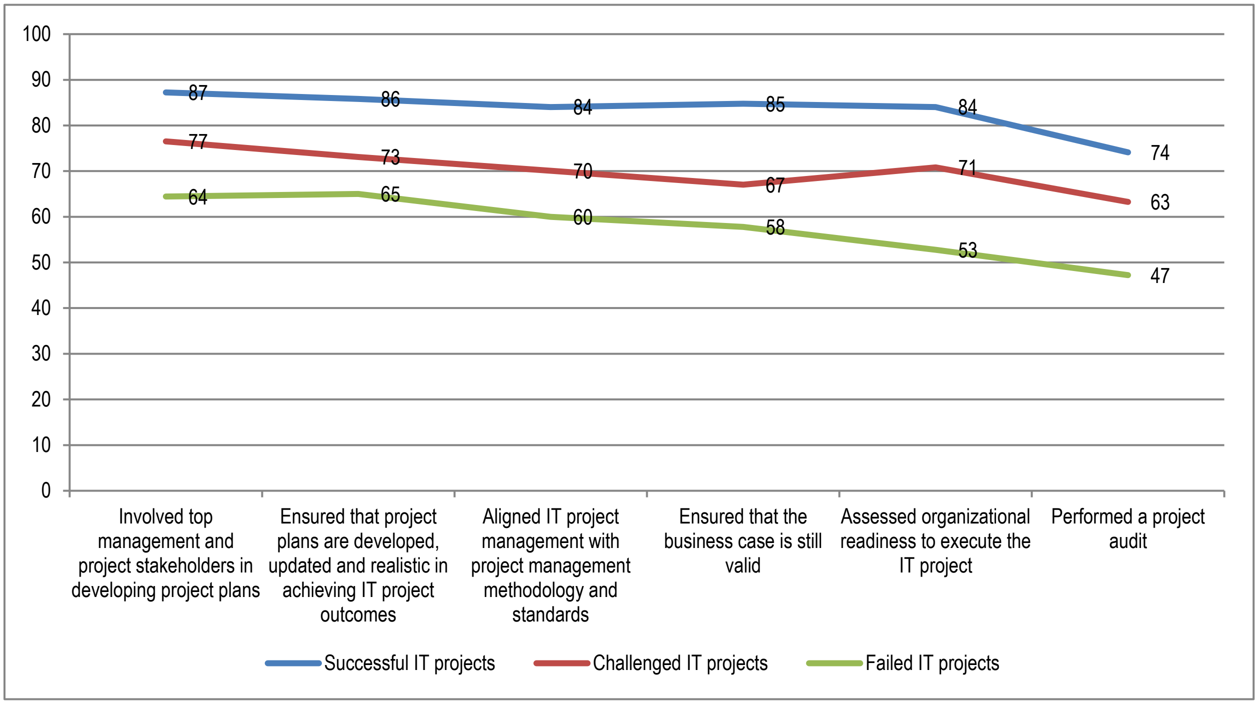

Figure 5. Weighted Percentage for Level of Quality Implementation of the Project Assurance Processes

The results in Figure 5 show that most of the project assurance processes were implemented better in successful IT projects than in challenged IT projects. However, they were not well implemented in failed IT projects.

Again, the results indicate that successful projects implement assurance processes better than challenged and failed projects.

Figure 6 shows that the results of successful, challenged, and failed IT projects are clustered together. This implies that all the project assurance processes in the planning phase were perceived as important across successful, challenged, and failed IT projects.

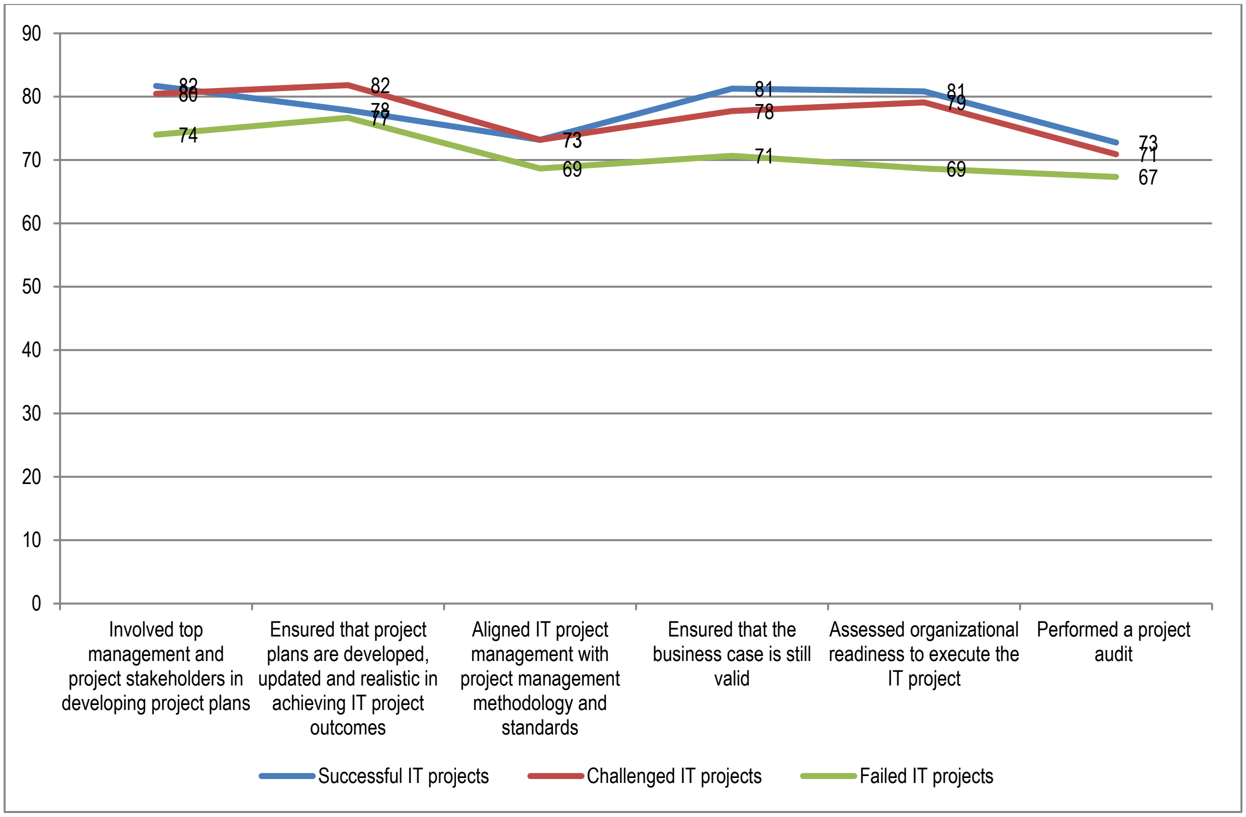

Figure 6. Weighted Percentage for Importance Level of the Project Assurance Processes

Execution phase

The weighted percentage was calculated to examine how well the project assurance processes were implemented and their importance in achieving a successful IT project outcome in the organization. The results are illustrated in Figure 7.

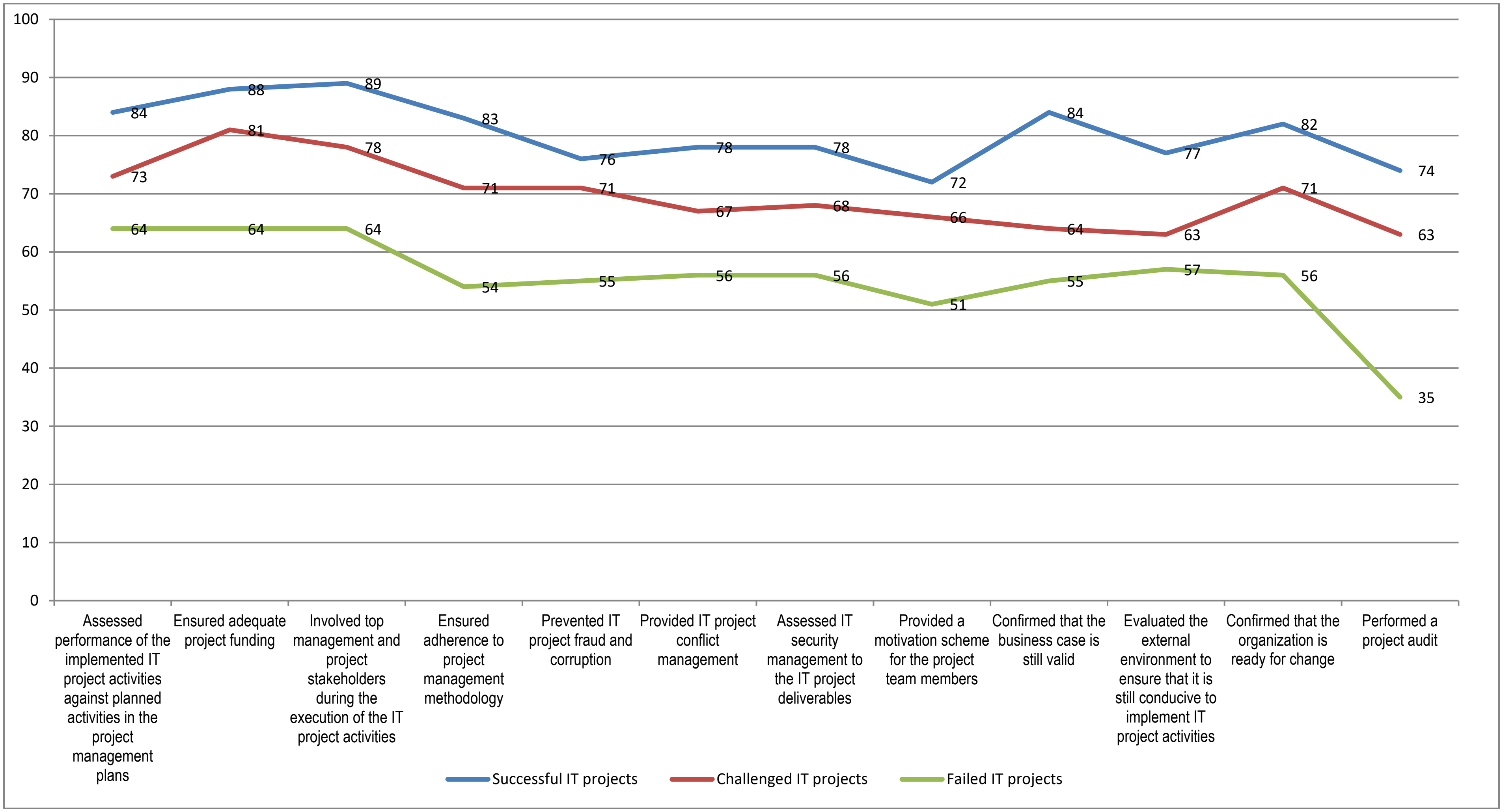

Figure 7. Weighted Percentage for level of Quality Implementation of the Project Assurance Processes

The results in Figure 7 show that most of the project assurance processes were implemented better in the successful IT projects than in the challenged IT projects. However, they were not well implemented in the failed IT projects. Again, the results indicate that successful projects implement assurance processes better than challenged and failed IT projects.

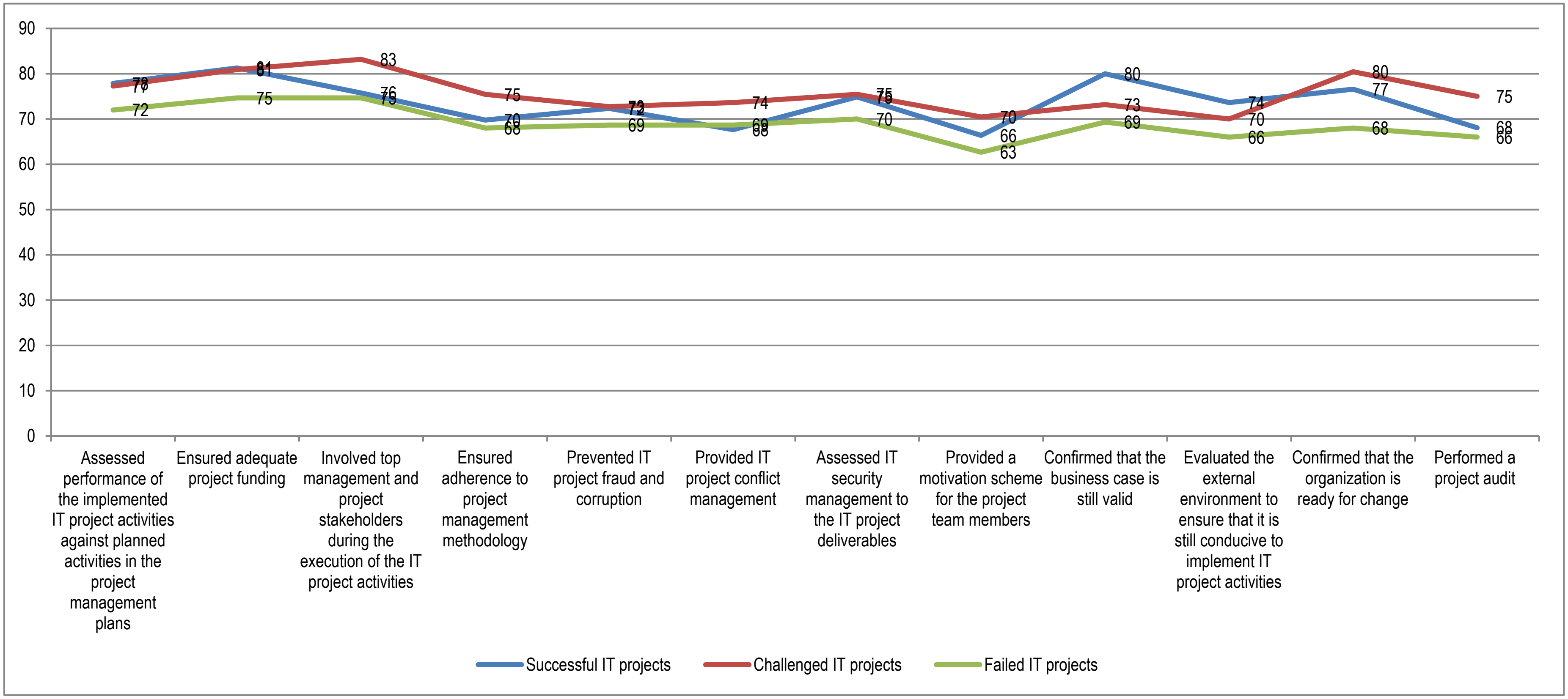

Figure 8. Weighted Percentage for Importance Level of the Project Assurance Processes

Figure 8 shows that the results of successful, challenged, and failed IT projects are clustered together. This implies that all the project assurance processes in the execution phase were perceived as important across successful, challenged, and failed IT projects.

Closing phase

The weighted percentage was calculated to examine how well the project assurance processes were implemented and their importance in achieving a successful IT project outcome in the organization. The results are illustrated in Figure 9.

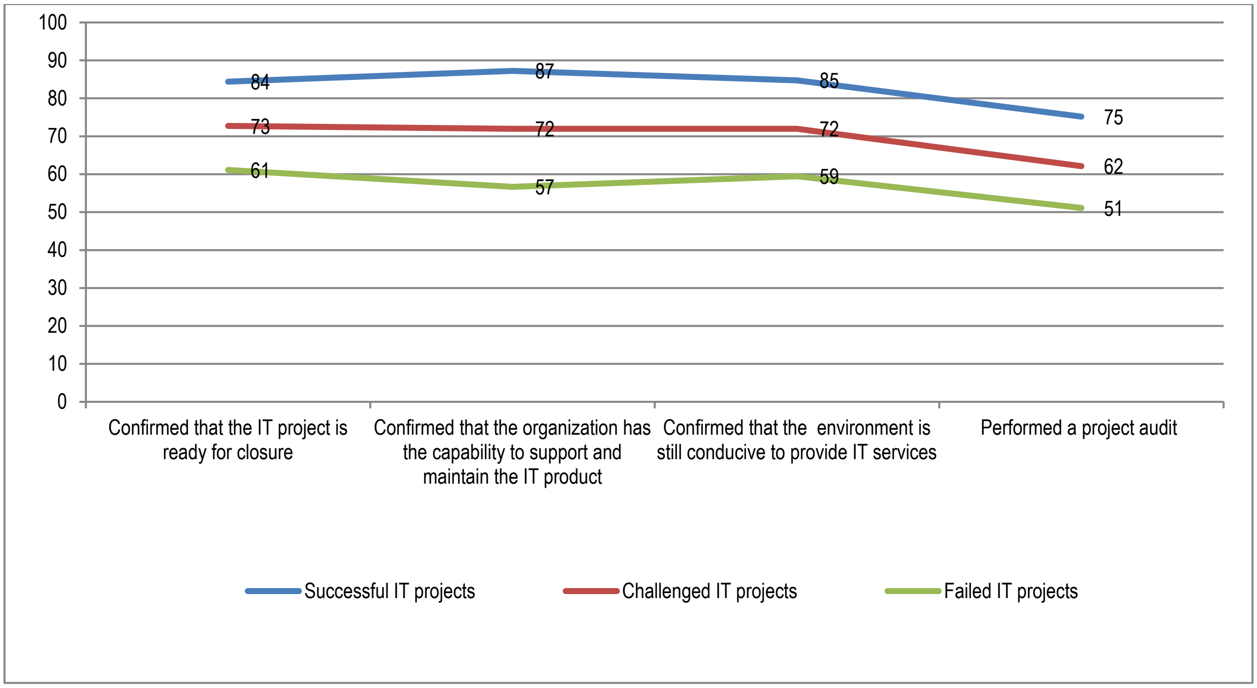

Figure 9. Weighted Percentage for Level of Quality Implementation of the Project Assurance Processes

The results in Figure 9 show that most of the project assurance processes were implemented better in the successful and challenged IT projects. However, they were not implemented well in the failed IT projects.

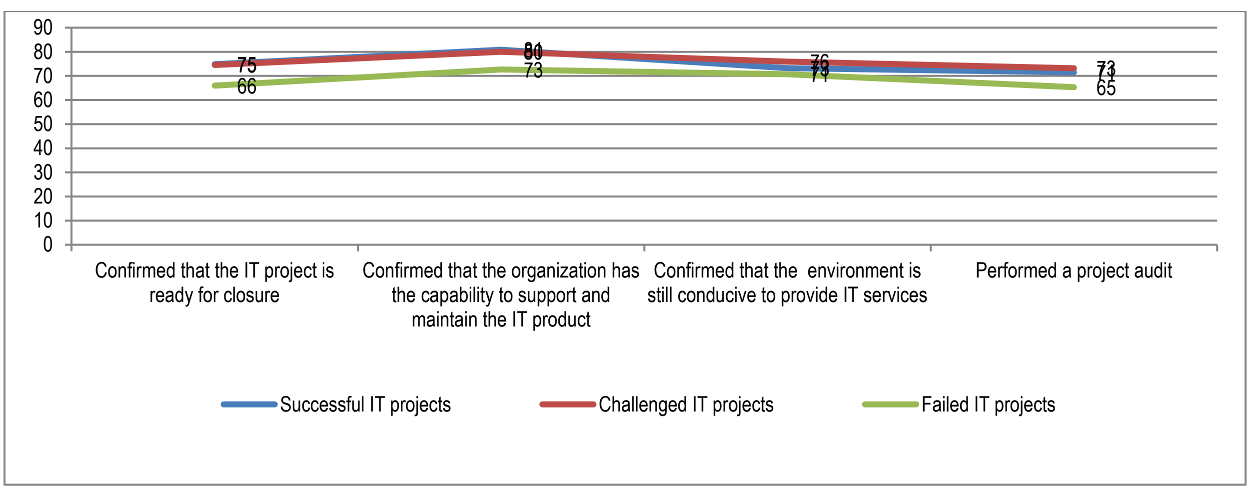

Figure 10. Weighted Percentage for Importance Level of the Project Assurance Processes

Figure 10 shows that the results of successful, challenged and failed IT projects are clustered together. This implies that all the project assurance processes in the closing phase were perceived as important across successful, challenged, and failed IT projects.

Operations and maintenance phase

The weighted percentage was calculated to examine how well the project assurance processes were implemented and their importance in achieving a successful IT project outcome in the organization. The results are illustrated in Figure 11.

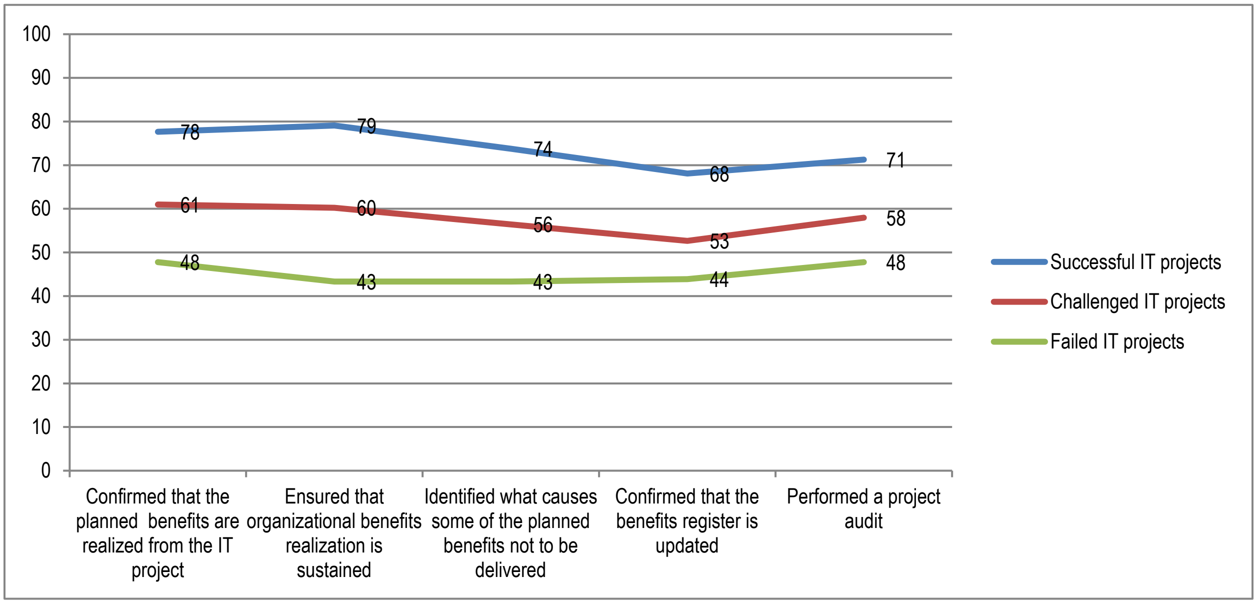

Figure 11. Weighted Percentage for Level of Quality Implementation of the Project Assurance Processes

The results in Figure 11 show that most of the project assurance processes were implemented better in the successful IT projects than in the challenged IT projects. However, they were not implemented well in the failed IT projects.

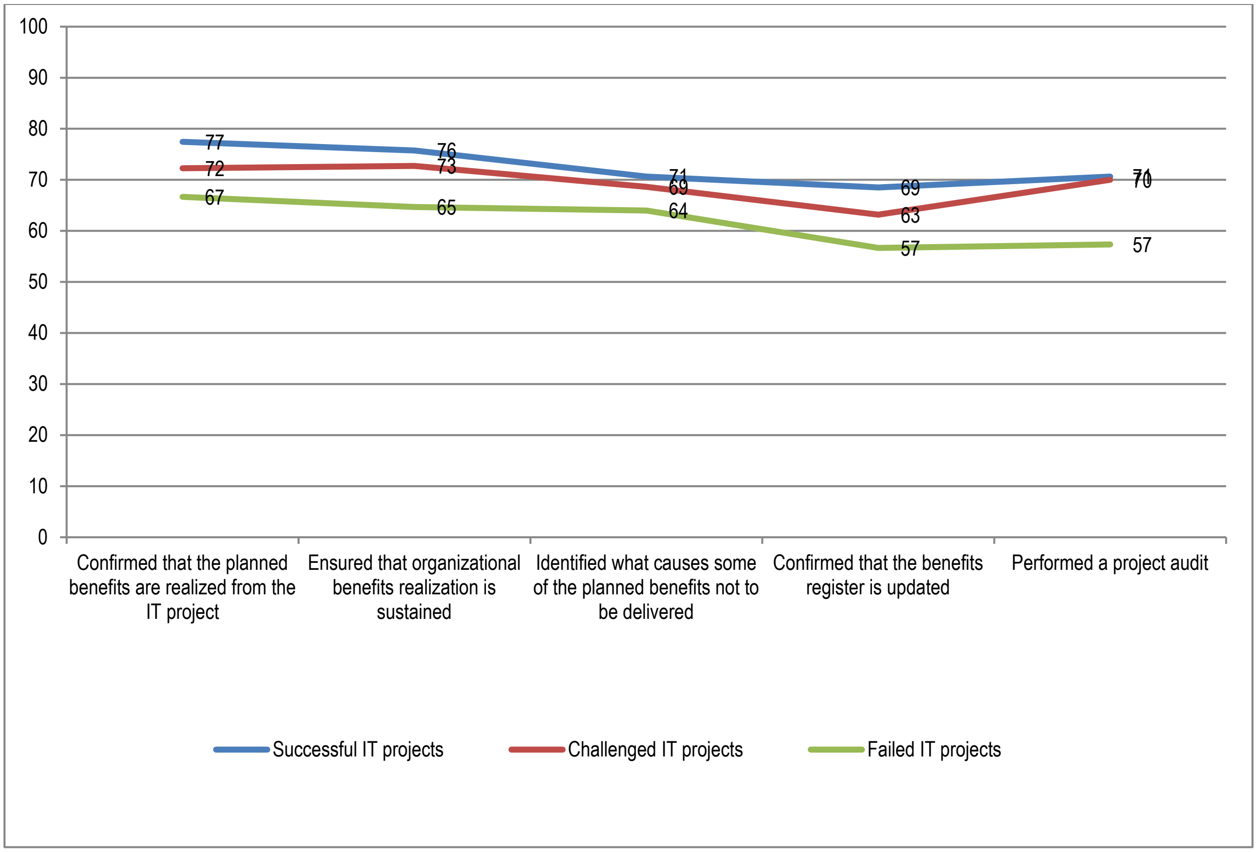

Figure 12. Weighted Percentage for Importance Level of the Project Assurance Processes

Figure 12 shows that all the project assurance processes in the closing phase were perceived as important processes across successful, challenged, and failed IT projects. This result indicates that all the assurance processes are important.

Analysis of variance (ANOVA)

The results of descriptive analysis (as shown in Figures 3, 5, 7, 9, and 11) indicate that the levels of quality implementation of project assurance processes differ in successful, challenged, and failed IT projects. This section presents ANOVA for three groups, that is, successful, challenged, and failed IT projects. Using SPSS 24.0, the ANOVA F-test was conducted to determine whether there is a significant difference between the levels of quality implementation and importance levels of project assurance processes across the successful, challenged, and failed IT projects (Argyrous, 2011). The ANOVA result for each project phase is discussed in the sections that follow.

Initiation phase

For the level of quality implementation, a null hypothesis was formulated: H_0: The level of quality implementation for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was then conducted for the level of quality implementation of each project assurance process (i.e., PSAR1, PSAR2, PSAR3, PSAR4, and PSAR5) and the results are shown in Table 4.

Table 4. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Level of Quality Implementation

Variables		Sum of squares	df	Mean square	F	Sig.
PSAR1: Aligned IT project with organizational strategy and business objectives	Between groups	18.517	2	9.259	8.844	**.000**
	Within groups	123.532	118	1.047		
	Total	142.050	120			
PSAR2: Provided business justification to invest in the IT project	Between groups	18.055	2	9.027	12.997	**.000**
	Within groups	81.962	118	.695		
	Total	100.017	120			
PSAR3: Provided approval to start IT project	Between groups	10.363	2	5.182	7.707	**.001**
	Within groups	79.339	118	.672		
	Total	89.702	120			
PSAR4: Performed a project audit	Between groups	46.809	2	23.405	11.586	**.000**
	Within groups	238.364	118	2.020		
	Total	285.174	120			
PSAR5: Aligned IT project with the existing program in the organization	Between groups	18.087	2	9.043	6.220	**.003**
	Within groups	171.566	118	1.454		
	Total	189.653	120			

The ANOVA results in Table 4 show that the F-scores have p-values (Sig.) less than 0.05 for all the variables, i.e., PSAR1, PSAR2, PSAR3, PSAR4, and PSAR5. This indicates that there is a significant difference between the levels of quality implementation of project assurance processes (PSAR1 – PSAR5) across successful, challenged, and failed IT projects. Therefore, the null hypothesis is rejected for all the variables.

For the importance level, a null hypothesis was formulated: H_0: The importance level for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was conducted for the importance level of each project assurance process (i.e., PSAR1, PSAR2, PSAR3, PSAR4, and PSAR5) and the results are shown in Table 5.

Table 5. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Importance Level

Variables		Sum of squares	Df	Mean square	F	Sig.
PSAR1: Aligned IT project with organizational strategy and business objectives	Between groups	4.101	2	2.051	4.130	**.019**
	Within groups	53.629	108	.497		
	Total	57.730	110			
PSAR2: Provided business justification to invest in the IT project	Between groups	4.779	2	2.389	3.795	**.026**
	Within groups	67.996	108	.630		
	Total	72.775	110			
PSAR3: Provided approval to start IT project	Between groups	3.868	2	1.934	3.795	**.026**
	Within groups	54.532	107	.510		

	Total	58.400	109			
PSAR4: Performed a project audit	Between groups	1.568	2	.784	.717	.490
	Within groups	118.072	108	1.093		
	Total	119.640	110			
PSAR5: Aligned IT project with the existing program in the organization	Between groups	4.442	2	2.221	2.637	.076
	Within groups	90.981	108	.842		
	Total	95.423	110			

The ANOVA results in Table 5 show that the F-scores have p-values (Sig.) less than 0.05 for PSAR1, PSAR2, and PSAR3. These results indicate that there is a significant difference between the importance levels across successful, challenged, and failed IT projects. Therefore, the null hypothesis is rejected for PSAR1, PSAR2, and PSAR3. The F-scores have p-values (Sig.) greater than 0.05 for PSAR4 and PSAR5. This indicates that there is no significant difference between the importance levels across successful, challenged, and failed IT projects. The null hypothesis for PSAR4 and PSAR5 is not rejected. This implies that it is important to perform a project audit and align IT projects with an existing program in the organization in successful, challenged, and failed IT projects.

Planning phase

For the level of quality implementation, a null hypothesis was formulated: H_0: The level of quality implementation for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was then conducted for the level of quality implementation of each project assurance process (i.e., PMPR1, PMPR2, PMPR3, PMPR4, PMPR5, and PMPR6) and the results are shown in Table 6.

Table 6. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Level of Quality Implementation

Variables		**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
PMPR1: Involved top management and project stakeholders in developing project plans	Between groups	34.579	2	17.289	15.630	**.000**
	Within groups	130.529	118	1.106		
	Total	165.107	120			
PMPR2: Ensured that project plans are developed, updated and realistic in achieving IT project outcomes	Between groups	36.799	2	18.399	21.105	**.000**
	Within groups	102.001	117	.872		
	Total	138.800	119			
PMPR3: Aligned IT project management with project management methodology and standards	Between groups	46.873	2	23.436	18.491	**.000**
	Within groups	148.294	117	1.267		
	Total	195.167	119			
PMPR4: Ensured that the business case is still valid	Between groups	53.186	2	26.593	14.794	**.000**
	Within groups	212.104	118	1.797		
	Total	265.289	120			
PMPR5: Assessed organizational readiness to execute the IT project	Between groups	64.544	2	32.272	24.359	**.000**
	Within groups	156.332	118	1.325		

	Total	220.876	120			
PMPR6: Performed a project audit	Between groups	47.685	2	23.843	10.700	**.000**
	Within groups	262.943	118	2.228		
	Total	310.628	120			

The ANOVA results in Table 6 show that the F-scores have p-values (Sig.) less than 0.05 for all the variables, i.e., PMPR1, PMPR2, PMPR3, PMPR4, PMPR5, and PMPR6. This indicates that there is a significant difference between the levels of quality implementation across successful, challenged, and failed IT projects. Therefore, the null hypothesis is rejected for all these variables.

For the importance level, a null hypothesis was formulated: H_0: The importance level for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was conducted for the importance level of each project assurance process (i.e., PMPR1, PMPR2, PMPR3, PMPR4, PMPR5, and PMPR6) and the results are shown in Table 7.

Table 7. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Importance Level

Variables		**Sum of squares**	**Df**	**Mean square**	**F**	**Sig.**
PMPR1: Involved top management and project stakeholders in developing project plans	Between groups	2.082	2	1.041	1.437	.242
	Within groups	78.242	108	.724		
	Total	80.324	110			
PMPR2: Ensured that project plans are developed, updated and realistic in achieving IT project outcomes	Between groups	.289	2	.144	.264	.769
	Within groups	58.584	107	.548		
	Total	58.873	109			
PMPR3: Aligned IT project management with project management methodology and standards	Between groups	.569	2	.284	.354	.703
	Within groups	86.855	108	.804		
	Total	87.423	110			
PMPR4: Ensured that the business case is still valid	Between groups	4.549	2	2.275	3.823	**.025**
	Within groups	64.261	108	.595		
	Total	68.811	110			
PMPR5: Assessed organizational readiness to execute the IT project	Between groups	6.134	2	3.067	4.241	**.017**
	Within groups	78.100	108	.723		
	Total	84.234	110			
PMPR6: Performed a project audit	Between groups	1.093	2	.546	.637	.531
	Within groups	92.601	108	.857		
	Total	93.694	110			

The ANOVA results in Table 7 show that the F-scores have p-values (Sig.) greater than 0.05 for PMPR1, PMPR2, PMPR3, and PMPR6. This indicates that there is no significant difference in the importance level across the successful, challenged, and failed IT projects. The null hypothesis for PMPR1, PMPR2, PMPR3, and PMPR6 is not rejected. This implies that across successful, challenged, and failed IT projects, the respondents perceived that it is important to: (i) involve top management and project stakeholders in developing project plans (PMPR1); (ii) ensure that project plans are developed, updated and realistic in achieving IT project outcomes (PMPR2); (iii) align IT project management with project management methodology and standards (PMPR3); and (iv) perform a project audit (PMPR6). The F-scores have p-value (Sig.) less than 0.05 for PMPR4 and PMPR5. This indicates that there is a significant difference in the importance level across the successful, challenged, and failed IT projects. Therefore, the null hypothesis for PMPR4 and PMPR5 is rejected.

Execution phase

For the level of quality implementation, a null hypothesis was formulated: H_0: The level of quality implementation for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was then conducted for the level of quality implementation of each project assurance process (i.e., PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR9, PIR10, PIR11, and PIR12) and the results are shown in Table 8.

Table 8. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Level of Quality Implementation

Variables		**Sum of squares**	**Df**	**Mean square**	**F**	**Sig.**
PIR1: Assessed performance of the implemented IT project activities against planned activities in the project management plans	Between groups	29.091	2	14.545	12.890	**.000**
	Within groups	133.157	118	1.128		
	Total	162.248	120			
PIR2: Ensured adequate project funding	Between groups	28.599	2	14.299	11.053	**.000**
	Within groups	151.368	117	1.294		
	Total	179.967	119			
PIR3: Involved top management and project stakeholders during the execution of the IT project activities	Between groups	40.094	2	20.047	17.933	**.000**
	Within groups	131.906	118	1.118		
	Total	172.000	120			
PIR4: Ensured adherence to project management methodology	Between groups	55.851	2	27.925	19.780	**.000**
	Within groups	166.595	118	1.412		
	Total	222.446	120			
PIR5: Prevented IT project fraud and corruption	Between groups	32.434	2	16.217	7.363	**.001**
	Within groups	255.499	116	2.203		
	Total	287.933	118			
PIR6: Provided IT project conflict management	Between groups	32.209	2	16.105	9.310	**.000**
	Within groups	202.383	117	1.730		
	Total	234.592	119			

PIR7: Assessed IT security management to the IT project deliverables	Between groups	31.627	2	15.813	8.936	**.000**
	Within groups	207.040	117	1.770		
	Total	238.667	119			
PIR8: Provided a motivation scheme for the project team members	Between groups	29.730	2	14.865	5.703	**.004**
	Within groups	307.592	118	2.607		
	Total	337.322	120			
PIR9: Confirmed that the business case is still valid	Between groups	59.131	2	29.565	17.464	**.000**
	Within groups	198.069	117	1.693		
	Total	257.200	119			
PIR10: Evaluated the external environment to ensure that is still conducive for IT project activities	Between groups	28.185	2	14.092	7.863	**.001**
	Within groups	209.682	117	1.792		
	Total	237.867	119			
PIR11: Confirmed that the organization is ready for change	Between groups	44.000	2	22.000	16.137	**.000**
	Within groups	160.876	118	1.363		
	Total	204.876	120			
PIR12: Performed a project audit	Between groups	44.629	2	22.314	10.482	**.000**
	Within groups	251.206	118	2.129		
	Total	295.835	120			

The ANOVA results in Table 8 show that the F-scores have p-value (Sig.) less than 0.05 for all the variables. This indicates that there is a significant difference in the levels of quality implementation across successful, challenged, and failed IT projects. Therefore, the null hypothesis is rejected for all these variables.

For the importance level, a null hypothesis was formulated: H_0: The importance level for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was conducted for the importance level of each project assurance process (i.e., PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR9, PIR10, PIR11, and PIR12) and the results are shown in Table 9.

Table 9. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Importance Levels of Project Assurance Processes

Variables		Sum of squares	Df	Mean square	F	Sig.
PIR1: Assessed performance of the implemented IT project activities against planned activities in the project management plans	Between groups	2.226	2	1.113	1.898	.155
	Within groups	62.765	107	.587		
	Total	64.991	109			
PIR2: Ensured adequate project funding	Between groups	2.687	2	1.343	2.082	.130
	Within groups	69.032	107	.645		
	Total	71.718	109			
PIR3: Involved top management	Between groups	1.490	2	.745	1.083	.342

and project stakeholders during the execution of the IT project activities	Within groups	72.950	106	.688		
	Total	74.440	108			
PIR4: Ensured adherence to project management methodology	Between groups	.486	2	.243	.295	.745
	Within groups	87.368	106	.824		
	Total	87.853	108			
PIR5: Prevented IT project fraud and corruption	Between groups	.966	2	.483	.447	.641
	Within groups	115.589	107	1.080		
	Total	116.555	109			
PIR6: Provided IT project conflict management	Between groups	1.633	2	.817	.892	.413
	Within groups	97.046	106	.916		
	Total	98.679	108			
PIR7: Assessed IT security management to the IT project deliverables	Between groups	2.809	2	1.405	1.549	.217
	Within groups	97.045	107	.907		
	Total	99.855	109			
PIR8: Provided a motivation scheme for the project team members	Between groups	1.979	2	.990	1.090	.340
	Within groups	96.204	106	.908		
	Total	98.183	108			
PIR9: Confirmed that the business case is still valid	Between groups	7.490	2	3.745	6.121	**.003**
	Within groups	64.859	106	.612		
	Total	72.349	108			
PIR10: Evaluated the external environment to ensure that is still conducive to implement IT project activities	Between groups	3.578	2	1.789	2.119	.125
	Within groups	89.505	106	.844		
	Total	93.083	108			
PIR11: Confirmed that the organization is ready for change	Between groups	5.602	2	2.801	3.563	**.032**
	Within groups	84.116	107	.786		
	Total	89.718	109			
PIR12: Performed a project audit	Between groups	2.221	2	1.110	1.171	.314
	Within groups	101.452	107	.948		
	Total	103.673	109			

The ANOVA results in Table 9 show that the F-scores have p-values (Sig.) greater than 0.05 for PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR10, and PIR12. This indicates that there is no significant difference in the importance levels across the successful, challenged, and failed IT projects. The null hypothesis for PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR10, and PIR12 is not rejected. This implies that across the successful, challenged, and failed IT projects, respondents perceived PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR10, and PIR12 as the important processes in the execution phase of the IT project. The F-scores have p-values (Sig.) less than 0.05 for PIR9 and PIR11. This indicates that there is a significant difference in the importance levels across the successful, challenged, and failed IT projects. Therefore, the null hypothesis for PIR9 and PIR11 is rejected.

Closing phase

For the level of quality implementation, a null hypothesis was formulated: H_0: The level of quality implementation for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was then conducted for the level of quality implementation of each project assurance process (i.e., PCR1, PCR2, PCR3, and PCR4) and the results are shown in Table 10.

Table 10. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Level of Quality Implementation

Variables		Sum of squares	df	Mean square	F	Sig.
PCR1: Confirmed that the IT project is ready for closure	Between groups	36.426	2	18.213	14.171	**.000**
	Within groups	151.657	118	1.285		
	Total	188.083	120			
PCR2: Confirmed that the organization has the capability to support and maintain the IT product	Between groups	62.730	2	31.365	23.548	**.000**
	Within groups	157.171	118	1.332		
	Total	219.901	120			
PCR3: Confirmed that the environment is still conducive to provide IT services	Between groups	43.081	2	21.541	18.888	**.000**
	Within groups	134.572	118	1.140		
	Total	177.653	120			
PCR4: Performed a project audit	Between groups	39.546	2	19.773	8.631	**.000**
	Within groups	270.339	118	2.291		
	Total	309.884	120			

The ANOVA results in Table 10 show that the F-scores have p-values (Sig.) less than 0.05 for all the variables, i.e., PCR1, PCR2, PCR3, and PCR4. This indicates that there is a significant difference in the levels of quality implementation across successful, challenged, and failed IT projects. Therefore, the null hypothesis is rejected for all these variables.

For the importance level, a null hypothesis was formulated: H_0: The importance level for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was conducted for the importance level of each project assurance process (i.e., PCR1, PCR2, PCR3, and PCR4) and the results are shown in Table 11.

Table 11. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Importance Level

Variables		Sum of squares	df	Mean square	F	Sig.
PCR1: Confirmed that the IT project is ready for closure	Between groups	4.515	2	2.257	3.333	**.039**
	Within groups	72.476	107	.677		
	Total	76.991	109			
PCR2: Confirmed that the	Between groups	3.937	2	1.968	3.012	.053

organization has the capability to support and maintain the IT product	Within groups	69.927	107	.654		
	Total	73.864	109			
PCR3: Confirmed that the environment is still conducive to provide IT services	Between groups	.521	2	.261	.463	.631
	Within groups	60.251	107	.563		
	Total	60.773	109			
PCR4: Performed a project audit	Between groups	2.387	2	1.193	1.315	.273
	Within groups	97.077	107	.907		
	Total	99.464	109			

The ANOVA results in Table 11 show that the F-score has a p-value (Sig.) less than 0.05 for PCR1. This indicates that there is a significant difference in the importance levels across successful, challenged, and failed IT projects. The null hypothesis is rejected. The F-scores have p-values (Sig.) greater than 0.05 for PCR2, PCR3, and PCR4. This indicates that there is no significant difference in the importance level across successful, challenged, and failed IT projects. The null hypothesis is not rejected for PCR2, PCR3, and PCR4. This implies that across the successful, challenged, and failed IT projects, respondents perceived that it is important to: (i) confirm that the organization has the capability to support and maintain the IT product (PCR2); (ii) confirm that the environment is still conducive to provide IT services (PCR3); and (iii) perform a project audit (PCR4).

Operations and maintenance phase

For the level of quality implementation, a null hypothesis was formulated: H_0: The level of quality implementation for each project assurance process is equal for successful, challenged, and failed IT projects. The ANOVA F-test was then conducted for the level of quality implementation of each project assurance process (i.e., PBRR1, PBRR2, PBRR3, PBRR4, and PBRR5) and the results are shown in Table 12.

Table 12. ANOVA Results for Successful, Challenged, and Failed IT Projects Regarding Level of Quality Implementation

Variable		**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
PBRR1: Confirmed that the planned benefits are realized from the IT project	Between groups	60.161	2	30.080	17.235	**.000**
	Within groups	204.206	117	1.745		
	Total	264.367	119			
PBRR2: Ensured that organizational benefits realization is sustained	Between groups	62.780	2	31.390	16.216	**.000**
	Within groups	220.673	114	1.936		
	Total	283.453	116			
PBRR3: Identified what causes some of the planned benefits not to be delivered	Between groups	61.780	2	30.890	15.505	**.000**
	Within groups	231.094	116	1.992		
	Total	292.874	118			
PBRR4: Confirmed that the benefits register is updated	Between groups	44.872	2	22.436	9.608	**.000**
	Within groups	268.552	115	2.335		
	Total	313.424	117			

PBRR5: Performed a project audit	Between groups	37.191	2	18.596	8.583	**.000**
	Within groups	253.476	117	2.166		

The ANOVA results in Table 12 show that the F-scores have p-values (Sig.) less than 0.05 for all the variables, i.e., PBRR1, PBRR2, PBRR3, PBRR4, and PBRR5. This indicates that there is a significant difference in the levels of quality implementation across successful, challenged, and failed IT projects. Therefore, the null hypothesis is rejected for all these variables.

For the importance level, a null hypothesis was formulated: H_0: The importance level for each project assurance process is equal for successful, challenged and, failed IT projects. The ANOVA F-test was conducted for the importance level of each project assurance process (i.e., PBRR1, PBRR2, PBRR3, PBRR4, and PBRR5) and the results are shown in Table 13.

Table 13. ANOVA Results for Successful, Challenged and Failed IT Projects Regarding Importance Level

Variables		Sum of squares	df	Mean square	F	Sig.
PBRR1: Confirmed that the planned benefits are realized from the IT project	Between groups	3.933	2	1.967	2.510	.086
	Within groups	81.487	104	.784		
	Total	85.421	106			
PBRR2: Ensured that organizational benefits realization is sustained	Between groups	.690	2	.345	.418	.659
	Within groups	84.167	102	.825		
	Total	84.857	104			
PBRR3: Identified what causes some of the planned benefits not to be delivered	Between groups	.235	2	.117	.135	.874
	Within groups	89.624	103	.870		
	Total	89.858	105			
PBRR4: Confirmed that the benefits register is updated	Between groups	4.963	2	2.482	2.522	.085
	Within groups	100.370	102	.984		
	Total	105.333	104			
PBRR5: Performed a project audit	Between groups	4.312	2	2.156	2.132	.124
	Within groups	105.165	104	1.011		
	Total	109.477	106			

The ANOVA results in Table 13 show that the F-scores have p-values (Sig.) greater than 0.05 for PBRR1, PBRR2, PBRR3, PBRR4, and PBRR5. This indicates that there is no significant difference in the importance levels across successful, challenged, and failed IT projects. The null hypothesis is not rejected for all these variables. This implies that across the successful, challenged, and failed IT projects, respondents perceived that it is important to: (i) confirm that the planned benefits are realized from the IT project (PBRR1); (ii) ensure that organizational benefits realization is sustained (PBRR2); (iii) identify what causes some of the planned benefits not to be delivered (PBRR3); (iv) confirm that the benefits register is updated (PBRR4); and (v) perform a project audit (PBRR5).

CONCLUSION

This paper presented the research findings on the conceptual information technology project management assurance framework which was validated among 121 IT project managers from public and private sector organizations in seven African countries. The research findings were based on: (a) how well the project assurance processes were implemented when a particular IT project outcome was achieved in the organizations; and (b) how important the project assurance processes are in achieving a successful IT project outcome.

With regard to how well the project assurance processes were implemented when a particular IT project outcome was achieved in the organizations, the results of descriptive analysis for successful, challenged, and failed IT projects reveal that most of the project assurance processes were implemented better in successful IT projects than in challenged and failed IT projects. The findings also indicate that failed IT projects are not well audited. The empirical evidence reveals that there is a positive relationship between project audit and project success. Auditing a project throughout the project life cycle has helped organizations to deliver a successful IT project.

With regard to how important the project assurance processes are in achieving a successful IT project outcome, it was found that across successful, challenged, and failed IT projects, most of the respondents perceived that all the project assurance processes in each phase of IT project are important in achieving a successful IT project outcome.

The ANOVA results for the quality level of implementation of project assurance processes indicate that there is a significant difference in the levels of quality implementation across successful, challenged, and failed IT projects. For the importance levels of project assurance processes, the ANOVA results indicate that there is no significant difference in the importance level across successful, challenged, and failed IT projects. This implies that across successful, challenged, and failed IT projects, respondents perceived that all the project assurance processes are important throughout the IT project life cycle to deliver a successful IT project outcome. These findings imply that organizations should utilize the project assurance processes throughout the IT project life cycle to increase the chances of delivering a successful IT project.

This research contributes to the body of knowledge on project auditing and assurance. It also provides practitioners of project management and project managers with a tool for delivering a successful IT project. Project governance or project boards can use the conceptual framework as a guide to conduct project reviews to ensure successful IT project completion. The overall data analysis results of the validated conceptual framework revealed that most of the project assurance processes were implemented better in successful IT projects than in challenged and failed projects. Thus, using the conceptual framework, organizations can manage and implement successful IT projects effectively, which enables them to realize benefits from the successful IT project.

Finally, future research will focus on the integration of the conceptual framework with project hybrid methodologies and agile project management methodology.

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