IT Project Definition: Setting conditions for IT project success.

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

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Abstract

The high failure rates in IT projects have been investigated since the inception of IT systems as a means of achieving business objectives. The factors that lead to IT project success and failure have been well documented since the inception of IT systems and can be categorised into the areas process, people, and technology.

Project definition is responsible for defining IT projects in a clear and concise manner in order to allow projects to start.

This research investigates the use of these factors at project definition and the impact their use has on subsequent phases of the project and ultimately project outcome. This research shows that application of these factors in project definition can significantly reduce variances between planned and actual estimation and ensure that projects coming out of project definition are well defined from a time, cost and scope perspective and variances between definition and actual preparation and execution project phases are minimised. In order to ensure that project definition is seen as robust and reliable process a conceptual framework is presented that provides a methodology for testing the impact that these factors have on IT projects. Finally, this research establishes key entry and exit criteria to ensure approach to project definition for all projects is robust and reliable thus ensuring confidence in the definition process.

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List of Abbreviations

PMBOK: Project Management Body of Knowledge

PRINCE2: Projects in Controlled Environments

PID: Project Initiation Document

1 Introduction

1.1 Background

Researchers have explored the topic of IT project success and failure for many years, however a high degree of IT projects are still considered unsuccessful. Current research by Standish Group (2015) highlights that nearly two thirds of IT projects are still regarded as unsuccessful based on the traditional metrics of time, cost and quality. The causes of these failures have been well documented as lack of executive management support, lack of a defined business case, incomplete requirements, lack of stakeholder engagement, failure to apply lessons learned from previous projects, poor alignment with business objectives and poor communication between project and operational teams (Kappleman et al., 2006; Project Management Institute, 2017 Standish Group, 2015). When these known factors are mitigated against and removed, research has shown that IT projects can show significantly higher success rates (Project Management Institute, 2017). However, the research identified above has focussed on the project preparation and execution phases. Project definition is a set of activities required to formally start a project (Project Management Institute, 2017). Feeney and Sult (2011) argued that a lack of focus on known causes of IT failure can lead to significant delays in subsequent project phases. The research discussed in this study focuses on the use of known success factors in project definition as opposed to project execution and the impact these factors have on the variances shown in subsequent project phases and ultimately project outcome.

1.2 Research Context

The success factors for IT projects are noted to be the converse of the referenced failure factors in section 1.1. Most large organisations run a process for defining and approving projects referred to as project definition (Project Management Institute,2017). However, it can be argued that this process has not significantly improved the fortunes of IT projects with regard to success figures as highlighted by the Standish Group (2015) in their annual CHAOS report and documented in the tables below. This led to the general research question of identifying the use of known success conditions at project definition and their impact on subsequent phases of IT projects.

1.3 Objectives and Scope of Research

The scope this research is limited to is IT projects in a sample project portfolio operating within the utilities sector in the United Kingdom and Ireland. This research attempts to establish key factors for IT project success and identify their adoption and use in IT project definition of projects in the aforementioned project portfolio to assess what impact these factors have on subsequent project phases.

1.4 Research Questions

The study addresses the following question:

- To what extent are known success conditions utilised consistently in project definition and how does their adoption at project definition impact on variances at subsequent project phases and ultimately project outcome.

This research will triangulate known success conditions in the reviewed literature, against perceptions from surveyed projects and compare these to variances extracted from survey data to answer the research question.

1.5 Relevance of this Research

It can be argued that most research regarding these topics has been focused on how projects are managed following project definition, a gap in the current literature on how the definition phase impacts on subsequent project phases appears to exist. This research will attempt to identify a consistent approach to project definition and establish a framework for testing the impact of the adoption of known success conditions on subsequent phases of IT projects.

1.6 Beneficiaries

This research may be of interest to any parties involved in IT project definition or parties responsible for testing the accuracy of project definition and how consistently this project phase utilised known success conditions to set IT projects up for success.

1.7 Dissertation Roadmap

Chapter 1 presents the background to the research, the context and objectives of the research and the question the research is attempting answer.

Chapter 2 presents a systemic review of the literature and extracts key causes for IT project success and failure for use in later chapters.

Chapter 3 defines an overview of the research methodology and presents the proposed conceptual framework that will be utilised for testing the impact of known success conditions at project definition on subsequent project phases.

Chapter 4 presents research data from a survey, and summative perspective and performs testing of this data by utilising the conceptual framework discussed in Chapter 3.

Chapter 5 presents the recommendations based on the findings in Chapter 4, how the framework can be generalised for use in testing projects outside of the portfolio, future work proposed to utilise this research and finally draws conclusions to answer the research question.

2. Literature Review

2.1 Introduction

Researchers have explored the topic of IT project success and failure for many years, however a high degree of IT projects are still considered unsuccessful. Most research regarding these topics is focused on how projects are managed following project definition, there appeared to be a gap in current literature on the extent to which the definition project phase impacts on the outcome of subsequent project phases. The Project Management Institute (2017) defined project definition as a set of activities required to start a project or phase of a project; however, it can be argued that its impact on success or failure of subsequent project phases has not been fully explored. The literature available on project failure and success factors will be explored in this study with a view to identifying the level to which these factors are integrated into project definition and the impact this has on subsequent project phases.

2.2 Literature Search Strategy

The Literature Review has been described as a systematic review of the literature associated with a given research area; the goal is to identify what is known and what is unknown about the topic (Macfarlane et al., 2015). The literature review involves the search, identification, examination, organisation and logical refinement of literature relevant to the topic or research question(s). In order to begin a search for literature, the research question(s) must be developed which will allow for the identification of search keywords.

This literature review seeks to investigate the following research question:

- To what extent are known success conditions utilised consistently in project definition and how does their adoption at project definition impact on variances at subsequent project phases and ultimately project outcome.

The key terms used for the search in this literature review included IT project failure, IT project failure factors, IT project success, IT project success factors, reasons for failure at IT project definition, success factors at IT project definition, reasons for success at IT project definition, traditional versus agile methodologies, waterfall project success factors, agile project success factors, IT project risk management, hybrid IT project methodologies, and agile methodologies. The search was iterative and included searches of numerous databases including ScienceDirect, ProQuest, IEEE Explore, and Google Scholar.

The literature review organises research sources that are relevant (Macfarlane et al., 2015). For this literature review, project failure and success were organised in a chronological fashion where project failure and success could be analysed over the last three decades. Further to this the literature was organised based on whether it related to project failure definitions, project failure factors, or project success factors. This would allow for the identification of factors that have an impact on the project outcome and allow for this study to assess the level of adoption of these factors at project definition and the impact the use or lack of thereof of these factors at the project definition had on subsequent project phases and ultimately project outcomes.

2.3 IT Project Definitions

Before IT project failure is discussed further it is important to assess the different definitions for IT project failure and how this has changed over the last three decades.

The Project Management Institute (2017) defined a Project as a temporary organisation whose purpose is to deliver one or more business products within an agreed business case.

The commonly accepted traditional definition for IT Project failure is any project that fails to deliver the expected output within the defined budget, schedule or functionality /scope constraints originally set out for the project (Standish Group,1994).

IT project failure can be defined as any project that is set up to exploit the information technology resources of the organisation in order support business operations and subsequently fails to deliver the intended output within the originally allocated cost, time schedule, and budget.(Al-Ahmad et al., 2009).

The Chaos report published by the Standish Group (2015), is a report based on the Standish Group’s Chaos Research Project on IT project success rates and project management best practices. The report is often cited as the de-facto authority on success rates of IT projects and has been released on a periodic basis from 1994–2015.

Along with the widely accepted measures of cost, time and quality the report splits the definition of IT project failure or success into three types; successful, challenged or cancelled.

- Successful: project delivered within budget, schedule and functionality constraints.
- Challenged: project delivered and operational but outside of budget, schedule, or functionality constraints.
- Failed: Project cancelled at some point within the software development lifecycle.

Table 2.3.1. Chaos Report Traditional Figures

% on Budget	**% not on Budget**	**% on Time**	**% not on Time**	**% On Target**	**% Off Target**
44	56	40	60	56	44

Source: CHAOS traditional report figures (Standish Group 2015, p.1)

Table 2.3.2. Standish Group Traditional Figures

	2011	2012	2013	2014	2015
Successful	39%	37%	41%	36%	36%
Challenged	39%	46%	40%	47%	45%
Failed	22%	17%	19%	17%	19%

Source: CHAOS traditional report figures (Standish Group 2015, p.1).

However, Eveleens, and Verhoef (2009) argue that the Standish Group figures are misleading and result in inaccurate conclusions. This research identifies that the Standish Groups figures are based on the initial estimation of projects and highlight how in some contexts a 25% estimation margin for error at the outset of a project should have no serious impact on the perceived success of a project or in other contexts how a 5% overrun would have a serious impact on a projects perceived success. Any variances should form an overall evaluation in conjunction with cost to assess the impact variances against the overall cost, time and scope of the project might actually have.

The argument can be made that the Standish Group figures do not highlight the context of the project or address success factors such as profit, user satisfaction or usefulness. The arguments of Eveleens and Verhoef (2009) challenge the Standish Group's estimation accuracy and argue that these figures neglect underruns for cost and time and overruns for the level of functionality implemented. For instance, using the Standish Groups criteria, a project would be classed as a failure if it ran one day over the originally defined time schedule or one unit of currency over the originally allocated budget. Utilising Barry Boehm's cone of uncertainty and Tom DeMarco's Estimation Quality Factor, the research concluded that there is a tendency to underestimate in IT projects of 11% for time cost and 20% for functionality in the organisations that were surveyed in the research (Boehm and Turner, 2005; Demarco, 1986). When the estimation deviations highlighted by this research for time, cost and functionality are applied to the Standish figures, the success rates increase significantly as shown in the table below.

Table 2.3.3. Comparing Standish Group figures to real estimation accuracy

Source	**Successful**	**Challenged**	**Median EQF of Initial Estimation**
Organisation X	67%	33%	1.1
Landmark Graphics	5.8%	94.2%	2.3
Organisation Y Cost	59%	41%	6.4
Organisation YTime	55%	45%	5.7
Organisation Y Functionality	35%	65%	6.5
Organisation Y Combined	94.2%	5.8%	2.3

Source: comparing Standish success to real estimation accuracy, (Eveleens, and Verhoef,2009, p.976).

Atkinson (1999) argued that the traditional measurements of budget, cost and quality form an iron triangle and that the first two of these measurements are at best guesses and quality

is a phenomenon that changes over time. This researcher proposed ‘Type one’ and ‘Type two’ errors that defined project failure. Type one errors are classed as something that has not been done and Type 2 errors are classed as something that has not been done as well as it could have been. This research concluded that not integrating the measurements of organisational benefits and stakeholder benefits as part of the success definition along with the iron triangle in the square route may constitute a type two error.
The Standish Group (2015) have recognised the shortcomings of their traditional measures of IT project failure and success and integrated this perceptual notion into their most recent Chaos Report as outlined below.

Table 2.3.4. Standish Group Chaos Report Modern Figures

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

Source: CHAOS modern report figures, (Standish Group 2015, p.2).
Based on the evidence highlighted in the figures above, these new measurements have had the effect of reducing the success rates. The perceptual notion of stakeholder satisfaction directly translates to the usability of the product delivered and how the delivered products are contributing to organisational and strategic goals. Interestingly, this measure of stakeholder perception does not seem to have had an impact on the challenged or failure category figures based on data in table 2.3.4, it could be argued that this is due to the fact that these figures are concerned with project time, and cost overruns and less with quality of functionality that is delivered by a given project along with the contribution to an organisations goals and objectives.

In order to capture these measurements, the Project Management Institute (2017) have outlined project success rates specifically in the areas of project goals, executive level support, time, cost, quality, and overall failure as highlighted below. However, it appears that overall these figures align to the standish groups figures of success 25-35% (challenged (50%) + failures 15-20%), challenged 50-60%% (approximate average for time, cost, and quality) and failures (14%-20%) with still no assumption made for margin for error in initial estimation for time, cost and quality. This against would be a key normalising factor that has been excluded from the aforementioned conclusions.

Table 2.3.5. % Breakdown of factors contributing to IT Project success

Measurement Criteria	Mean Percentages
Successfully met original business goals and intent of the project	69%
Included project sponsors who were actively supportive of the project	62%
Projects finished within their initial budgets	57%
Projects finished within their initially scheduled times	51%
Projects experienced scope creep or uncontrolled changes to project scope	49%
Lost project budget upon failure	32%
Projects were deemed failures	14%

Source: Pulse of the profession, Project Management Institute (2017,p.20).

2.4 IT Project Failure

As noted in section 2.3, the definition of IT project failure has changed little over the last three decades with only stakeholder satisfaction and contribution to organisational goals introduced in the recent past. IT projects continue to fail for the same reasons of; lack of management support, lack of user involvement and poorly documented requirements are still common causes of IT project failure (Standish Group,2015).

The Standish Group (2015) in the CHAOS Report which is discussed in section 2.3 separated projects into three categories; type 1: project success , type 2:challenged projects or type 3: failed / impaired. The Standish Group notes that 16.2 % of IT projects were defined to be successful, 52.7 % were defined to be challenged and 31.1% of were found to be impaired or failed.

Table 2.4.1. Project size by Chaos resolution

	Successful	Challenged	Failed	Total
Grand	6%	51%	43%	100%
Large	11%	59%	30%	100%
Medium	12%	62%	26%	100%
Moderate	24%	64%	12%	100%
Small	61%	32%	7%	100%

Source: CHAOS report figures by project size, (Standish Group 2015,p.3).

As one might expect the size of the project seems to dictate the complexity which in turn has a direct impact on the success rates for projects. The Standish Group (2015) highlight this in that a significant difference can be identified between the success rates for small projects (61%) and large projects (6%), it could argued that this is due to the difficulty in understanding the requirements and complexity associated with larger IT Projects. Brooks (1995) lends support to the Standish Group's figures outlined above, when the argument that the conceptual vision of the business leadership and the developers of IT systems were not aligned in many cases due to a different concept of the solutions these stakeholders held in their vision for the proposed system was put forward. This vision was often hidden through complexity or misunderstanding of requirements by developers. It can be argued that the conceptual constraint that Brooks refers to regularly leads to an inability to translate the organisation's vision into unambiguous requirements from which an IT product can be built and that vision and strategic organisational goals realised.
The leading causes for IT project failure are outlined in Table 2.4.2 below.

Table 2.4.2. Factors for failed and challenged projects

Failure Factors	% of responses	Challenged Factors	% of responses
Incomplete Requirements	13.1	Lack of User Input	12.8
Lack of User Involvement	12.4	Incomplete Requirements	12.3
Lack of resources	10.6	Changing Requirements	11.8
Unrealistic Expectations	9.9	Lack of Executive Support	7.5
Lack of Executive Support	9.3	Technological Incompetence	7.0
Changing Requirements	8.7	Lack of resources	6.4
Lack of Planning	8.1	Unrealistic Expectations	5.9
Project not required	7.5	Unclear objectives	5.3
Lack of IT Management	6.2	Unrealistic Timeframes	4.3
Technology Illiteracy	4.3	New Technology	3.7
Other	9.9	Other	23.0

Source: CHAOS failed and challenged projects report figures, (Standish Group 2014,p9).

Kappleman et al. (2006) identified figures similar to the Standish Group research of a 20% failure rate and also similar reasons for failure as noted below.

Table 2.4.1. Early Warning Signs of Project Failure

Item	**Source**	**Mean Score**
Lack of Top Management Support.	Schmidt, et al., 2001	6.59
Reliability of requirements and scope not documented.	Winters,2002	6.58
Projects Managers cannot lead and communicate	Schmidt, et al., 2001	6.38
No Change Control Process	Schmidt, et al., 2001	6.33
Stakeholders not interviewed for project requirements	Ward, 2003	6.32
No documented milestone deliverables and due dates		6.30
Undefined Project success criteria		
Project have weak commitment to scope and schedule	Schmidt, et al., 2001	6.17
Communication breakdown among stakeholders	May,1998	6.17
Key stakeholders do not participate in review meetings		6.16
Project Team do not have the required knowledge	Barki, et al., 2001	6.16
Reassignment of Project resources to higher priorities	Havelka,et al., 2004	6.12
No Business Case for Project	Ward, 2003	6.11

Source: Early Warning Signs of Project Failure: The Dominant Dozen (Kappleman, et al., (2006,p33)

The items for which no source is listed were not identified from earlier studies; they were added based on the authors' experiences and on feedback from a panel of 19 experts.

Utilising these causes of IT project failure Kappelman et al. (2006) combined reasons for project failure into six people / cultural and six process 'Early Warning Signs' of project failure which were referred to as The Dominant Dozen of Project Failure.

Table 2.4.2. Dominant Dozen of Project Failure

People Early Warning Signs	**Process Early Warning Signs**
Lack of Executive Management Support	Lack of Documented Requirements
Weak Project Manager	No Change Control Process
No Stakeholder involvement or input	Ineffective Schedule of Planning
Weak Commitment of Project Team	Stakeholder Communications Breakdown
Team Members lack skills	Resources assigned to higher priorities
Subject Matter Experts are over scheduled	No business Case

Source: Early Warning Signs of Project Failure: The Dominant Dozen, (Kappleman, et al, 2006,p.34).

Kappleman, et al. (2006) in a similar fashion to Brooks (1995) highlighted a set of differences as defined below that make IT projects different from other engineering projects.

These researchers outlined the following differences that often combine to make IT Projects liable to failure.

Table 2.4.3. IT project failure characteristics

Failure Characteristic	Symptom
Abstract Constraints	Generation of unrealistic expectations
Difficulty of 14isualization	Frontloaded Requirements
Perception of flexibility	Requirements not locked
Hidden Complexity	Due to poor 14isualization of product
The tendency to Software Failure	Requirements not captured
Uncertainty	Difficulty in specifying requirements
Change to existing business processes	Different views of Business Processes

Source: Early Warning Signs of Project Failure: The Dominant Dozen (Kappleman., et al., 2006,p.35).

Similarly, Smith (2002) proposed root causes of project failure which can be isolated to the following reasons:

- Lack of senior management involvement and commitment.
- Failure to focus on key business and end user needs.
- Failure to break large complex projects into manageable segments.
- Poor and unimaginative project management.
- Poor risk management and contingency planning.
- Poor contract management.
- Insufficient end user training.

Al-Ahmad et al. (2009) argued for a taxonomy of the root causes of project failure as outlined below which broadly aligns to the dominant dozen theory of Kappleman et al.(2009) with reference to the identification of IT project failure from an organisational, cultural and process standpoint. These researchers propose that the below factors will influence or lead to project failure if not adequately addressed.

- Project management factors of user input and scope.
- Executive management factors of a project champion and scope objectives.
- Technology factors of expertise / commitment.
- Organisational factors of culture and conflicts.
- Complexity factors of sizing of projects.
- Process factors of rigid management processes and conflicting interests.

The Project Management Institute (2017) in a survey of 3,234 project management practitioners highlighted the primary causes of project failure below:

Table 2.4.4. Primary causes of IT Failure

Root Cause of Project Failure	Mean Percentages
Change in organisations priorities	41%
Inaccurate requirements gathering	39%
Change in project objectives	36%
Inadequate vision or goal for the project	30%
Poor change management	28%
Inaccurate cost estimates	28%
Inadequate sponsor support	27%
Resource dependency	23%
Inadequate resource forecasting	23%
Limited / taxed resources	22%
Inexperienced Project Manager	20%
Other	11%

Source: Pulse of the Profession: (Project Management Institute 2017, p.21).

2.5: IT Project Failure by Industry and Timeline

Now that IT project failure factors have been discussed, the literature on IT project failure by industry was examined to establish if there are common trends in failure by industry. As with the other figures on project success and failure rates by industry or timeline.

2.5.1 CHAOS Report by Industry

The CHAOS Report Standish Group (2015) has proposed the following distribution of project failure by the industry as highlighted below. Although IT project success and failure rates by industry may provide little insight into the factors of why the various projects have failed, this perspective allows for identification of questions on whether a particular industry is more impacted by IT project failure than others and why this may be the case.

Table 2.5.1.1. Standish Group Report by Industry

	Successful	Challenged	Failed
Banking	30%	55%	15%
Financial	29%	56%	15%
Government	21%	55%	24%
Healthcare	29%	53%	18%
Manufacturing	28%	53%	19%
Retail	35%	49%	16%
Services	29%	52%	19%
Other	29%	48%	23%

Source: CHAOS Report figure by Industry (Standish Group 2015, p.4)

2.5.2.1 Software Failures and Timeline

Charette (2005) compiled the list of project failures from 1992-2005 as outlined below which compared IT project failure to an airline crash in that the majority of risks that lead to these failures were generic risks that were known from the outset such as complexity, planning and requirements specification, change control and ineffective project management, but little was done before project definition to address them. Based on this research it can be argued that the listed project failures also highlight that government, banking and financial services run projects would seem to be more liable to IT project failure which based on the evidence from the case studies conducted would be as a result of size, complexity and poor understanding of user requirements. This raises the question if the correct conditions are in place at project definition to prevent problems encountered in the past? Governmental projects will often commission projects with extremely large and complex scope as highlighted in the timeline of project failure below but neglect to put in place the conditions to remove ambiguity from scope and define requirements and plans in a clear and concise manner. This highlights that improper attention in early project phases often leads to large variances in project outcome between planned and actual estimates which is supported by the timeline of failures below.

Table 2.5.2.1. Project Failure Timeline 1992-2006

Project	Year	Sunk Cost	Failure Type
Budget Rent-A-Car	1992	$105 Million	Project cancelled due to cost and time overruns
London Ambulance Service Dispatch System	1993	£15 Million	Poor Quality, Reliability and usability
US Federal Aviation Authority, Advanced Automation System	1994	$2.6 Billion	Poor Quality, Reliability and usability
Toronto Stock Exchange, Electronic Trading System	1995	$28.8 Million	Size and Complexity
Ford Myer Drug Company ERP System	1996	$40 Million	Poor Quality, Reliability and usability
U.S Inland Revenue Tax Modernisation System	1997	$2.6 Billion	Size and Complexity
Snap On Inc Order Entry System	1998	$50 Million	Undefined
Hersey Food Corp ERP System	1999	$151 Million	Size and Complexity
Hewlett Packard ERP System	2004	$151 Million	Poor Quality, Reliability and usability
U.K Inland Revenue Tax Credit Payment System	2005	3.45 Billion	Poor Quality, Reliability and usability

Source: Why Software Fails, (Charette 2005, p.42-49)

From 2006 onwards, much of the high profile IT project failures have been publicised in the in the governmental, healthcare and banking industries and a list of the most notable IT project failures this decade has been compiled below and this inventory of IT project failure focuses on three main areas of:

- Government Projects.
- Healthcare Projects.
- Banking Failures.

(IEEE Spectrum Engineering and Science News, 2019)

The examples below highlight that IT projects especially in the public sector have a tendency to take on a traditional approach to IT project development. However, based on the failure types below for these projects it could be argued that the core conditions that lead to IT project failure are not an integral part of project definition. The complexity of these systems it would seem are not understood fully in definition as most of these governmental and health industry projects are poorly estimated with an ambiguous scope based on the inventory of failures highlighted below.

Table 2.5.2.2. Governmental IT Project Failure

Project	Year	Sunk Cost	Failure Type
DHS EMERGE2 Program	March 2006	$18 Million	Unacceptable risk level
UK C-NOMIS Prison IT System	January 2008	£205 Million	Poor schedule of planning and estimation
US Army future combat system program	June 2009	$18 Billion	Size and complexity
NASA National Polar Orbiting Satellite	February 2010	$13.9 Billion	Poorly defined scope
UK National Electronic Health Record Program	September 2011	£12.7 Billion	Poor schedule of planning and estimation
USAF Expeditionary Combat Support System	November 2012	$1 Billion	Poor schedule of planning and estimation
Victoria Ultra Schools Portal	April 2014	$180 Million	Size and complexity

Source: IEEE Spectrum Engineering and Science News, (2019)

Table 2.5.2.3. Health System IT Projects Failure

Project	Year	Sunk Cost	Failure Type
Irish HSE PPARS Payroll System	July 2007	€131 Million	Poor schedule of planning and estimation
VA's Health Information System	July 2006	$466 Million	Poorly defined scope
UK National Health Record Program	September 2011	£12.7 Billion	Poorly defined scope and estimation
Victoria Australia SMART Electronic Health System	May 2012	$566 Million	Poorly defined scope and estimation
DOD Electronic Health Record System	February 2013	$1.3 Billion	Poor schedule of planning and estimation
Oregan Health Insurance Exchange Contract	March 2014	$310 Million	Poor schedule of planning and estimation

Source: IEEE Spectrum Engineering and Science News, (2019)

Table 2.5.2.4. Banking Systems rely on obsolete technology

Issue	Year	Impacted Customers	Cause
National Australia Bank Frozen Accounts.	November 2010	11 Million	Corrupted file on mainframe during routine processing.
Korea NH Bank IT Crash	April 2011	30 Million	Data Breach / Intrusion
HSBC Online Banking and ATM Systems Crash	November 2011	15 Million	Hardware issue with server
Royal Bank of Scotland IT System Crash	February 2013	16 Million	Hardware fault

Source: IEEE Spectrum Engineering and Science News ,(2019)

2.6 IT Project Success Factors

The research on IT Project failure factors supports the assumption that the causes for project failure can be broken down into cultural, organisational and process factors that when addressed can lead to a higher success rate in IT Projects (Kappleman et al.,2006).

The key success factors below have been extrapolated from these failure factors and the literature associated with these will be discussed.

2.6.1 Project Management as an IT Project Success Factor

The Project Management Institute (2017) defined a project as a set of activities executed to provide a desired goal, a project has defined start and end points. Petter et al. (2013) note that the project provides the structure and the goal is the end deliverable of the project i.e. an IT product or system. A project has associated complex moving parts generally categorised into people, process, technology and environment and the complexity aligning these moving parts can generate uncertainty. De Wit (1988) proposed that in any discussion on success factors, it is essential that a distinction is made between project success and project management success. Based on the definitions above, project management success would comprise of successfully utilising the project structures to deliver the objectives of the project within the agreed time, budget and scope whereas project success would comprise the objectives of the project being met (Cooke-Davies,2002).
However, rigid utilisation of project structures can create a disconnect between the project and stakeholders, Stoica and Brouce (2014) identified lack of flexibility in the application of soft skills such as stakeholder management, and focus on collaboration as issues that block IT project success and argued that project managers having the ability to adapt to the changing nature of the project environment is a key condition for project success.
Cooke-Davies (2002) building on the work of De Wit (1988) identified the key factors for project management success as: risk management, scope definition, stakeholder management and portfolio management. The answers to these questions were based on 136 European projects which were executed between 1994-2002 and defined success factors for each question posed.

As argued in the research of Stoica and Brouse (2014), project management success requires a level of adaptability, flexibility and collaboration to manage complex interaction between different stakeholders associated with a given project. However, the research of Cooke-Davis (2002) seems to have overlooked the key role the application of soft project management skills play in successful project management. The focus on risk management processes is a core success factor in successful project management. As noted by Klein et al. (2015) plans may change and this should be noted in the project initiation document (PID) to allow the project manager the flexibility to adapt to the changes that may be required based on detailed requirements that will be extracted from the preparation phase of the project in order to successfully plan the project based on detailed information.

2.6.2 Risk management as Project Success Factor

Risk Management is a critical part of project management that involves the identification, analysis, and planning for potential responses to risk; it involves the controlling of risk (Project Management Institute, 2017). Risk management planning, risk identification, analysis, and response planning are typically done in the definition and preparation phases of a project, the actual management and control of risk occurs during project execution (Project Management Institute, 2017). Given this, it is of critical importance that risk management procedures and agreement are put in place at project definition and managed through the project lifecycle in order to manage uncertainty.

Tams and Hill (2015) separated risk into two areas, initial risk that may occur in the definition and preparation stages of a project and residual risk which potentially occurs in the execution phases of a project.

The hard risk management approach is largely based on predefined risks and planning to mitigate against known risk which points to a significant difference in the application of risk management in industry (Carvalho & Rabechini, 2015; Hartono et al., 2014). As was identified in this paper previously IT projects have significantly higher failure rates than projects in other industries and can have much greater complexity and uncertainty; (Liu, 2015; Tams & Hill, 2015). A more responsive approach to managing risk may include utilising past experience to draw on relational skills to align risks with the relevant context in which they occur (Carvalho & Rabechini, 2015; Hartono et al., 2014).

Hartono et al. (2014) found that many project managers make decisions through experience in managing risk instead of formal procedures; hence, they suggested a systemic approach to risk management. This can be done by using experience to establish the impact and probability of risk and then manage risk through the proximity of occurrence.

Janssen et al. (2015) identified that risk will have an impact through the various stages of the project and further in the product lifecycle, given this it would be advisable to put a risk management structure in place at project definition in order to identify and mitigate against potential risks in this project phase and reduce their impact on subsequent phases of IT projects.

2.6.3 Scope Definition and Management as Project Success Factor

Dvir et al. (2003) point to similar success factors as highlighted above but focus on the development of specifications and requirements and note that the focus of all projects should be in this area. Mirza et al. (2013) argue that a poorly defined scope accounts for the majority of causes of project failure and should be considered the paramount factor for project success. Kendrick (2015) identified 136 risks to IT Projects and out of the these, scope issues account for 64 out the most serious 127 risks. Standish Group (2015) and Project Management Institute (2017) list a poorly defined scope consistently as one of the top causes of project failure in their periodic reporting on the topic of IT project failure. Within the reviewed literature there is no substantial disagreement that clear, concise and unambiguous scope is a key factor that leads to project success and satisfying this condition at project definition would have to be highlighted as a contributor to ensuring that subsequent phases of projects are successful.

2.6.4 Stakeholder Management as Project Success Factor

Businesses define and execute projects to initiate change, this change is often as a result of a need to respond to market changes which executive management feel is necessary to ensure competitiveness (Hornstein, 2015). The project team is responsible for delivering agreed scope with the agreed time and budget; project delivery involves managing a complex array of internal project internal stakeholders, operational and business stakeholders who often have conflicting agendas (Mishra & Mishra, 2013; Radu et al., 2014). Müller and Jugdev (2012) argue that success factors in the future will be impacted by the quality of teamwork between project, operational and executive management along with the traditional metrics of time, cost and quality in order to align project success with organisational success. Nguyen et al. (2015) proposed that perception of success might be based on the expectations stakeholders have of the benefits of a project.

Jetu and Riedl (2012) placed significant value on project managers meeting with stakeholders to agree expectations. Jetu and Riedl (2012) targeted stakeholder satisfaction as a key success factor in IT projects. This area of management comprises of organisational change, risk management, communications management, and relationship management (Hornstein, 2015). In order to reduce the complexity of stakeholder management, Mazur and Pisarski (2015) proposed the classification of stakeholders into a hierarchy of priority such as primary and secondary stakeholders. Reed et al. (2009) argues that stakeholders should be managed based on their influence and power with the business which would allow management of positive messaging across the various business units and promote clear communication between the project environment and operational lines of the business.

The Project Management Institute, (2017) promotes the premise that stakeholder identification should take place in the definition and preparation of IT projects whereas the management of stakeholders is an activity that should take place within the execution phase of projects.

2.6.5 Project Methodologies and Project Success

As highlighted in section 2.3, there are definitions for successful, and unsuccessful projects (challenged and failed). Conventionally, a project is deemed successful if it meets the cost, time and scope objectives set out and agreed at project definition (Standish Group, 2015). The literature associated with measuring project success points to the argument that that this measure of success may be unreliable. If a project is one day late or a cent over budget it would be deemed an unsuccessful project (Everleens and Verhoef, 2009). The “Square Route” as proposed by Atkinson (1999) would in theory combine traditional project success measurements such as time, cost, scope with organisational success measurements such as stakeholder satisfaction and contribution to strategic business goals to provide a more reliable measure of project success. Similarly, Shenhar and Dvir (2007) argue that IT projects should not be defined as a success or failure based on their traditional constraints alone but on how well they contribute to the success and strategy of the organisation. Cecez-Kecmanovic et al. (2014) argue that rigid adherence to traditional measures of project success may potentially be inadequate; they proposed that the strategic contribution the project provides to the business as a more appropriate measurement of project success.

IT projects need to be managed in order to deliver the objectives for which they were commissioned. There are standard project management frameworks such as the project management body of knowledge (PMBOK), and Projects in Controlled Environments, Version 2 (PRINCE2) (Wells, 2012). IT project managers should also identify other methodologies such as waterfall, agile and software development lifecycle. (Ahsan et al., 2012). Balaji and Murugaiyan (2012) defined the waterfall model as a “sequential development model where testing is carried out once development is complete.” The Agile methodology which is a form of iterative software development came to the fore in the last decade due to the high rates of IT project failure and the reasons identified for this as mainly lack of stakeholder input, defining the proposed solution, and managing change in a dynamic business environment (Balaji and Murugaiyan, 2012).

Joslin and Müller (2015) argue that while there is a positive relationship between project success and project management methodology, however, these methodologies must provide the frameworks, tools and techniques to enable a project to be defined , executed and controlled. Project Management Institute (2017) propose that the stages involved in a project are; (a) initiating, (b) planning, (c) executing, (d) monitoring and controlling, and (e) closing; each stage has an associated group of activities at each phase of the project, with a view to planning and executing a project in a systemic and controlled fashion. Wells (2012) found that many organisations implemented project management methodologies to apply standard processes to their projects. Standish Group (2015) have published figures that identify that agile methods have improved success rates based on the traditional measures of time, cost, and quality as highlighted below. However, the overall headline figure of project success for large size projects does not seem to have increased from those figures presented in section 2.3 of this literature review. This would seem to support the arguments of Griffiths (2004) who proposed that showing the flexibility to choose the best aspects of both traditional and agile methods often results in the best outcome, this hybrid approach should also be considered at project definition.

Table 2.6.1. Standish CHAOS Figures by Size Resolution

SIZE	METHOD	SUCCESSFUL	CHALLANGED	FAILED
All Sized Projects	Agile	39%	52%	9%
	Waterfall	11%	60%	20%
Large Sized Projects	Agile	18%	59%	23%
	Waterfall	3%	55%	42%
Medium Sized Projects	Agile	27%	55%	11%
	Waterfall	7%	68%	25%
Small Sized Projects	Agile	58%	38%	4%
	Waterfall	44%	45%	11%

Source: Comparison between AGILE and Traditional Figures, (Standish Group 2015, p.7)

Leau et al. (2012) argues that agile methods are not particularly suitable for large complex implementations. Fernandez, and Fernandez (2008) propose that knowing which project management frameworks and methods should be selected can often lead to the best project outcome.

2.7 Literature Review Summary

A review of the literature above has defined what constitutes project failure and success through the analysis of various definitions associated with IT projects, and although there is no fully agreed definition, the traditional definition of time, cost and quality are widely accepted. The key causes of IT project failure have been accepted as a combination of process and socio- organisational factors of project management, risk management scope definition / scope management, executive support /stakeholder management and input, roles / responsibilities/ resourcing, and planning/estimation. These failure factors generally fit into a number of key success conditions, when managed correctly at project definition can provide projects with the best possible chance of success from the outset. Based on the literature these success conditions were determined to be; successful project management (planning, estimation risk management (including resource risk management), and project methodology decision making) scope management (including change control), and stakeholder management. In-depth analysis of the application of these factors at project definition was not apparent from the literature reviewed as the current research would appear to focus analysis of these factors at project execution. Based on this assessment, development of research that focused on the use of these factors at project definition and their impact on the variances experienced in subsequent project phases was deemed worthwhile and beneficial to the IT and Project Management communities. A method of testing their use and impact would provide a useful tool to assess the effectiveness of project definition in setting up projects for success. Based on the success conditions found in the literature review, a conceptual framework as discussed in chapter three of this research has been developed by which the impact of known success conditions on subsequent project phases on a sample IT project portfolio will be assessed and tested.

3. Research Methodology

3.1 Introduction

This chapter describes the research approaches considered for answering the research question. This chapter outlines the various research philosophies and research approaches. The rational for the chosen research methodology is discussed. Design and data collection methods that were used to support the chosen research strategy are discussed in relation to the development of the conceptual framework that is used for testing the data gathered in chapter 4. The issues with chosen methodology along with ethical issues are considered before outlining what lessons had been learned as a result of conducting this research.

3.2 Research Concepts

A commonly accepted research concept is the research onion (Saunders et al.,2009). This concept involves 'peeling back' each layer of the onion to reveal the answer to a given research question. The various layers of the onion are research philosophies, approaches, strategies, choices, time horizons and data collection techniques and procedures. This concept was utilised to refine the literature that was seen to have an impact on project definition. This concept was utilised to build a deductive framework that would allow for the development of a research method that would allow this study to assess the impact of project definition on subsequent project phases.

Figure 3.1. Research Methodology, Mark Bissett (2019)

Identifying a high level question was the first task in this research and following this refining this question via a systematic review of the literature was required to decide on the question outlined in section 3.6. Following this appropriate research philosophies, approaches and methods were reviewed and which are discussed in subsequent sections below. Based on these approaches a conceptual framework was built which would utilise mixed methods to analysis both primary survey data and secondary survey organisation data in order to answer the research question.

3.3 Research Philosophies

Saunders, et al. (2012, p.101) state "That the research philosophy contains assumptions about the way in which you view the world. These assumptions include the strategy that is used and the methods that are used as part of that strategy. The philosophy that is adopted will be influenced by practical considerations. These are likely to be the researchers view of the relationships between the knowledge and the process by which it is developed"

These authors outlined three major ways about thinking of research philosophies. These methods of thinking about research philosophies can be further broken down into standpoints on each.

Table 3.1. Research Philosophies

Epistemology	Ontology	Axiology
Positivist	Objectivist	Pragmatist
Interpretivist	Subjectivist	
Realist (Direct/Critical)		

Source: Research Methods for Business Students, Saunders et al.2012

Pragmatism

Interestingly Heron (1996) argues that being able to articulate values with regard to making judgements is a key axiological skill. It is further noted that values could be reflected in the philosophy and data collection techniques chosen, and the selection of interview and questionnaire.

Saunders, et al. (2012, p.110) state "the most important factor that determines research philosophy is the research question. If the question does not suggest unambiguously a positivist or interpretivist philosophy, then this would confirm the pragmatists view of the world". Creswell (2008) argues that paramount importance should be placed on understanding the research question and methodologies should be selected that best enable the answering of the research question.

The question for this research would appear to point to the positivist approach where existing theory is tested in a controlled environment, however, there is a certain amount of opinion on how social and cultural factors were used in IT projects that will have to be examined which would point to an interpretivist approach. Given this, the most appropriate choice of research philosophies would appear to be one which best facilitates the answering of the research question both from a positivist and interpretivist viewpoint and based on this pragmatism had been chosen as the appropriate research philosophy.

3.4 Research Approaches

There are two mainstream research approaches available, Deductive and Inductive. These approaches are outlined below.

Saunders, et al. (2012, p.117) states "A deductive approach involves development of a research theory that is subjected to rigorous test which allow anticipation of phenomena , predict their occurrence, and permit the testing of theories to be controlled. Deduction is the search to allow casual relationships between variables to be explained".
The Inductive approach is concerned with analysing and collecting data from which a theory can be built (Gray,2013). Theory follows data rather vice versa with deduction.
Creswell (2008) argues that when a wealth of knowledge and literature exists on a given research topic from which you can define a theoretical framework and hypothesis this lends itself more readily to deduction.

IT failure and the causes of this have been well documented and a wealth of literature exists on this subject. Existing research provides a number of success conditions that have been identified in the wider IT project lifecycle, this research will look to test the use of known failure and success conditions at project definition on the subsequent phases of projects to establish the impact to which use of these conditions affect the variances observed in subsequent project phases hence a deductive approach was chosen as the most appropriate.

3.5 Research Question

The research will address the following question:

- *To what extent are known success factors utilised consistently in project definition and how does their adoption at project definition impact on variances at subsequent project phases and ultimately project outcome.*

3.6 Research Strategy

Research strategies can be used for exploratory, descriptive or explanatory research (Yin, 2003). The below research strategies were considered when identifying the most appropriate strategy to use to answer the research question.

- Experiment
- Survey
- Case Study
- Action Research
- Grounded Theory
- Ethnography
- Archival Research

The case study is commonly concerned with answering the 'what' question in a research topic, because of this the case study is most often utilised for exploratory and explanatory research (Saunders, et al., 2012).

Morris and Wood (1991) argue that the case study will be of most interest when a researcher wishes to understand the context of the topic being studied and the process enacted.

This research looks to establish a correlation between the use of known success factors at project definition for a number of real world projects and their impact on the subsequent phases and ultimately project outcome of these projects. In order to achieve this a conceptual framework for testing was developed which is outlined in section 3.8. This framework is a method for triangulating the known success conditions against primary (survey data) and secondary research (organisation summative variance data). This framework employs aspects of the survey, and case study strategies.

3.7 Research Methods

The way in which quantitative and qualitative methods are combined is referred to as research design (Tashakkori and Teddlie, 2003).

The existing literature implies a number of generally accepted organisational and process conditions that can lead to project failure or success. These factors or conditions will form the basis for the question design that will be used in the survey presented to participants that take part in this research. This primary data will then be triangulated against secondary data in the form of organisational summative data to establish if a correlation exists between the use of these conditions and the outcome on subsequent project phases and ultimately project outcome. This will essentially mean using mixed methods to develop a conceptual framework for testing of theories.

3.8. Research Design

As outlined in Chapter 2, existing literature on project failure and success conditions will be used to develop a framework for testing the impact of these conditions at project definition and subsequent project phases. This framework is listed in figure 3.9 below and will be used to test variances against cost and time respectively. For each success condition a relevant survey question will be put to participants and categorised in the chapter as a high, moderate or low implementation of this factor at project definition. These perceptions will then be overlaid against project phases to establish a correlation between variances and the use of the factors.

Table 3.2. Conceptual Framework for Analysis

Success Condition	**Project A**	**Project B**	**Project C**	**Project D**	**Project E**	**Project F**	**Project G**
Project Management Strength	H	H	H	H	H	H	H
Change Control	H	H	H	H	M	L	H
Availability of Business Case	N	Y	Y	Y	N	N	N
Risk Management Procedures	H	H	H	H	M	M	M
Executive Level Support	H	H	H	H	L	L	H
Clear Goals and Objectives	H	H	H	H	L	L	H
Clear Requirements	H	L	H	H	L	L	M
SME Resource Availability	H	H	H	H	L	L	H
Accuracy of Estimation	H	L	H	H	L	L	H
Stakeholder Input	H	L	H	H	L	L	H
Resource Capacity	H	H	H	H	L	L	M
Phase Variances							
Design							
Build							
SIT Test							
Regression Test							
UAT Test							
Performance Test							
Training							
Deployment							
Support							
Overall Variance							

3.10 Data Collection and Analysis

This research will use convenience sampling to target stakeholders with involvement and experience in the definition and preparation phase of Enterprise IT projects. Participants will be requested to undertake a survey via a questionnaire in April/May 2019 to validate the use of known success conditions extracted from current literature to establish a correlation between the use of these conditions and project success based on the accepted criteria of time and cost. The data will be tested and analysed using the conceptual framework outlined in section 3.9.

3.11 Research Ethics

Ethical approval was obtained from Trinity College Dublin School of Computer Science and further detail on this can be found in Appendix 1 below.

The submission for ethical approval included the following documents:

- Research ethics application form.
- Research Proposal.
- Information sheet for Individuals.
- Organisation Consent Form.
- Consent form for individuals.
- Interview Questions.

The advice of Saunders, et al. (2012) was also followed with regard to ethical considerations of the research and ensuring that participants were fully informed regarding the requirements of informed consent such as; the nature of research, data collection, participants time, participants rights, anonymity assurances and use of the data.
Additional care as suggested by Saunders, et al. (2012) when performing research within an organisation in which you are employed, care should be taken to avoid pressuring subordinates or colleagues participation in any research as such pressure could be considered harmful and in turn unethical. A full debriefing will also be offered to all participants.

3.12 Lessons Learned

In designing the survey, given the different perspectives that were required in order to validate perceptions of respondents, a large number of questions had to developed which have a certain amount of repetition, a separate survey for each group may have been a more efficient way of gathering data. As the survey was performed with the organisation, some respondents that had an overarching position did respond to questions with the same response, a more qualitative interview approach would have allowed this research to drill down deeper and validate these responses.

3.13 Conclusion

A pragmatist philosophy was chosen to allow the researcher to select research approaches to best answer the question. Deduction was used to build a conceptual framework that utilised mixed methods of elements of the case study and survey strategies which utilised both primary and secondary data to deduce the impacts of success conditions at project definition on subsequent phases of IT projects and ultimately project outcome. This approach provides a robust and flexible method for testing survey perceptions against secondary data which gave unique insights.

4. Findings and Analysis

4.1 Introduction

The chapter presents the research data including primary data; which was collected through online survey and secondary data which was identified in the existing literature along with organisation specific summative data to which access was provided. As discussed and presented in chapter 3 of this study, a conceptual framework was developed that performs a comparative analysis between the literature review, survey data and organisation specific summative data. Firstly, the survey data will be presented with reference to the literature, secondly, the summative data will be presented in tabular format for each project. Thirdly, the projects will be tested against the conceptual framework discussed in Chapter 3 to triangulate the impact of success conditions at definition against variances observed in the summative data. Finally, the results will be discussed for each project

4.2 Participants, Location, Duration, Data Collection Setup, Data Storage

4.2.1 Participants of research

Participants were selected from a sample project portfolio in the organisation that was the subject of the research. This organisation operates within the utility sector in multiple jurisdictions in Europe, Africa and Asia. However, the sample Project Portfolio identified operates in the United Kingdom and the Republic of Ireland only. Participants were selected via convenience sampling in a number of roles that would be involved in the project definition or subsequent phases of IT projects.

Figure 4.2.1 Survey Participants Profile

4.2.1 Location of Research

This research took place within the utility organisation in question, specifically the survey took place between April and May 2019.

4.2.2 Duration of Research

As noted in section 4.1, this research consists of a conceptual framework of comparison of topics extracted from the literature review on project failure and success factors, survey and summative project closure data. This research took places between March and May 2019.

4.2.3 Data Collection Setup and Analysis

As noted previously, a conceptual framework was implemented to triangulate the analysis of primary and secondary data. This framework comprised of identifying topics upon which survey questions could be based by utilising topics and conclusions in existing literature, then validating these topics against primary data extracted from survey and secondary data available in summative organisation data.

4.2.4 Data Storage

Summative Data was stored on internal organisation shared drives and email and all personal copies of this data were deleted following completion of research. All survey data was collected and stored via the Qualtrics Platform and will be destroyed in accordance with this organisations data collection and retention policies.

4.3 Survey Data

The survey was based on a number of projects executed within the utility organisation in question, all projects were executed using the waterfall methodology, seven medium sized projects where included in the survey which varied in duration from three months to one year.

4.3.1 Survey Question Construction

Survey questions were constructed by identifying the main factors that relate to IT project failure and success from existing literature, an overview of the literature that was utilised to construct the questions for the survey is outlined below.

4.3.2 Demographic Questions

As noted in section 4.3, the participants were requested to answer questions on the specific project they were involved in and the role that they held on this project. A number of roles that were involved in the definition and subsequent project phases were targeted using convenience sampling which are listed Figure 4.3.2.1 and 4.3.2.2.

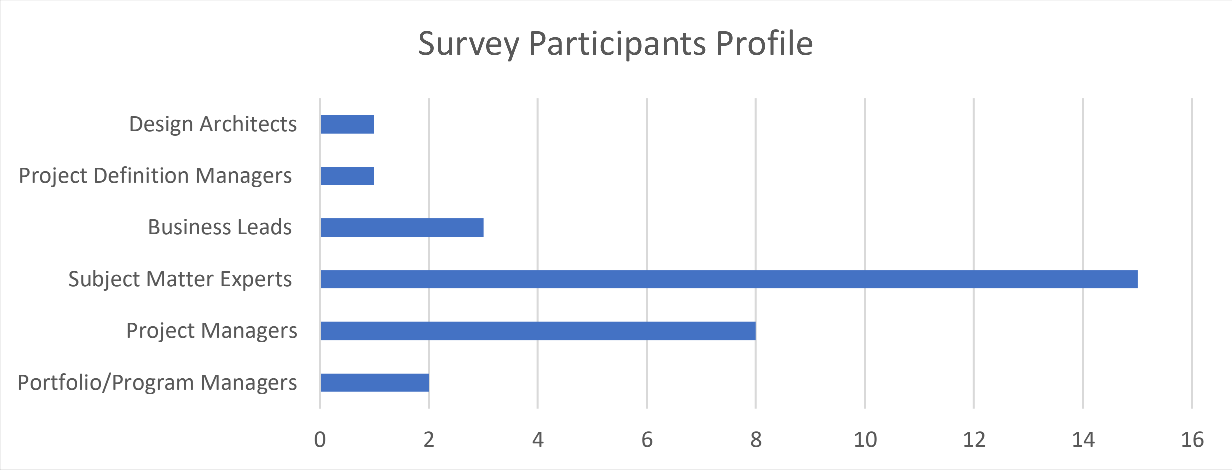

Figure 4.3.2.1. Survey Participants Profile

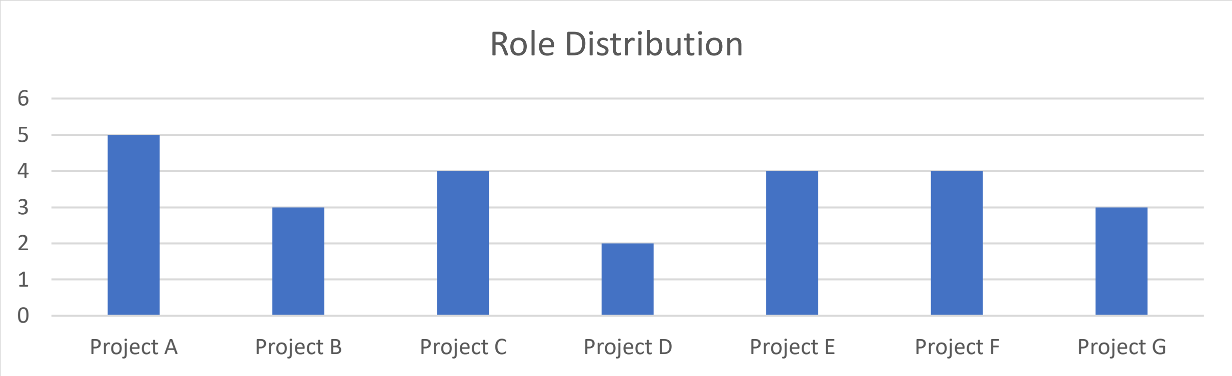

Figure 4.3.2.2. Survey Participants Role Distribution

4.3.3.1 Project Management Strength Success Factor

The lack of a strong project manager has been documented in the literature as key contributor to project failure (Kappleman, et al., 2006; Standish Group, 2015), and conversely, a strong Project Manager can be seen as a key factor in the success of a project. A strong and experienced Project Manager can deal with the ever changing project environments and this requires high levels of flexibility and adaptability (Klein et al.,2015; Stoica and Brouse, 2014). Based on the literature, a key question that was posed to survey respondents was to identify the strength and experience of the Project Manager assigned to their project.

4.3.3.2 Project Management Strength Success Factor Survey Results

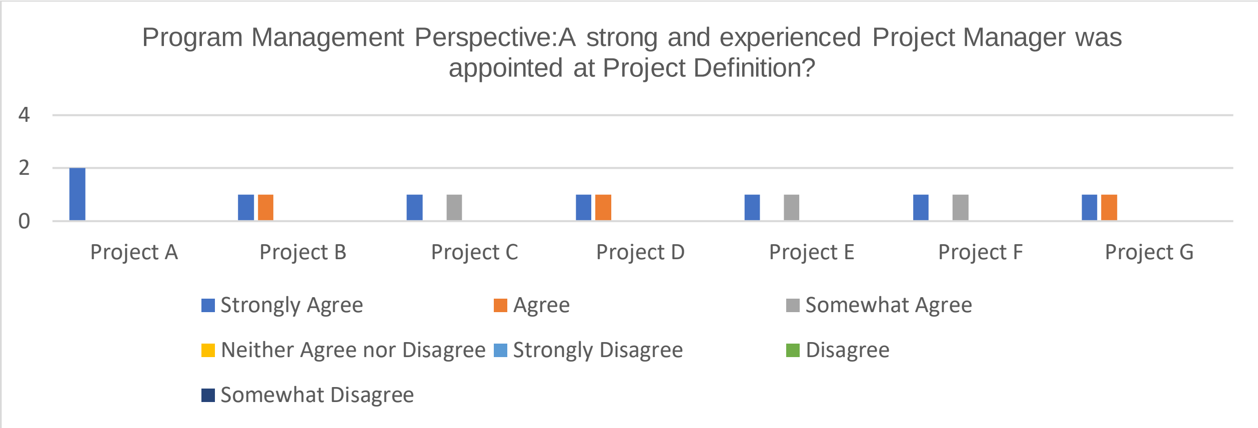

Figure 4.3.3.1. Project management strength; Program Management perspective

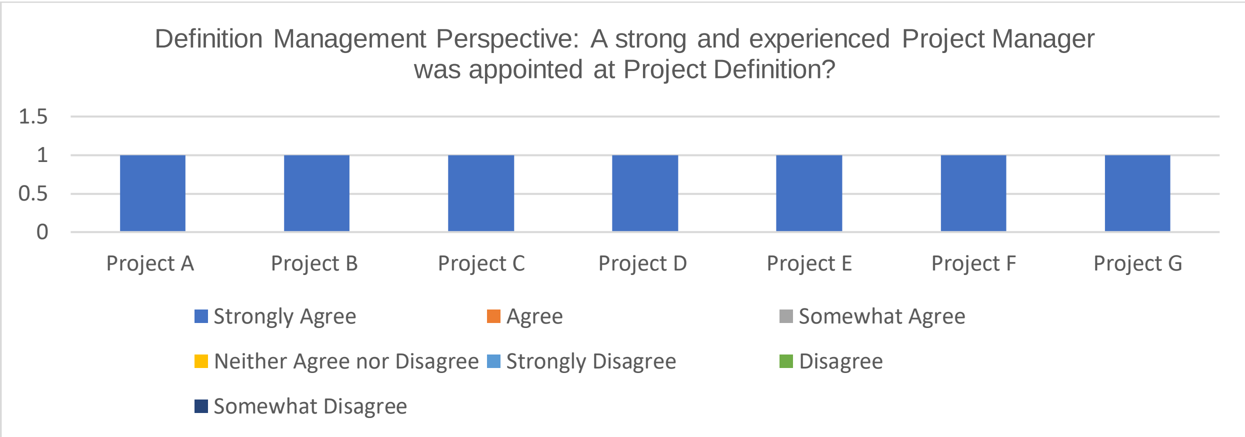

Figure 4.3.3.2. Project management strength; Definition Management perspective

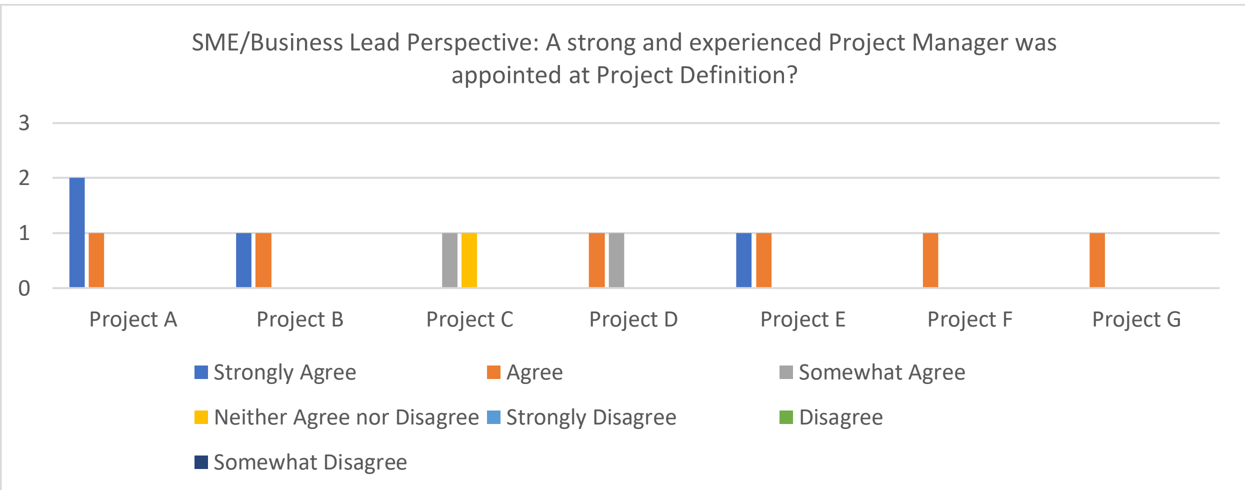

Figure 4.3.3.3. Project management strength; Subject Matter Expert/Business Lead perspective

4.3.4.1 Change Control Governance Success Factor

The criticality of a strong and robust change control process being available and its contribution to a successful project outcome cannot be overstated. Kappleman et al. (2006) list the lack of a well-documented and agreed change control process as fourth on the overall list of contributors to project failure. The Project Management Institute (2017) listed poor change management as accounting for 28% of known project failures. Based on this information two key questions where derived from the literature to be put to survey respondents;

1. An appropriate and robust change control process was in place at project definition?
2. Change control processes were communicated in a clear and concise manner following project definition?

4.3.4.2 Change Control Processes Survey Results

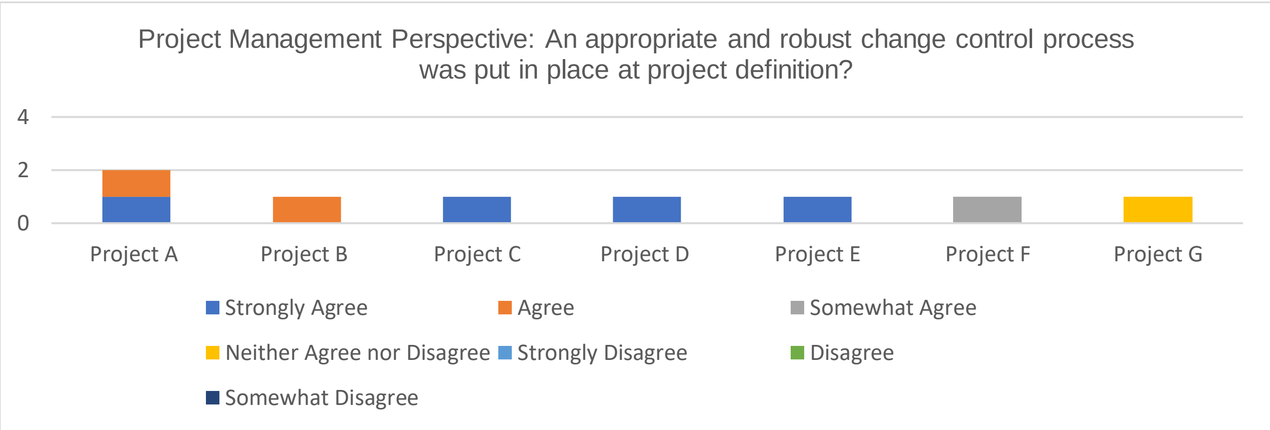

Figure 4.3.4.1. Robust change control processes; Project Management perspective

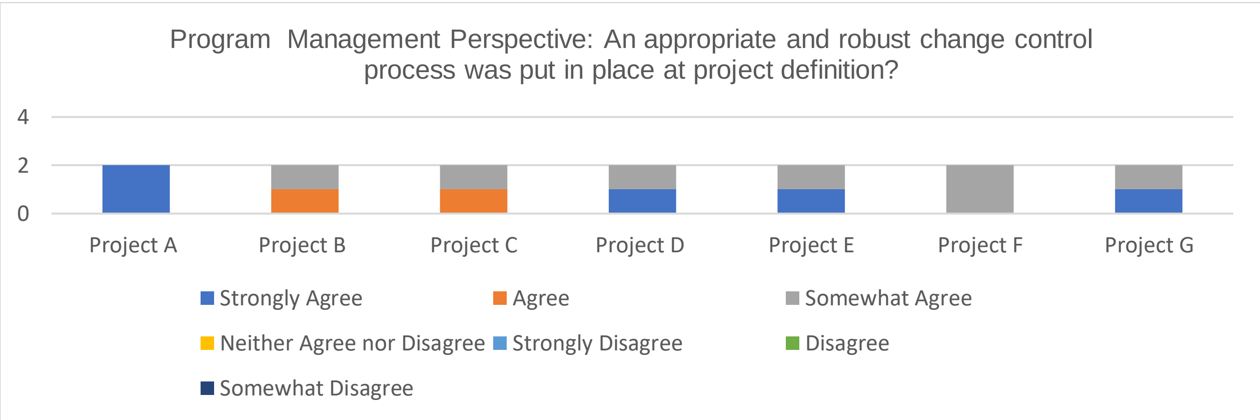

Figure 4.3.4.2. Robust change control processes; Program Management perspective

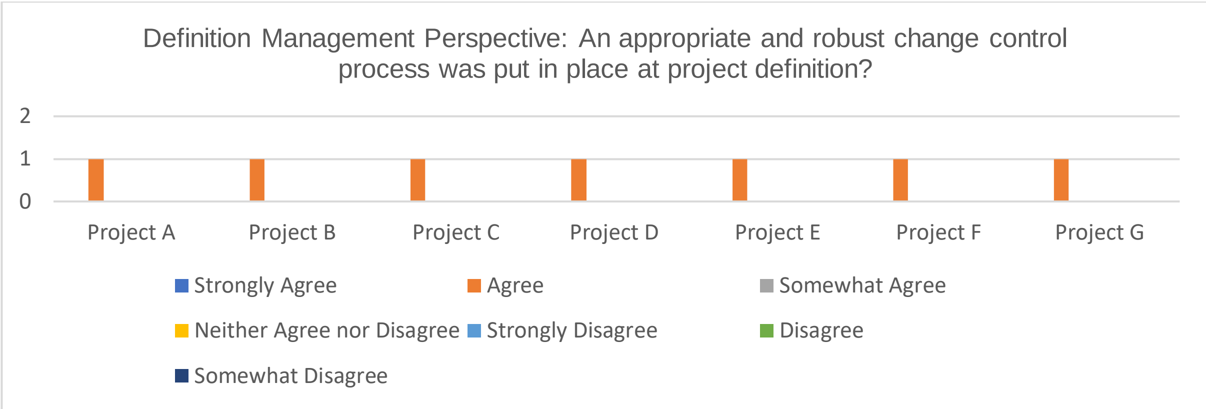

Figure 4.3.4.3. Robust change control processes; Definition Management perspective

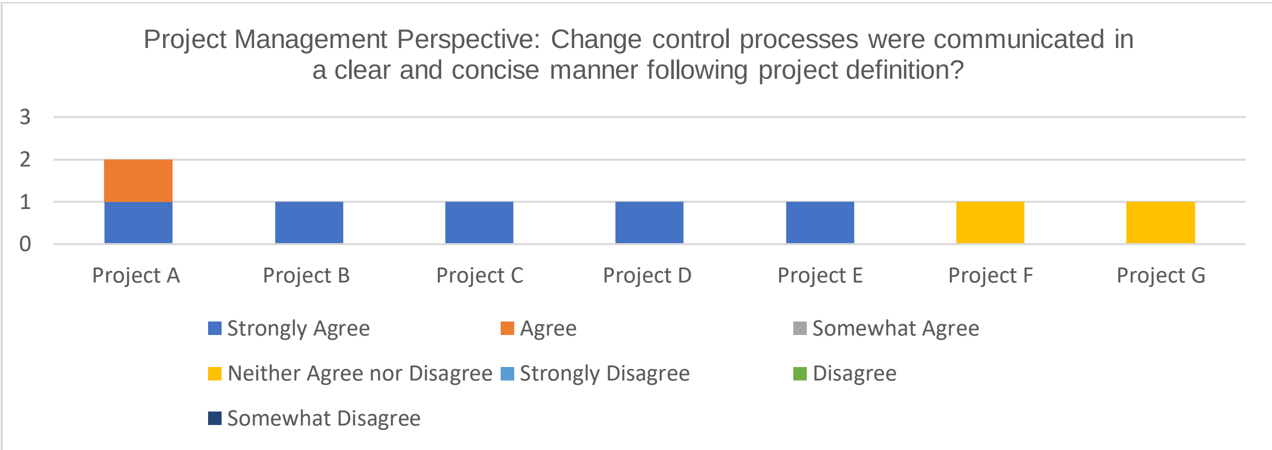

Figure 4.3.4.4. Change control process communication; Project Management perspective

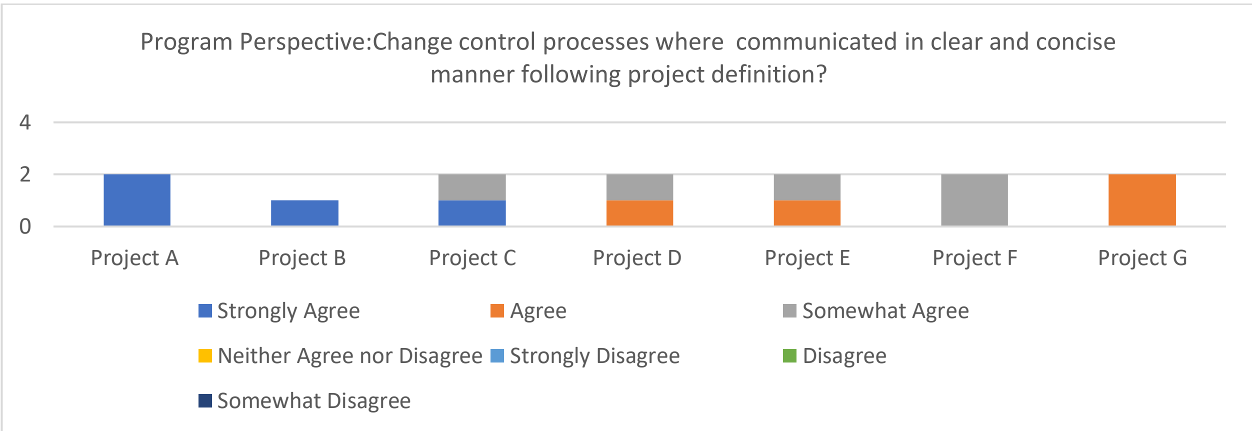

Figure 4.3.4.5. Change control process communication; Program Management perspective

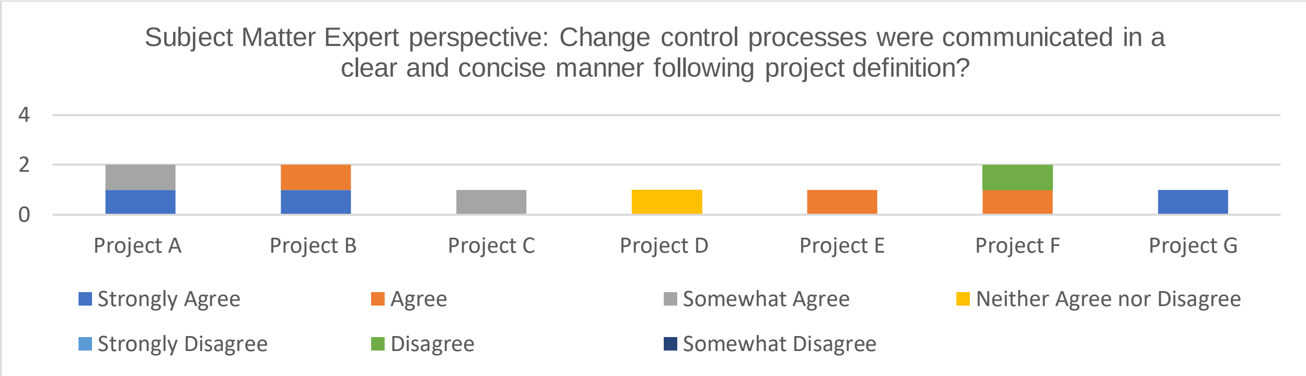

Figure 4.3.4.6. Change control process communication; Subject Matter Expert perspective

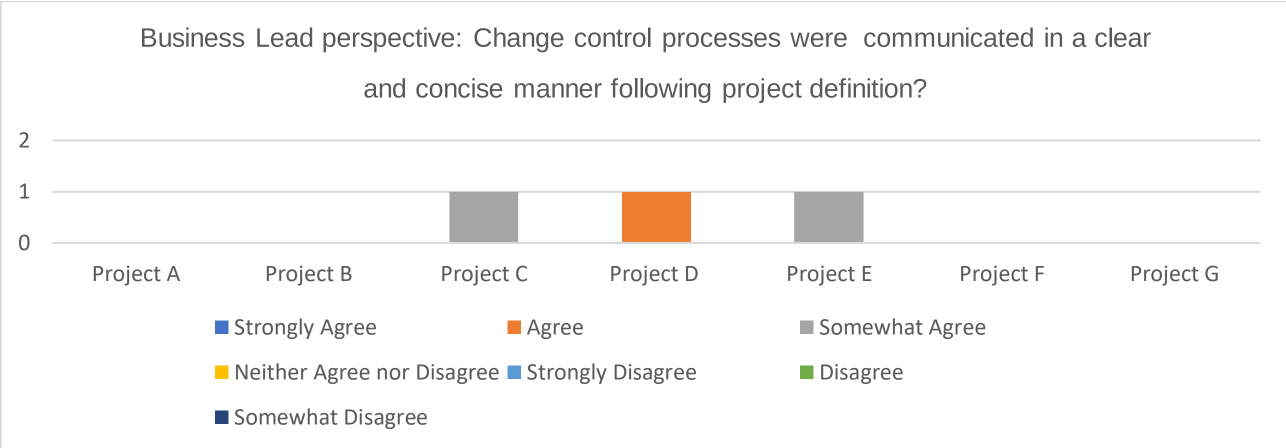

Figure 4.3.4.7. Change control process communication; Business Lead perspective

4.3.5.1 Success Factor Availability of Business Case

A well-documented business case is generally considered to be a key component of the project initiation document or PID as it is commonly referred to in project management terms. Lack of a business case was identified as a key factor in failed IT projects (Kappleman et al.,2006).

4.3.5.2 Availability of Business Case Survey Results

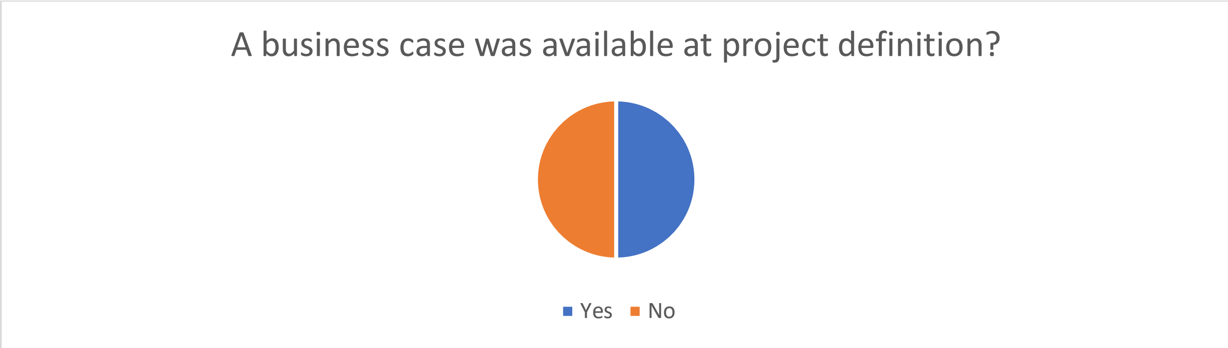

Figure 4.3.5.1. Existence of a documented business case

4.3.6.1 Success Factor Risk Management Procedures

IT projects have significantly higher failure rates than projects in other industries and can have much greater complexity and uncertainty; (Liu, 2015; Tams & Hill, 2015). A more responsive approach to managing risk may include utilising past experience to draw on relational skills to align risks with the relevant context in which they occur (Carvalho & Rabechini, 2015; Hartono et al., 2014). Janssen et al. (2015) identified that risk will have an impact through the various stages of the project and further in the product lifecycle, given this it would be advisable to put a risk management structure into place at project definition in order to identify and mitigate against potential risks. The question(s) below were formulated based on these observations.

4.3.6.2 Risk Management Procedures Survey Results

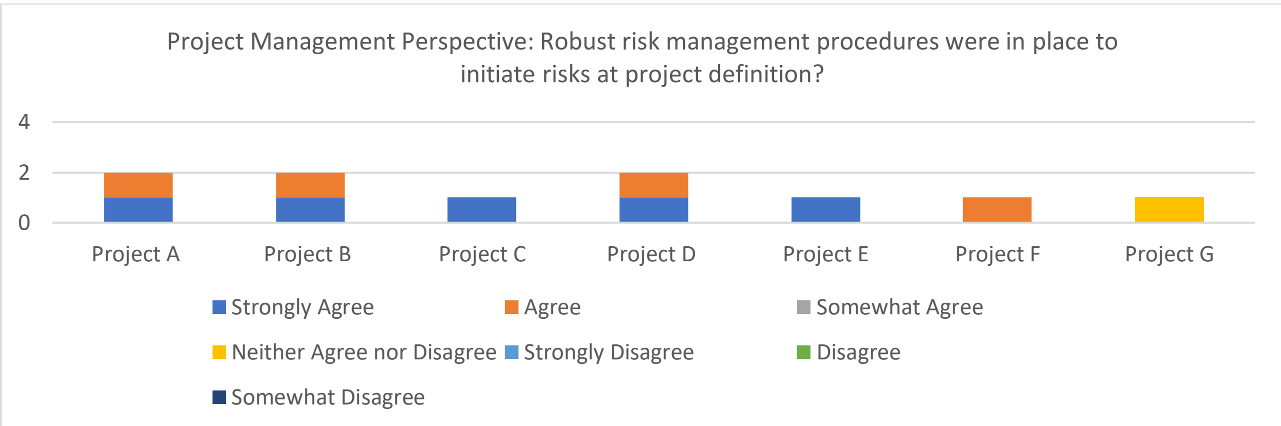

Figure 4.3.6.1. Risk Management Procedures; Project Management perspective

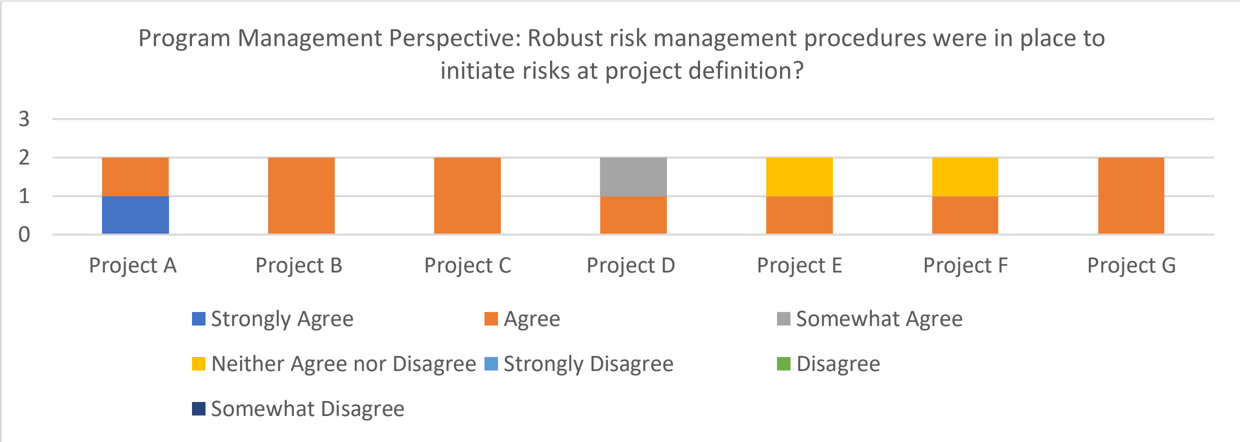

Figure 4.3.6.2. Risk Management Procedures; Program Management perspective

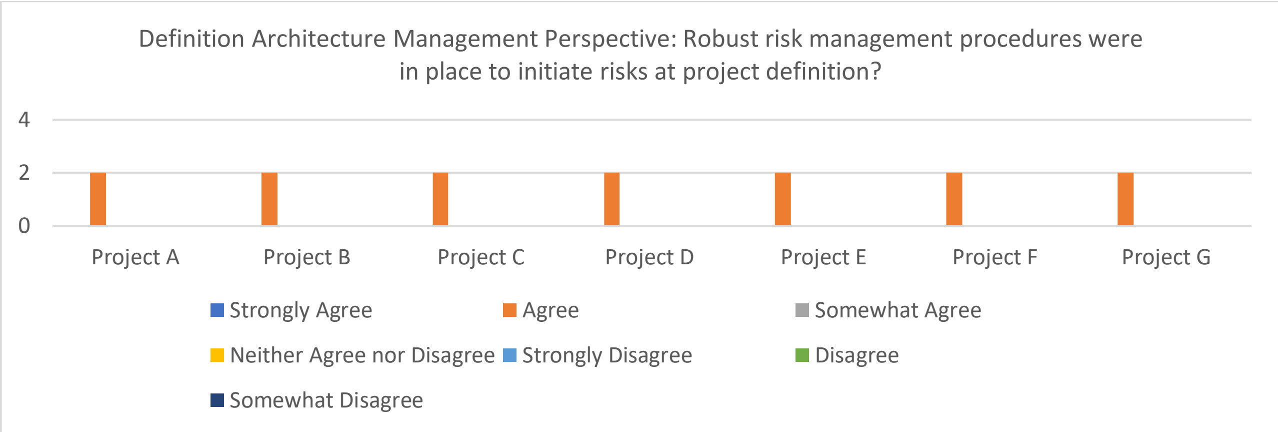

Figure 4.3.6.3. Risk Management Procedures; Definition Management perspective

4.3.7.1 Application of Lessons Learned Logs Success Factor

The history of project failure is littered with projects repeating known causes of project failure. This can be compared to an airline crash that continually repeats the same failures and does not apply the lessons of these failures to subsequent projects in order to improve potential for success (Charette, 2005). Based on this assessment, a key task for project definition would require the project definition phase to apply lessons learned to future projects in order to ensure that problems of the past are not repeated. This research lead to the formulation of the following question (s):

4.3.7.2 Application of Lessons Learned Logs Survey Results

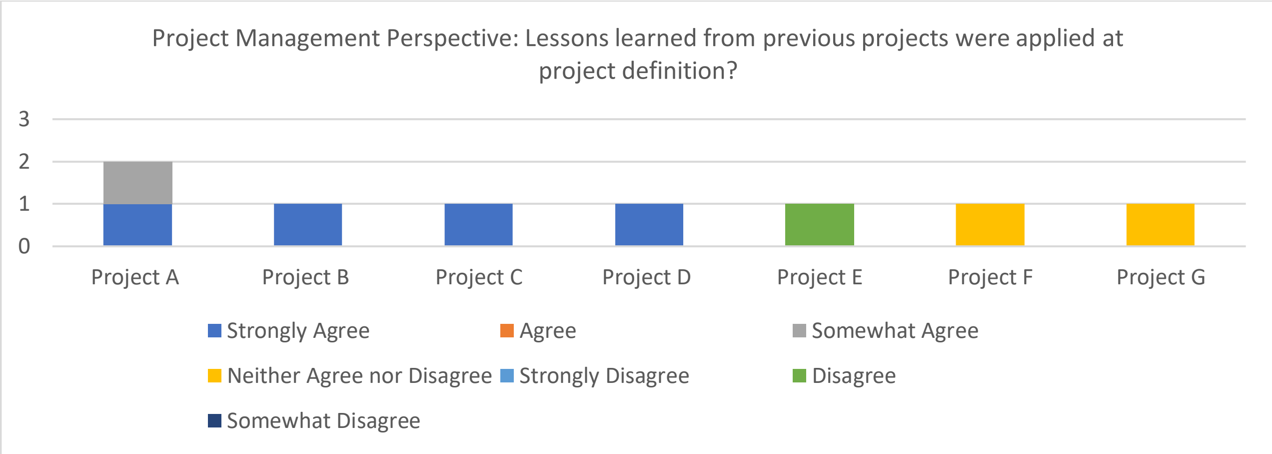

Figure 4.3.7.1. Application of lessons learned; Project Management perspective

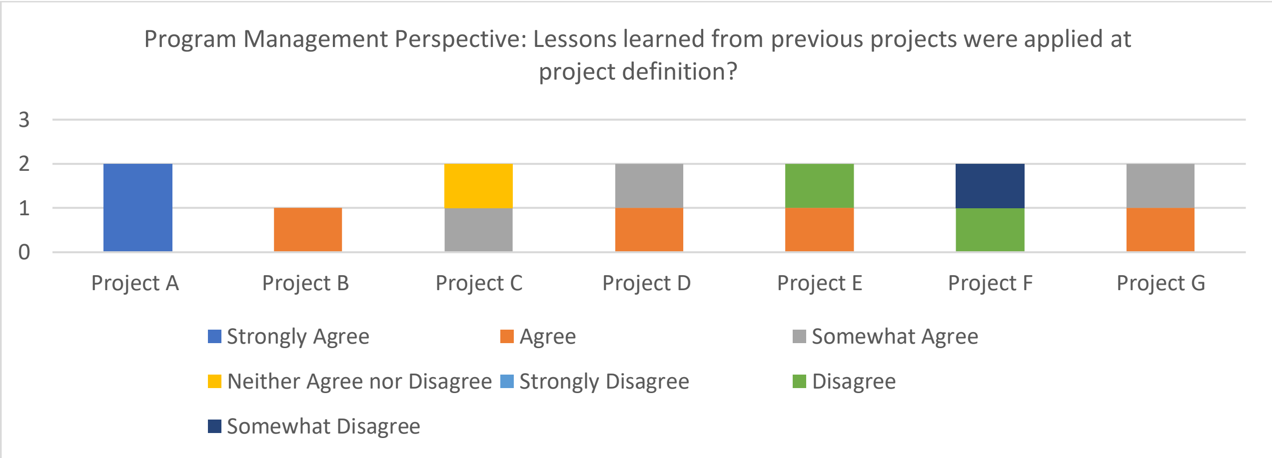

Figure 4.3.7.2. Application of lessons learned; Program Management perspective

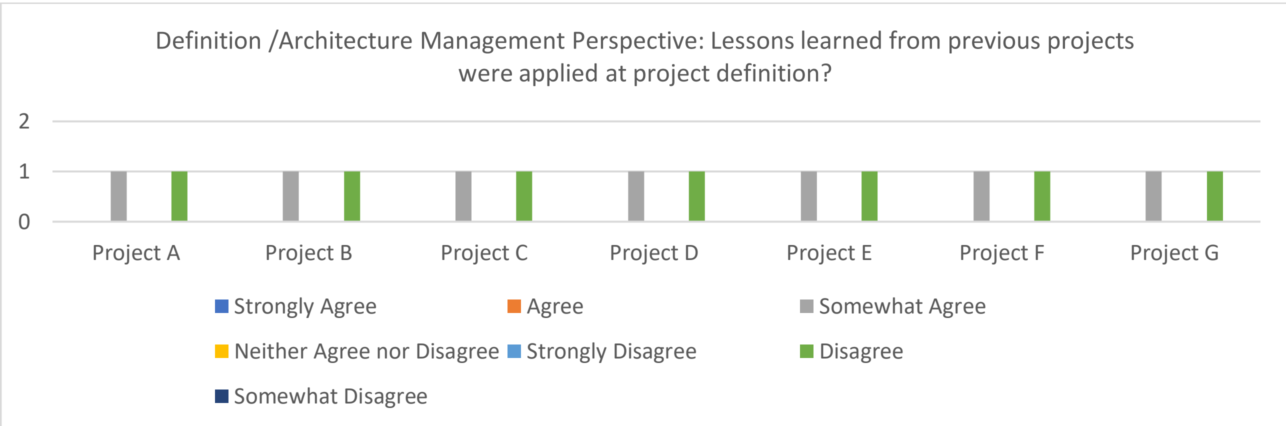

Figure 4.3.7.3. Application of lessons learned; Definition /Architecture Management perspective

4.3.8.1 Executive Level Support Success Factor

62% of IT projects considered to be successful have included project sponsors who were actively supportive of the project (Project Management Institute, 2017). Conversely, a lack of executive level support was listed as fourth most popular contributor to project failure (Standish Group, 2015).

This research lead to the formulation of the following question (s):

4.3.8.2 Executive Level Support Survey Results and Analysis

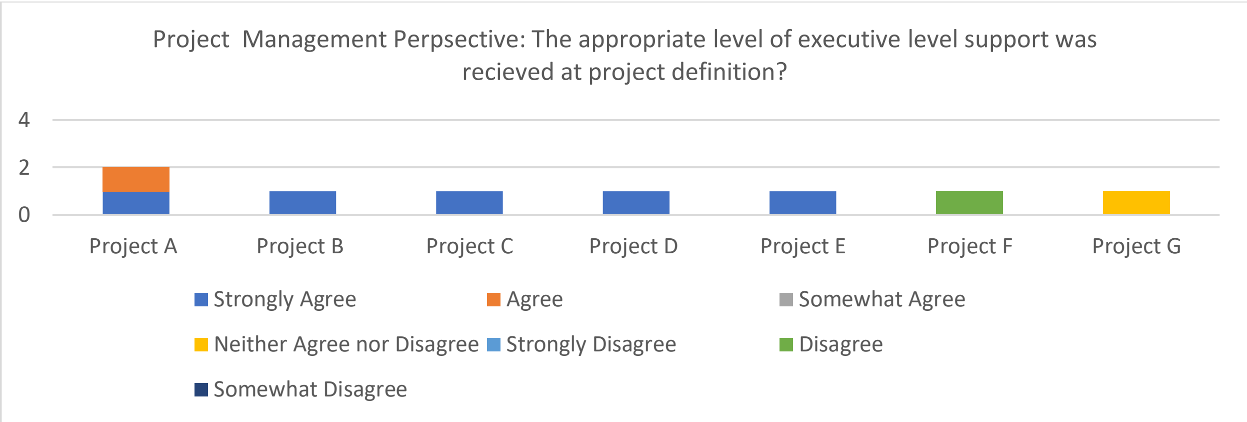

Figure 4.3.8.1. Executive Level Support; Project Management perspective

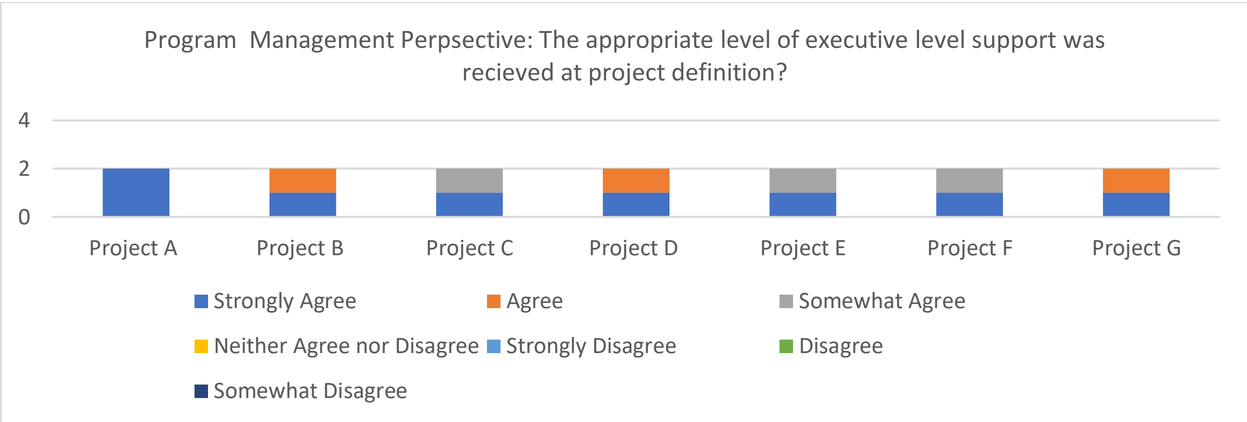

Figure 4.3.8.2. Executive Level Support; Program Management perspective

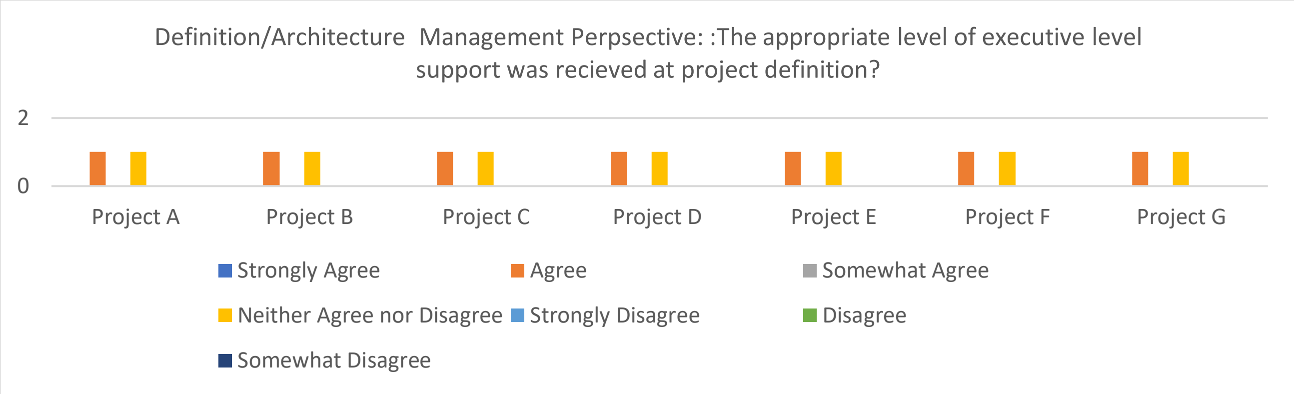

Figure 4.3.8.3. Executive Level Support; Definition /Architecture Management perspective

4.3.9.1 Clarity of Goals and Objectives Success Factor

Traditional measurements of time, cost and quality are no longer considered the only measure of project success, contribution to organisational goals and objectives have now been integrated to project success criteria (Atkinson ,1999). The transformation of business goals to IT systems is argued to be what makes IT projects more susceptible to failure than other projects. Accurately translating business vision and objectives into IT products provides IT projects with the best possible chance of success (Brooks,1995). 30% of IT projects considered to be successful were said to have successfully met business goals and intent. Conversely, 30% of projects considered unsuccessful display inadequate vision for the project goals or objectives (Project Management Institute, 2017). Lack of clear objectives has also been identified as one of the top ten reasons for project failure (Standish Group, 2015). This research lead to the formation of the following question(s)

4.3.8.2 Clarity of Goals and Objectives Survey Results

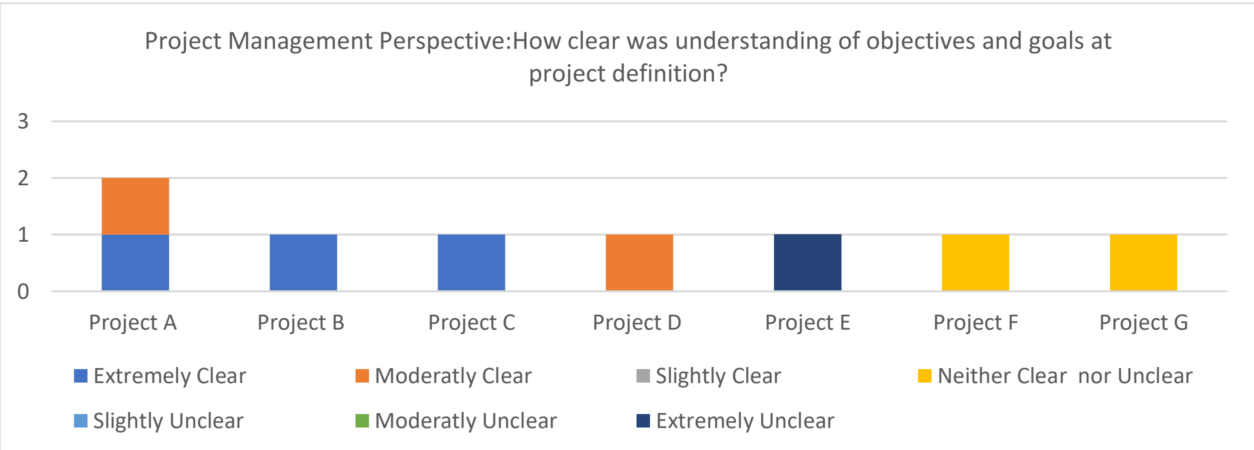

Figure 4.3.9.1. Goals and objectives; Project Management perspective

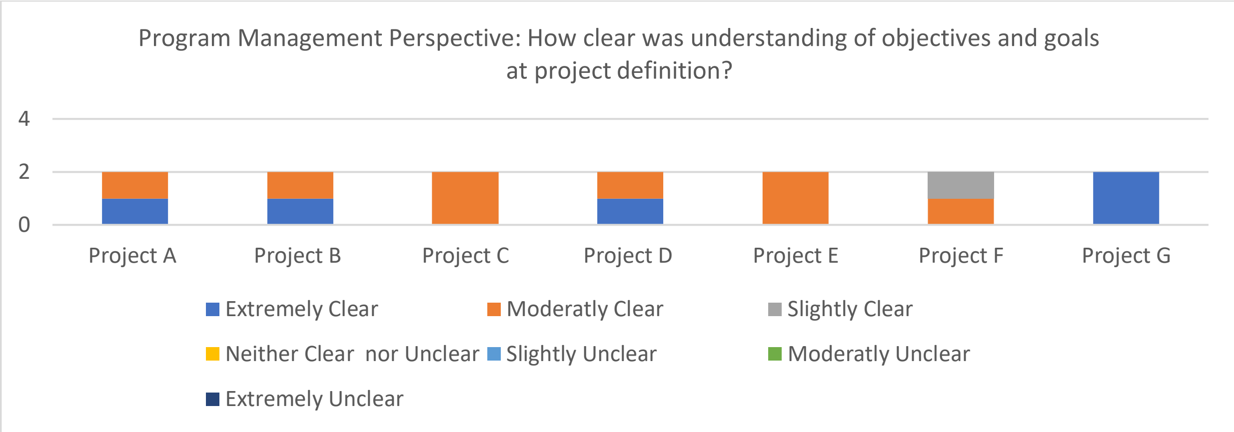

Figure 4.3.9.2. Goals and objectives Program Management perspective

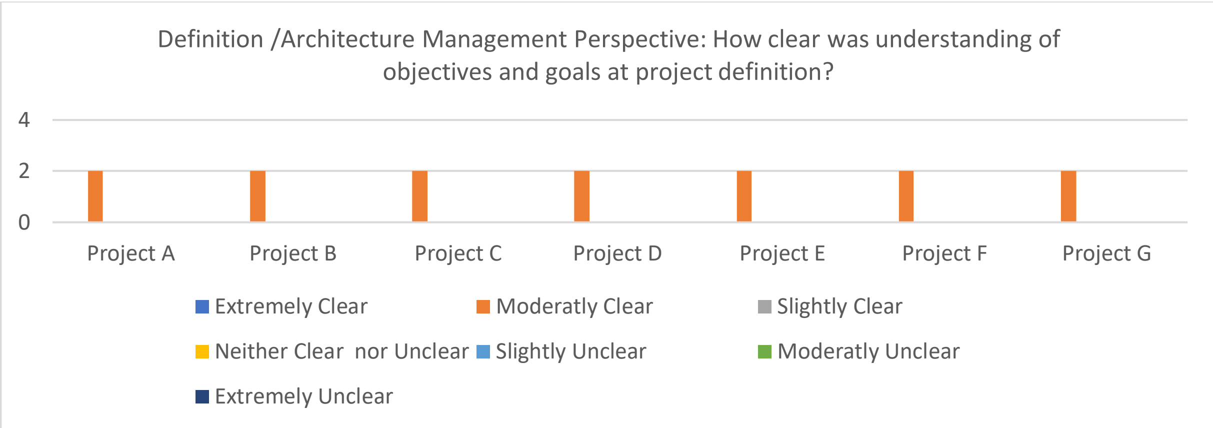

Figure 4.3.9.3. Goals and objectives Definition/Architecture Management perspective

4.3.10.1 Clarity of requirements Success Factor

Removing ambiguity and providing clear requirements ensures that business vision is aligned to the creation of IT products (Brooks,1995). Kappleman et al.(2006) listed unreliable requirements as the number two contributor to IT project failure. Standish Group (2015) in their annual CHAOS Report on project failure listed incomplete requirements as the number one contributor to project failure. Unreliable requirements account for 39% of projects that are deemed failures (Project Management Institute, 2017).

In reference to requirements gathering at project definition and the manner in which this impacted on subsequent planning, estimation and execution activities, respondents were requested to answer the following questions:

4.3.10.2 Clarity of High Level Requirements Survey Results and Analysis

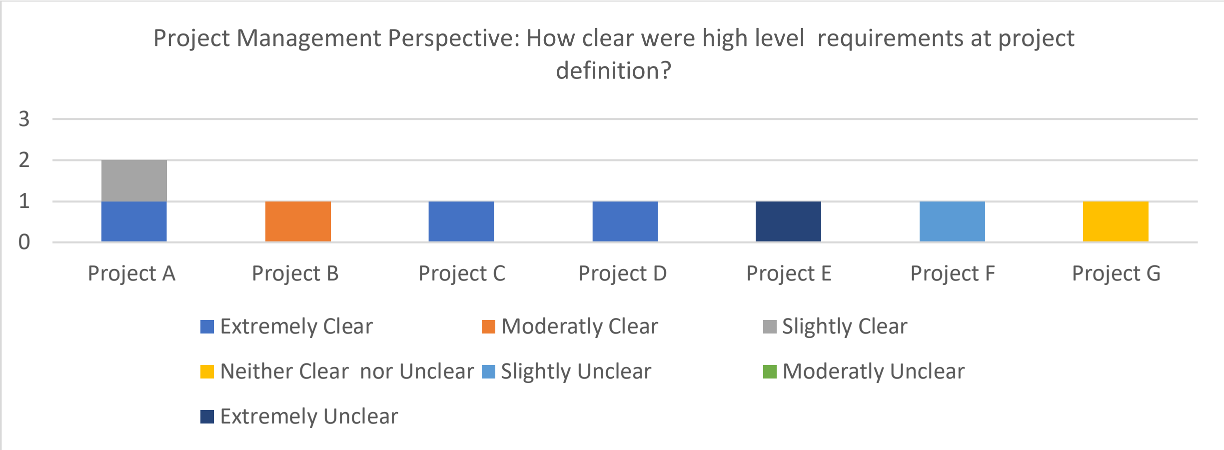

Figure 4.3.10.1. Clarity of high level requirements; Project Management perspective

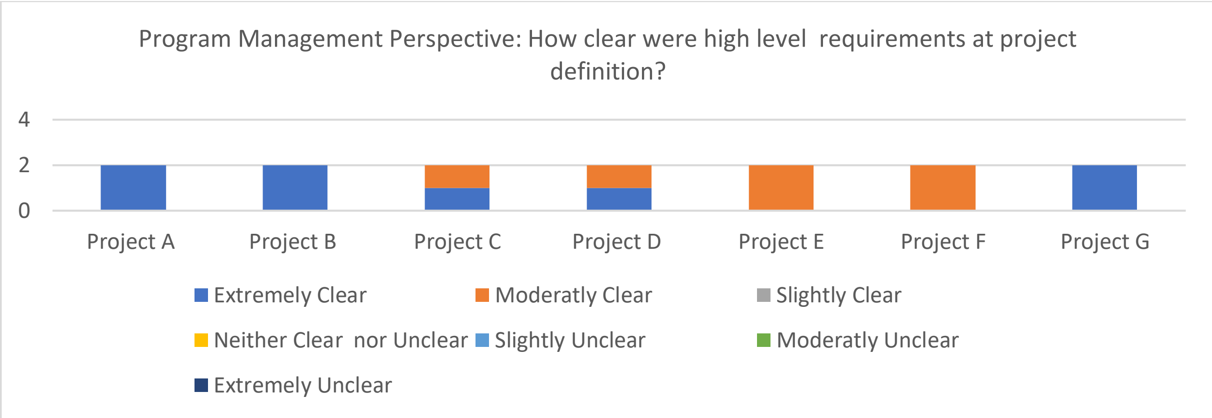

Figure 4.3.10.2. Clarity of high level requirements; Program Management perspective

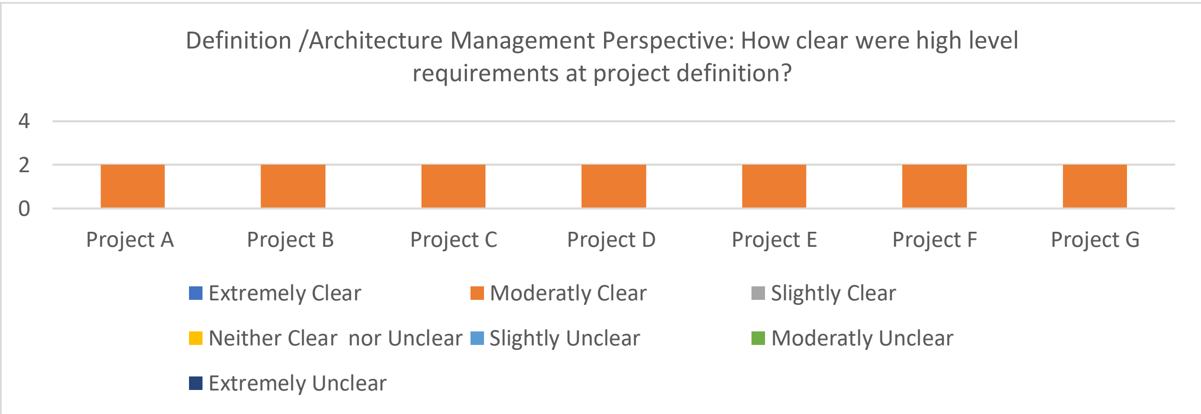

Figure 4.3.10.3. Clarity of high level requirements; Definition/Architecture Management perspective

4.3.10.3 Availability of required resources for requirements gathering survey results and analysis

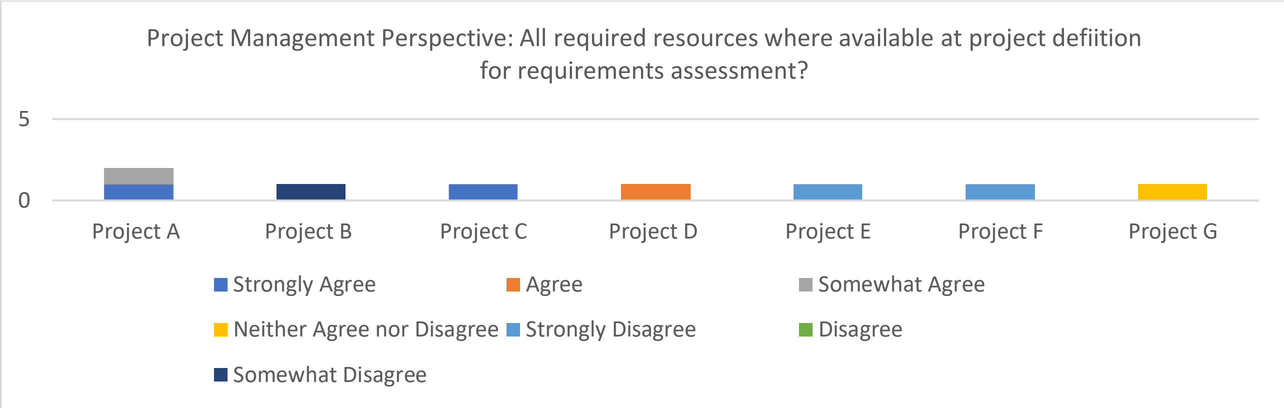

Figure 4.3.10.4. Resource availability; Project Management perspective

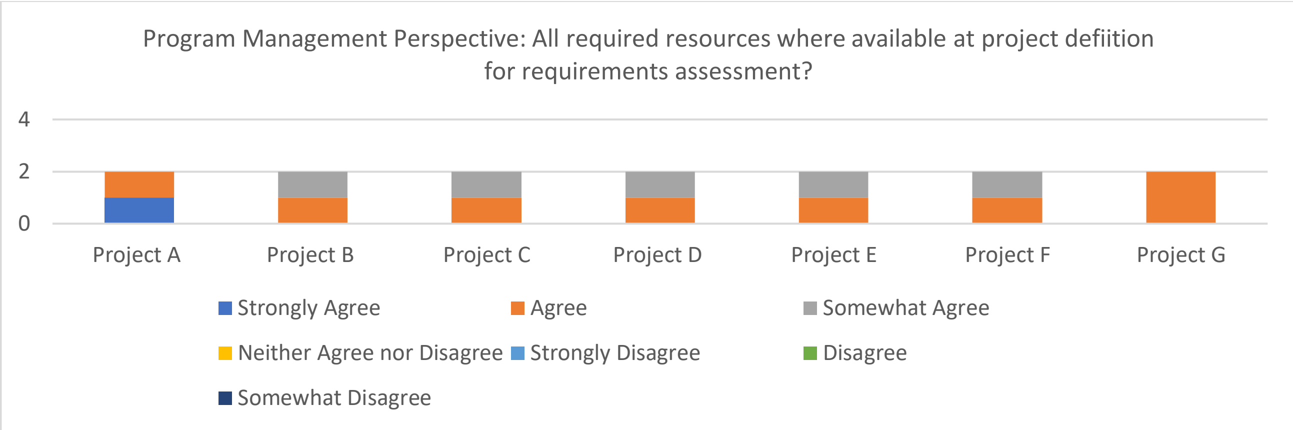

Figure 4.3.10.5. Resource availability; Program Management perspective

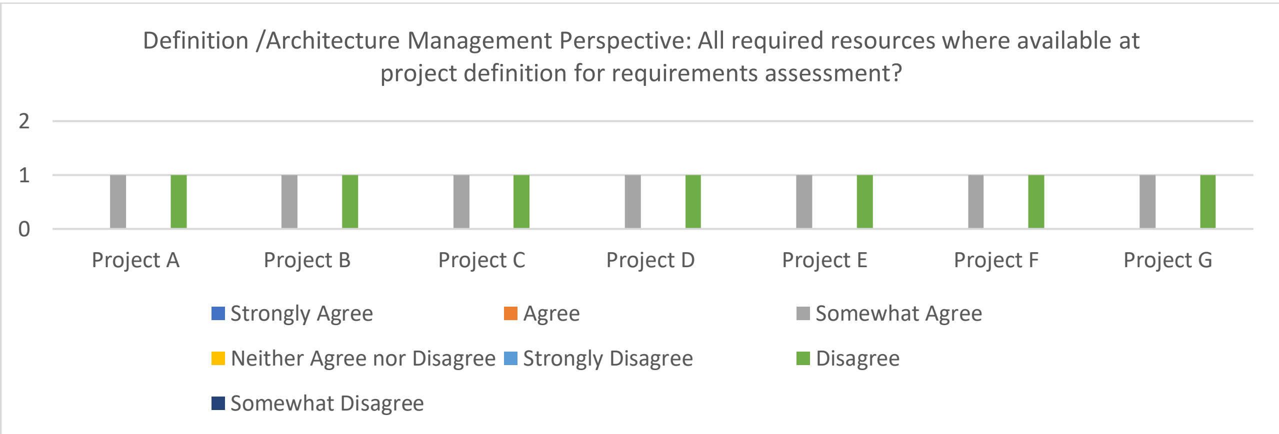

Figure 4.3.10.6. Resource availability; Definition/Architecture Management perspective

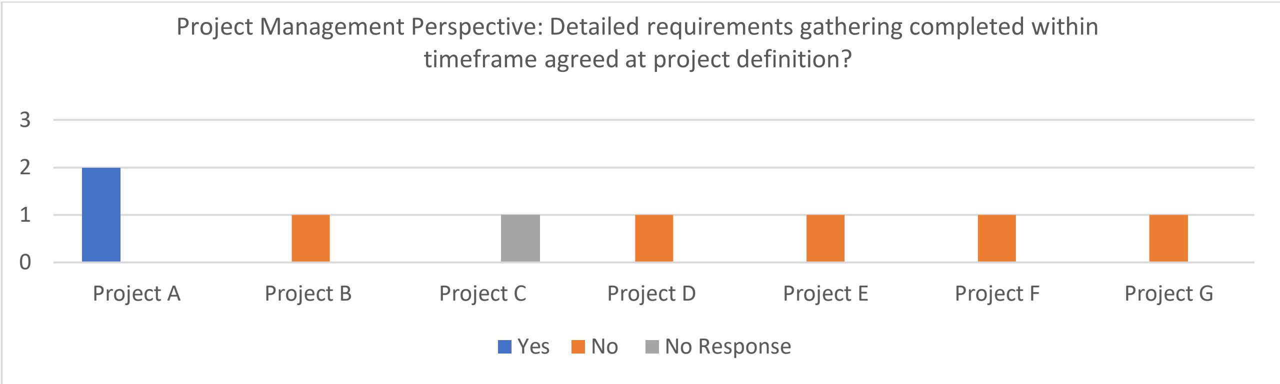

Figure 4.3.10.7. Detailed requirements gathering; Project Management perspective

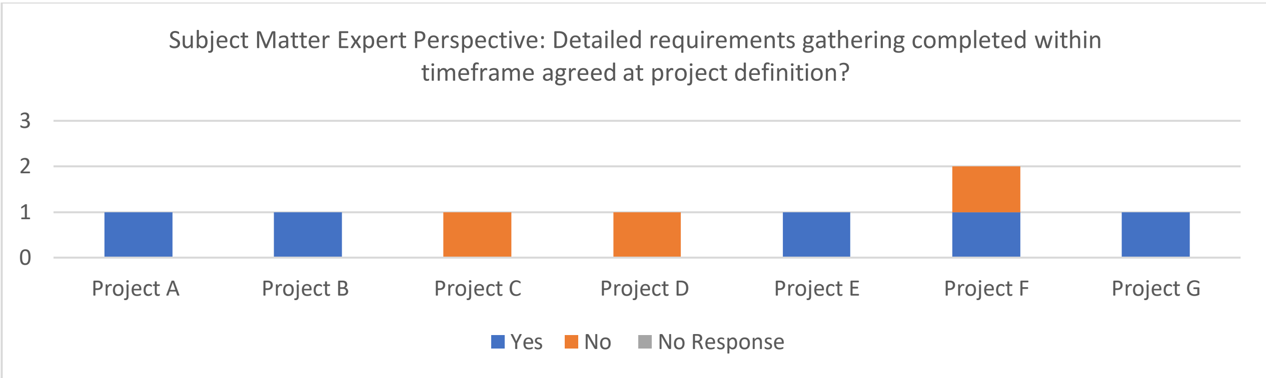

Figure 4.3.10.8. Detailed requirements gathering; Subject Matter Expert perspective

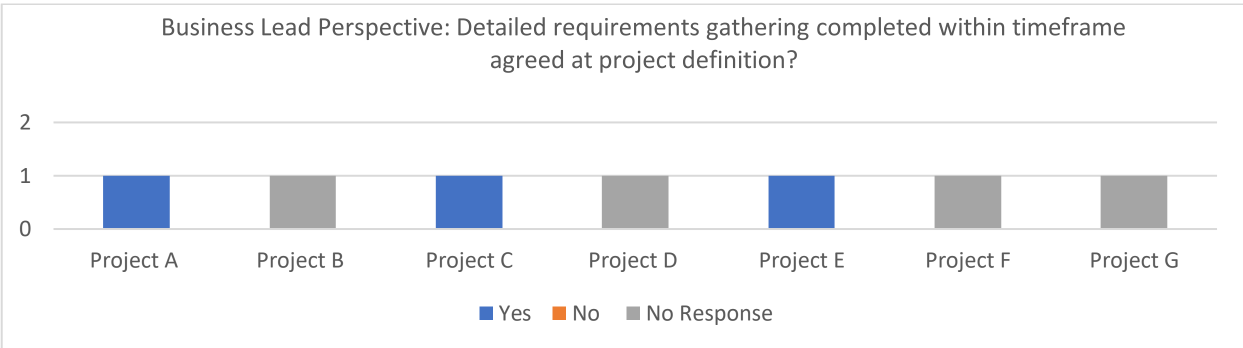

Figure 4.3.10.9. Detailed requirements gathering; Business Lead perspective

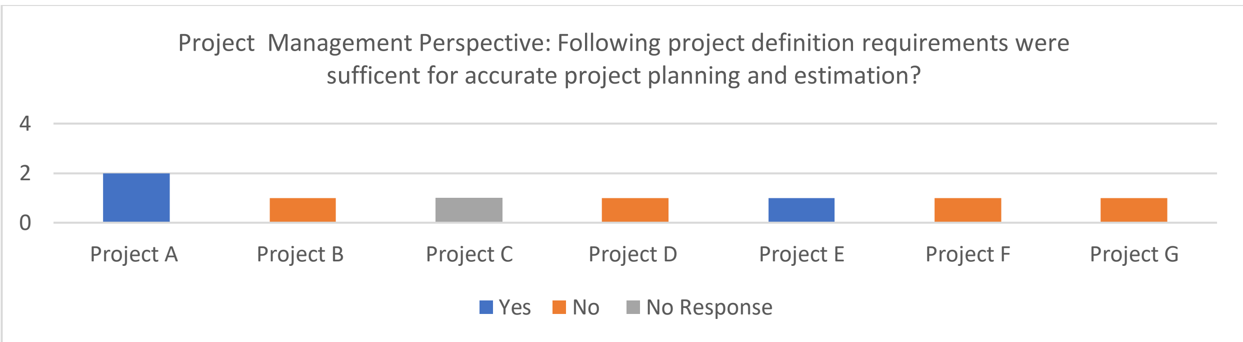

Figure 4.3.10.10. Requirements Planning and Estimation Project Management perspective

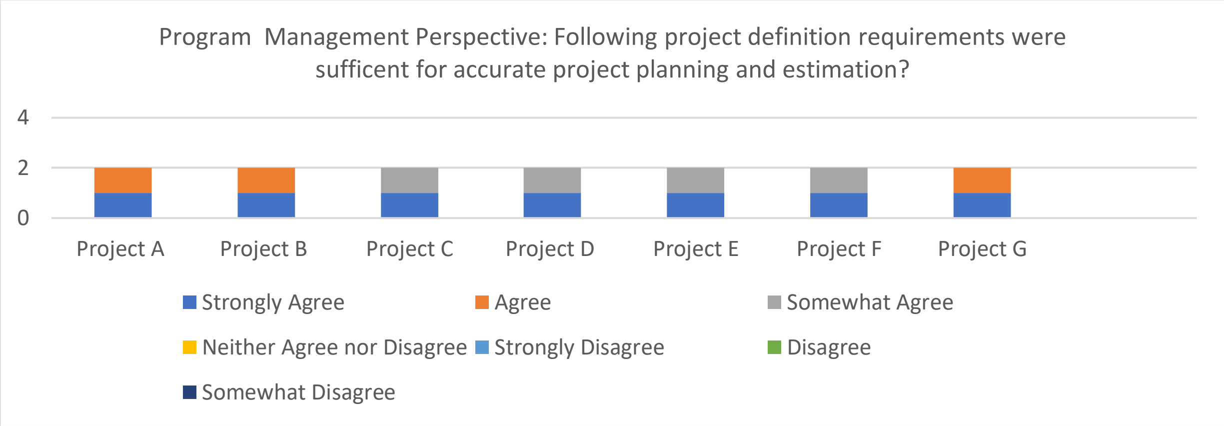

Figure 4.3.10.11. Requirements Planning and Estimation Program Management perspective

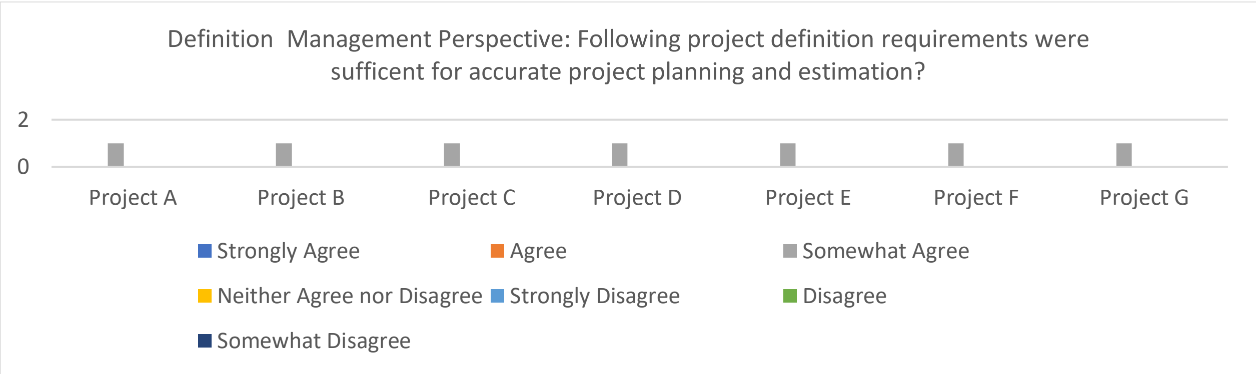

Figure 4.3.10.12. Requirements Planning and Estimation Definition /Architecture Management perspective

4.3.11.1 Stakeholder participation and input success factor

Kappleman et al. (2006) listed inadequate stakeholder input as the number three contributor to IT project failure. Standish Group (2015) in their annual CHAOS Report on project failure listed incomplete requirements as the number two contributor to project failure and the number one contributor to challenged IT projects. Unreliable requirements account for 39% of projects that are deemed failures (Project Management Institute,2017). Muller and Jugdev (2012) point out that success factors in the future will be impacted by the quality of teamwork between project, operational and executive management along with the traditional metrics of time, cost and quality in order to align project success with organisational success. Nguyen et al. (2015) proposed that perception of success might be based on the expectations stakeholders have of the benefits of a project.

Jetu and Riedl (2012) placed significant value on project managers meeting with stakeholders to agree expectations and areas of concern. Jetu and Riedl (2012) targeted stakeholder satisfaction as a key success factor in IT projects. Based on these theories the questions below were asked of respondents.

4.3.11.2 Stakeholder identification survey results and analysis

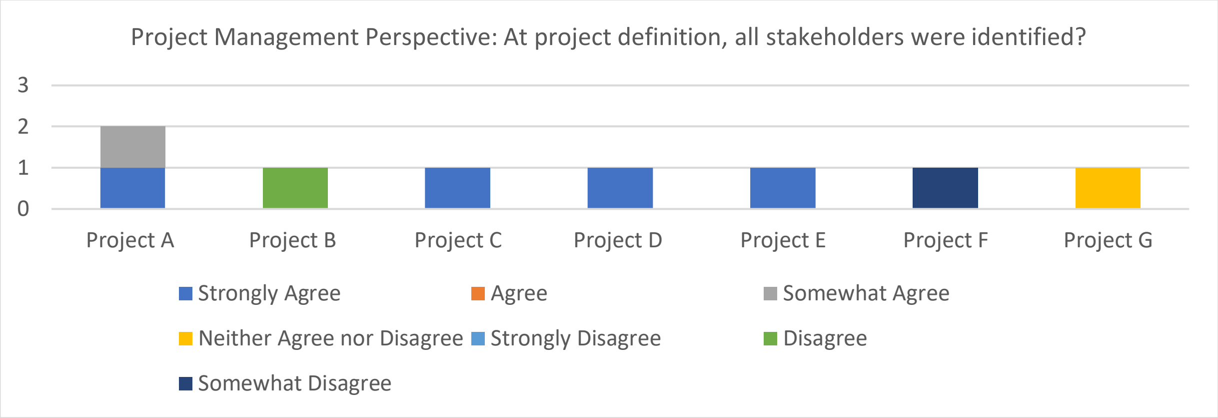

Figure 4.3.11.1. Stakeholder identification: Project Management perspective

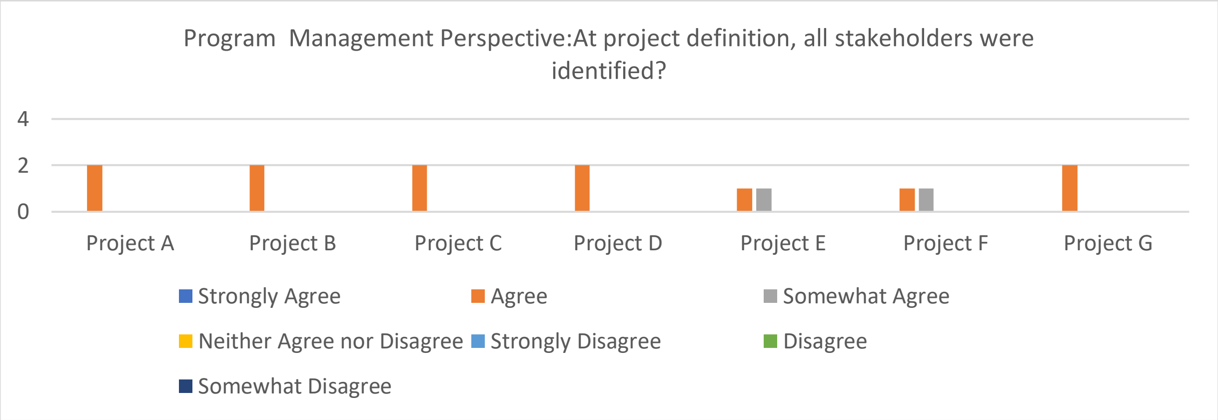

Figure 4.3.11.2. Stakeholder identification: Program Management perspective

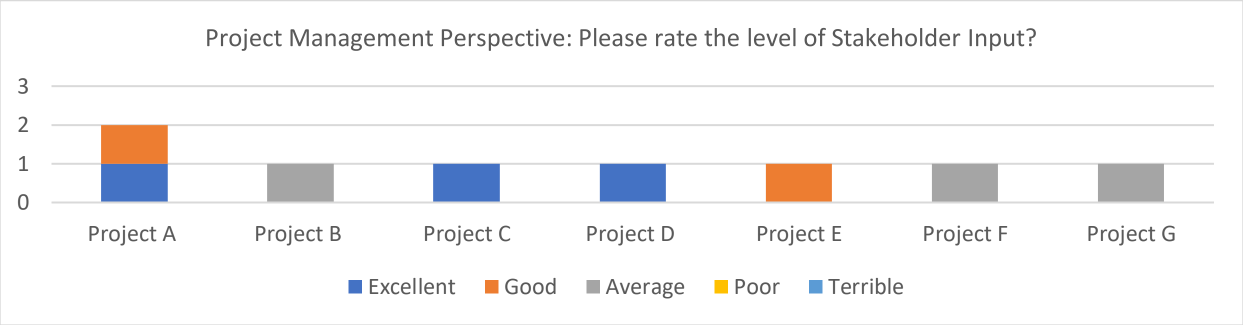

Figure 4.3.11.3. Stakeholder input: Project Management perspective

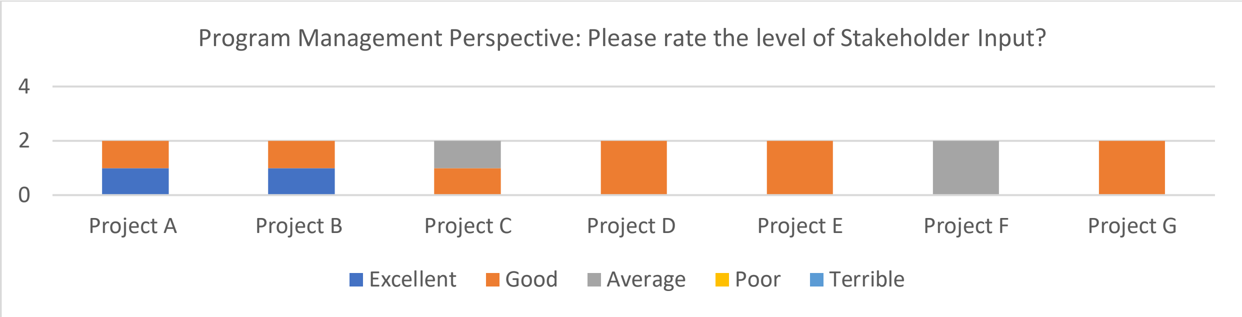

Figure 4.3.11.4. Stakeholder input: Program Management perspective

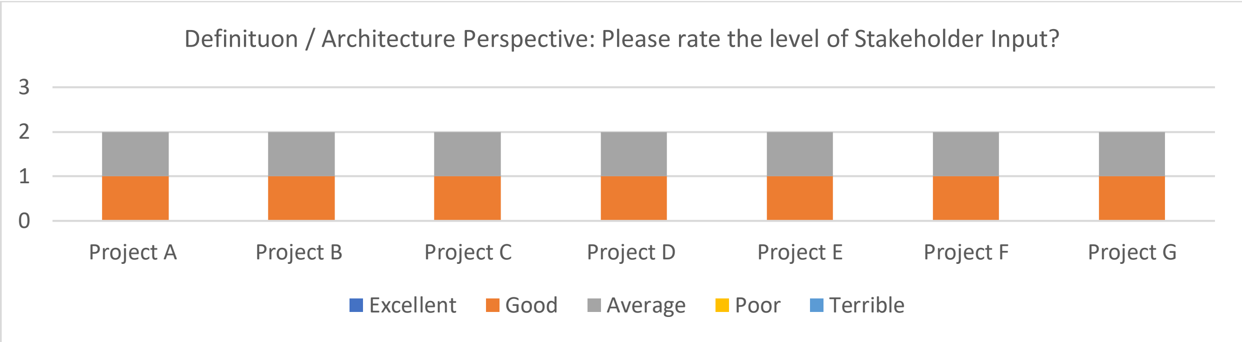

Figure 4.3.11.5. Stakeholder input: Definition /Architecture Management perspective

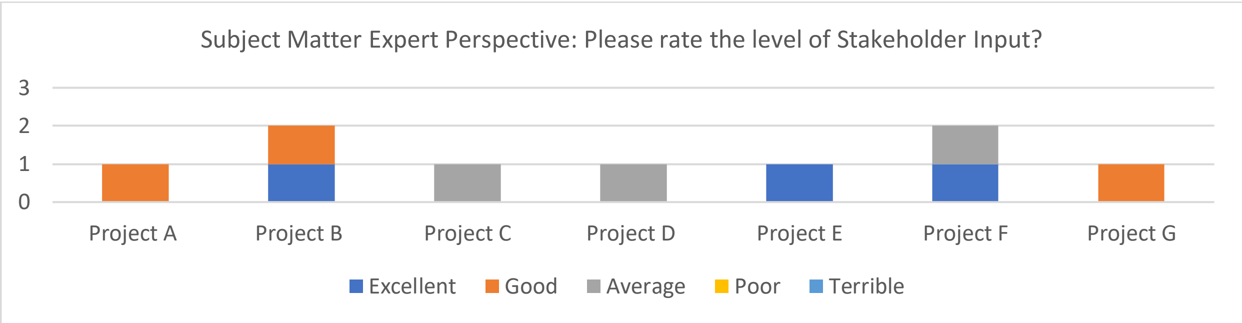

Figure 4.3.11.6 Stakeholder input: Subject Matter Expert perspective

4.3.12.1 Resource scheduling and capacity as success factor

The Project Management institute, (2017) in survey 3,234 Project Managers highlighted that overscheduling of resources accounts for 22% of project failures. Based this literature the questions below were formulated.

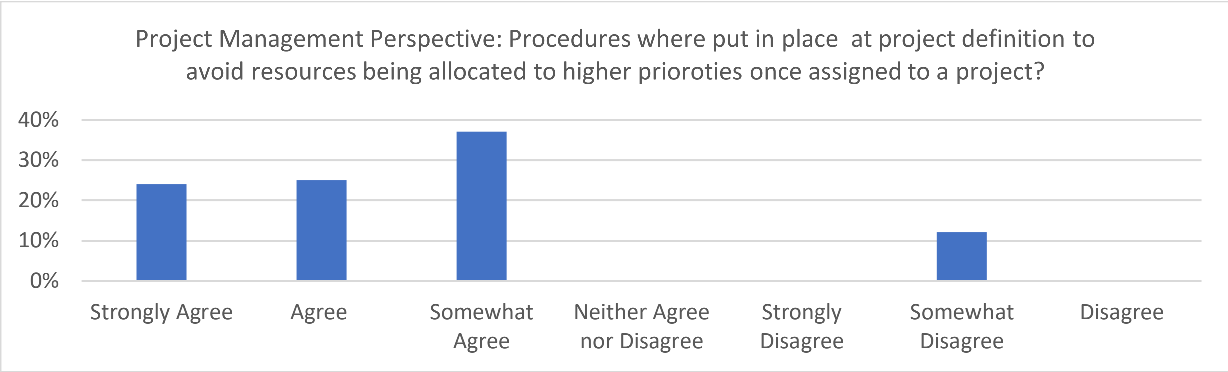

Figure 4.3.12.1. Resource Scheduling: Project Management perspective

4.4 Summative Data

Summative data was measured by planned estimates determined in project definition against actual time, costs and functionality required to successfully deliver projects. Estimates are structured using project phases of Design, Build, Test (System Testing and System Integration Testing, User Acceptance Testing, and Regression Testing), Training, Deployment and Support.

4.4 1: Summative Data for Project A

Project Description: Continuous delivery of operational changes with individual estimate of no more than twenty days effort.
Summary Findings: Additional design required impacted budget. Overall project delivery was seamless with no significant production /live environment defects. The Uplift in staff and partner rates also contributed to budget overrun. Project timeline achieved as per plan.

Methodology	Waterfall
Planned Start/Finish Date	01/09/2017-21/09/2018
Actual Start /Finish Date	01/09/2017-21/09/2018

	Cost		**Variance**	**Time**		**Variance**
	Planned	Actual		Planned	Actual	
Project Management	124,000	143,000	+14%	51.0	51.0	+0%
Design	466,000	330,400	-29%	16.0	18.0	+11%
Build	363,000	258,000	-29%	20.0	22.0	+10%
Test-SIT	271,000	219,000	-19%	12.0	12.0	+0%
Test-UAT	202,000	175,000	-13%	12.0	14.0	+16%
Test-Performance	-	-	-	-	-	-
Test-Regression	12,000	6,400	-53%	4.0	1.5	-73%
Training	15,000	17,000	+12%	1.0	1.0	+0
Deployment	34,000	37,800	+11%	1.0	1.0	+0%
Support	40,000	38,000	-9%	4.0	4.0	+0%
Overall	1,527,000	1,225,650	-19%	132.0	135.0	+9%

4.4.2 Summative Data for Project B

Project Description: Enable flexible payment date choice for billing of utility customers. Summary Findings: Additional design required impacted budget. Overall project delivery was seamless with no signification production /live environment defects. Uplift in staff and partner rates also contributed to budget overrun. Project timeline achieved as per plan.

Methodology	Waterfall
Planned -Finish Dates	01/09/2017-23/03/2018
Actual-Finish Dates	01/09/2017-13/04/2018

	Cost		**Variance**	**Time**		**Variance**
	Planned	Actual		Planned	Actual	
Project Management	46,000	14,500	-31%	28.0	30.0	+7%
Design	66,506	112,781	+41%	12.0	14.0	+15%
Build	31,388	47,634	+35%	2.0	2.0	+0%
Test-SIT	91,138	52,701	-43%	2.0	5.0	+60%
Test-UAT	50,783	65,465	+14%	7.0	3.0	-60%
Test-Performance	-	-	-	-	-	-
Test-Regression	-	-		-	-	-
Training	-	-	-	-	-	
Deployment	11,482	12,703	+9%	1.0	1.0	+0%
Support	15,703	9,100	-40%	4.0	7.0	+43%
Overall	313,000	344,884	+10%	57.0	62.0	+9%

4.4.3: Summative Data for Project C

Project Description: Delivery of automation of payments to broker vendors in order to gain additional market share.

Summary Findings: Technical contention with other projects lead to the project being delayed by eleven weeks. As a result delays during the build of the project was delivered 2.5 months late at a cost of @circa 20K over budget.

Methodology	Waterfall
Planned -Finish Dates	01/09/2017-25/10/2018
Actual Start -Finish Dates	01/09/2017-27/09/2018

	Cost		**Variance**	**Time**		**Variance**
	Planned	Actual		Planned	Actual	
Project Management	135,000	163,615	+18%	51.0	51.0	+0%
Design	278,922	298,500	+7%	16.0	18.0	+12%
Build	219,282	224,700	+2%	20.0	22.0	+10%
Test-ST/SIT	84,900	182,940	+54%	12.0	12.0	+0%
Test-UAT	25,700	67,910	+63%	12.0	14	+17%
Test-Performance	-	-	-	-	-	-
Test-Regression	-	-	-	-	-	-
Training	-	-		-	-	
Deployment	24,913	17,497	-27%	4.0	4.0	+0%
Support	20,500	23,252	+13%	3.6	12.0	+70%
Overall	788,217	978,415	+20%	123.0	135.0	+9%

4.4.4: Summative Data for Project D

Project Description: Delivery of changes to facilitate upgrade in operating systems from AIX to Linux.

Summary Findings: Originally project consisted of two separate deliveries, however it was discovered following project definition that synergies in build, testing and deployment could be achieved by delivering both projects together in one work package.

Methodology	Waterfall
Planned Start-Finish Dates	01/09/2017-28/07/2018
Actual Start Date	01/09/2017-29/08/2018

	Cost		**Variance**	**Time**		**Variance**
	Planned	Actual		Planned	Actual	
Project Management	67,000	88,000	+23%	42.0	50.0	+16%
Design	36,000	48,600	+25%	5.0	6.0	+17%
Build	312,000	307,000	-2%	24.0	20.0	-17%
Test-ST/SIT	265,000	214,000	-19%	6.0	6.0	+0%
Test-UAT	140,000	114,000	-18%	5.0	5.0	+0%
Test-Performance	38,000	34,000	-11%	2.0	3.0	+44%
Test-Regression	38,000	27,000	-29%	2.0	2.0	+0%
Training	-	-	-	-	-	-
Deployment	16,000	24,800	+34%	1.5	1.6	+7%
Support	38,000	38,400	+1%	4.0	4.0	+0%
Overall	950,000	896,500	-6%	91.5	97.6	+7%

4.4.5: Summative Data for Project E

Project Description: Delivery of changes to support competitiveness in energy services and smarter living environments.

Summary Findings: With the acceptance of a change request by the project board, the scope was reduced, the change request proposed to deliver all changes in scope excluding the ERP-Digital Integration to connect the organisations main systems to their E-commerce platform.

Methodology	Waterfall
Phase	Quarter 1 2018-Quarter 4 2018
Planned Start-Finish Dates	08/01/2018-03/11/2018
Actual Start -Finish Dates	08/01/2018-12/12/2018

	Cost		**Variance**	**Time**		**Variance**
	Planned	Actual		Planned	Actual	
Project Management	93,000	79,599	-16%	39.0	52.0	+25%
Design	273,240	304,338	+11%	12.0	20.0	+40%
Build	182,182	191,246	+5%	12.0	16.0	+25%
Test-ST/SIT	140,140	128,708	-8%	12.0	12.0	+0%
Test-UAT	27,000	70,421	+62%	12.0	14.0	+0%
Test-Performance	10780	32,924	+67%	3.0	3.0	+0%
Test-Regression	3,780	21,462	+83%	1.0	1.0	+0%
Training	10,780	27,050	+61%	1.0	2.0	+50%
Deployment	2,695	6,085	+56%	1.0	1.0	+0%
Support	32,340	41,636	+22%	4.0	4.0	+0%
Overall	775,937	903.470	+16%	97.0	125.0	+22%

4.4.6: Summative Data for Project F

Project Description: Delivery of changes to regulatory customer information campaign.
Summary Findings: Initial design was incorrect due to ambiguous requirements, hence solution failed UAT, and redesign of solution had to completed which delayed final go live, meaning resourcing were required on a more long term basis than was originally planned for.

Methodology	Waterfall
Planned Start-Finish Dates	04/06/2018-25/10/2018
Actual Start -Finish Dates	04/06/2018-31/12/2018

	Cost		**Variance**	**Time**		**Variance**
		Actual		Planned	Actual	
Project Management	12,400	76,125	+84%	15.0	25.0	+40%
Design	13,010	25,911	+48%	3.5	9.0	+58%
Build	20,100	82,614	+76%	3.0	8.0	+63%
Test-ST/SIT	25,500	59,552	+58%	6.0	5.0	-17%
Test-UAT	17,500	24,475	+30%	3.0	2.0	-33%
Test-Performance	-	-	-	-	-	-
Test-Regression	-	-	-	-	-	-
Training	-	-	-	-	-	-
Deployment	5.500	10,125	+50%	1.0	1.0	+0%
Support	9,250	1,400	-85%	3.0	6.0	+50%
Overall	103,260	280,202	+64%	34.0	56.0	+40%

4.4.7: Summative Data for Project G

Project Description: Delivery of regulatory changes to facilitate upgrade of Gas Market communications systems.

Summary Findings: No initial design workshops were executed to gather requirements with the result that the project had to accept three CR's to facilitate requirements discovered in design and build of the systems.

Methodology	Waterfall
Planned Start-Finish Dates	09/07/2018-25/10/2018
Actual Start Date	09/07/2018-02/02/2019

	Cost		Variance	Time		Variance
		Actual		Planned	Actual	
Project Management	8,000	8000	+0%	21.0	30.0	+30%
Design	13,875	11,427	-16%	2.0	3.2	+40%
Build	19,337	26,693	+27%	3.0	4.6	+35%
Test-ST/SIT	18,712	19,952	+7%	6.5	4.2	-36%
Test-UAT	14,512	18,935	+23%	5.0	2.6	-52%
Test-Performance	-	19,498	+100%	12.5	12.5	+0%
Test-Regression	-	-	-	-	-	-
Training	-	-	-	-	-	-
Deployment	500	500	+0%	1.0	1.0	-0%
Support	5,812	1,400	-76%	3.0	2.5	-17%
Overall	80,748	105,005	+24%	54.0	60.0	+9%

4.5 Conceptual Framework Summary Analysis and Findings

The tables below shows a generalised view of the success conditions extracted from literature, triangulated against generalised observations from the survey data in section 4.3 categorised into high, moderate and low usage at project definition. The variance for cost and time are then overlaid against each project to establish correlations between these three criteria.

Table 4.5.1. Conceptual Framework (Cost)

Success Condition	Project A	Project B	Project C	Project D	Project E	Project F	Project G
Project Management Strength	H	H	H	H	H	H	H
Change Control	H	H	H	H	M	L	H
Availability of Business Case	N	Y	Y	Y	N	N	N
Risk Management Procedures	H	H	H	H	M	M	M
Executive Level Support	H	H	H	H	L	L	H
Clear Goals and Objectives	H	H	H	H	L	L	H
Clear Requirements	H	L	H	H	L	L	M
SME Resource Availability	H	H	H	H	L	L	H
Accuracy of Estimation	H	L	H	H	L	L	H
Stakeholder Input	H	L	H	H	L	L	H
Resource Capacity	H	H	H	H	L	L	M
Phase Variances							
Design	-29%	+41%	+7%	+25%	+11%	+48%	-16%
Build	-29%	+35%	+2%	-2%	+5%	+76%	+27%
SIT Test	-19%	-43%	+54%	-19%	-8%	+58%	+7%
Regression Test	-53%	-	-	-29%	+83%	-	
UAT Test	-13%	-18%	+63%	-18%	+62%	+30%	+23%
Performance Test	-	+14%	-	-11%	+67%	-	+100%
Training	+12%	-	-		+61%	-	
Deployment	+11%	+9%	+27%	+34%	+56%	+50%	+0%
Support	-9%	-40%	+13%	+1%	+22%	-85%	-76%
Overall Variance	-19%	+10%	+20%	-6%	+16%	+64%	+24%

Table 4.5.2. Conceptual Framework Analysis (Time)

Success Condition	Project A	Project B	Project C	Project D	Project E	Project F	Project G
Project Management Strength	H	H	H	H	H	H	H
Change Control	H	H	H	H	M	L	H
Availability of Business Case	N	Y	Y	Y	N	N	N
Risk Management Procedures	H	H	H	H	M	M	M
Executive Level Support	H	H	H	H	L	L	H
Clear Goals and Objectives	H	H	H	H	L	L	H
Clear Requirements	H	L	H	H	L	L	M
SME Resource Availability	H	H	H	H	L	L	H
Accuracy of Estimation	H	L	H	H	L	L	H
Stakeholder Input	H	L	H	H	L	L	H
Resource Capacity	H	H	H	H	L	L	M
Phase Variances							
Design	+11%	+15%	+12%	+17%	+40%	+58%	-40%
Build	+10%	+0%	+10%	-17%	+25%	+63%	+35%
SIT Test	+0%	+60%	+0%	+0%	-0%	-17%	-36%
Regression Test	-73%	-	-	+0%	+0%	-	+0%
UAT Test	+16%	-60%	+17%	+0%	+0%	-33%	-52%
Performance Test	-	-	-	+44%	+67%	-	+0%
Training	+0%	-	-	-	+50%	-	-
Deployment	+0%	+0%	+0%	+7%	+0%	+0%	+0%
Support	-0%	+43%	+70%	+0%	+0%	+50%	-17%
Overall Variance	+9%	+9%	+9%	+7%	+22%	+40%	+9%

This section provides a triangulation of the arguments found in the reviewed literature, the observations from the survey data reviewed in section 4.3 and summative data captured following project closure.

4.5.3 Project A Findings

The summative data listed in table 4.4.1 notes summary findings as "Additional design required impacted budget. Overall project delivery was seamless with signification production /live environment defects. Uplift in staff and partner rates also contributed to budget overrun. Project timeline achieved as per plan." The empirical data shows little difference from the planned versus actual estimates between definition and subsequent project phases of a positive value of 19% for cost and +9% for time. As this project delivered operational changes in a continuous delivery model, the project received significant customer engagement and this was supported by the survey data outlined section 4.3. The contribution of this project to ongoing operational competitiveness was clear to all stakeholders as its function of delivering ongoing operational change receives significant support from executive level management. Given the fact that changes are smaller due its continuous delivery approach, requirements are gathered in an iterative fashion which reduces ambiguity and complexity. The perception of alignment to strategic goals and limited impacts on operational processes means that this project is often perceived favourably by end users and senior management.

The perceived success of this project does confirm a number of arguments found in the literature. Atkinson (1999) argued the alignment to strategic goals as a key condition for project success, based on the evidence provided by survey and summative data for Project A, it would seem that this is a key condition to perceived project success. This is also critical to ensuring that the project receives the required levels of executive level support which in turn ensures adequate resource allocation, stakeholder engagement and input at project definition as argued by various scholars in the literature (Kappleman et al., 2006; Project Management Institute,2017; Standish Group 1994-2015). Additionally, as resources are allocated at an early stage this ensures that requirements are validated on an ongoing and iterative basis, even though this project is executed utilising a waterfall methodology it utilises elements of the agile methodology to refine requirements in an iterative manner. This was confirmed by "Project Manager A" when they stated "Requirements were gathered via a number of dedicated teams iteratively and incrementally." This would seem to have resulted in the project delivering changes in line with objectives, timeframe and cost agreed at project definition, which lends support to the arguements of Balaji and Murugaiyan (2012) in which they argued that iterative development can provide the closest alignment between requirements and the end product that was put forward. This point also highlights the fact hybrid approaches to software development can be highly effective in delivering software products.

4.5.4 Project B Findings

The summative data listed in section 4.4.2 notes summary findings as “Additional design required impacted budget. Overall project delivery was seamless with no significant production /live environment defects. The Uplift in staff and partner rates also contributed to budget overrun. Project timeline achieved as per plan.” The fact that resources were not available at project definition was observed by project management in the survey as a contributing factor to overruns in the design phase. “Project Manager B” stated “Estimates were based on initial requirements, however a lack of specificity around requirements led to additional days in the design of the project. This was driven by the business need for additional requirements (and scope), identified during the detailed design phase. Early engagement could have assisted in preventing the additional design days that were required as a result of the additional requirements identified during detailed design.” The lack of specificity potentially accounted for a negative 41% variance and a similar variance for build of 35%. Following this the project was delivered in a seamless manner with only a 10% variance on cost and 9% on time. Additional time was allocated to support due to initial billing of customers that availed of new functionality. Similar to Project A, this project confirms the arguments in the literature for having required levels of executive level support and in turn stakeholder engagement at an early stage of the project to avoid scope creep (Kappleman et al. ,2006;Project Management Institute,2017 Standish Group 2015).

4.5.5 Project C Findings

The summary findings note in section 4.4.3 for Project C in the summative data stated “Technical contention with other projects lead to the project being delayed by eleven weeks. As a result of delays during build the project delivered 2.5 months late at a cost of @circa 20K over budget.” Interestingly, this view was not reflected in the Project Management perspective in section 4.3 but was noted by Internal Program Management, Subject Matter Experts and Business Leads. Additionally, the variances highlighted by the summary findings in the summative data do not appear to have been integrated into the summative data which would highlight that that these figures might need to be challenged. The variances of negative 70 % for support from a time perspective would appear to point to the difficulty in understanding the complexity of the solution delivered. The "Subject Matter Expert for Project C" did note that there was a lack of understanding of the complexity that the high-level requirements requested. It would appear that this translated into the system that was delivered based on the sizeable variance in post go-live support costs. Brooks (1995) highlighted this potential pitfall in not addressing complexity and it would appear that Project C confirmed this assessment and this impacted negatively throughout the entire project lifecycle.

4.5.6 Project D Findings

The summary findings in section 4.4.4 for Project D in the summative data stated "Originally project consisted of two separate deliveries, however it was discovered following project definition that synergies in build, testing and deployment could be achieved by delivering both projects together in one work package." Due to the decision to combine various releases the project did not suffer significant variances overall. Project Management in this project displayed the flexibility and adaptability to respond to ongoing change and deliver a solution with the original time, cost and quality agreed at project definition. As noted in the research of Stoica and Brouse (2014), project management success requires a level of adaptability, flexibility and collaboration to manage complex interaction between different stakeholders associated with a given project. The importance of this would appear to be confirmed by Project D and the ability of Project Management to get agreement from the various stakeholders on the different approach. However, this does also highlight a lack of overall planning from a Portfolio Management perspective in not identifying potential scheduling risks associated with contention with other projects on the landscape at the same time which has been highlighted as an early warning sign of project failure in the works of Kappleman et al.(2006).

4.5.7 Project E Findings

Summary Findings in section 4.4.6 for Project E stated "With the acceptance of a change request by the Project Board, the scope was reduced, the change request proposed to deliver all changes in scope excluding the ERP-Digital Integration to connect the organisations main systems to their E-commerce platform.", the summative data also highlights a 40% variance in design and with regard to the time criteria also a 22% negative variance for the project overall for time and a 16% negative variance for cost. In the survey responses, the "Project Manager" for this project stated the reasons for this as "Part-time Business Analyst, lack of technical resources, context switching of resources." It would appear this poor understanding of requirements resulted in wasted time in design and ultimately the introduction of the change request to reduce scope. The validation of scope and refinement of requirements is highlighted by various sources as key to ensuring project success (Brooks,1995, Kappleman et al., 2006; Project Management Institute, 2017; Standish Group, 1994-2015). The fact that estimates were not validated at definition had serious consequences for subsequent project phases would certainly have resulted in the perception of this project being regarded as challenged. Additionally, the fact that no business case was available may have prevented the possibility of additional funding required to deliver the initially agreed scope, this had been documented as an early warning sign of project failure in the existing literature by Kappleman et al .(2006) and conversely a blocker to project success.

4.5.8 Project F Findings

Summary Findings in section 4.4.6 for Project E stated, "Initial design was incorrect due ambiguous requirements, hence the solution failed UAT, and redesign of solution had to be completed which delayed final go live, meaning resources were required on a more long term basis than was originally planned for." The sizeable variances in the early stages of this project of 58% for design and 63% for build from a time perspective, and 48% and 76% for design and build perspective for cost suggest that this project suffered particularly as a result of poor requirements validation, executive level support , stakeholder involvement and resource allocation at the early stages of the project. At varying points of the survey, all of these factors were highlighted as contributing to an overall variance of 60% for cost and 40% for time between planned and actual definition estimates following project outcome. "Project Manager F" stated "Resources were not in place to gather requirements. Relevant stakeholders did not sit together during definition. Ultimately requirements were foisted upon separate teams." "Subject Matter Expert" for Project F stated "Requirements were high-level which, on further analysis, proved to be lacking. This ultimately made a mockery of project planning." More than any other project surveyed, this project confirms the arguments in the literature that lack of focus on these success conditions will lead to project failure. Based on this evidence it would appear that executive level management was not actively engaged and this generally accounts for 62% of successful projects (Project Management Institute, 2017). Requirements were lacking and this fact accounts for 39% of failed projects and this project suffered from lack of stakeholder engagement which is listed in the top three reasons for project failure (Kappleman et al., 2006; Project Management Institute, 2017; Standish Group 2015).

4.5.9 Project G Findings

The summary findings in section 4.4.7 for Project G were stated as "No initial design workshops were executed to gather requirements with the results that the project had to accept three CR's to facilitate requirements discovered in design and build of the systems. This project showed an overall variance of negative 9%, however, the lack of a definition process meant that large variances were observed in the design and build phases of the project. As this was a key regulatory project key resources were allocated as opposed to the situation observed in Project E and F. Key resources defined requirements in a clear and concise manner which required a higher amount of time to be spent in preparation, however this time was recovered in subsequent project phases. This evidence lends support to the argument of Brooks (1995) who argued that reducing complexity gives projects the best possible chance of success. This project lends further support to the literature (Kappleman et al., 2006; Project Management Institute, 2017; Standish Group 2015) that Executive Level Support and access to correct resources is a key contributor to project success.

5 Conclusions and Future Work

5.1 Introduction

The main objective of this research was to determine the impact of the use of known conditions for IT project failure and success at project definition on subsequent design, build, test phases of IT projects and ultimately project outcome.

This research utilised a conceptual framework which examined existing literature to extract known conditions for IT project failure and success. This research highlighted a number of key success conditions for IT Projects which are listed below with reference to the research in question:

- Project Management Strength (Cooke-Davies, 2002; Kappleman et al., 2006; Petter et al.,2013; Standish Group, 2015; Klein et al., 2015; Stoica and Brouse, 2014)
- Adherence to Change Control (Kappleman et al., 2006; Project Management institute, 2017.)
- Availability of Business Case (Kappleman et al.,2006;)
- Risk Management Procedures (Liu, 2015; Tams & Hill, 2015; Carvalho & Rabechini, 2015; Hartono et al., 2014; Janssen et al., 2015)
- Application of Lessons Learned (Charette, 2005)
- Executive Level Support (Kappleman et al., 2006; Project Management Institute, 2017; Standish Group 1994-2015)
- Clear Goals, Objectives, and Requirements (Atkinson, 1999, Brooks,1995; Dvir et al., 2003; Kappleman et al., 2006; Kendrick 2015; Mirza et al., 2013; Project Management Institute, 2017; Standish Group, 1994-2015)
- Estimation and Planning (Eveleens and Verhoef, 2009)
- Stakeholder Participation and Input (Brooks,1995; Hornstein 2015; Jetu and Riedl, 2012; Mazur and Pisarski, 2015;Mishra & Mishra, 2013; Muller and Jugdev, 2012; Radu et al., 2014)
- Resource Scheduling (Kappleman et al., 2006; Project Management Institute, 2017)

The above success conditions were utilised to build survey questions from which observations could be established on a number of perspectives involved in the project definition process. Following this the use of known success conditions at project definition could be examined against the backdrop of the variances observed between planned and actual estimates at project execution to identify any correlation between their use and observed variances.

Summary findings and recommendations will be proposed that will potentially allow for this framework to measure the use of these conditions at project definition in other IT projects to assess their impact on subsequent project phases. The limitations of the research will then be discussed along with any future research that this paper may present opportunities for. Finally, the contribution of this research to the field will be discussed.

5.2 Summary of Conceptual Framework Findings

The conceptual framework presented in chapter 4 analysed the impact of the use of key IT project success conditions extracted from literature against the perceptions observed in the survey data and the impact this use had on the variances outlined in the design, build, test, deployment, and transition activities and overall project outcome.

Based on conceptual framework findings analysis discussed in Chapter 4, a summary of the key points are discussed below.

- Project management flexibility, adaptability and responsiveness are key to project success.
- Risk Management procedures should not only be applied to project execution but also at project definition to identify risks associated with assumptions.
- Definition of change control processes are needed but vigilance of their effectiveness is required.
- A well-documented and agreed business case provides IT projects with clear goals and objectives.
- Executive level support is key to securing the most sought after resources along with required funding and engagement levels.
- Incomplete requirements and stakeholder engagement can be a symptom of lack of executive level support.
- Stakeholder engagement at project definition is key to reduce the impact of poorly defined requirements on subsequent project phases.
- Stakeholder selection should be based on skill and experience in the subject matter area in order to secure the best quality of input.

- Subject Matter Experts should be allocated specifically at project definition to support the definition and validation of requirements and estimates.
- Estimation and planning deviations should be integrated into project definition estimates especially for new technology projects.
- Context switching between projects can lead to lack of focus and quality.

5.3 Recommendations

The recommendations are based on the literature and findings from the previous chapters.

- *Appoint Project Managers based on project classification*

Although proper project management frameworks and processes are important, some projects call for certain levels of flexibility and adaptability in order to give these projects the best possible chance of success. As argued by Stoica and Brouce (2014) flexibility, adaptability and the application of soft skills are success factors in project management. With reference to the survey data, Project C had difficulty in translating complex technology constraints to business language to aid in understanding denoting a lack of flexibility. With reference to Project D and E Project Managers were able to take corrective action that rescued these projects for complete failure. Given this evidence, it would be recommended that a key activity for project definition would be to allocate flexible and adaptable project managers to projects where requirements are complex and not well understood in order to respond in an effective manner to constant change and communicate complex technical problems concisely to all stakeholders.

- *Define risk management procedures for project definition*

In a number of projects surveyed in Chapter 4, lack of executive management support , lack of required resources, lack of engagement, or poorly understood scope specifically with reference to Project E and F were identified. An appropriate implementation of risk management procedures that allows relevant parties involved in project definition raise risks and issues would lead to better-informed decisions on whether or not the project is in a position to exit definition. Project definition could not be completed until risk and issues of a certain level are resolved

- *Secure business case approval prior to exiting project definition*

Key to securing funding and commitment for IT projects is a well documented and agreed business case (Kappleman et al., 2006), when this is lacking, projects struggle to secure resources, engagement and the required levels of funding. This issue was observed for Projects E and F in the survey and summative data analysis in chapter 4. A key recommendation would have to be that no project enters or exits project definition without an agreed business case.

- *Prior to entering project definition, specific resources should be allocated*

The availability of resources to input in project definition is a key condition for project success. This had been highlighted as a key factor in failed IT projects. Selecting resources is also a key factor in IT project success as argued by multiple Scholars and authorities on the subject of IT project failure and success (Kappleman et al., 2006; Project Management Institute, 2017, Standish Group, 2015). Based on the evidence from all projects surveyed, the commitment of executive level management to the project can be seen in their willingness to commit funding and resources at an early stage in project definition. The impacts of this are significantly felt in the subsequent project stages, from a positive perspective when committed at project definition and from a negative perspective when commitment in this area is lacking as evidenced by both survey and summative data analysis in Chapter 4. Based on this evidence, a recommendation that no project enters project definition without required resources being assigned would be put forward.

- *Select business stakeholders with relevant skills in the subject matter area*

Stakeholder engagement was defined as a key factor of project success and conversely project failure (Kappleman et al., 2006; Project Management Institute, 2017; Standish Group,2015). When a project is fully supported, key stakeholders will be engaged, stakeholders engaged will be experts in their relevant area in order to provide the most valuable input. The skill level of stakeholders is a key point that seems to be overlooked in the reviewed literature and selection of stakeholders with the most relevant skills is a key condition for project success.

- *Define procedures to apply lessons learned at project definition*

Charette (2005) argued that issues with IT projects repeating past failures, based on this argument, procedures should exist in project definition for identifying and applying applicable lessons learned to new projects which would reduce the possibility of repeating mistakes of the past projects. These procedures should be a key exit criteria for project definition, that documents the investigation and results of this investigation in the project definition exit criteria thus ensuring that due diligence in this regard is performed.

- *Define and apply estimation deviations for new technology projects*

Eveleens and Verhoef (2009) noted the tendency to underestimate in IT projects as a reason why these projects often overrun on cost and timeline. With reference to this point and the variances observed for the projects identified in Chapter 4 it would seem prudent to apply an estimation deviation of 10% for time and 20-25% for cost especially for new technology projects. When this buffering is applied to the projects surveyed, the projects that were considered successful in the summative summary findings fall within thresholds for initially estimated time and cost.

- *Subject Matter Expert validation of definition requirements and timeline.*

Brooks (1995) argues that not refining complex requirements is the task that leads to IT projects failing at a higher rate than projects in other industries, and similar figures produced in the CHAOS Report (Standish Group,1994-2015) and by the Project Management Institute (2017) confirm this as one of the leading causes of IT failure. The evidence for this is also highlighted with regard to Project E and F in the survey and summative data as highlighted in Chapter 4. It would appear that key to resolving this issue and refining requirements could be the introduction a proof of concept in the project definition phase to allow for refinement of complex requirements and timelines for a proposed project. Particularly with reference to new Project E, this activity may well have prevented the likelihood of the poorly defined timeline and scope from exiting definition had these procedures been in place.

5.4 Generalisability of Findings

Saunders et al. (2012) note that generalisability refers to the relevance of a particular research study to other sources of researcher. Saunders, et al. (2012, p.110) state “the most important factor that determines research philosophy is the research question. If the question does not suggest unambiguously a positivist or interpretivist philosophy, then this would confirm the pragmatists view of the world". Creswell (2008) argues that paramount importance should be placed on understanding the research question and methodologies should be selected that best enable the researcher to answer the research question. As this research extracted generalised IT project success and failure conditions from existing literature, assessed the use of these conditions at project definition and ultimately their impact on subsequent project phases and outcomes. A conceptual framework that triangulated the literature, survey data and summative was identified to be the most efficient method of generalising the findings. Additionally, this framework can be applied to any IT project portfolio to assess the impact of the use of success conditions at project definition on subsequent phases and project outcome.

5.5 Research Limitations

A major limitation of the research is the relatively small sample size of participants. Only seven projects were implemented over the time period selected. This also led to a limited pool of participants in project program management (2 participants), definition management (1 participant) and architecture management (1 participant) perspectives. Additionally, in some cases these particular perspectives demonstrated the same responses for projects surveyed which would highlight a lack of variation. Project Managers could potentially display an element of bias to their own projects but the survey data did not appear to point to this. This point could potentially be argued for Project C both from a survey and summative data perspective but the other projects were assessed in an honest and open fashion. As the largest group the Subject Matter Expert perspective was the group least open to bias. The volume of Business Lead response was low with only three respondents which meant limited analysis could be performed on this perspective. The vast amount of literature on project failure and success factors meant that a fully comprehensive review of this literature could not be completed due to the timeframes involved in this research. The lack of a qualitative approach to this research via semi-structured interviews would have perhaps lead to more insightful comments and the ability drill down into results and opinions of participants. Difficulty in categorising survey participants lead to a complex and large number of questions distributed across multiple perspectives for the survey, a single survey on each role may have made the analysis more efficient.

5.6 Future Research

This research has identified a number of success factors that do not have formal sign off procedures as discussed in section 5.2 within the organisation that is the subject of this research. An interesting proposal with regard to future research would be to put into place formal approval procedures for these success factors to ensure that they are part of the entry and exit criteria for project definition. A comparative study executed in a similar fashion to this study would provide an interesting perspective where these conditions were enforced at project definition. The checklist outlined in table 5.6.1 could be utilised as exit criteria for project definition and the results of the enforcement of this checklist would be captured using the conceptual framework discussed in chapter 4.

Table 5.6.1. Project definition entry / exit checklist

Definition Entry Condition		**Definition Exit Condition**	
Business case approved	X	Benefits realisation plan defined	X
Technical resources allocated	X	Profile project management classification	X
Business resources allocated	X	Lessons Learned Investigation	X
Definition risk management agreed	X	Subject Matter Expert scope and time approval and validation	X
Estimation Deviation Agreement	X	Proof of concept completion	X

Currently, the organisation that is the subject of this research is attempting to investigate methods by which the definition process can be improved. This solution has not yet been found which appears to be supported by the projects that were complex and required requirements to be refined in an iterative fashion. It would also appears that stringent procedures are required to ensure resource allocation at project definition as it would appear from the survey and summative data that resources are not secured until the preparation phase which has resulted in large variances in this phase and ultimately overall project outcome. A formalised process that addresses the issues that have been observed in this research using entry and exit criteria would at least document an agreed process for ensuring key success conditions were applied in a consistent manner in project definition.

Additionally, a retrospective exercise could take place that expanded the above checklist based on lessons learned following the closure of a given project. This checklist could be expanded to allow the success criteria to be waived but only with acceptable rational documented for this in relevant appendices for perspective projects, this checklist could be utilised and then tested with the conceptual framework outlined in chapter 4.

5.7 Research Contribution

Based on existing theories, and observations from recent projects, and organisational summative data, this research built a conceptual framework as discussed in Chapter 4 that can be utilised for testing the use of known success conditions in a general sense across IT projects. This framework can be used to continually improve the use of success conditions at project definition and potentially reduce issues in subsequent phases of IT projects and overall project outcome. This research has identified that causes for IT project failure do not exist in isolation and can be symptoms of lack of focus on known causes of IT project failure such as lack of executive level support resulting in poor stakeholder engagement and requirement gathering. The CHOAS report figures are quoted as the de-facto authority on IT project definitions, however, this research provides evidence to challenge these definitions and lend support to arguments against these definitions. This research provides an opportunity to implement a formalised approval process that can be applied at project definition to future projects to ensure that projects apply success conditions in a consistent manner to project definition.

5.8 Conclusion

Based it can be argued that a consistent approach to applying success conditions to project definition is missing. There would appear to be a lack of formal processes to ensure that key IT Project success conditions outlined in section 5.1 are applied in this project phase.

The research lends support to the arguments of Kappleman et al. (2006) that lack of focus on known causes of IT project failure at the early stages of IT projects can lead to large variances in subsequent phases of the project and ultimately project outcome. Interestingly this research found that these reasons do not exist in isolation and executive level support is critical to receiving full engagement and resource allocation at project definition. The causes of IT project failure are often discussed in isolation, this research would appear to confirm that the causes are linked into a hierarchy of causes of failure with most causes of failure stemming from lack executive support. This can take the form of lack of engagement, funding or focus on business cases and benefits realisation. These issues can be a symptom of lack of alignment to organisational goals as argued by Atkinson (1999) in that projects will not truly be considered successful unless that contribute to the competitiveness of the organisation. This was confirmed in the fact that largest variances were observed in surveyed projects that lacked engagement and a defined business case. Project management also play a key role in project success, understanding the specific project management skills applicable to specific projects promotes the possibility of success in projects.

The definitions found in the CHAOS (Standish Group, 1994-2015) are not in line with reality as most projects were found to have a variance of between -10% /+10-25% for time and cost. The definition for success would appear to require these estimation deviations to be integrated in order to provide more robust definitions for success and failure and ensure the accuracy of definition estimates, this assessment supports the arguments of Eveleens and Verhoef (2009).

Integration of lessons learned from previous projects at project definition would appear to be key to not repeating the mistakes of the past. This must be an enforced exercise at project definition as too often this is an optional activity that leads to the same mistakes on the next project and this can be seen in works of Charette (2005) which shows repetition of the same failure reasons.

The waterfall methodology can implement some level of proof of concept to reduce complexity and increase visibility as noted by Brooks (1995) which can reduces variances in subsequent project phases.

The findings in the conceptual framework support the arguments in the literature that lack of focus on known success conditions lead to large variances between what was planned in the definition phase and what the actual outcome of the project was seen to be. Based on the observations in the conceptual framework it would appear to support the argument that consistent application of known success conditions within project definition can lead to smaller variances between planned estimates and actual phase/project outcomes. Ultimately gaining executive level support is the success factor that influences other success factors such as gaining access relevant resources, full stakeholder engagement and in turn refining requirements to reduce the issues that causes variances in later project phases. By gaining this support for a formal framework as discussed in this study, organisations can ensure that they have a formal and consistent process for applying key success conditions at project definition to give projects the best possible chance of success and ensure that projects can be planned and executed effectively with the minimum level of variances between estimates and actual time and cost.

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APENDENCIES

APPENDIX 1 ETHICS APPLICATION FORM

School of Computer Science & Statistics Research Ethics Application

Part A

Project Title: **IT Project Definition: Setting conditions for Project success**

Name of Lead Researcher (student in case of project work): **Mark J Bissett**

Name of Supervisor: Diana Wilson

TCD E-mail: mbissett@tcd.ie

Contact Tel No.: 087 371 3215

Course Name and Code (if applicable): Msc in Management of Information Systems (PTCS-MISY-1)

Estimated start date of survey/research: April 2019

I confirm that I will (where relevant):

- Familiarize myself with the Data Protection Act and the College Good Research Practice guidelines
http://www.tcd.ie/info_compliance/dp/legislation.php;
- Tell participants that any recordings, e.g. audio/video/photographs, will not be identifiable unless prior written permission has been given. I will obtain permission for specific reuse (in papers, talks, etc.)
- Provide participants with an information sheet (or web-page for web-based experiments) that describes the main procedures (a copy of the information sheet must be included with this application)
- Obtain informed consent for participation (a copy of the informed consent form must be included with this application)
- Should the research be observational, ask participants for their consent to be observed
- Tell participants that their participation is voluntary
- Tell participants that they may withdraw at any time and for any reason without penalty
- Give participants the option of omitting questions they do not wish to answer if a questionnaire is used
- Tell participants that their data will be treated with full confidentiality and that, if published, it will not be identified as theirs
- On request, debrief participants at the end of their participation (i.e. give them a brief explanation of the study)
- Verify that participants are 18 years or older and competent to supply consent.
- If the study involves participants viewing video displays then I will verify that they understand that if they or anyone in their family has a history of epilepsy then the participant is proceeding at their own risk
- Declare any potential conflict of interest to participants.
- Inform participants that in the extremely unlikely event that illicit activity is reported to me during the study I will be obliged to report it to appropriate authorities.
- Act in accordance with the information provided (i.e. if I tell participants I will not do something, then I will not do it).

Ethics Application Guidelines – 2016

Part B

Please answer the following questions.		*Yes/No*
Has this research application or any application of a similar nature connected to this research project been refused ethical approval by another review committee of the College (or at the		No
Will your project involve photographing participants or electronic audio or video		No
Will your project deliberately involve misleading participants in any way?		No
Does this study contain commercially sensitive material?		No
Is there a risk of participants experiencing either physical or psychological distress or discomfort? If yes, give details on a separate sheet and state what you will tell them to do if they should		No
Does your study involve any of the following?	Children (under 18 years of age)	No
	People with intellectual or communication difficulties	No
	Patients	No

Part C

I confirm that the materials I have submitted provided a complete and accurate account of the research I propose to conduct in this context, including my assessment of the ethical ramifications.

Signed:  Date: 19/03/19

Lead Researcher/student in case of project work

There is an obligation on the lead researcher to bring to the attention of the SCSS Research Ethics Committee any issues with ethical implications not clearly covered above.

Part D

If external or other TCD Ethics Committee approval has been received, please complete below.

External/TCD ethical approval has been received and no further ethical approval is required from the School's Research Ethical Committee. I have attached a copy of the external ethical approval for the School's Research Unit.

Signed: Date:

Lead Researcher/student in case of project work

Part E

If the research is proposed by an undergraduate or postgraduate student, please have the below section completed.

I confirm, as an academic supervisor of this proposed research that the documents at hand are complete (i.e. each item on the submission checklist is accounted for) and are in a form that is suitable for review by the SCSS Research Ethics Committee

Signed: Diana Wilson .... Date: 19/3/19...........
Supervisor

The status of 'IT Project Definition: Setting conditions for Project success' has been updated by the Committee.

Title: 'IT Project Definition: Setting conditions for Project success'
Applicant Name: Mark Bissett
Submitted by: Mark Bissett
Academic Supervisor: Diana Wilson
Application Number: 20190301

Result of the REC Meeting: Approved

The Feedback from the Committee is as follows:
This project may now proceed, we wish you the best with your study.

APPENDIX 2 INFORMATON SHEET FOR PARTICIPANTS

TRINITY COLLEGE DUBLIN

INFORMATIONSHEETFORPROSPECTIVEPARTICIPANTS

IT Project Definition Success Conditions: A study into the success conditions required at project definition for IT projects.

Survey Link: https://scsstcd.qualtrics.com/jfe/form/SV_cCG4fvuxrcBRb0N

Researcher: Mark Bissett

Contact Details: mbissett@tcd.ie

You are invited to participate in this research project which is being carried out by Mark Bissett as part of a dissertation for the MSc in Management of Information Systems in the School of Computer Science & Statistics, Trinity College Dublin.

RESEARCH TITLE

IT Project Definition Success Conditions: A study into the success conditions required at project definition for IT projects.

Participants will be requested to participate in a qualtrics survey using the below link and will be provided with the information sheet as shown in the below screenshot on the first page of the survey.

BACKGROUND OF THIS RESEARCH

The aim of the research will be firstly, to establish the use of IT project success and failure conditions at project definition. Secondly to compare the definition estimates from a timeframe, budget and functionality perspective against similar estimates from the detailed requirements gathering project phase to measure the accuracy of definition estimates at a point when all detailed requirements were known and signed off. Finally to establish if a correlation exists between the accuracy of estimates at definition and use of known success conditions and failure risk factors.

WHY YOU HAVE BEEN ASKED TO PARTICIPATE IN THIS RESEARCH

As a person who was involved in the project definition or preparation phase utility IT projects, I would like to invite you to participate in this study. Your participation is entirely voluntary, all questions asked are optional, and you have the right to withdraw from this survey at any time without penalty. Your response will be confidential and anonymous as we will not collect identifying information such as name, email or IP address.

The survey and data collected will be stored within Qualtrics, and secured as per their privacy and security statements, and research reported on aggregate results. The researcher is the only person with access to the Qualtrics project and both project and all data collected or retrieved will be destroyed in September 2019.

DECLARATION OF CONFLICTS OF INTEREST

Please be advised that this research is being conducted by an employee of utility organisation that utilises a product or service similar to the object of study within the research and may further use similar project structures for implementing future projects. The researcher is not currently working in this area.

PUBLICATION

A 'stay' for five years will be requested for this publication as results will relate to an organisation recently implemented projects. This means that the dissertation cannot be accessed for the aforementioned period without prior consent.

Ethics Application – February 2019

ANTICIPATED RISK / BENEFITS OF PARTICIPATION
There is no anticipated risk to your participation in this research.

ILLICIT ACTIVITY
While it is unlikely that illicit activities would be disclosed, if you do so, we would be obliged to report them to the appropriate authorities.

THE PROVISIONS FOR DEBRIEFING AFTER PARTICIPATION
A full explanation of the research at the participant's request can be provided. If required a copy of the dissertation can be sent to participants. The researcher can be contacted following interview completion if required using the details below.

ETHICAL APPROVAL
The researcher has obtained ethical approval for this research from the School of Computer Science and Statistics, Trinity College Dublin

APPENDIX 3 INFORMED CONSENT FORM

TRINITY COLLEGE DUBLIN

INFORMED CONSENT FORM

Participants will be provided with the informed consent form below via survey link.

https://scsstcd.qualtrics.com/jfe/form/SV_cCG4fvuxrcBRb0N

RESEARCHER DECLARATION

I the researcher (Mark Bissett) confirm that I will (where relevant):

• Familiarize myself with the General Data Protection Regulation (GDPR) of 2018 and the College Good Research Practice guidelines:

http://www.tcd.ie/info_compliance/dp/legislation.php

• Tell participants that any recordings, e.g. audio/video/photographs, will not be identifiable unless prior written permission has been given. I will obtain permission for specific reuse (in papers, talks, etc.)

• Provide participants with an information sheet (or web-page for web-based experiments) that describes the main procedures (a copy of the information sheet must be included with this application)

• Obtain informed consent for participation

• Tell participants that their participation is voluntary

• Tell participants the fact they may withdraw at any time and for any reason without penalty

• Give participants the option of omitting questions they do not wish to answer if a questionnaire is used. Tell participants that their data will be treated with full confidentiality and that, if published, it will not be identified as theirs

• On request, debrief participants at the end of their participation (i.e. give them a brief explanation of the study)

• Verify that participants are 18 years or older and competent to supply consent.

• Tell participants that if they or anyone in their family has a history of epilepsy, then they are proceeding at their own risk.

• Declare any potential conflict of interest to participants.

• Inform participants that in the extremely unlikely event that illicit activity is reported to me during the study I will be obliged to report it to appropriate authorities.

• Act in accordance with the information provided (i.e. if I tell participants I will not do something then I will not do it.)

INFORMED CONSENT OF THE PARTICIPANT

I am 18 years or older and am competent to provide consent.

• I have read, or had read to me, a document providing information about this research and this consent form.

• I have been provided the researchers contact details and know that I can contact him to have any questions answered to my satisfaction and to understand the description of the research being provided to me.

• I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.

• I understand that if I make illicit activities known, these will be reported to appropriate authorities

• I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.

• I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.

• I understand that my participation is fully anonymous and that no personal details about me will be recorded.

APPENDIX 4 SURVEY QUESTIONS

Survey questions posed to participants are outlined in section 3.4.