



**MODELLING AN INDUSTRY-RELEVANT PROJECT MANAGEMENT  
CURRICULUM FOR ENGINEERING SCIENCES**

by

**JADE JACOBS**

Dissertation submitted in partial fulfilment of the requirements for the degree

**Master of Technology: Business Administration in Project Management**

in the **Faculty of Business**

at the **Cape Peninsula University of Technology**

**Supervisor: Dr L.E. Jowah**

**Cape Town  
September 2020**

**CPUT copyright information**

The thesis/dissertation may not be published either in part (in scholarly, scientific or technical journals), or as a whole (as a monograph), unless permission has been obtained from the  
University

## **DECLARATION**

I, Jade Jacobs, declare that the contents of this thesis/dissertation represent my own unaided work, and that the thesis/dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

**Signed**

**Date 7 September 2020**

A handwritten signature in black ink, appearing to be 'Jade Jacobs', written over a large, light-colored circular scribble or mark.

## **ABSTRACT**

The practice of Project Management has been thoroughly researched, giving rise to theories, standards, skills and competencies, which have governed the expectations of the Project Management industry. Research has shown that these skills, standards and attributes also differ from one industry to another, noting that the industries that make use of Project Management practices are all vast, evolving and distinctive. With these expectations in mind, it became apparent that training and teaching these skills, competencies and theories to future generations of Project Managers is key to providing these industries with capable, equipped and prepared Project Managers who are qualified and sufficiently prepared to positively impact their workplaces and fulfil their job requirements. It then stood to reason that the quality and content of the curriculum these Project Management students are provided with should be aligned with these expectations in industry.

In order to ascertain whether or not Project Management graduates from a Tertiary Institute in Cape Town, South Africa, are adequately equipped for the workplace within their industries, research was carried out using the mixed method approach. From a sample of 300, 100 participants from the Engineering, Construction and Information Technology industries completed online surveys, resulting in quantitative results as well as qualitative expressions through open-ended questions in the survey.

It was found that currently, graduates from the Project Management fraternity are not adequately equipped for industry once they graduate and that the current curriculum does not lend itself to the current evolution in industry, especially in the Information Technology sector. It was thus recommended that Project Management at Tertiary Institutes move from a generic approach to an industry-specific model which would then allow students to hone in on their sectors and the varying attributes required to be successful in those fields.

## **ACKNOWLEDGEMENTS**

I wish to thank:

- My Saviour, for blessing me with the opportunity to complete my Masters Degree.
- My parents, family and friends for the unwavering support through every class, exam and late night.
- Dr. Larry Enoch Jowah, for assisting me, believing in me and encouraging me through this process.

## DEDICATION

For my Parents, Grandfather and Brother.  
I am, because you are.

## TABLE OF CONTENTS

<i>DECLARATION</i> .....	<i>i</i>
<i>ABSTRACT</i> .....	<i>ii</i>
<i>ACKNOWLEDGEMENTS</i> .....	<i>iii</i>
<i>DEDICATION</i> .....	<i>iv</i>
<i>CHAPTER 1: OVERVIEW OF THE STUDY</i> .....	<i>1</i>
1.1 INTRODUCTION .....	1
1.2 BACKGROUND TO THE STUDY .....	1
1.3 PROBLEM STATEMENT .....	9
1.4 RESEARCH OBJECTIVES.....	9
1.5 RESEARCH QUESTION.....	10
1.6 RESEARCH DESIGN AND METHODOLOGY .....	11
1.7 ETHICAL CONSIDERATION .....	13
1.8 CHAPTER CLASSIFICATION.....	14
1.9 SUMMARY OF THE CHAPTER.....	14
<i>CHAPTER 2:</i> .....	<i>15</i>
<i>KNOWLEDGE MANAGEMENT AREAS, UNIVERSITY COURSE OFFERINGS, REQUIRED COMPETENCIES AND THE HIGH FAILURE RATE OF PROJECTS</i> .....	<i>15</i>
2.1 INTRODUCTION .....	15
2.1 DEFINING PROJECTS AND PROJECT MANAGEMENT.....	16
2.2 PROJECT FAILURE .....	21
2.3 PROJECT SUCCESS.....	34
2.4 CHAPTER SUMMARY .....	39
<i>CHAPTER 3:</i> .....	<i>40</i>
<i>COMPETENCIES REQUIRED FOR PROJECT MANAGERS IN THE ENGINEERING, CONSTRUCTION AND INFORMATION TECHNOLOGY INDUSTRIES</i> .....	<i>40</i>
3.1 INTRODUCTION .....	40
3.2 SECTOR-SPECIFIC COMPETENCIES.....	46
3.3 CURRENT COURSE STRUCTURE.....	55
3.4 CHAPTER SUMMARY .....	57
<i>CHAPTER 4:</i> .....	<i>58</i>
<i>RESEARCH DESIGN AND METHODOLOGY</i> .....	<i>58</i>
4.1 INTRODUCTION .....	58

4.2 PURPOSE OF THE STUDY .....	59
4.3 OBJECTIVES OF THE RESEARCH .....	60
4.4 RESEARCH METHODOLOGY AND DESIGN .....	60
4.5 TARGET POPULATION.....	65
4.6 SAMPLING FRAME .....	66
4.7 SAMPLING METHOD.....	66
4.8 SAMPLE SIZE .....	66
4.9 THE QUESTIONNAIRE AS A MEASURING INSTRUMENT .....	67
4.10 DATA COLLECTION INSTRUMENT.....	67
4.11 DATA COLLECTION, ANALYSIS AND INTERPRETATION.....	68
4.12 VALIDITY AND RELIABILITY .....	69
4.13 ETHICAL CONSIDERATIONS .....	71
4.14 SUMMARY .....	72
<i>CHAPTER 5:.....</i>	<i>73</i>
<i>DATA ANALYSIS AND INTERPRETATION.....</i>	<i>73</i>
<i>Section A: Biography Questions .....</i>	<i>73</i>
QUESTION 1: Which industry do you work in? .....	74
QUESTION 2: How many years of experience do you have? .....	74
QUESTION 3: Do you work directly with Project Managers in your Organisation?.....	76
QUESTION 4: Where do you fit in to your Organisation? .....	77
QUESTION 5: What percentage of your daily activities are project-related?.....	78
QUESTIONS 6: How many projects have you worked on?.....	79
QUESTION 7: Of those projects that you have worked on, how many of them were deemed successful? .....	80
<i>Section B: Likert Scale Statements .....</i>	<i>81</i>
STATEMENT 1: It is important for Project Managers to have Industry-relevant technical knowledge. ....	81
STATEMENT 2: Soft skills (interpersonal traits such as leadership, communication etc. that enable them to interact harmoniously with others) are more important than technical knowledge for Project Managers. ....	83
STATEMENT 3: In my Organisation, Project Team Members report directly into their Project Manager.....	84
STATEMENT 4: Project Managers can rely solely on their teams for the technical knowledge required to run the project.....	85

STATEMENT 5: In my Company, most of our clients/stakeholders are technical and understand most aspects of the project. ....	86
STATEMENT 6: Project Managers must be able to fully understand client requirements in order to run the project. ....	87
STATEMENT 7: In my Company, Project Managers are directly involved in recommending solutions to Clients.....	88
STATEMENT 8: At my Company, we make use of Software Programs to aid us in the running of Projects.....	90
STATEMENT 9: At my Company, there are specific, standard documentation required from the Project Manager throughout the lifecycle of the Project.....	91
STATEMENT 10: Project Managers largely influence and contribute to Project success. ...	92
STATEMENT 11: A Project Manager’s lack of technical knowledge largely influences and contributes to Project Failure .....	93
STATEMENT 12: At my Company, it is very important that the Project Team members are able to trust in the abilities of their Project Manager. ....	94
STATEMENT 13: At my Company Project Managers are actively managing Projects from inception to closure as well as every phase in between.....	95
STATEMENT 14: Project Managers at my Company report to Clients without the presence of other team members and handle delivery reporting on their own. ....	96
STATEMENT 15: At my Company, Project Managers fulfil an administrative role rather than an advisory, more hands-on role .....	97
STATEMENT 16: Project Managers in my industry do not need industry-relevant knowledge in order to be successful.....	98
<i>Section C: Open-ended Discussion Questions</i> .....	99
STATEMENT 1: Project Managers should have the following soft skills (interpersonal traits such as leadership, communication etc. that enable them to interact harmoniously with others); .....	99
QUESTION 3: In your opinion, are Project Management graduates equipped enough to function in industry straight after University? .....	101
STATEMENT 4: Project Managers should have the following hard/technical skills (specific, taught abilities); .....	102
QUESTION 5: Would you rather employ a generalist (no specific industry knowledge but able to administrate projects well) or specialist (industry-specific knowledge) Project Manager? .....	103
QUESTION 6: Do you believe that there is a space in your industry for generalist Project Managers? .....	104
<i>CHAPTER 6:</i> .....	105



<i>SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS</i> .....	105
6.1 FINDINGS AND RECOMMENDATIONS .....	106
6.2 CONCLUSION .....	122
<i>APPENDIX: QUESTIONNAIRE</i> .....	134

## LIST OF FIGURES

Figure 1.1: Elements of a Project that require management. ....	5
Figure 2.1: Project Performance Metrics.....	16
Figure 2.2: Global Total of The Primary Causes of Project Failure in the past year. .....	23
Figure 2.3: Challenged, Successful and Failed Projects .....	24
Figure 2.4: Types of Delays in Projects.....	29
Figure 2.5: Types of Delays in Projects.....	30
Figure 2.6: Aspects of Success.....	35
Figure 2.7: Widespread and conventional project management success criteria. .	39
Figure 3.1: Consultant Project Managers' Competence Mix Model. ....	43
Figure 3.2: The IPMA Standard Competence Eye.....	50
Figure 3.3: Conceptual framework of competencies required by engineering project managers. ....	51
Figure 5.1: Percentage of Respondents working in various sectors of the Engineering industry. ....	80
Figure 5.2: Years of work experience in Industry.....	75
Figure 5.3: Percentage of respondents who work directly with Project Managers.	76
Figure 5.5: Percentage of daily project-related activities. ....	78
Figure 5.6: Number of projects worked on. ....	79
Figure 5.7: Number of successful Projects which respondents have worked on.....	86
Figure 5.8: The importance of project managers having industry-relevant technical knowledge.....	88
Figure 5.9: Soft Skills are more important than technical knowledge for Project Managers. ....	83
Figure 5.10: Team Members reporting directly to Project Managers. ....	84
Figure 5.11: Project Managers can rely solely on their teams for the technical knowledge required to run the project. ....	85
Figure 5.12: Percentage of clients that are technical and understand most aspects of the project. ....	86
Figure 5.12: Project Managers must fully understand client requirements in order to run a project. ....	88
Figure 5.13: Project Managers are directly involved in solution .....	89
Figure 5.14: Use of software programs to aid the running of projects.....	90
Figure 5.15: At my Company, there are specific, standard documentation required from the Project Manager throughout the lifecycle of the Project. ....	91
Figure 5.16: Project Managers largely influence and contribute to Project success. .....	92

Figure 5.17: A Project Manager’s lack of technical knowledge largely influences and contributes to Project Failure..... 93

Figure 5.18: At my Company, it is very important that the Project Team members are able to trust in the abilities of their Project Manager..... 94

Figure 5.19: Project Managers actively manage projects from inception to closure. .... 95

Figure 5.21: Project Managers fulfil an administrative role rather than an advisory, more hands-on role..... 97

Figure 5.20: Project Managers at my Company report to Clients without the presence of other team members and handle delivery reporting on their own. .... 96

Figure 5.22: Project Managers in my industry do not need industry-relevant knowledge in order to be successful.....98

## LIST OF TABLES

Table 1.1 Generic characteristics of a project.....	2
Table 1.2: Summary of Knowledge Areas.....	6
Table 1.3: Competences linked to Project success .....	11
Table 2.1: The underlying theories and assumptions of project management.....	17
Table 2.2: PMI PMBOK: The nine knowledge areas of project management.....	19
Table 2.3: Explanation of Categories for Projects investigated. ....	22
Table 2.4: Five common causes of project failure in Engineering projects. ....	23
Table 2.5: Causes of failure on Projects. ....	26
Table 2.6: Most frequent and least frequent causes of project failure.....	27
Table 2.7: Risk (failure) factors of Information Technology projects. ....	32
Table 2.8: Contributors to Failure in Information Technology projects. ....	34
Table 2.9: Critical success factors and Project performance indicators.....	37
Table 3.1: Most important project manager skills and competencies in the context of a particular project characteristic.....	45
Table 3.2: Top five sought knowledge, skills and attributes for the engineering sectors.....	46
Table 3.3: The Five Functions of Project Management. ....	47
Table 3.4: Knowledge and Competencies Critical to Software Project Management Success.....	49
Table 3.5: Summary of Competence Categories for Effective IT Project Management. ....	49
Table 3.6: Forecasted Challenges.....	52
Table 4.1: Strengths and Weaknesses of Qualitative Research. ....	62
Table 4.2: Strengths and Weaknesses of Quantitative Research. ....	63
Table 4.3: Strengths and Weaknesses of Mixed Research.....	64
Table 4.4: Terminology and criteria used to evaluate the credibility of research findings.....	70
Table 6.1: Construction and Engineering Stream Approach .....	113
Table 6.2: Information Technology Stream Approach .....	116
Table 6.3: Generic Approach.....	119

## **CHAPTER 1: OVERVIEW OF THE STUDY**

### **1.1 INTRODUCTION**

Kruss et al. (2017: 2) posit that there seems to be a serious disjuncture between what institutions of higher learning offer as the ideal curriculum and what the industry expects. Continuously new entrants into the workplace notice that the theory learnt in the class room does not seem to find place in the realities of the workplace. In designing an entry level course for the university, Jowah (2015: 40-47) opined that there is a need for the academia to regularly update their offering to the realities of the industry. It may also be argued that universities may do well to give priority to employing people in the industry or coming from the industry as both lecturers and developers of curriculum. It may also be concluded based on this that it may be more pro-active for the writing of books by local practitioners (be they academics or operatives) in that the material for study will be relevant and specific to the workplace.

Beretu (2017:21-40) postulated that this disjuncture is common in all disciplines. This was in specific reference to the curriculum developed by academia without cooperation and collaboration with the industry that does the actual work. In the South African context, this is compounded by the absence of local academics getting involved in the authoring of the study material used. Most of the decision on what is included is guided by the use of existing textbooks written specifically for universities in the West (United Kingdom and United States) Slattery and Carlson (2005:159-164). This thesis seeks to explore the possibility of an engineering-sciences-industry relevant project management curriculum.

### **1.2 BACKGROUND TO THE STUDY**

According to Mesly (2017: 52) a project can be defined as an organized endeavour carried out due to a problem, opportunity or need. A project seeks to deliver a unique and novel outcome

despite being constrained by factors such as time, budget and quality. Jensen and Dinitzen (2011: 14) explain that a project can be defined in many ways. They describe it to be “tasks” or a “task” that is usually unique and once-off in nature, with a limited time-frame and restricted resources such as budget and manpower. Turner and Müller (2003: 1-8) concur and suggest that a project can be used in a context referring to an organisation that is set up temporarily in order to carry out a specific function or task.

The Project Management Institute (PMI) is a global association for Project Management Professionals. The PMI has combined processes, guidelines and best practices for professionals in the industry and published this in the in a guide, the Project Management Body of Knowledge (PMBOK). In the fifth edition of the guide, “A Guide to the Project Management Body of Knowledge” PMI (2015), the PMI concurs with the definition cited by Jensen and Dinitzen (2011: 14). A project is explained as a series of activities or tasks with a particular objective, which need to be completed within specific budgetary, time and resource constraints, Kerzner (2017: 3).

Ogbeiwi (2017: 324) explains that a project is defined by being specific in its aims and objectives and consists of a measurable achievement as the outcome once project closure is reached. Project goals and outcomes must be achievable and realistic given the current condition of the environment which the project finds itself in – all whilst been bound by the constraints of budget, quality, time and scope.

Considering the definition above, a project therefore has expected specifics which should be met. Consequently, many other definitions have come up altering the traditional meaning of a project from being engineering based to a more generic definition. Wysocki (2011: 1) defines a project as any undertaking or event that is to be performed within a specified time, within budget and within specified quality. This has led to the understanding that the success of project execution is based on the ability of the process to be done within the triple constraints – the iron triangle.

Even though it is evident that the definitions explored are expanded in some cases, analysing these definitions has clarified that the definition of a project does not depend on the industry in which it is taking place. The fundamental definitions are common and generic in nature and to further explore the context of the proposed study, the manner

in which projects are managed in various fields of engineering has been studied and considered.

Whilst it is clear that the definition of a project now crosses the borders of industries and is able to be used cross-functionally, this gave rise to the research at hand – whether or not students studying generic project management material at a tertiary level, are adequately equipped to contribute positively to industry in their various fields of engineering once they've graduated from tertiary institutions. To further understand this phenomenon, more research was explored regarding the specific requirements of project managers in various fields of the engineering industry.

Welfolo (2019: 2) postulates that knowledge of construction and the processes involved in this specialised industry is key to the success of projects in the industry. This differs from the point of view of Jensen and Dinitzen (2011: 17) in that whilst there are common elements that must be managed in any project (regardless of the industry it is found in), for each industry, there is specific required knowledge and skill. Shokri-Ghasabeh and Kavousi-Chabok (2009: 456) explain that even though the age-old definition of project success has been determined by meeting the time, cost and quality requirements of the project, there are many more factors that should be considered when determining the success of a project. In their text, they also explain that these success factors will differ on each project and in each industry.

According to Ramazani and Jergeas (2015: 41-52), the role of the project manager is to bring together both technical and non-technical resources and skills in order to carry out the project in alignment with the strategic plan of the business. In agreement with this, Senthill (2018: 1) states that it is the competence of the project manager which determines the success of the project. That being noted, the research sought to understand whether the current curriculum and methods being used to teach the subject of project management at a tertiary level were sufficient to equip students as well as whether the subject matter was aligned with what is being done in the sectors of the engineering industry.

It is established in the research by Radujković and Sjekavica (2017: 613) that project management is unavoidable in today's age and landscape where improvement of societies and businesses rely on projects for the constant change required. In their conclusion, they state that the only way in which projects can be sustained for their cause (which is of utmost importance to the globe) is to place extreme emphasis on the education of project managers and the competencies which will inevitably affect the outcomes of the projects they work on.

Hoxal and McMahn (2019: 12-19) continue to explain that project management intends to manage the project through the application of tools and techniques. They include that project management involves defining the work required, the extent thereof and how resources will be allocated and work distributed and executed in order to achieve the end result. They also add that monitoring progress and adjusting to deviations are also inherent to Project Management.

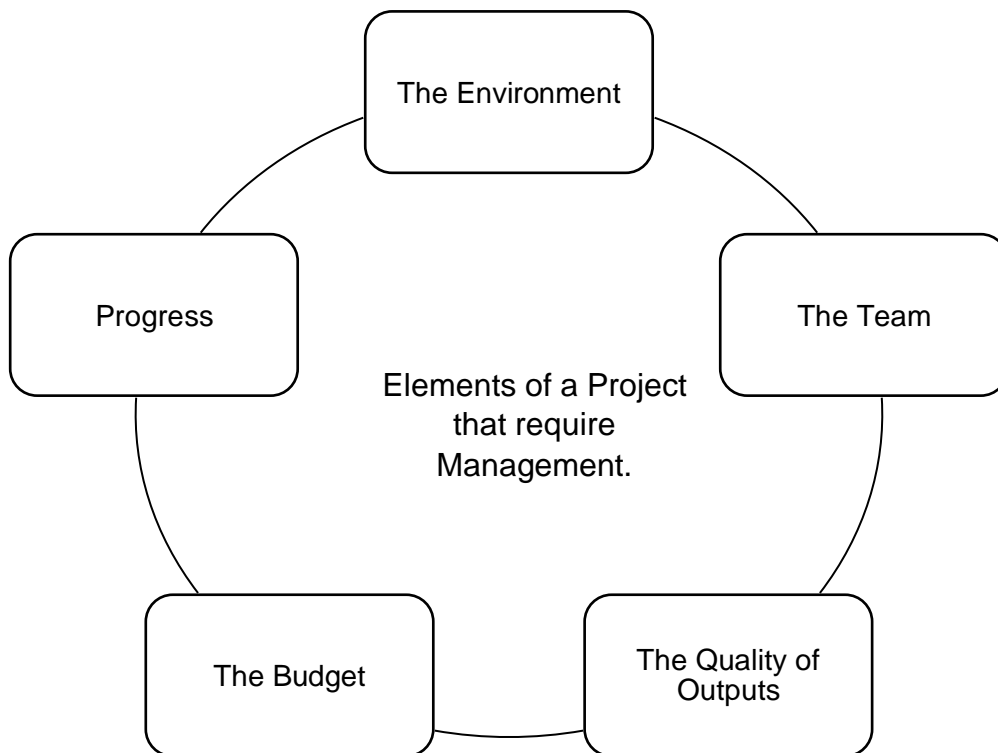
According to Hamilton et al. (2012: 73), a great deal has been discussed regarding whether or not specific industry knowledge is required in order for Project Managers to be successful in the running of their teams and the delivery of their projects. In their text it is also concluded that there has been a huge shift in the Project Management industry regarding the qualification of project managers.

Previously, it was almost a given that Project Managers had a certain level of industry and technical knowledge and skills because they were employees already carrying out technical functions now being promoted to a managerial position, according to Burke (2001:1-6). In more recent times however, it has been noted by Webb (2017: 2) that despite the many meanings of the term "project" – the ever evolving state of this century requires that this term be seen to contain four ideas. The basis of this theory is that to carry out a project means to move from a current state, to a desired one. Thus, the ideals of change, novelty, the future and a result must be kept in mind and the shift from the initial school of thought where the focus of project management was on the process instead of the human element, must not be repeated.



Jensen and Dinitzen (2011:17) explain that there are elements that need to be managed in all projects. Their text is seen to support the general approach to Project Management. These elements are outlined in the figure 1.1 below.

**Figure 1.1: Elements of a Project that require management.**



**Source: Jensen and Dinitzen (2011: 17).**

From this diagram we can see that these elements tie in directly with the definitions of a project previously explored. In an article published for the International Conference on Civil, Architecture and Sustainable Development journal, Khamaksorn (2016: 93-97) explains that whilst Project Management can apply to any project in any industry – Project Management is often tailored to accommodate the specific needs of different and highly specialised industries.

The PMBOK (2008) stated that in the construction industry, Project Managers need industry knowledge, project management knowledge and management skills in order to manage projects and teams effectively. The same view is maintained by Cunningham (2017: 21) in which the findings depict and reinforce that construction

Project Managers require industry knowledge in order to complete certain tasks and bring the project to successful closure.

The PMI has done thorough research regarding the requirements for Project Managers and acknowledge that the role of a project manager is plenty-fold, fulfilling roles such as facilitator, leader and coordinator as explained by Massillon (2018: 5). The roles which are acknowledged in this study include general management skills, knowledge of the generally accepted Project Management areas and industry specific management knowledge. Due to the PMI recognising that there are industry specific areas that are essential to the success of Project Managers in certain industries, a PMBOK focused on Construction was released, Brioso (2015: 78). Despite the school of thought which many Universities worldwide have subscribed to, that Project Management is a skill that can be utilised across all industries despite background and industry specific requirements, the PMI released this document to aid Project Managers in the construction industry.

Hwang and Ng (2013: 272-284) references and focuses on the table below from an article by for the International Journal of Project Management. The article focuses on the skills and knowledge areas required for Project Managers in the Construction Industry. The table below clearly depicts their findings in which they reference other researchers and authors who have explored this area in the Construction Industry.

**Table 1.1: Summary of Knowledge Areas**

Essential Knowledge Area	Dogbegah et al. (2011)	PMI (2008)	Ling (2003)	Odusami (2002)
Schedule Management and Planning	X	X	X	X
Cost Management	X	X	X	
Quality Management	X	X	X	
HR Management	X	X		X
Risk Management	X	X		
Supply Chain Management	X	X		

Claim Management	X			
Knowledge Management	X		X	
Health and Safety Management	X		X	
Conflict and Dispute Management	X			
Ethical Management	X			
Stakeholder Management	X			
Information Technology Management	X		X	
Communication Management	X	X	X	X
Materials Resources Management	X			
Financial Management	X			X
Plant and Equipment Resource Management	X			

**Source: Hwang and Ng. (2013: 272-284)**

The shift in mind-set regarding the specific requirements of Project Management in specific industries further proved that there was a need for some further investigation into what it was that Project Management students were being offered at a tertiary institution in Cape Town, South Africa.

Bothma (2012: 10) elaborates on this point by explaining that a Project Manager should ideally have experience in their particular field as well as competencies in leadership and planning. It is explained in this paper that in the Construction industry, technical engineering skills are important to this role as it is the responsibility of the Project Manager to manage the project within the specified requirements, budget and the client relationship and using industry-specific knowledge in order to do so.

Zulch (2016: 25) defines Technological Understanding as a key skill for Project Managers in the industry. It is explained here that the Project Manager is required to have an accurate and complete understanding of what is required of the project so that client and business needs can be met. Similarly, Conforto and Amaral (2016: 1-14) states that Project Managers must be able to gauge whether they have been given all of the information required and know which questions to ask in order to gain answers.

This statement reveals that technical knowledge and experience are two factors that aid Project Managers, however only technical knowledge is able to be passed on.

In an article for the Project Management Journal, the PMI published an investigation by Besner and Hobbs as cited by Galvez et al. (2018: 4) in which they investigated the use of Project Management tools and techniques. Their investigation examined the Engineering and Construction industry and compared the frequency of use of tools and techniques in this industry in comparison with their use in the Information Technology (IT) industry. In their article, Fernandez et al. (2018: 810) further explain the Besner and Hobbs (2008) research, drawing attention to the recognition of how Project Management practices change and vary according to the type of the project and the industry in which it is being run. This investigation of which practices tools and techniques vary in which contexts in these two industries speaks to the topic currently proposed. The study brought to the fore that whilst there are similarities in tools and techniques used across all projects in varying contexts, there are also important differences.

These findings highlight that requirements analysis differs largely between the two industries and that it is least often made use of in engineering and construction. In IT however, this technique is widely used throughout the project to ensure that the correct specifications are being delivered. Another technique which strongly differs between the two industries is the process of awarding contracts by competitive bidding. This is an important part of Engineering and Construction projects however it is very seldom used in the IT and Software Development industries, Fernandez et al. (2018: 810).

The purpose of the Project Management Body of Knowledge when it was first formed, was to facilitate the sharing of experiences amongst Project Managers and to discuss issues. Author of the article, Sliger (2008: 2) explains that this purpose has now been expanded in order to further improve and advance practice knowledge in the Project Management profession. Just as the PMBOK was expanded to contribute to the Construction Project Management industry, so has it expanded to contribute and advocate the Agile Methodology used in the Software Development and Information Technology industry. According to the PMI, the latest edition of the PMBOK includes

an Agile Practice Guide which was created due to the rise in demand from their stakeholders for more information regarding Agile Project Management. During their research called “Pulse of Profession” it was found that Agile practices are being used by more and more project management professionals as the rise of Information Technology continues (PMI, 2017).

### **1.3 PROBLEM STATEMENT**

Much is expected in terms of both theoretical knowledge and practical experience for a project manager or leader to be considered effective. The engineering projects (any form) present a challenge to the effective management of the projects that the industry is increasingly getting involved in. At the same time, the increase in *projectification* in the industry operations has created a demand for qualifications in the project management. Meanwhile, the institutions offering these courses do not seem to draw much of their academic staff from individuals with industrial experience. The authors of the textbooks used for training do not seem to have practical experience in the industry. The training material choice and the presentation leaves a serious gap between industry expectations and university productions. Because of the demand in management-by-projects, the study seeks to identify and make comparison between industry expectation and academic offerings.

### **1.4 RESEARCH OBJECTIVES**

Research objectives are the expectations of the researcher considering the study gap that emanates from the problem statement. The research objectives in this study are derived directly from the problem statement and are divided into two parts, namely; primary research objective and secondary research objectives.

#### **Primary research objectives**

- Identify the industry expectation from a project management graduate from a tertiary institution

#### **Secondary research objectives**

- To identify what project practitioners do on a daily basis in the place of work in relation to project execution
- To identify what their expectations in terms of knowledge considering the type of roles they play at work
- To identify what they perceive to be missing knowledge aspects which they need for effective performance
- Identify their expectations from any individual claiming to have graduated in a project qualification
- To point out areas of concentration in the selection of the curriculum and the writing of the training material

These objectives are primarily what the researcher sought to achieve, as a critical imperative to effectively supplying appropriate training. It is accepted that there may be other spin-offs from the study that may assist in a holistic view of what project managers need to know from the classroom to the industry.

## **1.5 RESEARCH QUESTION**

The research question is a derivation from the research objectives to be achieved in the research, the research question leads the research to the objective. Much of the literature to be reviewed and the questionnaire (or whatever the research instrument is to be used) is informed by the questions for which answers are required. The research questions have been classified into two types (along the same way with objectives), primary research question and secondary research questions.

### **Primary research question**

- What are the competencies expected of a project management graduate by the industry to which they get employed?

### **Secondary research questions**

- What does a project practitioner do daily as work tasks for which certain competencies are required?

- What specific knowledge / skill / competency do you require for you to perform your functions effectively?
- What specific knowledge / competency / skill are you short of that affects your effectiveness at work?
- What competencies / skills / knowledge do you expect from a project management graduate?
- What knowledge / competency / skill / subject do you think should be included in a project management graduate course?

## **1.6 RESEARCH DESIGN AND METHODOLOGY**

A research design is the path or the road map that will be followed in the process of carrying out a research. The design lists what should be done, when and also suggests (depending on methodology) what time periods for the research will be required. It is essential the plan for the research. In this study the descriptive research design was used because of versatility in that both qualitative and quantitative research methodologies could be used simultaneously. The research methodology used was essentially a mixed research methodology combining simultaneously the use of both quantitative and qualitative methodologies. These methodologies were chosen to enable their differences to complement each other in the research. This would allow for both depth and breadth in the study and provide comprehensive understanding of the phenomenon at hand.

### **Target Population**

Project practitioners in engineering organization who were involved in different capacities but directly involved. These may have been as project team members, project administrators or other project stakeholders.

### **Sampling methods**

The sampling was done in two stages, initially all engineering firms within the Cape Metropolis were randomly selected by choosing every second company on the list. Then the same method (random sampling) was used to get every second or third project practitioner who was available and willing to participate. This method was adopted / used to remove any form of bias that would have created subjectivity in the study.

### **Sample frame and sample size**

Only 20 engineering companies in total participate and the sample frame was estimated at 300, of which a total of 100 participated in the process. The size was considered adequate as that implied that 1 out of every 3 of the total population was sampled. The higher the sample size the more accurate the results would be and simultaneously reducing the margin of error.

### **Data Collection Instrument**

A questionnaire with three sections was used for the collection of the data, the sections were; Section A – which focused on the biography, specifically to qualify the respondents. Section B – was the Likert scale (range) used to rank the statements that had been derived from the literature review. The instrument was constructed with the assistance of a statistician who helped with the pilot study, reconstruction of the instrument, testing for validity and reliability.

### **Data Collection Method**

Four research assistants were trained on data collection methods, ethics, and provided with knowledge on the questions, the subject and expectations. The training was meant to facilitate effective data collection in that they new how to random sample, consider ethical issues, avoid arguments and answer questions where clarity was required. The method specifically help with a high return rate of the data collection instrument in that all the questionnaires administered were returned.

### **Data Analysis and Data Reporting**

All the questionnaires were brought to one place and the processes of cleaning and editing started, there were no significant errors. The coding exercise was done, completed and the data was captured on to an excel spreadsheet (it was readily available, at no cost and was good enough for the purpose). The entered data was converted into easy to ready frequency polygons, graphs, bar charts, pie charts and other such illustrations that are easy to read. The audience for this research was considered to have low mathematics literacy rates and would not be able to interpret easily mean deviations, standard deviations, etc. The illustrations helped in the comparison of the variables understudy, and explanations (interpretations) were made on question by question as it appeared on the research instrument.



## **Significance of the Research**

The aim and purpose of the research was to identify weaknesses and strengths if there are any in the tertiary offerings in project management. This would be accessible to the ordinary aspirant wanting to be a project management graduate, to the academic developing material for project management qualifications, and to all short courses training organisations. Most of these offer short courses, based on the textbooks in the market and not necessarily tailored towards industry needs. Above all this, research should challenge South African academics to go out and look for information relevant to the industries and they should use that to write books for the country within the context of the country.

### **1.7 ETHICAL CONSIDERATION**

According to Wiles (2013: 6) the sphere of research ethics is concerned with issues of morality in research contexts. Adding to this, it is explained that there are various attributes to ethical research which should be considered by the researcher, and adequately applied throughout the research. These attributes such as informed consent, anonymity and duty of confidentiality are detailed below, explaining how these important factors were considered in this research.

- **Informed Consent:** Each potential participant had the opportunity to decide (without any influence) whether or not they would like to participate in the study. Only those who, by their own free will, decided to participate and complete the survey were considered as part of the 100 participants. Participants were able to stop the survey at any time.
- **Anonymity:** Once participants received the survey, there was no way of the Researcher being able to tell which online survey belonged to which Participant. In the same way, no other participant was able to access any other participant's survey or data.
- **Duty of Confidentiality:** All information gathered by the Researcher from participants, and all results from surveys and the interpretation thereof remains confidential throughout and after the study, and no personal data which could possibly identify any participant had been collected.

## **1.8 CHAPTER CLASSIFICATION**

- Chapter 1:** Research Proposal
- Chapter 2:** Knowledge Management Areas, University Course Offerings ,  
Required Competencies and The High Failure Rate of Projects
- Chapter 3:** Competencies Required for Project Managers in the Engineering,  
Construction and Information Technology Industries
- Chapter 4:** Research Methodology and Design
- Chapter 5:** Data Analysis and Interpretation
- Chapter 6:** Summary of Findings, Conclusion and Recommendations

## **1.9 SUMMARY OF THE CHAPTER**

This chapter covers the introduction and background to the study and provides the basis and reasoning for which the research was conducted. It outlines pertinent research underpinning the need for this study and explains the objectives, ethical considerations undertaken and the problem sought to be addressed by this research. The literature reviewed in this chapter shows the many facets to the subject matter of project management. It introduces the key concepts of the topic and gives insight into the knowledge areas requiring full understanding by project managers in order to foster positive project outcomes. This also gives rise to the investigation into how these knowledge areas are perceived in industry, whether graduates are sufficiently equipped with the industry-required knowledge and if the views of academia and industry are not harmonious, how to proceed to bridge this gap.

## **CHAPTER 2:**

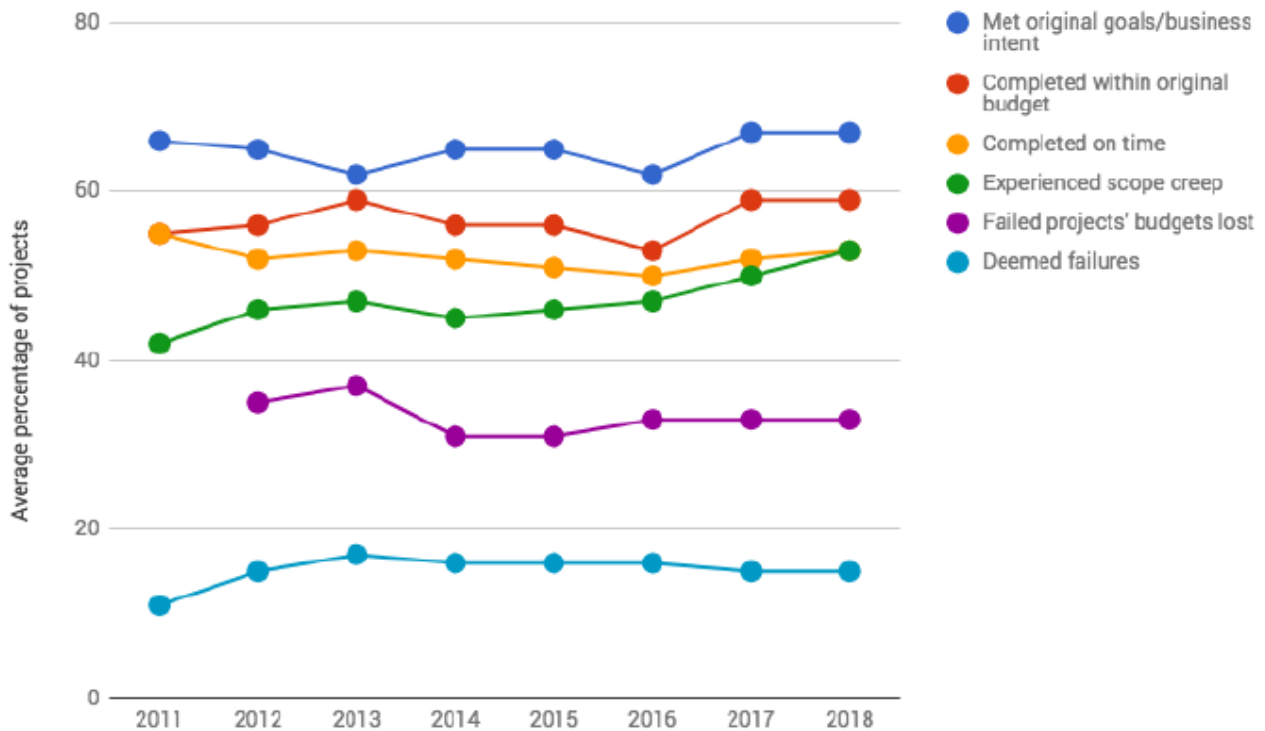
### **KNOWLEDGE MANAGEMENT AREAS, UNIVERSITY COURSE OFFERINGS, REQUIRED COMPETENCIES AND THE HIGH FAILURE RATE OF PROJECTS**

#### **2.1 INTRODUCTION**

Analysing the failure rates, causes of failure and success factors opened the investigation into what project managers needed to be skilled and knowledgeable in. Once this was proven through literature, the researcher could carry out an analysis into the content being taught to prospective managers at a tertiary level be concluded in order to match the curriculum with what is required in order foster higher rates of project success in industry.

The failure rate of projects is key in understanding the relevancy and pertinence of this study. The rate at which projects across the engineering industry fail and the factors contributing to this negative outcome must be explored. Similarly, it is of critical importance to this study that success factors are also considered. By investigating the elements which contribute to success, a clear depiction of what is required by project managers in order to ensure that the success factors are present throughout the projects which they work on, and that the factors contributing to failure on projects were mitigated.

**Figure 2.1: Project Performance Metrics**



**Source: The Pulse Report, PMI. (2018: 14).**

From figure 2.1 above by the PMI (2018: 14), it can be seen that since 2011 there has been a significant increase in the projects that met the original goals and business intentions. A noteworthy point is that from 2014, projects that experienced scope creep has been rising rapidly. This is a contributing factor to project failure. It is also noted from this graph that there is a rise in the number of projects that are deemed failures between 2017 and 2018. Figure 2.1 also clearly depicts where the issues in industry lie and how greatly they affect projects.

## **2.1 DEFINING PROJECTS AND PROJECT MANAGEMENT**

Lester (2014: 15) defines a project as a unique operation composed of co-ordinated activities undertaken to reach specific targets and goals within specific constraints including time, cost and resources. Munk-Madsen (2016: 6) argues that a project

should be defined as an organisational unit which solves a unique or complex task. Mirza et al (2013: 722-723) opines that a project is an interim endeavour with a defined beginning and end, carried out in order to create a product or provide a service.

In order to effectively analyse the failure rates of projects outlined in figure 2.1, further note must be given to what project management is and involves. Since the definitions of a project (as researched above) all allude to activities and endeavours carried out within defined parameters of time, cost and resources – the management of these (or mismanagement thereof) is critical in the investigation into the causes of failure in projects. Koskela and Howell (2002: 3) identified various theories and assumptions based on project management. According to the outcomes of this research, numerous issues in project management and fundamentally cause failure in the practice thereof.

Table 2.1 below discusses these theories and assumptions which have detrimental effect on the practice of project management.

**Table 2.1: The underlying theories and assumptions of project management.**

<b>Theory of Project</b>		<p><b>Conceptualization:</b> Project is a transformation of inputs to outputs</p> <p><b>Principles:</b></p> <ol style="list-style-type: none"> <li>1. The total transformation of a project can be decomposed into manageable and well-understood sub-transformations, tasks</li> <li>2. A project can be realized in a optimal manner by realizing each task in an optimal manner and the tasks in optimal sequence</li> </ol> <p><b>Corollary:</b> Project performance can be performed by improving the tasks</p> <p><b>Assumptions:</b></p> <ol style="list-style-type: none"> <li>1. Tasks are independent, except sequential relationships</li> <li>2. Tasks are discrete and bounded</li> <li>3. Uncertainty as to requirements and tasks is low</li> <li>4. All work is captured by top-down decomposition of the total transformation</li> <li>5. Requirements exist at the outset and they can be decomposed along with work</li> </ol>
<b>Theory of Management</b>	<b>Theory of Planning</b>	<p><b>Conceptualization:</b> There is a managerial part and an effector part in the project; the primary function of the managerial part is planning, and the primary function of the effector part is to translate the resultant plan into action.</p>

		<p><b>Principles:</b></p> <ol style="list-style-type: none"> <li>1. Knowing the current state of the world, the desired goal state, and the allowable transformations of state that can be achieved by actions, a series of actions, the plan, can be deduced.</li> <li>2. The plan is translated into reality by the effector part of the organization.</li> </ol> <p><b>Assumptions:</b></p> <ol style="list-style-type: none"> <li>1. Translating a plan into action is a simple process, by following directions.</li> <li>2. The internal planning of a task is a matter of the person to whom the task has been assigned</li> </ol>
	<b>Theory of Execution</b>	<p><b>Conceptualization:</b> Managerially, execution is about dispatching tasks to work stations.</p> <p><b>Principle:</b> When, according to the plan, the time has arrived to begin task execution, it is authorized to start, in speech or in writing.</p> <p><b>Assumptions:</b></p> <ol style="list-style-type: none"> <li>1. The inputs to the task and the resources to execute it are ready at the time of authorization.</li> <li>2. The task is fully understood, started and completed according to the plan once authorized.</li> </ol>
	<b>Theory of Control</b>	<p><b>Conceptualization:</b> There is a process to be controlled, a unit for performance measurement, a standard of performance and a controlling unit (thermostat control).</p> <p><b>Principle:</b> The possible variance between the standard and the measured value is used for correcting the process so that the standard can be reached</p> <p><b>Assumptions:</b></p> <ol style="list-style-type: none"> <li>1. The process is of continuous flow type, the performance of which is measured at aggregate terms</li> <li>2. The process can easily be corrected by the control available.</li> </ol>

**Source: Koskela and Howell (2002: 3)**

According to the Prince 2 Project Management Methodology (2010), project failures are extremely common with varying reasons for these failures. A common cause of failure noted by Prince 2 is the lack of coordination and communication – two functions acknowledged to be key factors in the practice of project management. In agreement with this, Belout as cited by Hyttinen (2017: 14), the success or failure of a project is largely dependent on the management of people. In further concurrence to this, Cooke-Davies (2002: 189) opines that it is people who deliver the projects and who need to be managed as opposed to simply managing the processes and systems which make up a project.

Considering the explanations above which focus largely on the management of the people who carry out the activities on a project, it is important to further seek out the other elements which encompass the practice of project management. The Project Management Institute split the practice of project management into the following knowledge areas in order to support the success of the projects.

The knowledge areas are outlined in the table below.

**Table 2.2: PMI PMBOK: The nine knowledge areas of project management.**

<b>1. Project Integration Management</b>
<b>2. Project Scope Management</b>
<b>3. Project Time Management</b>
<b>4. Project Cost Management</b>
<b>5. Project Quality Management</b>
<b>6. Project Human Resources Management</b>
<b>7. Project Communications Management</b>
<b>8. Project Risk Management</b>
<b>9. Project Procurement Management</b>

**Source: PMBOK Guide. 5<sup>th</sup> Edition. (2013).**

### **Project Integration Management**

This knowledge area explains the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities within the project team, PMBOK Guide. 5<sup>th</sup> Edition. (2013).

### **Project Scope Management**

Scope management on a project refers to the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully, PMBOK Guide. 5<sup>th</sup> Edition. (2013).

### **Project Time Management**

Previously known as Project Schedule Management, this knowledge area seeks to complete the processes required to manage the timely completion of the project, PMBOK Guide. 5th Edition. (2013).

### **Project Cost Management**

This knowledge area covers the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget, PMBOK Guide. 5th Edition. (2013).

### **Project Quality Management**

Project Quality Management is the completion and management of processes and activities that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken, PMBOK Guide. 5th Edition. (2013).

### **Project Human Resources Management**

This knowledge area refers to the process of managing the processes that organize, manage, and lead the project team, PMBOK Guide. 5th Edition. (2013).

### **Project Communications Management**

This covers the processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information, PMBOK Guide. 5th Edition. (2013).

### **Project Risk Management**

This is the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project, PMBOK Guide. 5th Edition. (2013).

### **Project Procurement Management**

This refers to the processes necessary to purchase or acquire products, services, or results needed from outside the project team. Processes in this area include



Procurement Planning, Solicitation Planning, Solicitation, Source Selection, Contract Administration, and Contract Closeout, PMBOK Guide. 5<sup>th</sup> Edition. (2013).

## **2.2 PROJECT FAILURE**

Noting the nine knowledge areas outlined in Table 2.2 above, it then stands to reason that should these elements be mismanaged, it would ultimately contribute to the entire project being at risk thus potentially contributing to the failure of a project.

In research by Greene (2018: 1-4) it is cited that projects in the Information Technology sector of the Engineering industry fail due to three common issues which are discussed below.

Inaccurate requirements, poor documentation and communication of requirements could lead to the development team completing a project that is not aligned to the expectations of the client. Greene (2018: 2) posits that this not only incurs additional costs, but also often leads to extensive time delays and harsh effects on the iron triangle. Another reason for project failure noted by Greene is uninvolved project sponsors, throughout the project as the development should be reviewed, tested and assessed.

Another factor contributing to failure of Information Technology projects is noted to be shifting project objectives. Once a project has started, changes to objectives of the project will either have negative effects on the time to complete the project or the budget initially planned for the project.

In agreement with Greene (2018: 3), Discenza and Forman (2007: 56) state that the customer should be included at the beginning of the project. The customer should also be continually involved as things evolve on the project, so that the required adjustments can be made together.

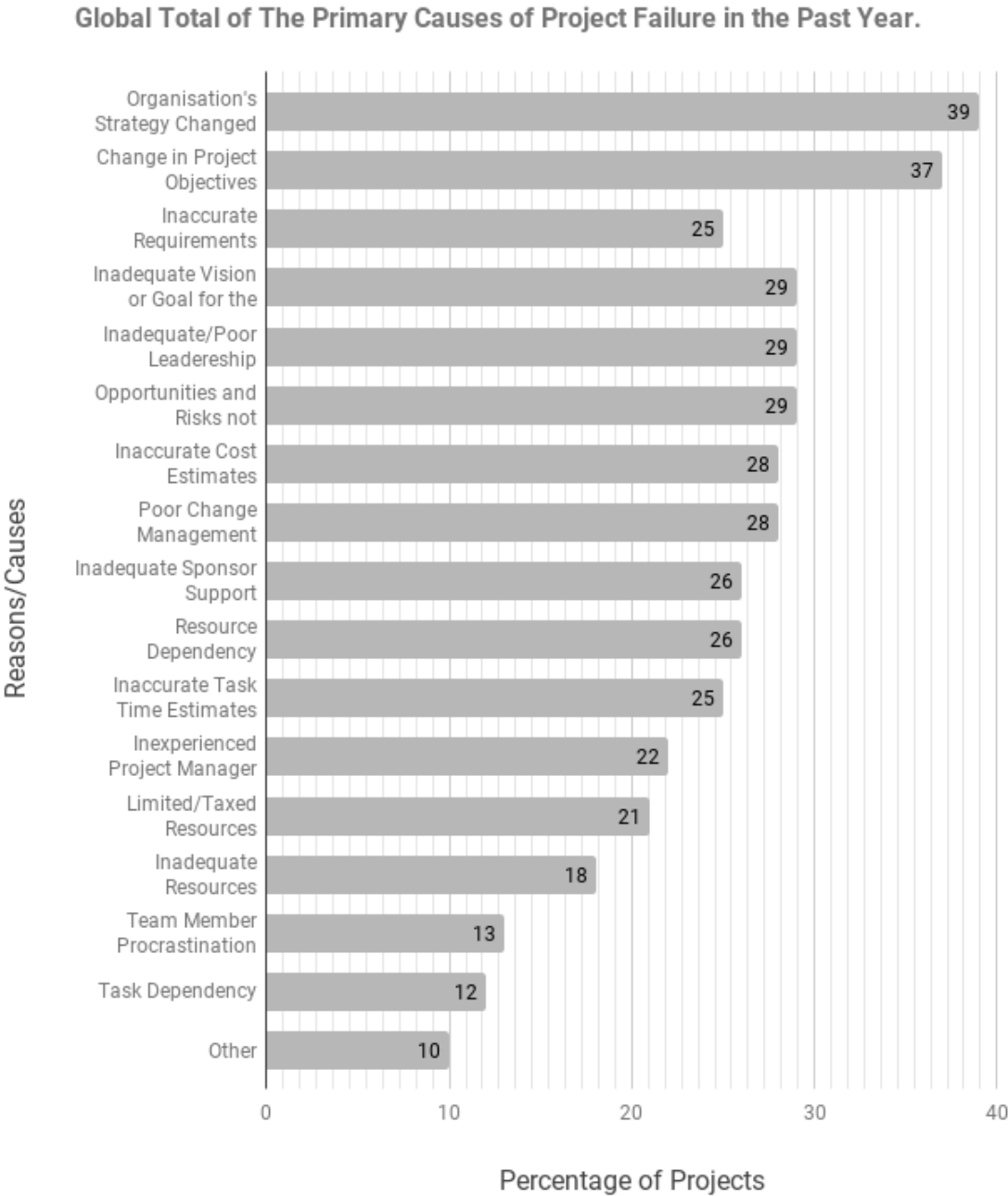
Adding to this, the Project Management Institute conducts an annual survey regarding Project Management services in global organisations. The report, conducted since 2006, provides its readers with pivotal insights into these organisations, their projects as well as their Project Management standards. Langley (2018: 7) posits that if an organization is not succeeding at Project Management, then it is true that they would then be putting the delivery of their strategies at risk. This statement indicates the great importance of Project Management in any business desiring to achieve goals and

strategies, despite the industry or sector it finds itself in. It is this importance that must drive us to further investigate how to better the training of Project Managers to equip them well enough for the significance of their role in businesses and industry.

Montequin et al. (2016: 441) explain that it is no longer sufficient for the success of projects to be solely based on cost, deadlines and specifications. From this study, it is opined that what is of more importance in this regard is whether the parties affected by or associated with the project are satisfied with its outcome, since meeting time or cost constraints would be futile if the final product or service does not meet expectations in its performance or purpose.

Figure 2.2 is key to gauging where Project Managers should be more skilled in to lower the rate of failure in projects.

**Figure 2.2: Global Total of The Primary Causes of Project Failure in the past year.**

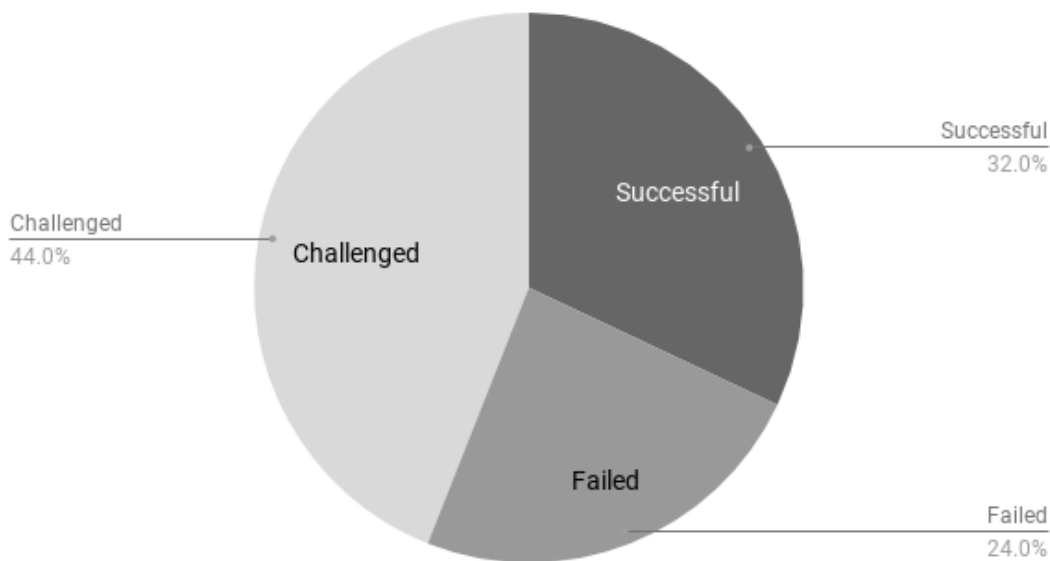


**Source: The Pulse Report, PMI. (2018: 25).**

Barron, M and Barron, A. R. from The Standish Group carried out research in order to ascertain the failure rates of projects across engineering industries over a 12 month period. Figure 2.2 illustrates the results of this research by splitting up the projects investigated into three categories.

**Figure 2.3: Challenged, Successful and Failed Projects**

Percentage of Projects in the three Standish Group Categories



**Source: The Standish Group. Barron, M. & Barron, A.R. (2009: 28).**

Projects found in the successful group were characterized as being delivered on time, within budget, with the required and specified features and functions of the product or service. According to Barron and Barron (2009: 28), projects found to be in the challenged category were delivered late, outside of their budgets and without or with less features and functions that specified and originally agreed upon. Those projects in the failed category were either cancelled before they were completed or they were delivered but never used.

From the results depicted in Figures 2.2 and 2.3, it is clear that the exploration into the reasons for failure would surely be a stepping stone to a more indicative image of what the project management fraternity is currently lacking. In the same way, the investigation into factors leading to project success would aim this research at what is required from project managers in order to run and complete projects that are deemed successful.

Whether or not a project is deemed successful upon its completion has been widely debated in literature. Baskshi et al. (2016: 1199) opines that with every project operates in its own unique eco-system, with its own level of complexity. Owing to this, it is very difficult to specifically explain what exactly would constitute a project being deemed successful. Alami (2016: 62-79) posits that the success of a project is based on parameters that are unique to each endeavour – in agreement with the characteristics of a project explained by Bakshi et al. (2016). Attesting to this, Jorgensen et al. (2017: 1573) maintains that the reasons for project failure are more diverse than simply not adhering to time, cost and resourcing constraints.

Jenner (2015: 4) suggests that there are five common causes of project failure particularly geared at the engineering industry. The first of these causes are a lack of clear links between the project and organisation strategies. This is explained to be the misalignment of strategic objectives. For projects to succeed, Jenner suggests that projects must be aligned with the strategic objectives of their organisations' in order to ensure that measures of success, viability and strategy are agreed upon and aligned.

The second common cause of failure in projects is a lack of clear senior managements, ownership and leadership. According to Jenner (2015: 4), when projects are lacking in these aspects, they are highly likely to fail. Projects require clear lines of leadership and ownership to aid accountability and direction. Another cause of project failure cited is the lack of effective engagement with stakeholders. It is explained that effective and timeous engagement is critical to meeting the expectations of delivery.

Lack of skills and the absence of a proven approach to project and risk management is considered to be the fourth case of project failure according to Jenner (2015: 5). Effective project and risk management enables the project team to deliver tasks according to the required quality, trusting that risks are being averted and addressed continuously by project leadership. Too little attention given to breaking up activities and deliveries into manageable steps is also cited as a cause of project failure. Jenner (2015: 6) maintains that projects are more likely to meet expectations if they are completed in realistic portions and delivered accordingly.

**Table 2.2: Causes of failure on Projects.**

<b>Cause</b>	<b>Cause</b>
Irruption of competitors	Project manager lack of competence
Continuous or dramatic changes to the initial requirements	Project manager lack of vision
Customer's requirements inaccurate, incomplete or not defined	Project requirements deficiently documented
Disagreement or conflict of interest among departments	Project staff changes
Inaccurate cost estimations	Project team lack of competence
Inaccurate time estimations	Project team misunderstanding related to customer/user needs
Deficient management of suppliers and procurement	Project team lack of commitment
Lack of management support	Public opinion opposition to Project
Lack of previous identification of legislation	Quality checks badly performed or not performed at all
Badly defined specifications	Extremely new or complex technology
Political, social, economic or legal changes	Unexpected events with no effective response
Project manager lack of commitment	Unrealistic customer expectations
Project manager lack of communication skills	Wrong number of people assigned to the project

**Source: Montequin et al. (2016: 442).**

Since it is explained by Montequin et al. (2016: 441) that the element of subjectivity is present in both concepts of success and failure on projects, their research was conducted to ascertain what the causes are associated with project failure. The study presented the most common factors contributing to project failure from literature, listed in Table 2.3 above. From the list in the table above it is clear that there are a vast range of instances and scenarios contributing to project failure. It thus stand to reason that the management of these risks is required in order to mitigate them and either lessen their effect on the project or even if possible, eradicate them altogether. Once completed, the study by Montequin et al. (2016) resulted in the Table 2.4, indicating which of the common contributing factors to failure from literature were most common to the industry at the time of the study.

**Table 2.3: Most frequent and least frequent causes of project failure.**

<b>Most Frequent</b>	<b>Least Frequent</b>
Incomplete, wrong or not defined customer specifications	Irruption of competitors
Continuous or dramatic changes to initial requirements	Political, social, economic or legal changes
Inaccurate time estimations	Project Manager's lack of commitment
Project requirements inadequately documented	Public opinion opposition to project

**Source: Adapted from Montequin et al. (2016: 444).**

In many instances, a large cause of project failure can be attributed to delays in completion time. These delays can be explained as time overrun or the fact that extended amounts of time are required in order to complete the project. This in effect suggests that when delays are reported, it can be inferred that the progress of the project and planned progress of the project are no longer aligned.

In construction and other similar engineering projects where many of the required activities are outsourced to third parties, these delays are often out of the control of the Project Manager and the core Project Team.

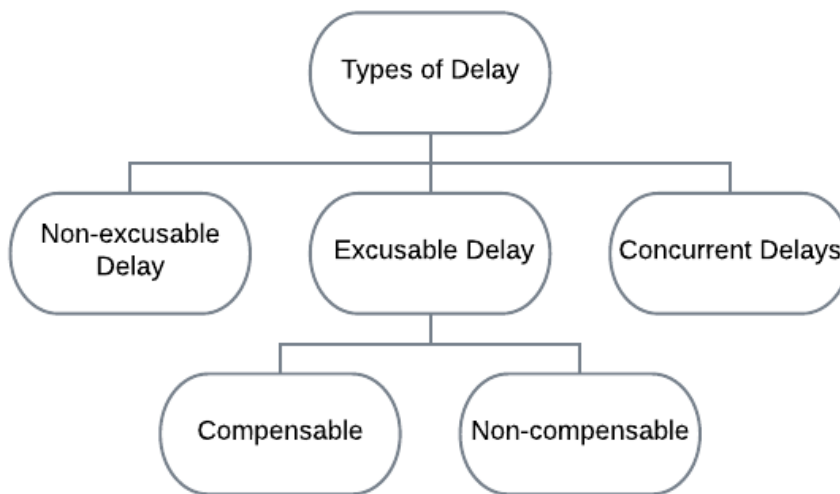
According to literature, there are two types of delays which need to be managed by a Project Manager working on these types of Projects; excusable and non-excusable delays. Al Hadi Tumi et al. (2009: 265).

When contractors or their suppliers are delayed without any fault of the owner of the Project – these delays are referred to as a non-excusable delay. It is the responsibility of the contractor or supplier to correct an incident of this nature, make up lost time or remunerate the owner of the Project as compensation for the delays on their part. In cases such as these, cost constraints are felt by the third party at fault instead of by the owner and these policies are noted at the outset during the contracting stages of the project. Conversely, excusable delays can be categorized into compensable and non-compensable delays. The first kind are caused by the owner of the Project, whilst the latter are caused by uncontrollable circumstances experienced by third parties. In the case where the incident is unavoidable – these delays are not deemed the responsibility of either party but are simply noted as such by both parties. Al Hadi Tumi et al. (2009: 266).

Concurrent delays are more complex than simply identifying and managing one delay or factor at a time. Instead, these delays (which are very common in the construction industry) occur when “more than one factor delays the project at the same time or in an overlapping period of time. (Hamzah, N. et al. 2011: 490-495). Figure 2.4 below clearly depicts the explanations provided by the literature alluded to above.



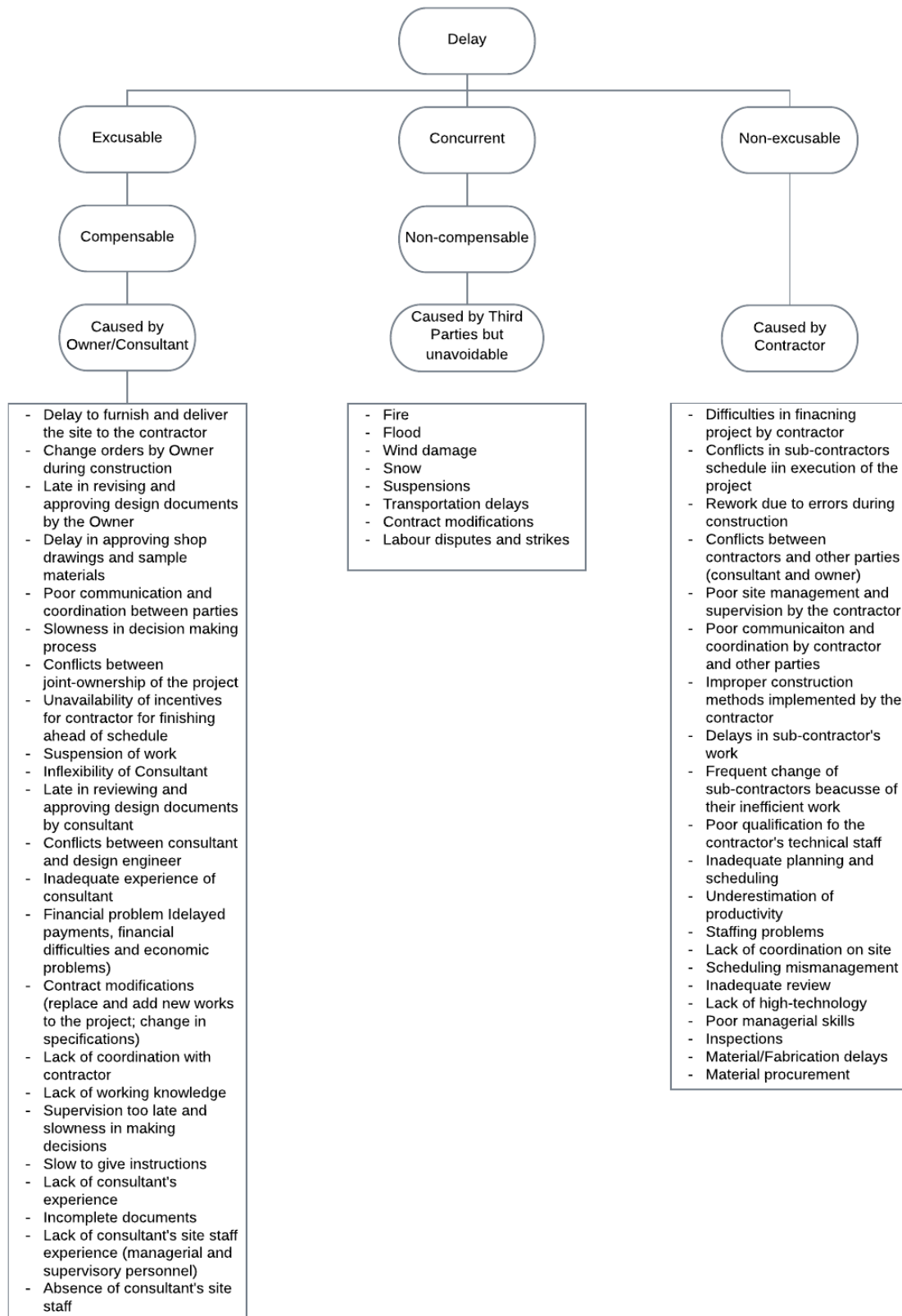
**Figure 2.4: Types of Delays in Projects.**



**Source: Hamzah, N. et al. (2011: 493)**

Figure 2.4 is further explained in Figure 2.5 which details what each type of delay consists of in the construction industry. In order to prove the relevance of this study it was important that attention was drawn to the types of issues pertinent in the various sectors of the engineering industry. Investigating whether these issues and factors differ from sector to sector lead to whether the research into varying the educational offering for each stream would be relevant. The research depicted in Figure 2.4 clearly indicates that these delays explained by Hamzah et al. (2011: 493) are unique to the construction industry. Therefore would not be found in the other sectors explored such as engineering and information technology. Whilst there could be similarities therein, delays in construction cannot be addressed in the same way in the information technology sector as an example of this.

**Figure 2.5: Types of Delays in Projects.**



**Source: Hamzah, N. et al. (2011: 494)**

This framework (depicted in Figure 2.5) allows us to see the extent to which Project Management is required in order to mitigate and manage these delays, as well as clearly defines examples of each. The in-depth analysis of delays as a cause of project failure and the focus on projects in the construction industry drew attention to the very specific industry dilemmas and challenges which face project managers in this industry.

Whilst there are commonalities between causes of delays across projects in all industries, the differences in delays between these industries far outweigh the similarities. It can also stand to reason that the management of the delays (which ultimately could result in project failure) is key to the impact that these delays could have on a project. Experience, knowledge of industry and good stakeholder relations would indeed improve the way and extent to which the project manager would be able to mitigate, manage and even report on these delays to the relevant parties. It is this kind of insight that would aid project managers in minimizing the impact of these delays or factors on the project as a whole.

In 2009, a report was published by the International Data Corporation. According to this report which was focused on improving Information Technology project outcomes, 25% of IT projects were deemed complete failures. Adding to this, the report also found that up to 50% of the projects in their specific study required rework, whilst 20-25% of the projects studied did not provide any return on the initial investment, Pucciarelli and Wiklund (2009: 5).

Just as the potential risks (referred to as delays) to construction and engineering-type projects were highlighted earlier in this chapter, so will we now highlight the risks to projects in the Information Technology industry. In a research paper written by Hamed Taherdoost and Abolfazl Keshavarzsaleh for the 9<sup>th</sup> International Conference Interdisciplinary in Engineering in 2016, they examined what risks are involved in projects within the Information Technology and Software Development industries.

Whilst examining these factors, researchers were able to categorise the risks into multiple areas which would require focus and management in order to mitigate the risks and lower the chances of them coming to fruition throughout the lifecycle of the project; Taherdoost and Keshavarzsaleh (2016: 1071.)

These categories and risks are listed in the table below, explaining each category and detailing what each category could entail, making us aware of elements to look out for in this particular environment and industry.

**Table 2.4: Risk (failure) factors of Information Technology projects.**

<b>Risk Factor</b>	<b>Dimensions</b>
Complexity	High level of technical complexity
	Highly complex tasks
	Many vendors
	One of the largest projects attempted
	Significant integration and customization required
	Use of new technology
	Use of technology that has not been used in prior projects
Contract	Failure to specify appropriate measures
	Failure to specify non-performance penalties
	Not flexible
	Neglect post-outsourcing
	Contract in favor of vendor
Financial	Currency exchange fluctuations
	Hidden costs
	Insufficient funds
Legal	Inadequate protection of intellectual property
	Privacy and security intrusion
	Socio-political instability
	Trade barriers
	Uncertainty about the legal environment
Scope & Requirements	Conflicting requirements
	Gold plating or over specification
	Ill-defined project
	Incorrect requirements
	Inadequate requirements
	Not based on sound business case
	Unclear requirements

Planning & Control	Changing and creeping objectives/scope/requirements
	Low visibility of project process
	Poor audit, quality assurance and control
	Poor change management
	Poor project governance
	Poor project leadership
	Poor project management
	Poor project planning
	Poor systems of authority
	Poor user expectations management
	Unrealistic estimation of schedule and required resources
Execution	Inadequate disaster recovery operations
	Incompatible development choices
	Noncompliance with specified methodologies
	Technical and performance problems
	Organisational change inadequately addressed
	Lack of readiness to implement
	Logistical complications
	Technological discontinuity

**Source: Taherdoost & Keshavarzsaleh. (2016: 1072).**

In agreement with the literature explored regarding factors contributing to the demise of projects, Schmalz et al. (2019: 2) lists the following to be factors influencing the failure of information technology projects.

**Table 2.5: Contributors to Failure in Information Technology projects.**

<b>Contributing Factor</b>
Scope creep
Continually changing project scope/objectives
Project Management
Solution ambiguity
Staffing resources
Introduction of new technology
Inadequately trained development team members
Inexperienced team members
Lack of required knowledge/skills in project team
Organisational culture

**Source: Author's own elaboration. (2019).**

Since the factors contributing to failure have been explored in order to prove the relevance of this study, the converse must be considered in order to ascertain the variety of skills and sector-relevant, technical knowledge required in order to deliver projects deemed successful in industry, thus leading us to the investigation of what industry requires of project managers in order to deliver accordingly.

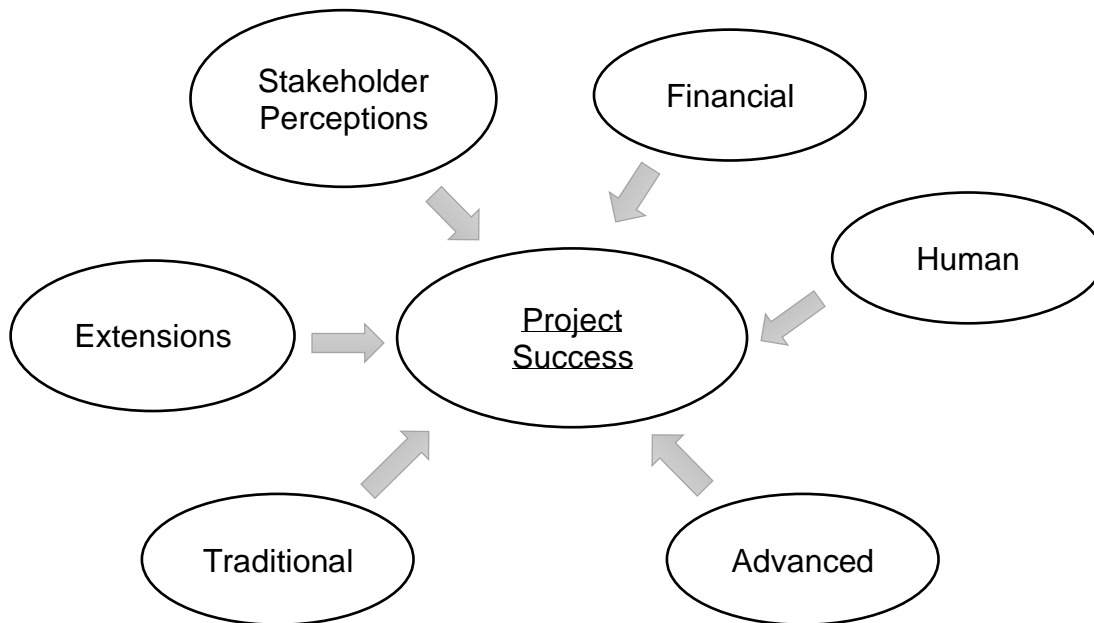
## **2.3 PROJECT SUCCESS**

Radujkovic and Sjekavica (2017: 607) posits that when considering project success, there are two main concepts that should be taken into account; project success and project management success. Whilst there are similarities between these two concepts, Rudijkovic and Sjekavia (2017: 607) maintain that the main different between these two concepts is that project success is concerned with linking the success of the project with the overall evaluation of the achievement of the project goals. On the other hand, project management success is related to the traditional measurement of time, cost and quality performance.

In agreement with this, Sebestyen (2017: 571) states that there are distinguishing factors between the project success and project management success. Despite this, it is also noted that there is a very clear relationship between the two concepts and that

successful project management would in turn lead to a successful project. Figure 2.3.1 below shows the aspects of project success as concluded in this research.

**Figure 2.6: Aspects of Success.**



**Source: Sebestyen, Z. (2017: 572)**

Table 2.6 depicts the elements affecting the success of a project. Without remaining cognisant of these aspects and understanding how they impact the success of a project will enable the project manager to successfully deliver the tasks at hand. Each of these aspects are explained below.

**Extensions aspect:**

The traditional iron triangle of cost – time – quality is the basis of success criteria on any project. Reich et al. (2010: 35) published that whilst the iron triangle is common in projects across industries, the standard and criteria to which they are upheld differs from industry to industry. In addition to this, the final goal of a project is to add or create value for a business, community or to accomplish the goals of the project set out at its inception. This sentiment reinforces the claim that this would differ in various industries owing to the fact that not only is value perceived differently in different industries, but is also seen in the way in which value is created and the iron triangle is satisfied.

**Stakeholders' Perception aspect:**

Davis (2013: 189) postulates that the perception of success will differ for each stakeholder. Adding to this, the perceptions of senior management, the core project team and the client will all have differing perceptions, but which will all be critical to the evaluation of the success of the project.

Williams et al. (2016: 1836) based project success on two factors; customer satisfaction and the quality of the client relationship. Whilst in literature the quality of the client relationship has not been added to the iron triangle of success, it is seen that should this relationship not be positive, the perception of the project and its success could be impacted solely based on the subjective nature of this particular aspect.

#### **Human aspect:**

Sebestyen (2017: 571). Projects are carried out by people contributing to the realisation that human assets must be considered as part of project success criteria. In order to properly consider the human element as an aspect of project success, Liphadzi et al. (2015: 286) found that there had been a strong connection between positive leadership styles, the manner in which the project team responded to these styles and that there is a definite relation between the human element, the manner in which they are led and the overall success of the project.

#### **Financial aspect:**

Sebestyen (2017: 575) asserts that private and public projects (across industries) would have differing financial goals. For private projects the goal is to create financial value – an element which can be measured objectively. In contrast to this, it is suggested that public projects aim to be economically valuable which unlike the private sector, this is an element which is often exposed to subjective opinion. Since communities value various elements of economic and social value subjectively, the success of a project could be seen differently by different communities. The economic approach therefore suggests that a delay in a public sector project or scope creep or even exceeding the budget of such projects may not render the project a failure should the community concerned still see the value in its final delivery.



**Advanced Considerations aspect:**

Muller and Turner (2007: 299) found that ascertaining project success must involve analysing the type of project, the sector and industry in which it exists or operates and the personal excellence of the project manager. Other advanced considerations in the success of a project like project management methodology are presented by Joslin and Müller (2015: 1379). Serrador and Pinto (2015: 1042) echo this view as they posit that agile project management methods could improve the likelihood of project success. Of course, it is to be considered that the statement by Serrador and Pinto (2015: 1043) would be aligned to projects in the Information Technology industry where agile principles have been a proven method of success.

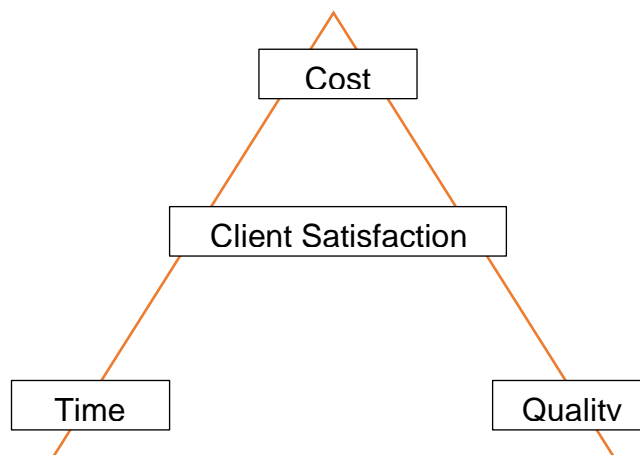
**Table 2.6: Critical success factors and Project performance indicators.**

<b>Critical Success Factors</b>
Support from Senior Management
Skilled Designers
Skilled Project Managers
Troubleshooting
Project Team motivation
Commitment of all project participants
Strong/detailed plan effort in design and construction
Adequate communication channels
Effective control, such as monitoring and updating plans
Effective feedback
Adequate financial budget
<b>Project Performance Indicators</b>
Construction cost
Construction time
Quality
Construction, time and defect predictability
Client satisfaction with the service
Client satisfaction with the product

**Source: Author’s own elaboration. (2019).**

Alias et al. (2014: 61) explain that success on a project is determined by various expectations being met. From a project management perspective, critical success factors are variables or characteristics that have a significant impact on the success of a project if these are well maintained and managed. Considering this, it is also brought to the fore that there are various indicators which demonstrate that a project has been successful. In this way, it can be seen that should the critical success factors be present, the performance indicators too shall be met. These performance indicators differ between varying industries and sectors as can be seen from the table below. Table 2.6 above lists the success factors and performance indicators present in construction projects, as researched by Alias et al. (2014: 64-65).

**Figure 2.7: Widespread and conventional project management success criteria.**



**Source: Alotaibi and Nufei (2014: 329)**

Whilst the triangle in figure 2.7 above (like the traditional one) can be used and related to all industries where projects take place, it is critical to note that there are varying contributors to failure and success on projects in varying sectors. Similarly, the subjective opinions of clients and communities which contribute to the perspective in which the project is viewed also differs between industries and sectors. From this it can be deduced that in order to manage these factors of failure, success and subjective opinions as well as to adequately manage a project team and deliver work and results

of a high standard, the knowledge of the project manager is surely critical in achieving this.

## **2.4 CHAPTER SUMMARY**

To conclude, it is noted in the review of literature above that there are clear distinctions and expectations regarding the success of a project. This success is comprised of different standards between industries and various sectors within it. The iron triangle commonly used to gauge project success has since been expanded upon in order to cater for the rising need to ensure client satisfaction – a subjective criteria of success which must be managed in order for projects to be deemed successful. Alotaibi and Nufei (2014: 329) constructed an updated version of the iron triangle when explaining this in order to depict the importance of the client satisfaction factor as a criteria for project success. It can thus be posed that a generic approach to the teaching of project management as a subject would only equip new project managers with limited knowledge. This risks sending them into the workforce as generic project managers with inadequate industry specific knowledge, both theoretically and practically.

This links directly to the research question at hand which seeks to ascertain whether Project Management graduates are adequately equipped to immediately enter their particular industries and positively participate in these various sectors of the engineering industry.

**CHAPTER 3:**  
**COMPETENCIES REQUIRED FOR PROJECT MANAGERS IN THE  
ENGINEERING, CONSTRUCTION AND INFORMATION TECHNOLOGY  
INDUSTRIES**

**3.1 INTRODUCTION**

According to Chouhan and Srivastava (2014: 14), a competency is the capability of applying or using knowledge, skills, abilities, behaviours, and personal characteristics to successfully perform critical work activities, specific functions, or operate in a given role or position. It is also explained that competencies are thus underlying characteristics of people which indicate ways of behaving or thinking, that spans across a wide range of situations and endure for long periods of time. Using this as a basic definition, one is able to deduce that competences of a particular standard would be required in order to carry out a specific job. This is the approach to this chapter.

Summer and Powell (2013: 2) describe a core competency to be the skill, trait, motive, attitude, knowledge and value (or any other personal attribute or characteristic) deemed important to completing a particular job or function. It is explained that a core competency could be a hard skill (one where technical skills are prioritised and necessary) or a soft skill where the human interaction and interpersonal skills are required. According to Ballesteros and Chavarria (2015: 14), technical skills and competencies involve the understanding of an activity involving its processes, techniques, methods and procedures followed in order to carry out and complete the activity or job. Conversely, it is suggested that human skills (or soft skills) are the traits required to work effectively with others, identifying and harnessing relationships and managing these relationships with those working on the project as well as with various stakeholders of the project.

Adding to this, Marnewick et al. (2016: 8) noted that competencies of a project manager should be arranged into three overarching competence areas. The first of these being People; referring to personal and interpersonal skills. The second competency noted was Practice - referring to the technical skills required to manage a project, and lastly, Perspective; referring to the skills required in order to navigate various contextual issues in the broader project environment.

Whilst it can be seen that there are clear differences in the perspective of the literature cited above, Fisher (2011: 1000) suggests that there are six soft skills and behaviours that effective project managers possess, clearly in agreement with Marnewick et al. (2016) and Summer and Powell (2013). Understanding, leading and influencing the behaviours of the project team, are described to be some of the soft skills and behaviours that effective project managers have. Adding to these are the ability to manage conflict and developing cultural awareness on their project teams.

Stevenson and Starkweather (2010: 663) posit that soft skills positively impact the effectiveness of a project manager. Skills such as leadership, communications, verbal and written abilities, positive attitudes and the ability to handle ambiguity and manage change are all noted in this research to have an impact on the success of the project and the perceived success of the project manager. Abdelnaser et al. (2012: 28) opined that the job of a project manager is of critical importance in the engineering industry and the sectors within it. Taking this into account, it is thus critical to analyse the training and development of these individuals in order to properly equip them with the competencies required by industry to bring projects to their successful completion.

Mahmood et al. (2006: 3) postulated that professional project managers working in engineering and construction industries where technical issues are of importance (and could lead to the failure of the project), must be able to confidently identify these issues and ensure that the appropriate action is taken to mitigate these technical risks and issues. In the same study, four key components of professional competence for project managers were discovered.

**Knowledge/Cognitive Competence**

Having the necessary work-related knowledge and the capability to put this knowledge to applicable use. The combining of both knowledge and cognitive proficiency in order to apply knowledge to a variety of situations.

**Functional Competence**

The functional competence is the capacity to carry out a variety of work-based tasks and activities effectively and efficiently in order to produce specific desired outcomes.

**Personal/Behavioural Competence**

This refers to the ability to adopt and adapt to accepted, apparent conducts in work-related circumstances.

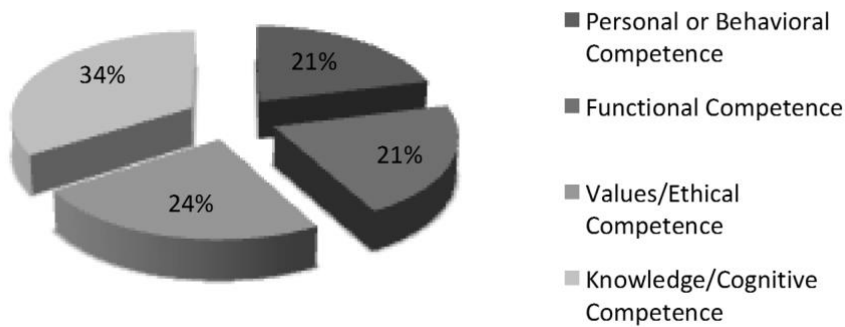
**Values/Ethical Competence**

Having the suitable personal and professional standards and morals and being capable of making sound decisions and conclusions based on these values in work-related circumstances.

During the research respondents were asked to rate the competencies based on the acceptance of the four competencies and the accuracy of the components within them. The results of the research show the importance of these four competencies rated in percentages according to the level of acceptance, importance and agreement the respondents assigned to each of them.

In figure 3.1 below, the recommended occupational mix for Consultant Project Managers is depicted, as a result from the research by Mahmood et al. (2006: 5).

**Figure 3.1: Consultant Project Managers' Competence Mix Model.**



**Source: Mahmood et al. (2006: 7)**

From the diagram it can be deduced that the largest and most important component to the respondents is the knowledge and cognitive competence. It is important to note that the functional and personal and behavioural competence were rated equally – noting that whilst performing tasks to set standards is critical in achieving job success, the manner in which one does so and the values and ethical standards are just as critical to the success of a project manager.

In another view of the competencies required, Krahn and Hartment (2006: 1-14) take a different approach to their research into the competencies required by project managers. During their research, the aim was to investigate and further understand the fundamental elements of effective project leadership.

The first phase of the research sought to identify and rate the most important characteristics, skills and competencies for project managers. Whether the importance ratings of these competencies changed if project characteristics were changed was also investigated.

The results from their first phase of research listed the ten most important competencies (out of 50 competencies presented to the participants) in order of importance as rated by the professionals interviewed;

### **People skills**

Rated as the most important skill, Donald (2015: 65) explains this to be the manner in which someone interacts with another.

### **Leadership**

Kickul and Neuman (2000: 36) define leadership as the ability of an individual to influence, direct and lead other individuals, teams or even entire organisations.

### **Listening**

Defined in this instance as a required skill for project managers, Halone et al. (1998: 15) explains listening to be the ability to give attention to individuals sharing information with you and actively processing that information in order to derive meaning from it.

### **Integrity, ethical behaviour, consistency**

Pillai (2011: 163) defines integrity as the practice of being honest and showing a consistent and uncompromising adherence to strong moral and ethical principles and values. Being consistent in this behaviour is critical in being considered as ethical.

### **Strong at building trust**

Braynov (2001: 501) posits that the ability of a leader to establish and build trust with their teams is of critical importance to project success. Without this aspect, team members will find it hard to relate, work with and follow instruction from their project manager.

### **Verbal communication**

The importance of verbal communication amongst teams is noted by Krahn and Hartment (2006: 13) as pertinent in the carrying out of tasks and the completion of the project as a whole. Without communication skills, project managers and team members will struggle to communicate requirements, progress and updates to each other as well as to other stakeholders.



### **Strong at building teams**

Krahn and Hartment (2006: 11) define this competency as the ability to bring the correct people with the required skills together and forging relationships with them in order to build the team required to best carry out the tasks at hand.

### **Conflict resolution and management**

Lundgren (2016: 198) opines that the ability to resolve conflict amongst team members and the processes involved in coming to agreements, understandings and common ground is critical to the synergy of the team. This is especially true for projects spanning longer periods of time.

### **Critical thinking**

Visser and Visser (2019: 233) explain critical thinking to be the analysis of facts in order to form judgment, often making use of problem solving skills and techniques.

### **Understands, balances priorities**

Krahn and Hartment (2006: 11) posit that by understanding and balancing the priorities at hand, a project manager is effectively able to run multiple tasks at any given moment, understand how they impact each other and keep their teams on track.

Whilst the researchers note that the list above correlated with the knowledge gained in the literature studied, it was important to test whether the rankings of these competencies changed when project characteristics were added. Indeed, when testing the hypothesis that the ranking of the competencies would change when various project characteristics were added, it was discovered that this was a valid construct.

**Table 3.1: Most important project manager skills and competencies in the context of a particular project characteristic.**

<b>A large project with large scope</b>
1. Leadership
2. Relevant prior experience
3. Planning
4. People skills
5. Verbal communication and Strong at building teams
<b>A project with high uncertainty</b>
1. Risk management

<ol style="list-style-type: none"> <li>2. Expectation management</li> <li>3. Leadership</li> <li>4. People skills</li> <li>5. Planning</li> </ol>
<b>A novel project where considerable innovation is required</b>
<ol style="list-style-type: none"> <li>1. Leadership</li> <li>2. People skills</li> <li>3. Has vision, purpose and goals</li> <li>4. Self-confidence</li> <li>5. Expectation management and Listening skills</li> </ol>

**Source: Krahn and Hartment (2006: 12)**

By comparing the table and the list above, it is clear that the list of ten most important characteristics is altered when a project characteristic or context is considered. Elements such as planning, expectation management and risk management come to the fore when the context of the project is altered.

### **3.2 SECTOR-SPECIFIC COMPETENCIES**

Whilst the research analysed above brings to the fore a generalized approach to the competencies required by project managers, it is important to explore whether or not there are differences in the competencies required by project managers across various sectors of the industry.

Ahsan et al. (2013: 48) identified through their study that in each sector of the engineering industry, the knowledge, skills and attributes required for employment varied. This knowledge, skill and set of attributes were ranked according to their importance and the five most pertinent (as determined by industry) were listed for each sector in order to highlight the varying skills and competencies required per sector.

**Table 3.2: Top five sought knowledge, skills and attributes for the engineering sectors.**

<b>Information and Communication Technology</b>	<b>Construction</b>	<b>Engineering</b>
Technical Skills	Education	Education
Communication	Communication	Cost Management
Stakeholder Management	Cost Management	Time Management
Certification	Technical Skills	Communication
Time Management	Stakeholder Management	Technical Skills

**Source: Adopted from Ahsan et al. (2013: 48)**

Due to their natural make-up, software projects require the software project manager to manage and direct the efforts of the development team. In the past, this role was seen to be a highly technical one, however as this area of the industry evolves, there are constant investigations into whether these are the most important and only skills required for the role, Peters (2016: 241-243). In a study published in 2014, successful software engineering projects were studied in order to assist project managers in this sector in recognizing the characteristics that successful project managers had in common, Ghazi et al. (2014: 92-96).

The researchers achieved this by examining published research papers that reported on the subject. It was found that there was a common set of factors contributing to the success of the project at the start of all of these projects, and particular factors present at the end. Whilst most of these factors were technical in nature, a common factor at the end of each project contributing to the success of it was one not technical in nature – a “competent software project manager,” Peters (2016: 241-243). This alludes to the importance of the study the researchers then carried out; that a software project manager plays a critical role in the success of a project.

In order for the study by Ghazi et al. (2014: 92-96) to contribute positively to the industry, it was of utmost importance that they answered the question which arose from the first analysis completed during their research;

What knowledge and skills must a software project manager possess in order to be competent thus increasing their likelihood of success?

In the table below, the researchers define five primary functions required in order to successfully manage software projects. Peters (2016: 241-243) formed this table as a summary of the research he had completed.

**Table 3.3: The Five Functions of Project Management.**

Category	Description
Plan	Tasks and Subtasks
	Synchronised with the Project Schedule

	Shows how each event will be achieved
Schedule	Done in collaboration with the team
	List of dates of project events
	Supported by the Project Plan
	Done in collaboration with all involved
Control	Continuous monitoring and analysis (e.g. using Earned Value Management)
	Apply corrective action to achieve plan
Staff	Acquire skilled, knowledgeable team with compatible personalities and complimentary skills
	Resolve intra-team conflicts
Motivate	Review/Evaluate team and individuals
	Help develop individuals' career goals
	Engage team to perform well on project

**Source: Peters (2016: 241-243).**

Whilst the table discussed above details these five important functions, Peters (2016: 241-243) notes that it is important to understand that these skills alone are not necessarily enough to run a software project successfully. Further on in his research, Peters (2016: 241-243) explores what these specific skills are that would inevitably (when combined with the competencies above) produce a successful project manager. This skillset is detailed in the table below.

**Table 3.4: Knowledge and Competencies Critical to Software Project Management Success.**

Category	Description
Estimating	Use of various estimation methods
	Use of Reference Class Forecasting
Communications	Written Expression (e.g. status reports, proposals)
	Presentation skills
Personnel Management	Ability to evaluate and direct the actions of individuals and teams
	Labour law
Negotiation Collaboration	Obtain consensus among stakeholders
Cultural Sensitivity	Awareness & response to the effects of culture(s) represented on the development team
	Sensitivity and response to value system differences
Accounting	Cost allocation, general and administrative overhead expenses

**Source: Peters (2016: 241-243).**

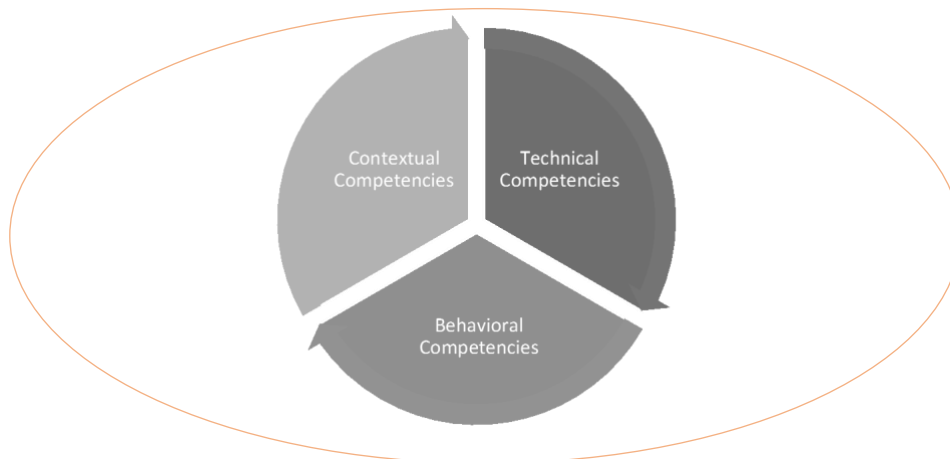
In conclusion to his study, Peters (2016: 241-243) notes that for many years it was believed that the key to delivering successful projects in this field was technology. Through research and years of experience it has come to the fore that this assumption may have been displaced. The recognition of the project manager’s role is now pertinent and increasing the “soft” knowledge and competencies as well as expertly handling people and the eccentricities that come with the practice of managing people (as depicted in the tables above) is what really drives a project of this nature to success.

In agreement with Peters’ research of 2016, Aruajo and Pedron (2015: 53-75) divided the competencies required for project managers in the Information Technology sector. This research split up the competencies into technical, behavioural and contextual competencies. The technical competency refers to competencies relating to the practices of project management such as planning and time management. Behavioural competencies are categorized by interpersonal skills such as leadership and

commitment, whilst the contextual competency consists of skills directly related to the context of the project like technical skills for example (Aruajo & Pedron, 2015: 53-75).

The figure below depicts the IPMA Standard Competence Eye which highlights each of the competencies, explaining that all three sets of competencies are required in order for a project manager in this sector to be most effective and efficient.

**Figure 3.2: The IPMA Standard Competence Eye.**



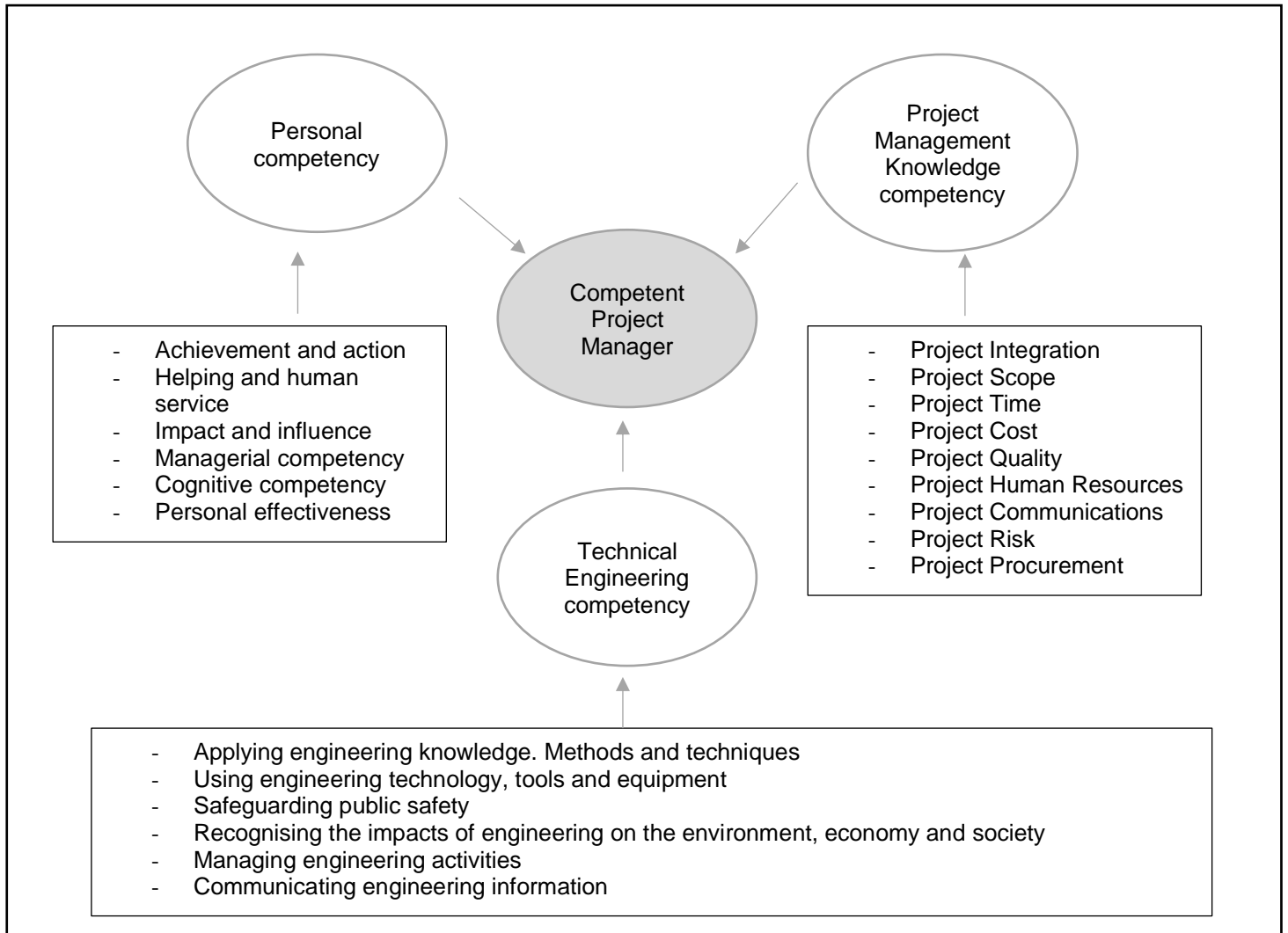
**Source: Aruajo and Pedron (2015: 53-75).**

Continuing in this study, the researchers discovered a profound finding in many areas of literature – that many project managers in the Information Technology industry are lacking soft skills such as communication and leadership, ultimately exposing their weaknesses and dampening their ability to perform optimally (Aruajo & Pedron, 2015: 53-75).

In an effort to collate the data which Aruajo and Pedron (2015: 53-75) discovered in the articles and literature written by Keil et al. (2013) and Skulmoski and Hartman (2009) amongst others, an extensive table was formed grouping the characteristics and competencies project managers in this field need to possess.

For the engineering sector, it can be seen in research by Hashim et al. (2018: 336-337) that there are sector-specific competencies required by project managers in the field of engineering. Figure 3.3 below clearly depicts the competencies and skills required by project managers in the engineering sector.

**Figure 3.3: Conceptual framework of competencies required by engineering project managers.**



**Source: Hashim et al. (2018: 337).**

In another pertinent view, Wiezel and Badger (2015: 2-3) explain that for the construction industry, the changes in industry is what should be driving the education of current learning project managers. This too should be the driver for the content provided by learning institutions on the subject matter. During their research it was found that there are trends in the varying challenges which face project managers in the construction sector. Similar to the education and skill required by project managers in the engineering and information technology sectors (as explored in the aforementioned literature), so too are unique skills and learnings required by project managers in the construction in order to manage risks, issues and the project at large.

What is interesting about the research by Wiezel and Badger (2015: 2-3) is that their findings take an in-depth look at what the environment and sector looks like in the near future (2022 and beyond). This depicts how project managers currently in the learning stages of their career and those currently working in industry should focus their energies should they wish to remain at the fore of their careers. Table 3.5 below explains these forecasted challenges.

**Table 3.5: Forecasted Challenges.**

<b>Trends</b>	<b>Challenges</b>
Globalisation	Projects in areas with difficult conditions
	Safety issues and training beyond traditional areas
	Price/schedule/resource pressure means more competitiveness
	Global supply chains
	Relationship building at multiple locations
	Balance traditional success factors with sustainability objectives and compliance
	More oversight and regulation
Workforce Demographics	Workforce diversity, dynamic and styles
Technology	24/7/365 access from all directions
	Information collected faster than resources can manage and analyse
	Information for decision making will change in minutes



	Constantly evolving project methods, systems and software tools
	More work done off-site
	Global, virtual teams
New and changing organisations	Increase in number of stakeholders with competing agendas
	Increase in number of non-fulltime/contract employees
	Shift in risk sharing models
	Low cost execution centres with more capabilities
	Increased probability of unexpected project risks

**Source: Wiezel and Badger (2015: 3).**

It is noteworthy that in Table 3.5 above, the challenges regarding globalisation and technology are what influence the other two trends of workforce demographics and new and changing organisations. The more technology evolves, in turn so will the way organisations work and approach their projects. As globalisation increases, so too will the way in which teams and organisations are able to work and interact with each other despite their geographic location. It thus stands to reason that these would be important areas of learning and awareness for graduates and students alike.

In addition to this, Collins and Baccarini (2015: 2) posit that in order for Project Managers to become great in the construction industry, they must possess five critical abilities, namely; delegate tasks, reassess project status and prioritisation of activities, problem solving skills, communicating clearly and effectively and understanding the importance of teamwork.

### **Delegate Tasks**

The nature of construction projects are never single-person events. In fact, all construction projects require teams of appropriately and highly skilled people in order to achieve its objectives. Project Managers must have the ability to assign tasks to appropriate resources and teams as well as manage this delegation in terms of timings, costs and any risks that may be involved in delegating tasks in order to complete the project.

## **Reassess the Current Project Status and Prioritize Activities**

Knowing the current state of the project is critical. Throughout the lifecycle of a project the availability of resources fluctuates and there other factors at play that may influence the progress of the project. In order to not fall behind, project managers must remain proactive in their decision making in order to most effectively and efficiently make use of the resources at their disposal.

## **Problem Solving Skills**

Project Managers will never be able to prepare for every possible challenge or problem which they could experience during the lifecycle of a project. Having excellent problem solving skills will enable the project manager to adapt to changing circumstances and evolve strategies that suit the project's needs as these needs arise. It is likely that due to the (sometimes) sensitive nature of construction projects that there could be community backlash, political sentiments or even public outcry. This could hold up the progress of the project and these issues can rarely be foreseen. Problem solving experience and skills will enable the project manager to evaluate these types of situations and keep the project on track as they can.

## **Communicate Clearly and Effectively**

Effective and clear communication is critical on projects where there are multiple teams carrying out tasks and activities. In order for every team and resource to achieve their goals and complete their tasks according time, budget and scope, all requirements must be clearly communicated to them in order for the project to remain on track.

## **Understand the importance of Teamwork**

A project manager cannot achieve success without a team of skilled team members. Great construction project managers understand that their team makes for the success or failure of the project and that they are the driving force within the team keeping everyone focused, informed and the project within budget, time and scope. Project managers in the construction industry must work hard at constantly fostering an environment and culture of teamwork in order to yield the best results from their teams and resources.

## 5.1 CURRENT COURSE STRUCTURE

Whilst the demand for people with qualifications in Project Management is soaring, many institutions offering these courses depend on international textbooks. Of critical importance is the fact that most of the offerings may not be context relevant in the South African environment. The researcher proposes, based on the course structure in table 3.6 below that a more context relevant approach is needed to the material used in these courses.

**Table 3.6: B. Tech Project Management Courses At a University**

<b>B. Tech Course Structure</b>	<b>M. Tech Course Structure</b>
Project Management Processes	Project Resources
Project Quality	Project Management Process
Entrepreneurship	Project Ethics and Governance
Procurement Management	Project Accounting
Research Methodology	Project Quality
Project Accounting	Operational Research
Project Resources	Dissertation
Operations Management	

**Source; website of an unnamed tertiary institute.**

The courses are highly demanded for are thought to be of critical importance, and the students themselves are highly impressed by these offerings. Yet the industry captains do not consider these graduates to be adequately prepared for the workplace, for which they have been groomed; Jaison et al. (2014: 2). It would appear therefore that there is much that needs to be done in terms of the curriculum offered to these prospective graduates to enable them to be ready. The table above displays the different subjects at the institution (arguably the most popular in this course) at the different levels from the Bachelor's degree to the Masters' degree level.

A comparison is therefore made between the offerings in these institutions and the 10 project management Knowledge Areas as recommended by the PMBOK. These are listed below in the table as propositions of subjects that should be offered to project managers under training.

**Table 3.7: Knowledge Management Areas**

Project integration management	Project scope management
Project time management	Project communications management
Project cost management	Project risk management
Project quality management	Project procurement management
Project resource management	Project stakeholder management

**Source; adopted from the PMBOK**

The disparity between the subjects offered in training institutions and the expectations of the PMBOK may be the course for dissatisfaction. Over and above the 10 knowledge management areas (competencies), there are processes that are used in project execution. PMBOK Guide (2008: 128) identifies 5 processes, namely; initiating, planning, executing, monitoring and evaluation, and closing.

- **Initiating:** During this phase, the project is conceptualized and feasibility is determined. This phase often includes defining the project goal; defining the project scope; identifying the project manager and the key stakeholders; identifying potential risks; and producing an estimated budget and timeline.
- **Planning:** It is during this phase that the project manager will create a blueprint to guide the entire project from ideation through completion. This blueprint plans out the project's scope; resources required to create the deliverables; estimated time and financial commitments; communication strategy; execution plan; and proposal for ongoing maintenance.
- **Executing:** During this phase, the project manager will conduct the procurement required for the project as well as staff the team. In this phase, Project Managers are also responsible for delegating and overseeing the work on the project while maintaining good relationships with all team members and keeping the entire project on time and on budget. The Project Manager must therefore be highly organized and an exceptional leader.
- **Monitoring and control:** During this phase, Project Managers must closely measure the progress of the project to ensure it is developing properly.

Documentation plays a huge role during this phase in order to control and efficiently document the phases prior to this as well as the occurrences of the current phase. This becomes crucial to the Closing out phase.

- **Closing:** The closing process group occurs once the project deliverables have been produced and the stakeholders validate and approve them. During this phase, the project manager will close contracts with suppliers, external vendors, consultants, and other third-party providers. All documentation will be archived and a final project report will be produced.

## 5.1 CHAPTER SUMMARY

From the literature explored, it is noteworthy that whilst many of the interpersonal competencies are shared across industries, there are very specific challenges, processes and activities which require industry knowledge and experience in order to achieve success on particular projects. Construction, Engineering and Information Technology projects all require varying industry-specific skills and competencies – those of which are common amongst these industries are rated differently according to their importance in the specific industry.

Based on the research presented and analysed, it must be noted that the competencies required by each sector of the engineering industry, and the developments in these sectors it stands to reason that there is cause for research into what students are being offered at tertiary institutions. Ascertaining how current graduates are performing in industry and what industry needs from project managers in order to achieve successful projects.

By exploring these industry requirements and the current status-quo for project managers across these sectors, an updated curriculum can be formed in order to cater to the needs of the industry, considering the learnings from theoretical sources and to equip project managers for environments of the future.

## CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

### 4.1 INTRODUCTION

According to literature by Rajaseker et al. (2013: 2), research can be defined as a coherent and methodical search for new and valuable information on a specific subject. During research, the words *how* and *what* fundamentally explain what research is. In an article by Naidoo (2011: 47-48) it is noted however that the practice of simply gathering information and examining data is not considered to be research. In order for research to be known as such, according to Naidoo (2011: 48), it must contain the following characteristics; namely; relevance, conceptions of research, research orthodoxies, theoretical orientations and ethical frameworks.

#### 1. Relevance

The research must be based on a topic and background that is of relevance. Conducting research makes use of valuable resources and should your research not be relevant and reliable, it is considered to be unethical as these resources will be wasted. These resources consist of time, material resources and reasoning from participants for example.

#### 2. Conceptions of Research

Research should intend a particular outcome like producing a model or theory, suggesting an intervention, producing information that will aid policy-making or even legislation. Research can be basic or applied – but failing to have an outcome puts the relevance of research into question.

#### 3. Research Orthodoxies

Depending on the industry in which the research is being conducted, there are various types of research that may be more (or less) suited or relevant. Researching attitudes, perception and views for example may not be as relevant in more science-oriented fields as opposed to more quantitative based fields and vice-versa. Selecting the correct type of research is key in establishing the validity of the outcomes.

#### **4. Theoretical Orientations**

Research should be framed in such a way that the scope of the research is limited and the aims of the research are anchored. Frameworks such as grand or substantive theories, feminism eco-systemic trends and critical theories for example all provide the research with a set position in the discipline or theme in which one is working.

#### **5. Ethical Framework**

Research must have magnanimity, non-maleficence and complete reverence for the independence of all of the participants. Every consideration must be made to ensure that participants and practices used throughout the research are of the highest ethical standards.

### **4.2 PURPOSE OF THE STUDY**

The study sought to contribute to the consideration of the future curricula for Project Managers in the Engineering Sciences. By carrying out this study, the data collected aimed to bring to light findings directly from individuals in the industry regarding their experiences with Project Managers in their organisations. The outcome of the data enabled the researcher to put together a revised curriculum that is suited for Project Managers from Construction, Engineering and Information Technology sectors, to not only educate them on the common principles of project management but to also offer these students industry-specific knowledge and skills to better equip them for practical work in their industry. The Information Technology, Engineering and Construction sectors will benefit from this research as their input into the survey and research is critical in the formulation of the proposed curricula. By ensuring that students are prepared according to industry standards, the industries will in turn become more efficient and effective at project management, increasing their profitability and overall capabilities as an organization and industry.

Learning institutions adopting this industry-specific curriculum will also benefit from the research by becoming the institution of choice and possibly a trusted, feeder institution into industries – placing well-equipped students in industries and

maintaining a good relationship with those industries in order to continuously improve on their offerings to students.

### **4.3 OBJECTIVES OF THE RESEARCH**

The primary objective of the research is to identify the knowledge expected from a project manager in the engineering fields of Engineering, Construction and Information Technology.

The secondary objectives of the research are listed below;

- To suggest the design of an appropriate curricula that fits into the industry needs with emphasis on engineering sciences industries in South Africa.
- To design a model that can be used to bring together the industry and academia to work symbiotically to improve on skills training.

### **4.4 RESEARCH METHODOLOGY AND DESIGN**

Before the method and design of a study could be decided upon, it was of utmost importance for the researcher to ascertain which paradigm the research will belong to, Patel (2015: 2). These paradigms are explained by Patel (2015:3-4) to be;

- **Positivist:** Researchers in this paradigm believe there is a single reality which can be measured and known. Researchers using this paradigm are more likely to make use of quantitative techniques to measure this reality.
- **Constructivist:** In this paradigm, researchers believe that there is no single truth or reality and that both truth and reality need to be interpreted. For these reasons researchers in this paradigm are most likely to make use of qualitative research methods in order to interpret their findings and sources.
- **Pragmatist:** Researchers in this paradigm believe that reality is constantly renegotiated, debated and interpreted. Therefore, they believe that the best method to use is the one that identifies and solves the problem.

This study took on a pragmatist approach. This was due to the fact that even though the industry has particular needs, these needs are not constant and change as



technology and the working environments evolve. For this reason, the pragmatist paradigm was used to ensure that recommendations and solutions to the problem could be found, and at any point debated, interpreted by others or used as a basis for future research should it be required.

Much enquiry has been made into the various types of research available to researchers and academics and considering the magnitude of importance placed on the design and methodology selected, extensive research was carried out before a decision was made. Kothari (2014: 15-21) goes on to rationalize these types of research by comparing two sorts, seemingly opposite in nature in order to demonstrate the various types of research.

- Descriptive vs. Analytical Research
- Applied vs. Fundamental Research
- Quantitative vs. Qualitative Research
- Conceptual vs. Empirical Research

For the purposes of this study, it was critical that the researcher made use of both quantitative and qualitative research techniques and methods in order to gather the data required. Whilst there were many quantitative elements to the study, it was just as critical for the researcher to explore the qualitative nature of those currently working in the fields under investigation. The best way for the researcher to approach this was to employ both quantitative and qualitative approaches. This is known as the mixed method approach.

Johnson and Onwuegbuzie (2004: 17-19) there is another method of research that must be included – Mixed Methods. This method is defined by the researchers to be the type of research which allows the researcher to combine quantitative and qualitative research practices, methods, notions, or language into one study; Johnson and Onwuegbuzie (2004: 17). These three methods; quantitative, qualitative and mixed methods were compared and thus, using this knowledge, researchers are able to unequivocally decide on a method and use it to its full extent. In tables 4.1, 4.2 and 4.3 below, the strengths and weaknesses of each of these approaches are explored.

**Table 4.1: Strengths and Weaknesses of Qualitative Research.**

<b>Strengths</b>	<b>Weaknesses</b>
The data is based on the participants' own categories of meaning.	Knowledge produced may not generalize to other people or other settings (i.e., findings may be unique to the relatively few people included in the research study).
It is useful for studying a limited number of cases in depth.	It is difficult to make quantitative predictions.
It is useful for describing complex phenomena.	It is more difficult to test hypotheses and theories.
Provides individual case information	It may have lower credibility with some administrators and commissioners of programs.
Can conduct cross-case comparisons and analysis.	It generally takes more time to collect the data when compared to quantitative research.
Provides understanding and description of people's personal experiences of phenomena (i.e., the "emic" or insider's viewpoint).	Data analysis is often time consuming.
Can describe, in rich detail, phenomena as they are situated and embedded in local contexts.	The results are more easily influenced by the researcher's personal biases and idiosyncrasies.
The researcher identifies contextual and setting factors as they relate to the phenomenon of interest	
The researcher can study dynamic processes (i.e., documenting sequential patterns and change).	
The researcher can use the primarily qualitative method of "grounded theory" to generate inductively a tentative but explanatory theory about a phenomenon.	
Can determine how participants interpret "constructs" (e.g., self-esteem, IQ).	
Data is usually collected in naturalistic settings in qualitative research.	
Qualitative approaches are responsive to local situations, conditions, and stakeholders' needs.	
Qualitative researchers are responsive to changes that occur during the conduct of a	

study (especially during extended fieldwork) and may shift the focus of their studies as a result.	
Qualitative data in the words and categories of participants lend themselves to exploring how and why phenomena occur.	
One can use an important case to demonstrate vividly a phenomenon to the readers of a report.	
Determine idiographic causation (i.e., determination of causes of a particular event).	

**Source: Johnson & Onwuegbuzie (2004: 20)**

**Table 4.2: Strengths and Weaknesses of Quantitative Research.**

<b>Strengths</b>	<b>Weaknesses</b>
Testing and validating already constructed theories about how (and to a lesser degree, why) phenomena occur.	The researcher's categories that are used may not reflect local constituencies' understandings.
Testing hypotheses that are constructed before the data are collected. Can generalize research findings when the data are based on random samples of sufficient size.	The researcher's theories that are used may not reflect local constituencies' understandings.
Can generalize a research finding when it has been replicated on many different populations and subpopulations.	The researcher may miss out on phenomena occurring because of the focus on theory or hypothesis testing rather than on theory or hypothesis generation (called the confirmation bias).
Useful for obtaining data that allow quantitative predictions to be made.	Knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals.
The researcher may construct a situation that eliminates the confounding influence of many variables, allowing one to more credibly assess cause-and-effect relationships.	
Data collection using some quantitative methods is relatively quick (e.g., telephone interviews).	
Provides precise, quantitative, numerical data.	
Data analysis is relatively less time consuming (using statistical software).	

<p>The research results are relatively independent of the researcher (e.g., effect size, statistical significance).</p> <p>It may have higher credibility with many people in power (e.g., administrators, politicians, people who fund programs).</p>	
<p>It is useful for studying large numbers of people.</p>	

**Source: Johnson & Onwuegbuzie (2004: 20)**

**Table 4.3: Strengths and Weaknesses of Mixed Research.**

<b>Strengths</b>	<b>Weaknesses</b>
Words, pictures, and narrative can be used to add meaning to numbers.	Can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently; it may require a research team.
Numbers can be used to add precision to words, pictures, and narrative.	Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.
Can provide quantitative and qualitative research strengths (i.e., see strengths listed in Tables 3 and 4).	Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm.
Researcher can generate and test a grounded theory.	More expensive.
Can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach.	More time consuming.
The specific mixed research designs discussed in this article have specific strengths and weaknesses that should be considered (e.g., in a two-stage sequential design, the Stage 1 results can be used to develop and inform the purpose and design of the Stage 2 component).	Some of the details of mixed research remain to be worked out fully by research methodologists (e.g., problems of paradigm mixing, how to qualitatively analyze quantitative data, how to interpret conflicting results).
A researcher can use the strengths of an additional method to overcome the weaknesses in another method by using both in a research study.	
Can provide stronger evidence for a conclusion through convergence and corroboration of findings.	

Can add insights and understanding that might be missed when only a single method is used. Can be used to increase the generalizability of the results.	
Qualitative and quantitative research used together produce more complete knowledge necessary to inform theory and practice.	

**Source: Johnson & Onwuegbuzie (2004: 21)**

Based on the information gathered during the exploration of research methods, the mixed method of research was selected since it is best suited to the study in question. It allowed the researcher to gain a broader understanding of the current opinions of those in industry by obtaining data based on straight forward, quantitative questions. The mixed method approach also allowed the researcher to expand the research into a more qualitative approach where respondents could express their subjective opinions on the subject matter. Sein et al. (2011: 35) has added that the major motivation to use quantitative research is that it enables the researcher to observe and understand a group of people sharing a particular characteristic or behaviour pattern which is under study in the research.

#### **4.5 TARGET POPULATION**

The population under study were people who were actively working in project teams or those involved in executive positions at Engineering firms (Construction, Information Technology and related industries) in Cape Town, South Africa. This will allow the researcher to ascertain what requirements and the expectations are from project management graduates in the same geographical location. It was critical to the research that only those actively involved in current industry participated in the study. Those with industry experience but not currently active in industry would skew data since their feedback would not be based on current occurrences but rather past experiences.

#### **4.6 SAMPLING FRAME**

Sapsford and Jupp (2006: 28) define a sample frame as a list of individuals within a population that fit the criteria for a specific means. In this study, the total number of people eligible for this research was 300 in total. This comprised only of active project practitioners in the relevant industries. In order to ensure the validity of the sampling frame, the researcher took care in ensuring the following;

- Each individual listed in the sampling frame was given a unique numeric identifier
- The contact details of each individual was listed and correct
- All 300 eligible participants were present in the sampling frame list
- Each participant only appeared once in the sampling frame list

#### **4.7 SAMPLING METHOD**

Yates et al. (2008: 5) explain that a simple random sample is a grouping of individuals, also known as a sample, chosen from a larger population. In simple random sampling, each individual is selected at random and entirely by chance, to the extent that each individual and subset has the same chance or probability of being chosen at any stage during the selection process. A convenience sample, as posited by Saunders, Lewis, and Thornbill (2012: 65), is a type of sampling approach where the sample is taken from a group of people who are relatively easy to contact or to reach and agree to participate in the research. Systematic random sampling was chosen to remove any bias in the process of selecting respondents. Every third manager who was available was selected for the survey, there was also an element of convenience sampling since not all the prospective respondents were not always available or willing.

#### **4.8 SAMPLE SIZE**

Särndal et al. (2003: 9) stated that the larger the sample the smaller the margin of error and the higher the probability of coming up with more reliable findings. Of the 300 project practitioners in the system, every third individual available was selected and a total of 101 practitioners participated.

Convenience and simple random sampling was utilised in order to approach employees in managerial and project team positions to participate in the research. In

view of the size of the industry, and the target population being generally smaller (always fewer managers than employees and project teams requiring highly specialised and unique skillsets), it has been estimated that 100 project team members will be interviewed from a sample frame of 300.

Brown and Hirschfield (2002: 469-478) explain that using multiple informants improves the quality of response data and thereby the validity of research findings. In order to conform to this, organisations within the relevant sectors were contacted in order to gain permission to carry out the research. These organisations were asked to put the researcher in contact with the employees who are in management or team roles on projects within the organisation.

#### **4.9 THE QUESTIONNAIRE AS A MEASURING INSTRUMENT**

The data collection instrument utilised for this study was an online structured questionnaire which was checked and approved by a statistician to ensure and validate the legitimacy, reliability and ethical use thereof. Sansoni (2011: 8) defines a questionnaire to be a document seeking specific information from its respondents. Considering this definition, the questionnaire contained multiple sections of questions in order to best derive the information required.

#### **4.10 DATA COLLECTION INSTRUMENT**

The nature of information required would be better served by using a questionnaire considering its advantages. The questionnaire was constructed and with the assistance of a statistician a “trial run – pilot of 15 people was conducted. Corrections were made on the instruction of the statistician, who also tested and corrected the instrument for both validity and reliability. The ”SOURCE says that the questionnaire brings uniformity to the study in that all respondents are asked the same questions with possibly the same level of understanding. Besides, the questionnaires can be kept for future use if necessary. The questionnaire was made up of three sections, namely;

**Section A = Biography** – this assisted with controls on the eligibility of the respondents to the research. The questionnaires from those who did not qualify would be removed during editing and cleaning.

**Section B = Likert scale** – for ranking of perceptions, attitudes, beliefs and some of the unmeasurable aspects of the questions asked.

**Section C = Open ended questions** – this assisted with getting some form of discussion / statement from the participants on other issues relating to this matter which might not have been covered in the questionnaire.

Section one contained Biography Questions focusing on the eligibility of the respondents in terms of their relevance to the study. Section two comprises of Likert Scale used to gauge the current situation in industry from the respondents. Section three contains open-ended questions allowing the researcher the opportunity to further engage with the participants on the subject.

Once the instrument had been approved, data was collected by gaining permission from organisations in the relevant sectors to approach the appropriate level of employees and obtain their consent to participate in the research. Likert-scale and open-ended questions as well as the online format of the instrument aided the completion of the survey by participants, by ensuring ease of use and ethical spending of their valued time.

Once the researcher had gathered respondents, they were sent the online survey accompanied by a covering letter via a link in an email. Once a respondent began the survey, there was no way of tracking which respondent completed which survey, ensuring their anonymity throughout the research process and the analysis of the results. The use of an online survey was relevant since respondents all had varying amounts of time available. The online survey allowed respondents to begin the survey and return to complete it at a later stage if need be, creating convenience for the respondents and a higher participation rate for the researcher since respondents are able to complete the survey at a time most convenient for them.

#### **4.11 DATA COLLECTION, ANALYSIS AND INTERPRETATION**

Patton (2002: 434), explains the last phase of the analysis process; interpretation, as encompassing an explanation and account of the results, answering “why” questions, attaching meaning to specific results and putting patterns into an investigative and logical framework. The discipline and thoroughness of qualitative analysis, Patton (2001: 434) explains, depends entirely on exhibiting solid explanatory data in a manner



that others (interpreting the results) are able to understand the results and thus draw their own conclusions from the research.

For the purposes of this study, Excel and SPSS was used in order to graphically explain and interpret the data collected. The data will be validated, cleaned and analysed to ensure the legitimacy and strength of the construct, methods and procedures used to ensure that the research has;

- met the purpose of the research design
- ensure that the questionnaire was derived from the written literature review
- ensure that only relevant and eligible participants were used for the research

The process of editing data was also rigorous. According to literature by Krishnan et al. (2015: 59) data requires cleaning which is further explained to be the process of correcting or removing corrupted, inaccurate records from a set of data.

Surveys were analysed upon completion to ensure that all data to be analysed is properly prepared to ensure the validity of the study and the results.

#### **4.12 VALIDITY AND RELIABILITY**

According to Mohajan (2017: 59), validity and reliability increase the transparency of the research and minimise the chances of the researcher being able to use any bias in qualitative research. Taherdoost (2016: 28) explains that validity refers to how well the data collected covers the aim of the investigation. In a study by Noble and Smith (2015: 34) it is opined that mixed method and qualitative research methods are often criticised for lacking scientific thoroughness and have a reputation of simply being the collection of personal opinions that are subject to the researcher's bias. To clearly validate the reliability and importance of mixed method and qualitative research, Noble and Smith (2015: 35) created Table 4.4 below in order to distinctly note the similarities in the scientific rigour between qualitative and quantitative research methods – despite their differing naming conventions.

**Table 4.4: Terminology and criteria used to evaluate the credibility of research findings.**

Quantitative research terminology & application to qualitative research	Alternative terminology associated with credibility of qualitative research
<p><i>Validity</i> The precision in which the findings accurately reflect the data.</p>	<p><i>Truth value</i> Recognises that multiple realities exist; the researchers' outline personal experiences and viewpoints that may have resulted in methodological bias; clearly and accurately presents participants' perspectives.</p>
<p><i>Reliability</i> The consistency of the analytical procedures, including accounting for personal and research method biases that may have influenced the findings.</p>	<p><i>Consistency</i> Relates to the 'trustworthiness' by which the methods have been undertaken and is dependent on the researcher maintaining a 'decision-trail'; i.e. the researcher's decisions are clear and transparent. Ultimately an independent researcher should be able arrive at similar or comparable findings.</p> <p><i>Neutrality (or confirmability)</i> Achieved when truth value, consistency and applicability have been addressed. Centres on acknowledging the complexity of prolonged engagement with participants and that the methods undertaken and findings are intrinsically linked to the researchers' philosophical position, experiences and perspectives. These should be accounted for and differentiated from participants' accounts.</p>
<p><i>Generalisability</i> The transferability of the findings to other settings and applicability in other contexts.</p>	<p><i>Applicability</i> Consideration is given to whether findings can be applied to other contexts, settings or groups.</p>

**Source: Noble and Smith (2015: 35)**

To ensure that this research met the criteria of truth value, consistency, confirmability and applicability, the researcher chose members of industry at random by contacting organisations and allowing participants to volunteer to participate – eliminating any sort of bias for the type of respondent desired by the researcher. Since the surveys

were online and anonymous, the researcher was never able to identify which individuals completed which surveys nor could they identify any relation to which organization the participants were from. This, combined with the anonymity and volunteer process, achieved the neutrality aspect and ensured that other independent researchers would be able to carry out the same research and obtain similar findings. The element of applicability is addressed in the recommendations of this research where curriculum guidelines are proposed which can be applied to students studying project management.

#### **4.13 ETHICAL CONSIDERATIONS**

In the field of Research, ethics refers to the application of moral principles to investigations and research. It ensures that research is governed by and protected from academically unscrupulous behaviour, illegal activities, misconduct, fraudulent actions, bias and plagiarism. Participants in the research survey were fully informed and educated regarding the purpose of the study, the importance and sensitivity of their anonymity and any questions they had regarding the research was answered. Researchers are bound and influenced by ethical requirements which speak to our professional, institutional and national and international expectations. Smith (2003:56) explains that there are five fundamentals of research that must be considered throughout studies. In essence, these are honest discussions regarding intellectual property, visibility of roles during research, adhering to rules of consent, honouring the privacy of participants and the acknowledgement of use of other resources in the study. This indicates that it is important for the researcher to lean on these fundamentals and follow these principles throughout the study – keeping the participants informed and assured of their anonymity, ensuring that outside sources are acknowledged, communicating risks (if any) beforehand and confirming that each participant is willing, knowledgeable and aware of how the data will be used and comfortable with the process of participation.

According to Wiles (2013: 6) the sphere of research ethics is concerned with issues of morality in research contexts. Adding to this, it is explained that there are various attributes to ethical research which should be considered by the researcher, and adequately applied throughout the research. These attributes such as informed consent, anonymity and duty of confidentiality are detailed below, explaining how these important factors were considered in this research.

- **Informed Consent:** Each potential participant had the opportunity to decide (without any influence) whether or not they would like to participate in the study. Only those who, by their own free will, decided to participate and complete the survey were considered as part of the 100 participants. Participants were able to stop the survey at any time.
- **Anonymity:** Once participants received the survey, there was no way of the Researcher being able to tell which online survey belonged to which Participant. In the same way, no other participant was able to access any other participant's survey or data.
- **Duty of Confidentiality:** All information gathered by the Researcher from participants, and all results from surveys and the interpretation thereof remains confidential throughout and after the study, and no personal data which could possibly identify any participant had been collected.

#### **4.14 SUMMARY**

As a detailed overview of the research methodology adopted for this study, this chapter explained and justified the chosen research design, methodologies and sample framework. It outlined the theoretical aspect of each element involved in carrying out the research and clearly depicts the methods fulfilling the basis outlined in the literature. This ensured that the research processes, methodologies and design of the research were aligned to research standards and ethical considerations.

## **CHAPTER 5:**

### **DATA ANALYSIS AND INTERPRETATION**

The primary purpose of this study was to ascertain whether Tertiary Institutes provide sufficient industry-relevant theoretical and practical knowledge to Project Management students, is correct and could be scientifically proven. By interviewing people employed and working on projects within the relevant industry and sectors, the researcher was able to gain relevant insight into the current situation in industry and the expectations these sectors within the industry have for graduate Project Managers. It is often taken for granted that the material taught to students in tertiary institutes reflects the trends currently occurring within the industry, however this unfortunately is not always the case as stated in the research problem.

During this chapter, the results of the study will be presented as well as each question explained. This will aid the interpretation of the data and present the results in a logical manner making use of graphical representations ensuring that the data and analysis thereof are accessible and comprehensible. The questions in the survey were split into three sections which will be discussed in this chapter. Section A consisted of Biographical questions, Section B of Likert Scale questions and Section C of open-ended questions to further engage the participants.

From a total of 300 possible respondents approached to participate in the study, 123 agreed to participate however 23 surveys were incomprehensible due to being incomplete. To this end, the goal of reaching 100 respondents from the industry was attained with 100 reliable, complete surveys being collected.

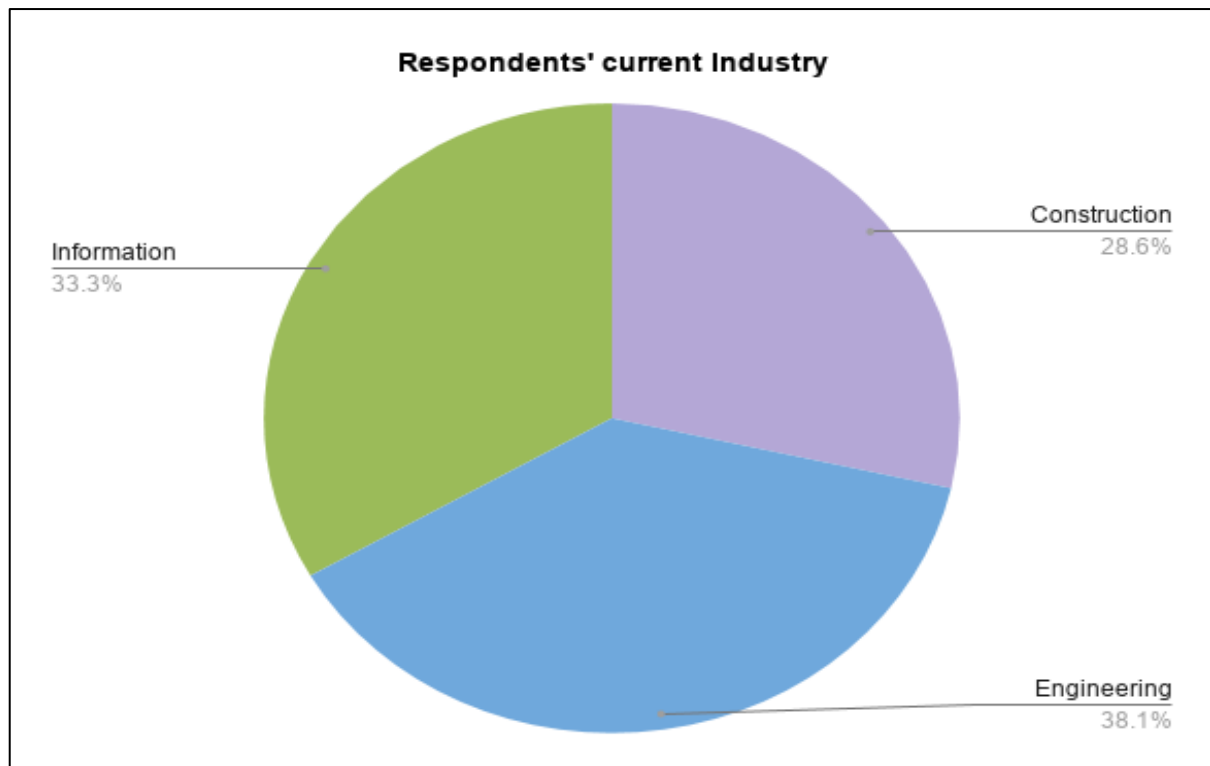
#### **Section A: Biography Questions**

The Biographical questions were used to ascertain whether the participants were eligible to participate in the study. It was also designed to give further insight into the experience and knowledge of the participant and the extent to which they engage with projects, project teams and project managers.

**QUESTION 1: Which industry do you work in?**

**RESPONSE;** It was important to know the industry in which the respondent worked from, as this would inform the researcher on the profile of the respondents. The participants' responses are illustrated in figure 5.1 below.

**Figure 5.1 Industries that the respondents worked in.**



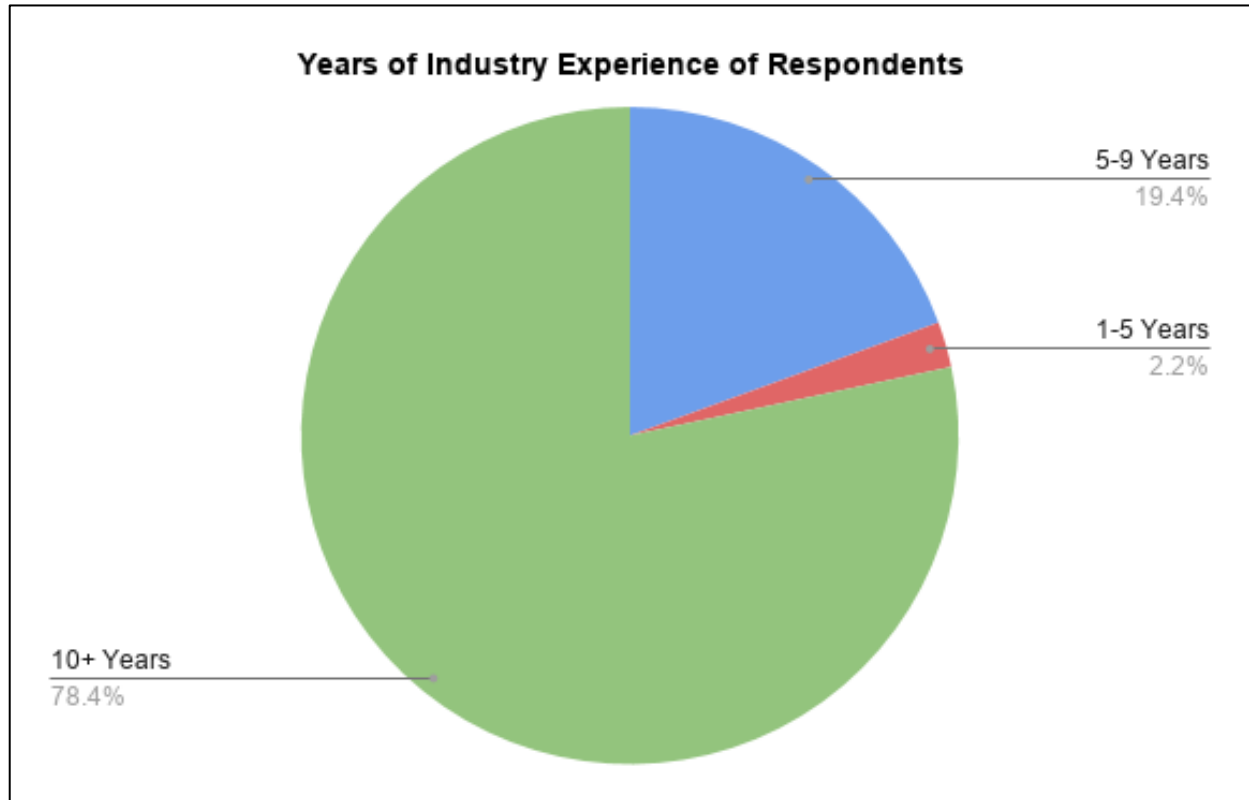
**Source: own construction from research**

The target population was engineering firms, and in the response the different respondents indicated as, the highest number at 38% was from engineering in general (not specified), this was followed by 33% from information which may have included both software and hardware installations. The last was 29% from construction, this may include civil engineering as well as construction of buildings.

**QUESTION 2: How many years of experience do you have?**

**RESPONSE;** It is critical to the study to ensure that the feedback we obtain are from a broad spectrum of individuals with varying levels and years of experience. This allows the responses to be indicative of an overall view of what is currently occurring in industry.

**Figure 5.2: Years of work experience in Industry.**



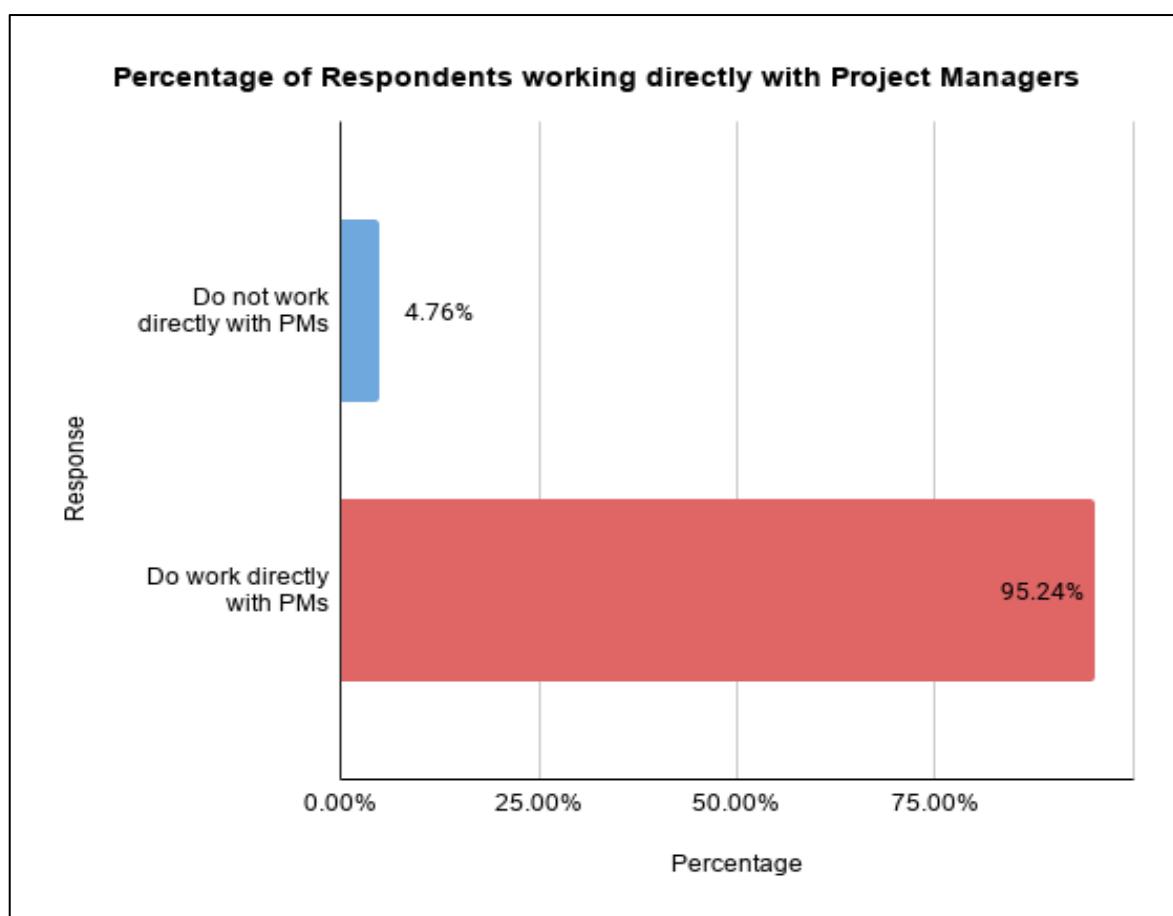
**Source: Author's own construction.**

Figure 5.2 above indicates that the vast majority of respondents (a total of 78.4%) have 10 or more years of experience in their industries, speaking directly to the reliability of the results. 21.6% of respondents have between 1 and 9 years of experience. It is important to note that responses are not negated based on the number of years of experience of respondents.

**QUESTION 3: Do you work directly with Project Managers in your Organisation?**

**RESPONSE;** Understanding how many of the respondents work directly with Project Managers is an important aspect of this research. The criteria for participants to take part in the research was that they either work directly with Project Managers or are involved in the recruitment, screening or in executive positions. Those in the latter roles do not work directly with Project Managers every day, however they do possess the knowledge and insight to have participated in this study.

**Figure 5.3: Percentage of respondents who work directly with Project Managers.**



**Source: Author's own construction.**

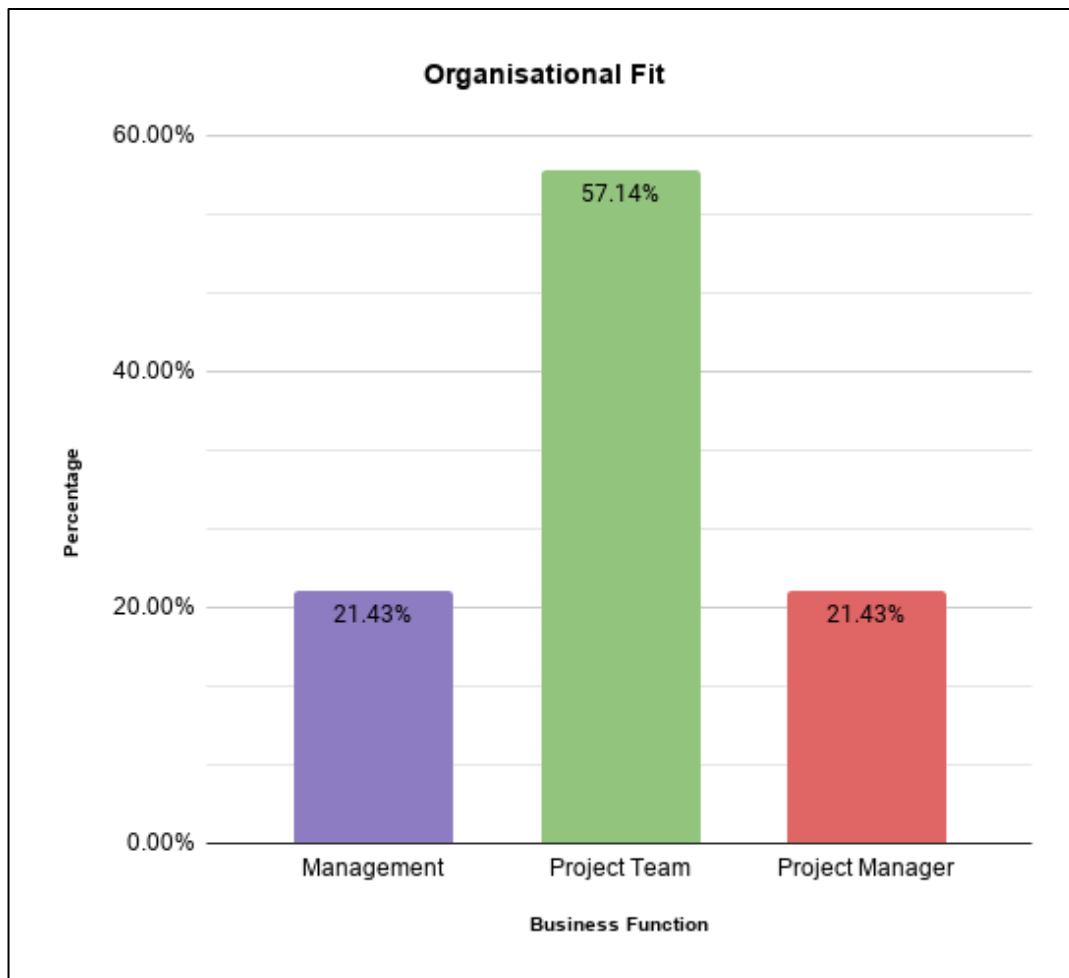
Figure 5.3 shows that 95.2% of the respondents work directly with Project Managers in their day to day activities. 4.76% of the respondents do not work directly with Project Managers however we know that they are involved either in the recruitment of Project Managers, or the management of these resources and their teams.



#### QUESTION 4: Where do you fit in to your Organisation?

**RESPONSE;** The results of this question indicate that there are respondents in multiple areas of business. From the results it can be seen that the majority (57.14%) of respondents were active Project Team members.

**Figure 5.4: Organisational Fit.**



**Source: Author's own construction.**

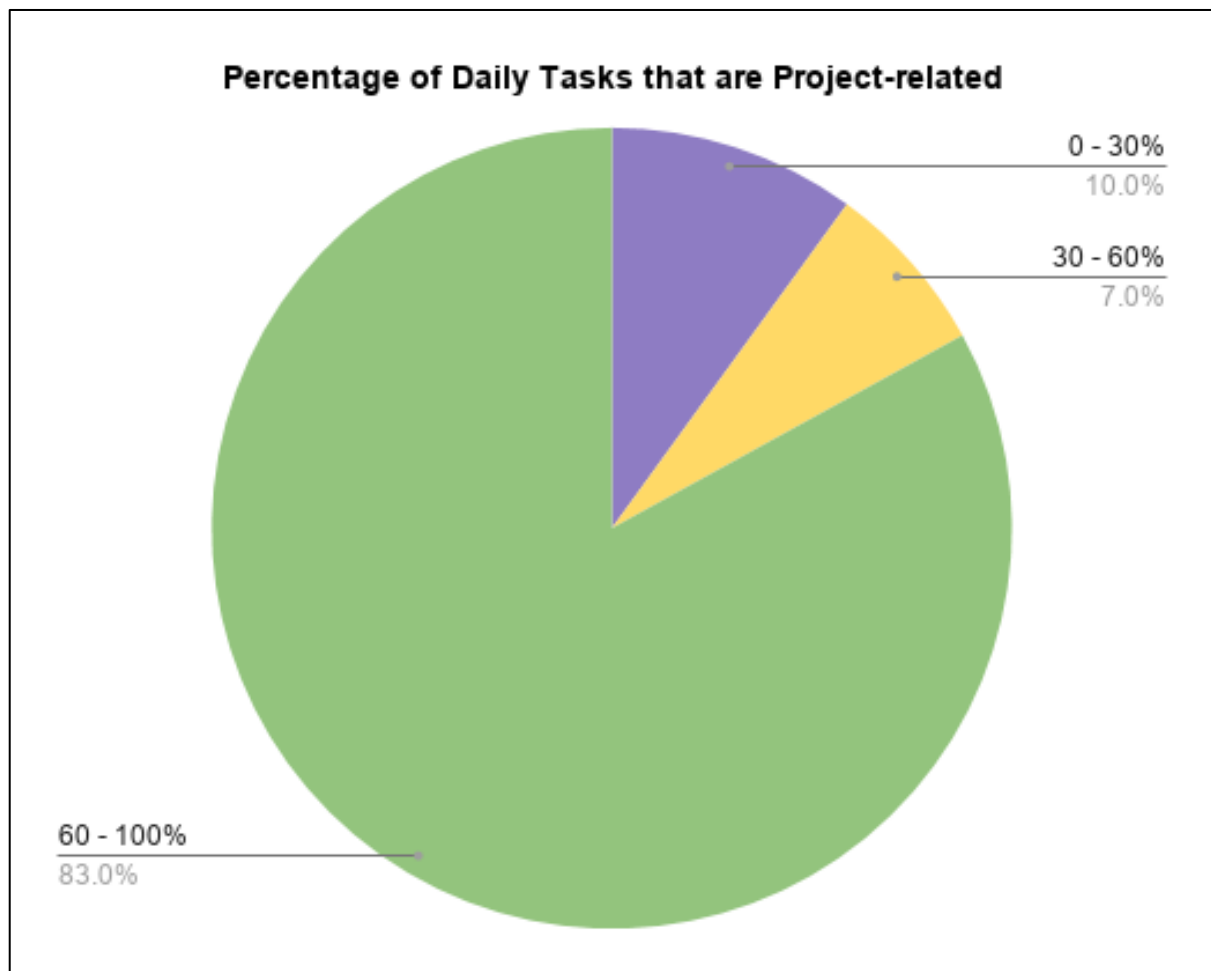
In Figure 5.4 above it can be seen that more than half of the respondents are from the Project Team. This was a positive element as these are the individuals receiving direction, instruction and maintaining the most contact and relationship with Project Managers in the industry. The participants from Management and Project Management facets of the industry were extremely useful as the Managers know exactly what skills and competencies they look for when hiring Project Managers and assessing their progress and work, whilst the Project Managers themselves are able to account for their skills, attributes and responsibilities first-hand. Having Project

Managers as a part of the study also gave the researcher insight into their tertiary experiences and where these courses or institutions are currently lacking in their offerings to students studying Project Management.

**QUESTION 5: What percentage of your daily activities are project-related?**

**RESPONSE;** The data derived from this question clearly indicates to the researcher that whilst more than 95% of the respondents worked directly with Project Managers, a smaller amount of the respondents participated in project-related activities on a daily basis.

**Figure 5.5: Percentage of daily project-related activities.**



**Source: Author's own construction.**

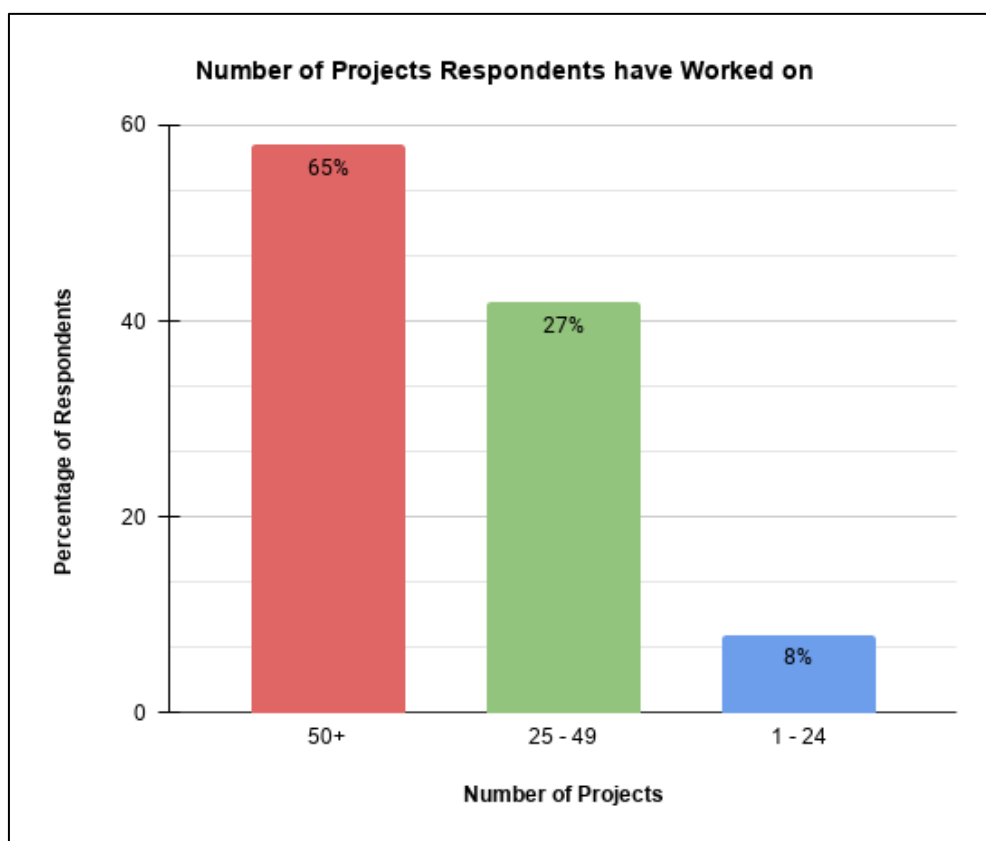
This correlation is important to note as this indicates that 17% of respondents spend more than half of their working day not actively participating in project related tasks.

From figure 5.5 above and tasks for between 60% - 100% of their working days. This is likely to represent the 78.57% of participants who are either Project Managers or a part of a Project team (as seen in Figure 5.4 above).

**QUESTIONS 6: How many projects have you worked on?**

**RESPONSE;** Considering the total amount of projects worked on is important to the study to get a better understanding on the expanse of relevant experience to harness within the population on respondents. It is also important to note that the more projects worked on could mean more experience with various project teams, organisations and project managers, increasing the possibility of a vaster experience base.

**Figure 5.6: Number of projects worked on.**



**Source: Author's own construction.**

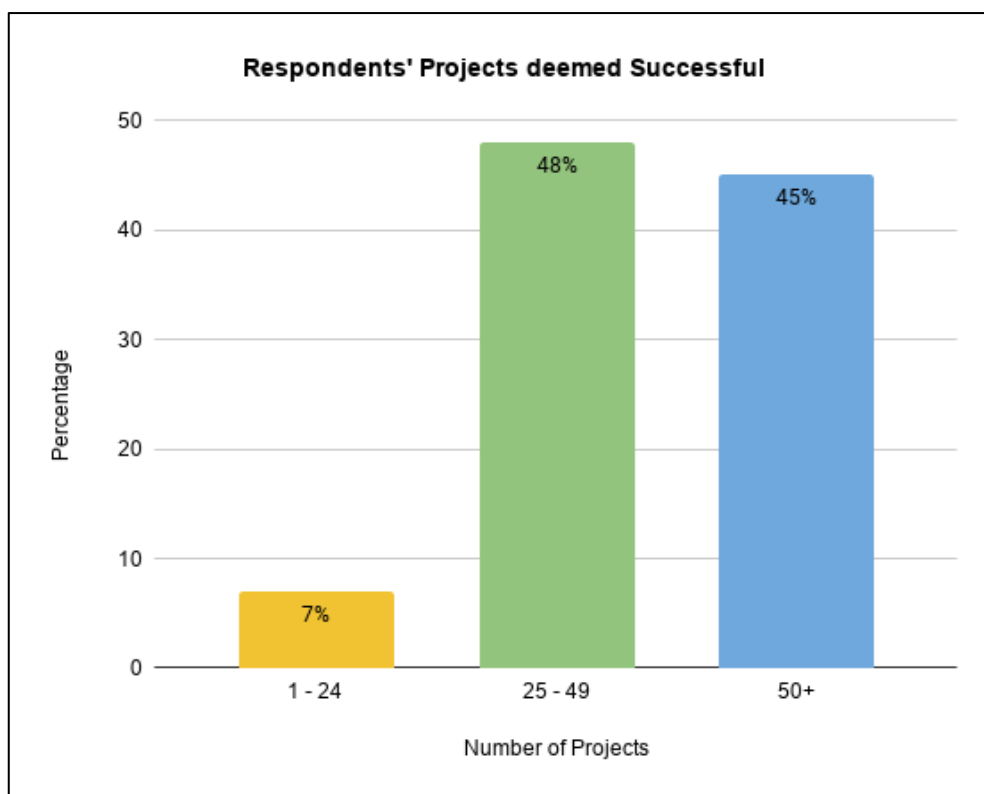
Above, Figure 5.6 indicates that 92% of respondents have worked on 25 or more projects. This points out that the experience of the respondents is vast and it can be deduced that they have had the opportunity to work with more than one Project Manager in their time in industry. It was critical to the research to note that the respondents have an extensive experience base of which to draw from in order to participate in the research considering their overall experience with Project Managers

as opposed to having any sort of narrowed view based on only working on 1 or 2 projects. It is critical to note at this stage that no responses were negated based on the answers provided to this question. All completed surveys were regarded as relevant data for this research since they were sent out to resources who fit the requirements.

**QUESTION 7: Of those projects that you have worked on, how many of them were deemed successful?**

**RESPONSE;** The data from this question, as can be seen in figure 5.7 below, in relation to that of the previous question is noteworthy in that although the majority of respondents had participated in more than 50 projects, it can be seen that the majority of success rate is actually in the middle category of 25 – 49 projects.

**Figure 5.7: Number of successful Projects which respondents have worked on.**



**Source: Author's own construction.**

Whilst we can see that 45% of the respondents worked on 50 or more projects that were deemed successful, this is a much lower number in comparison to 65% of respondents who indicated that they had worked on more than 50 projects. This data

is a clear indication that there had been some failures in the projects worked on by respondents and is also a suggestion that there were learnings from those projects which contributed to their current knowledge base and the manner in which the current situation in industry is perceived, what is required and what project managers and the practice of project management could do to mitigate those factors in the future.

## **Section B: Likert Scale Statements**

Likert Scale Questions were presented to respondents in order to retrieve data regarding how the respondents felt about certain tasks and traits carried out by Project Managers in their organisations. The Likert Scale made use of options to get an accurate view of the situation and to determine a degree of severity to a certain extent regarding what is required by Project Managers in the industry.

The options provided to the respondents were;

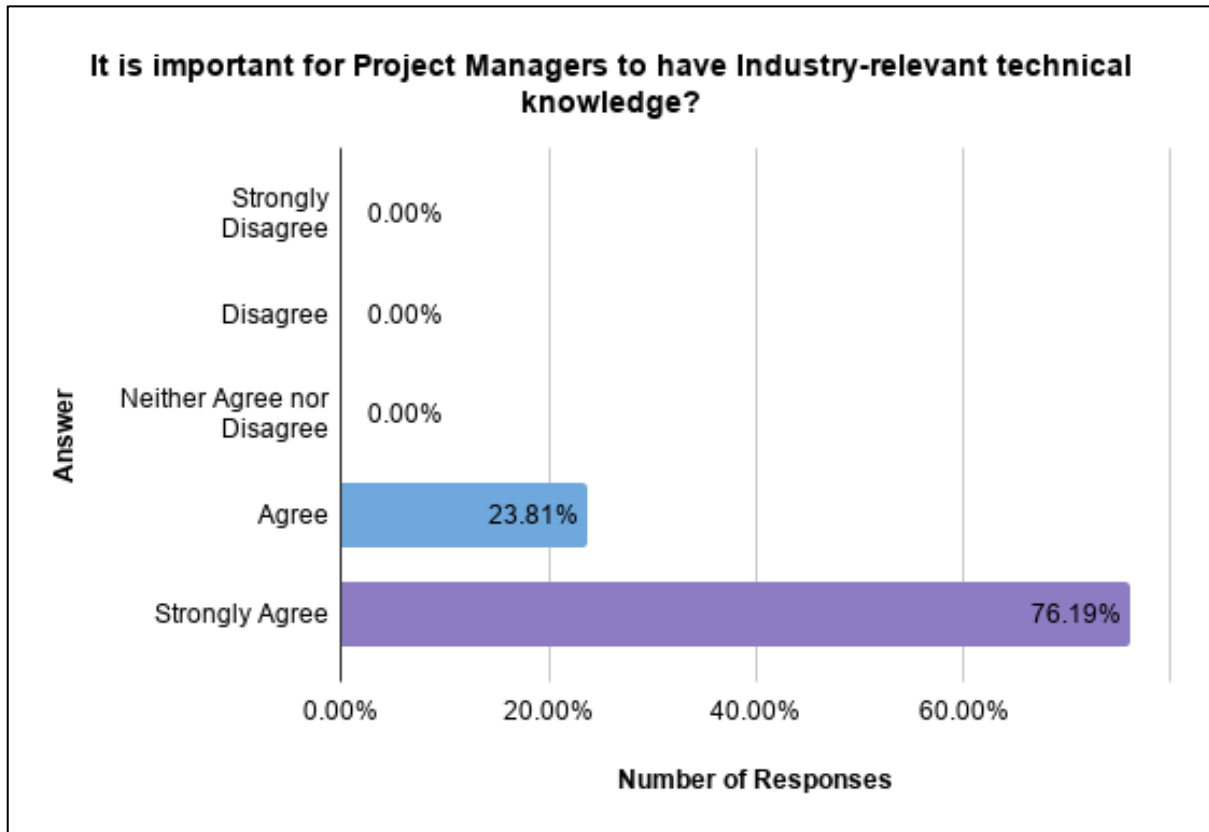
- 1. Strongly Agree (SA),
- 2. Agree (A),
- 3. Neither Agree nor Disagree (NAD),
- 4. Disagree (D) and
- 5. Strongly Disagree (SD).

Respondents were asked to select the option that best suited their opinion of the statements made.

### **STATEMENT 1: It is important for Project Managers to have Industry-relevant technical knowledge.**

**RESPONSE:** From the data presented in figure 5.8 below, it can be seen that 100% of the respondents agree that it is important for Project Managers to have industry-relevant technical knowledge. It can thus be deduced from this response that industry-relevant learnings and technical knowledge are key in the education and training of students studying to become qualified Project Managers. It also then stands to reason that Project Managers who come into industry without this required and relevant industry knowledge are at a disadvantage in comparison to those who have this knowledge.

**Figure 5.8: The importance of project managers having industry-relevant technical knowledge.**



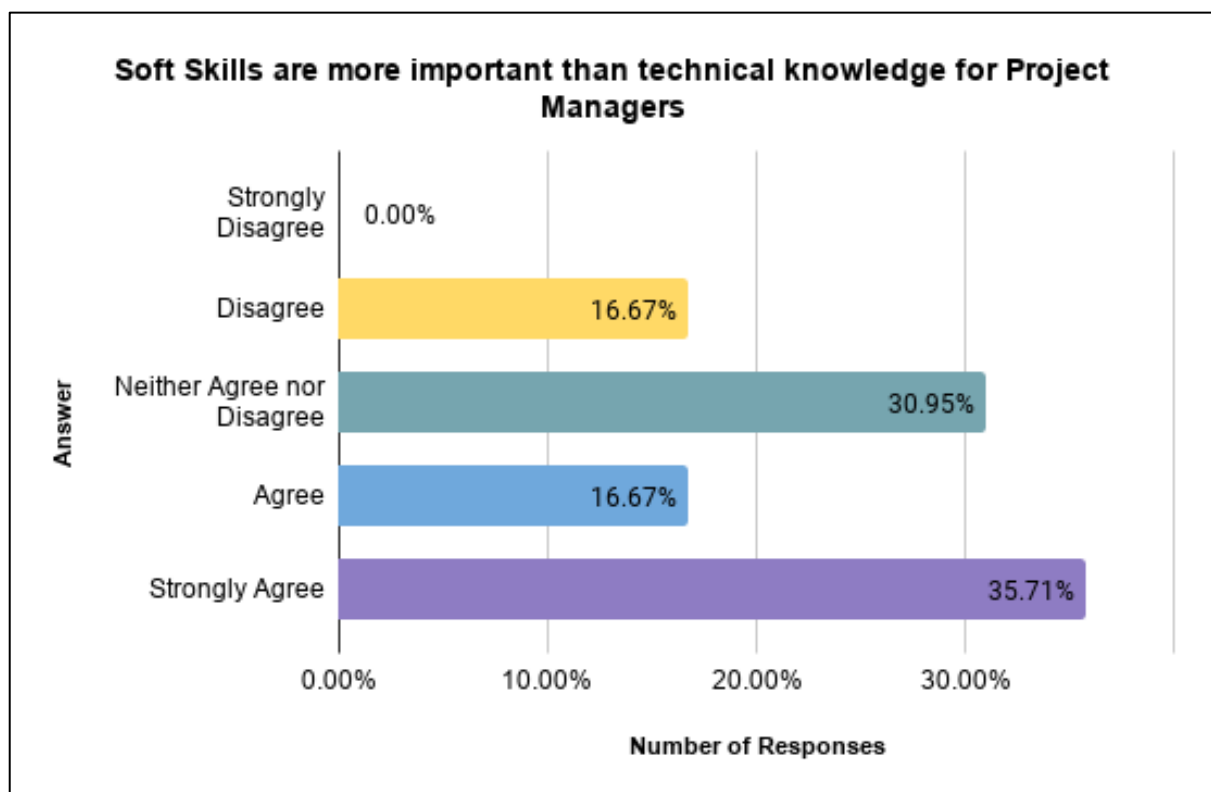
**Source: Author's own construction (2019).**

It is clear from the data below that industry-relevant technical knowledge is absolutely critical across all of the sectors in which the participants operate. There was no indifference or disagreement with the statement making this a key focus point of the results. It is also noteworthy that respondents at all levels, across all positions and sectors, and with varying levels of experience all agree that this attribute is critical for a project manager.

**STATEMENT 2: Soft skills (interpersonal traits such as leadership, communication etc. that enable them to interact harmoniously with others) are more important than technical knowledge for Project Managers.**

**RESPONSE:** The data presented in figure 5.9 below clearly indicates that there is some disparity in opinions regarding this statement.

**Figure 5.9: Soft Skills are more important than technical knowledge for Project Managers.**



**Source: Author's own construction (2019).**

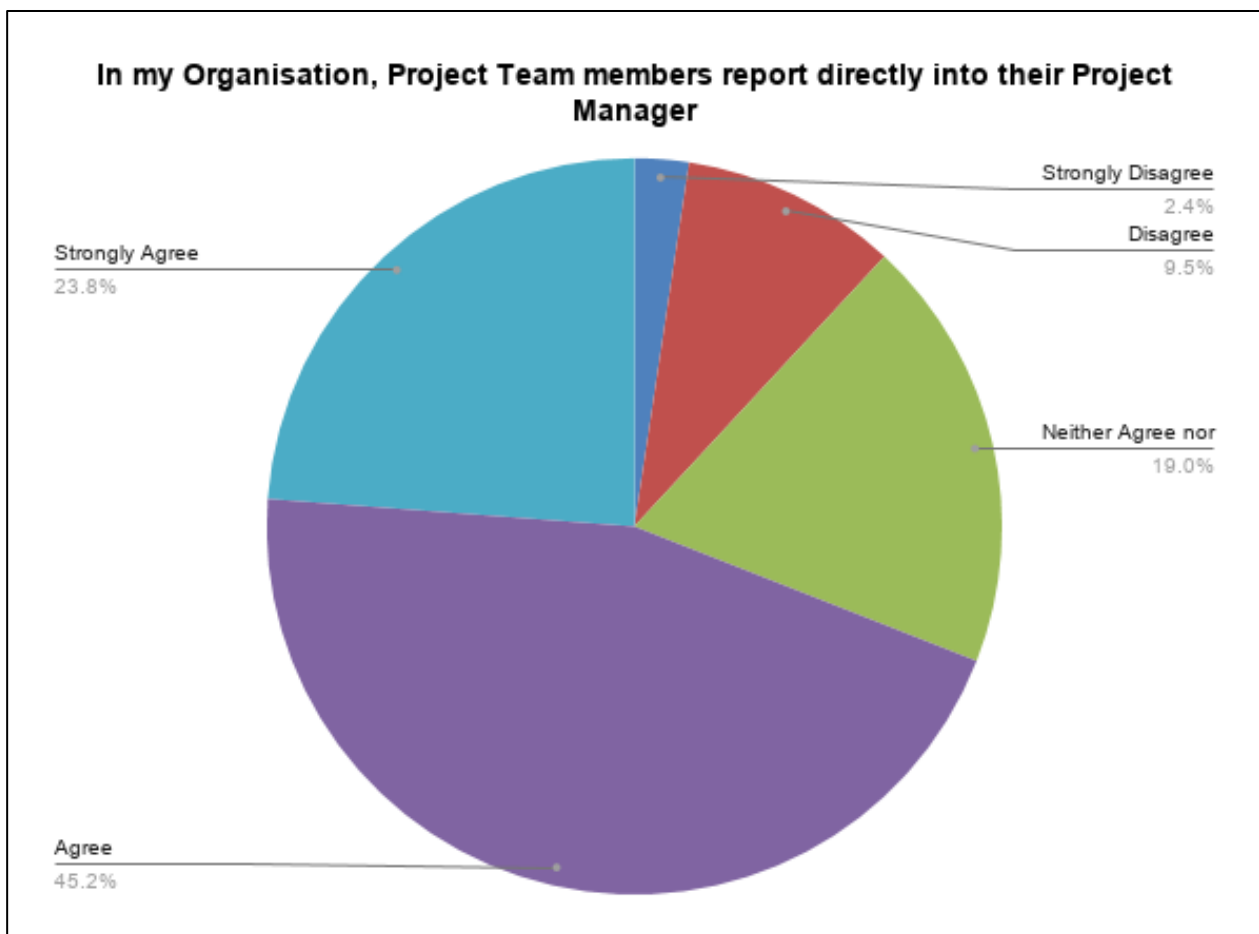
Whilst just over half (52.38%) of respondents responded in agreement, 30.95% of respondents responded with indifference to the matter. When comparing the results from this statement with those from the previous question it is significant that whilst all of the respondents agree that it is important for Project Managers to have industry-relevant technical knowledge, there is a pool of the respondents who lean toward soft skills being more important than the technical knowledge. The amount of indifferent

responses to this questions can be noted as soft skills still being a very relevant and necessary skillset for Project Managers in these sectors of industry and thus, this must be considered in the outcomes of the research.

**STATEMENT 3: In my Organisation, Project Team Members report directly into their Project Manager.**

**RESPONSE:** The data collected from this statement shows that there is a level of people and resource management required from the Project Manager.

**Figure 5.10: Team Members reporting directly to Project Managers.**



**Source: Author's own construction (2019).**

With 69% of the respondents confirming that Project Team members report directly into their Project Manager, it indicates that there would be a specific, soft skill and people-related competency needed in order to manage the team well – not only to

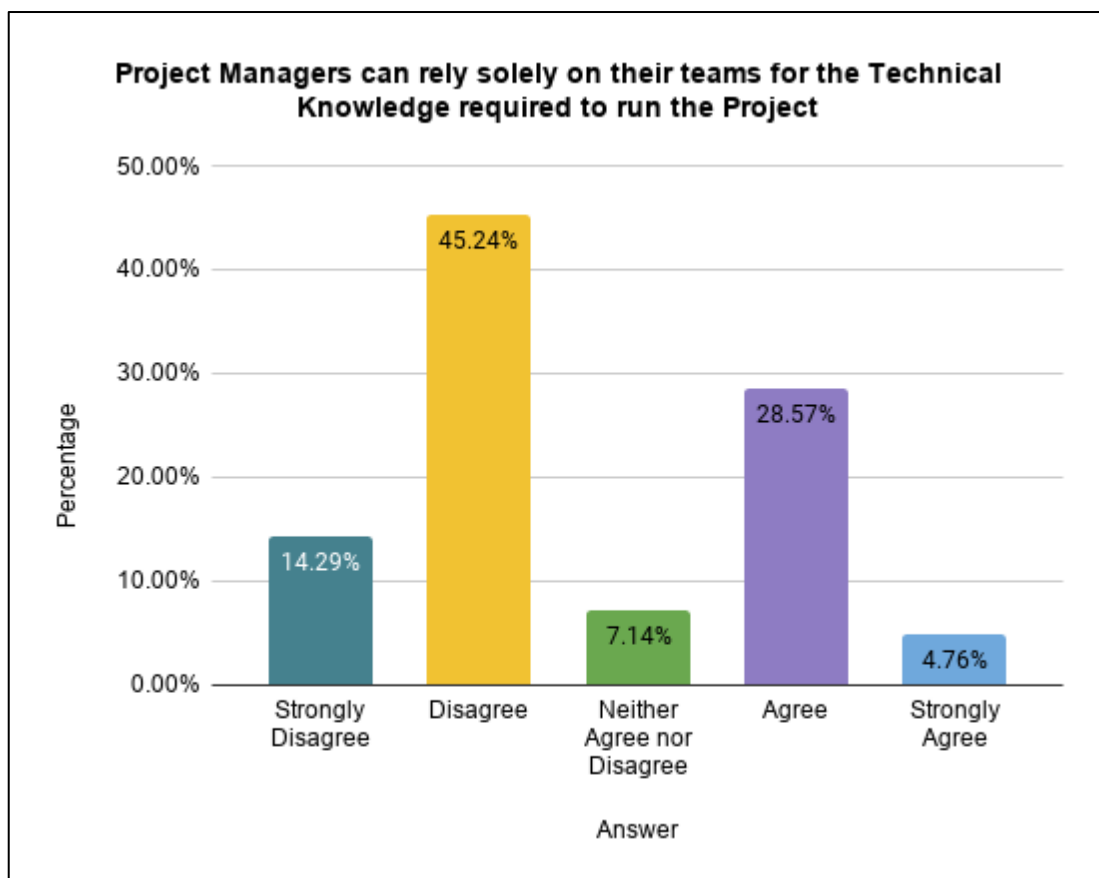


ensure that the Project is completed well and to all specifications and within all constraints, but also to ensure that whilst resources are working on the Project, that overall organisational standard, processes and procedures are followed. This data correlates directly with that displayed in figure 5.9 where there was an indication of soft skills still being a pertinent element and skill for Project Managers to hone in on.

**STATEMENT 4: Project Managers can rely solely on their teams for the technical knowledge required to run the project**

**RESPONSE:** The results shown in figure 5.11 below show that there is some disparity regarding whether or not this is an accurate assumption.

**Figure 5.11: Project Managers can rely solely on their teams for the technical knowledge required to run the project.**



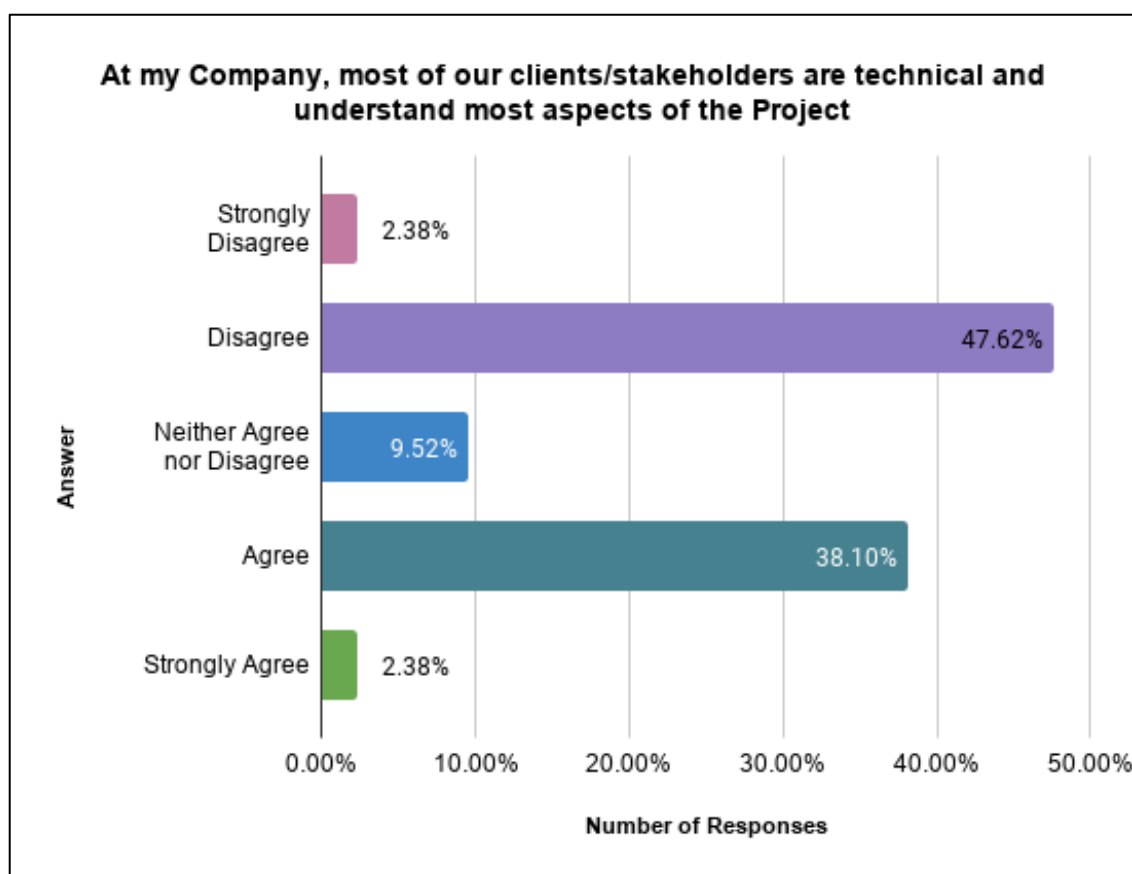
**Source: Author's own construction (2019).**

For the most part, respondents are in disagreement with the statement with 59.53% of respondents disagreeing with the statement. This leads to the assumption that Project Managers require technical knowledge in order to run the project and confirms the statistic from figure 5.8 where 100% of respondents agreed that technical knowledge is required.. What is noteworthy though is that there is a relatively large number of respondents who agree with the statement which could be due to these teams having technical leads on the Project to aid the technical decision making, architecture and quality thereof, for example.

**STATEMENT 5: In my Company, most of our clients/stakeholders are technical and understand most aspects of the project.**

**RESPONSE:** This statement was presented in order to gauge whether Project Managers need to be able to translate technical requirements, plans or progress to clients who are not technically inclined.

**Figure 5.12: Percentage of clients that are technical and understand most aspects of the project.**



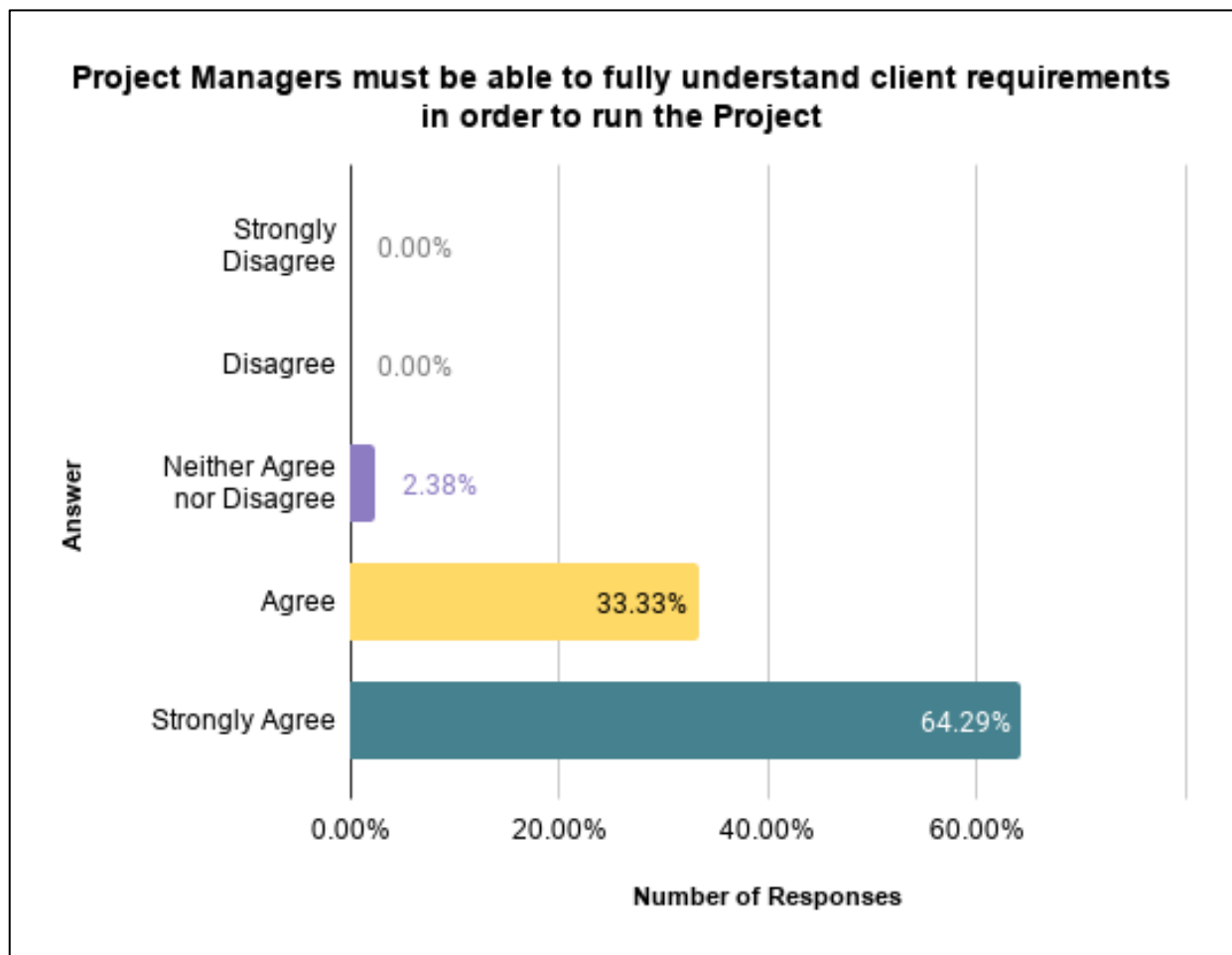
Source: Author's own construction.

From the data presented in figure 5.12 below, it is clear that this is the case for the majority of organisations since it can be seen that 50% of the respondents' companies have clients and stakeholders on Projects who are not technical and would require a level of information that is easy to understand and relate to as well as still cover the information needed in order to best make decisions. This result links clearly to the research from Collins and Baccarini (2015: 2) which posit that effective and efficient communication within the project team and with the Client is an important factor in the success of a project. This research specifically noted that the management of client expectation through clear and informed communication is crucial in maintaining positive client relationships and the perception which the client will have of the project once it is concluded. Although almost 10% of respondents were indifferent on this matter, there was only a 2.38% of respondents who could strongly agree that their clients were technical and needed no hand-holding and explanations of technical terms and concepts that were crucial to the management and delivery of the project.

**STATEMENT 6: Project Managers must be able to fully understand client requirements in order to run the project.**

**RESPONSE:** This statement was presented to respondents in order to gain an understanding of the level of understanding that a Project Manager needs in order run the project. In the research by Montequin et al. (2016: 444) it is cited that one of the leading causes of project failure is incomplete, wrong or ill-defined customer specifications.

**Figure 5.12: Project Managers must fully understand client requirements in order to run a project.**



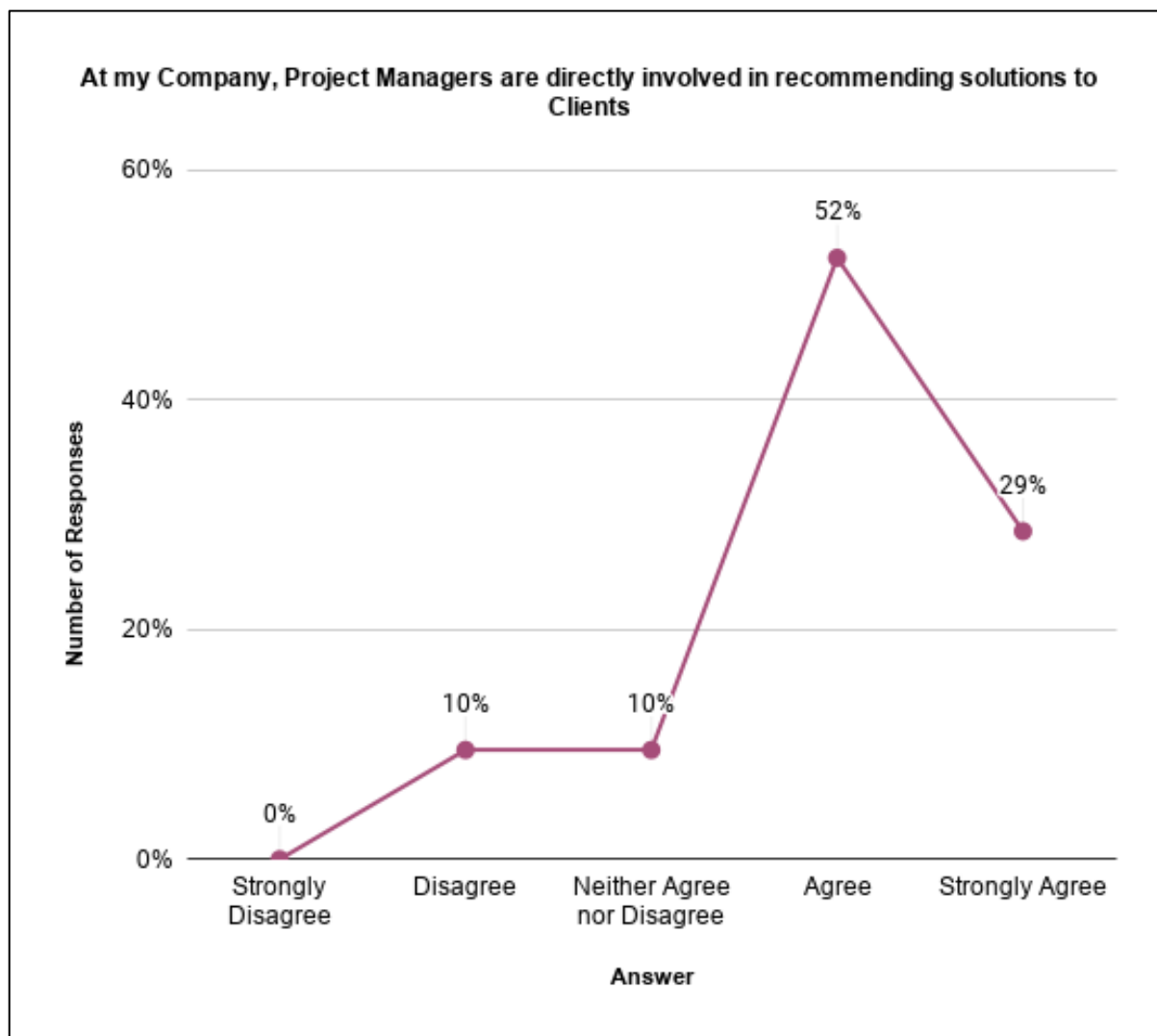
**Source: Author's own construction.**

From Figure 5.12 above it can be seen that 97.62% of the respondents agreed with this statement, allowing the researcher to deduce that requirements analysis, documentation and the understanding of specifications are both a critical skill for Project Managers as well as a pertinent element to project success

**STATEMENT 7: In my Company, Project Managers are directly involved in recommending solutions to Clients**

**RESPONSE:** Gauging the level of agreement to this statement allows the researcher to discover the breadth of a Project Manager's duties regarding the initiation phase of the Project.

**Figure 5.13: Project Managers are directly involved in solution recommendations to Clients.**



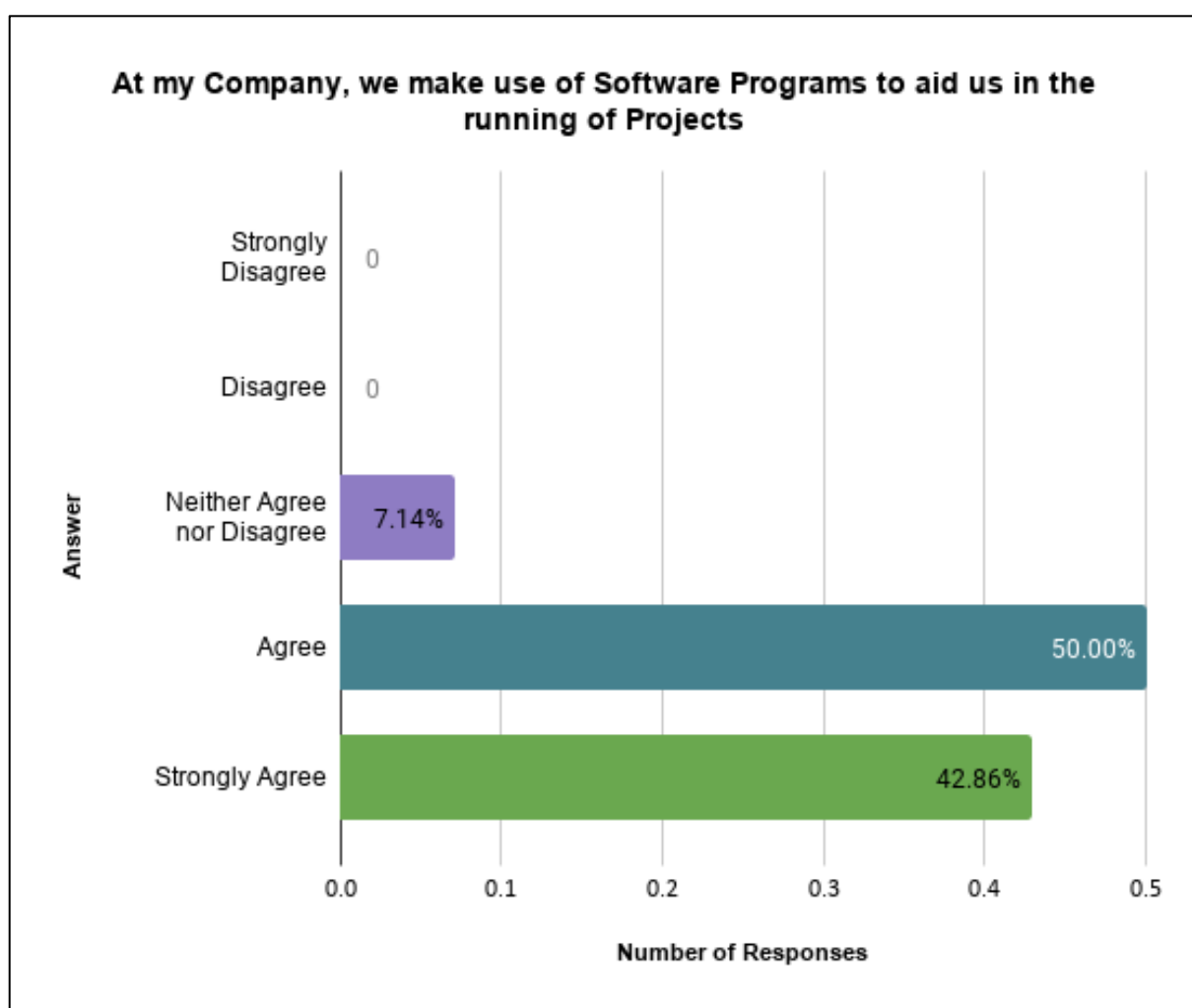
**Source: Author's own construction.**

It can be seen from Figure 5.13 above, that respondents that 80.95% of the respondents agree with the statement indicating that Project Managers must be able to provide plausible, viable and efficient solutions to Clients that fit into their time, scope and budgetary constraints. Project Managers thus also need to be able to justify solutions and ensure that the solutions presented to Clients are aligned with the capabilities of their teams and resources.

**STATEMENT 8: At my Company, we make use of Software Programs to aid us in the running of Projects**

**RESPONSE:** By putting this statement forward to the respondents the researcher was able to discover how much technical (in software terms) knowledge is required from a Project Manager. From the results it must be noted that across all of the sectors represented by the respondents, a vast majority of Project Managers are using Software in order to aid the running of their Projects.

**Figure 5.14: Use of software programs to aid the running of projects.**



**Source: Author's own construction.**

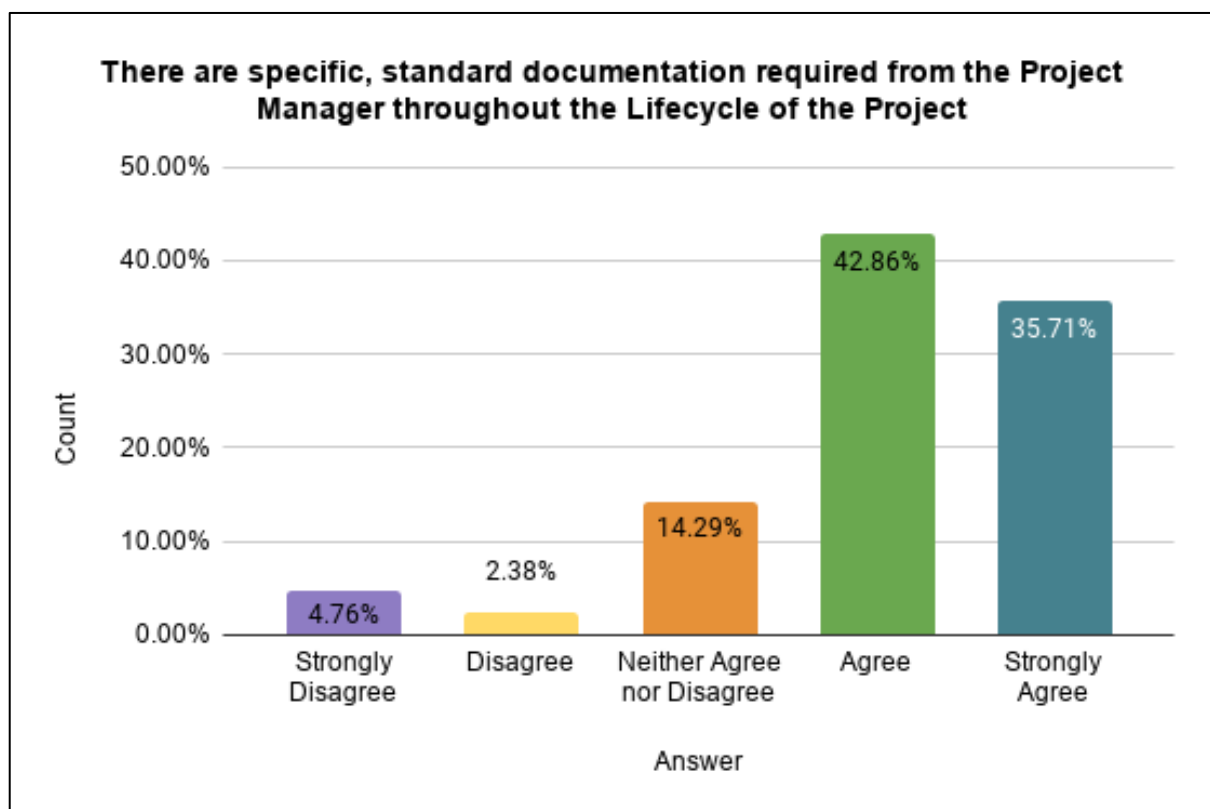
As seen in Figure 5.14 above, 92.86% of the respondents agreed with this statement. It cannot be deduced which Software is being utilised however it can be derived from the data retrieved that this is an important skill and that there is a high possibility that not all sectors are making use of the same Software programs. The fact that it is likely

that software programs are highly likely to differ from one sector to the next is an important consideration for the curriculum for Project Managers as this should be taken into account according to the sector in which the Project Manager finds themselves.

**STATEMENT 9: At my Company, there are specific, standard documentation required from the Project Manager throughout the lifecycle of the Project.**

**RESPONSE:** By determining the level of agreement of this statement, the researcher is able to validate whether Project documentation is an area of development for Project Managers to focus on.

**Figure 5.15: At my Company, there are specific, standard documentation required from the Project Manager throughout the lifecycle of the Project.**



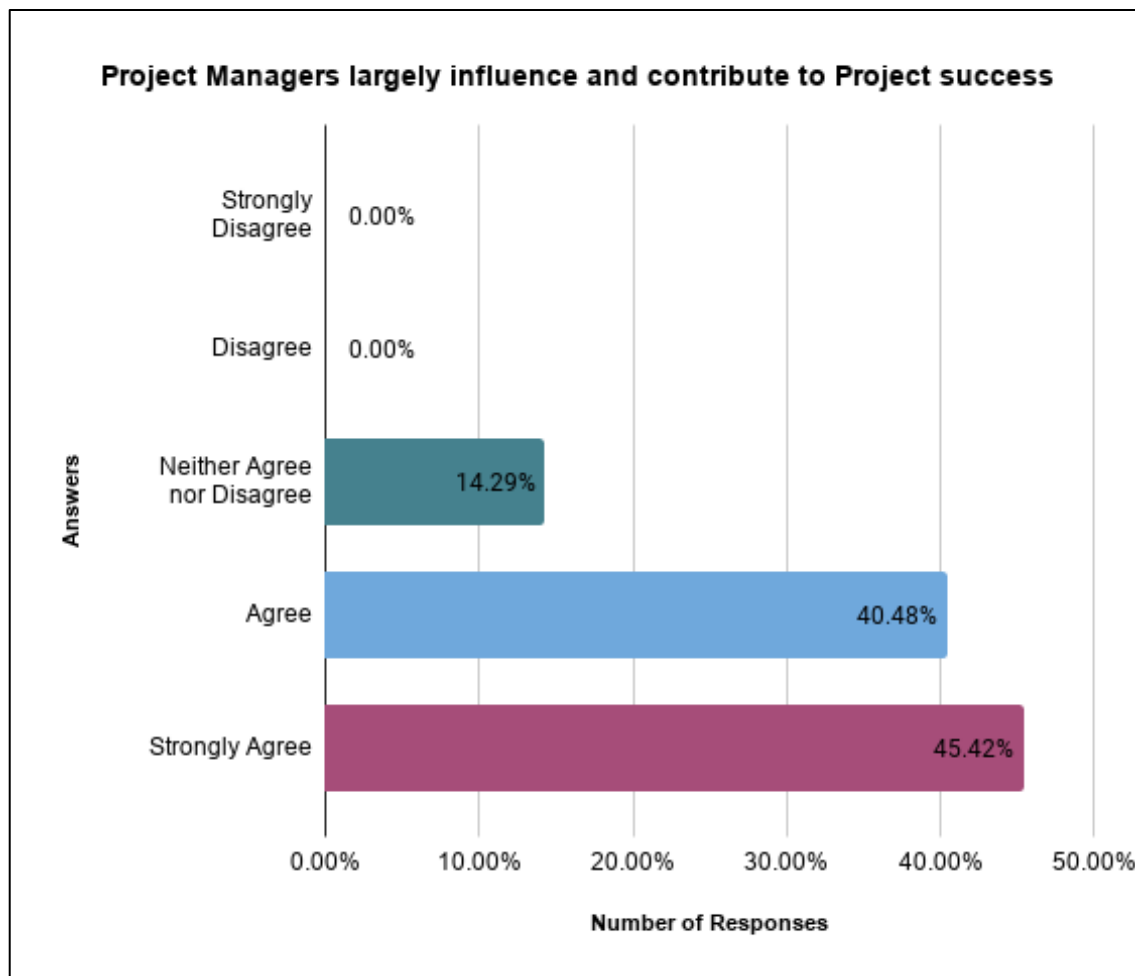
Source: Author's own construction.

In figure 5.15 below, 78.57% respondents agreed with the statement, thus allowing the researcher to deduce that this indeed is an area for focus when teaching and training Project Managers. From the results it isn't clear which industries disagree with or are indifferent to the statement however the vast majority of agreement indicates that this is a requirement for Project Managers across all three represented sectors.

**STATEMENT 10: Project Managers largely influence and contribute to Project success.**

**RESPONSE:** The researcher saw it fit to present this statement to the respondents in order to ascertain whether the Project Manager's capabilities contributed to the success of the project.

**Figure 5.16: Project Managers largely influence and contribute to Project success.**



**Source: Author's own construction.**

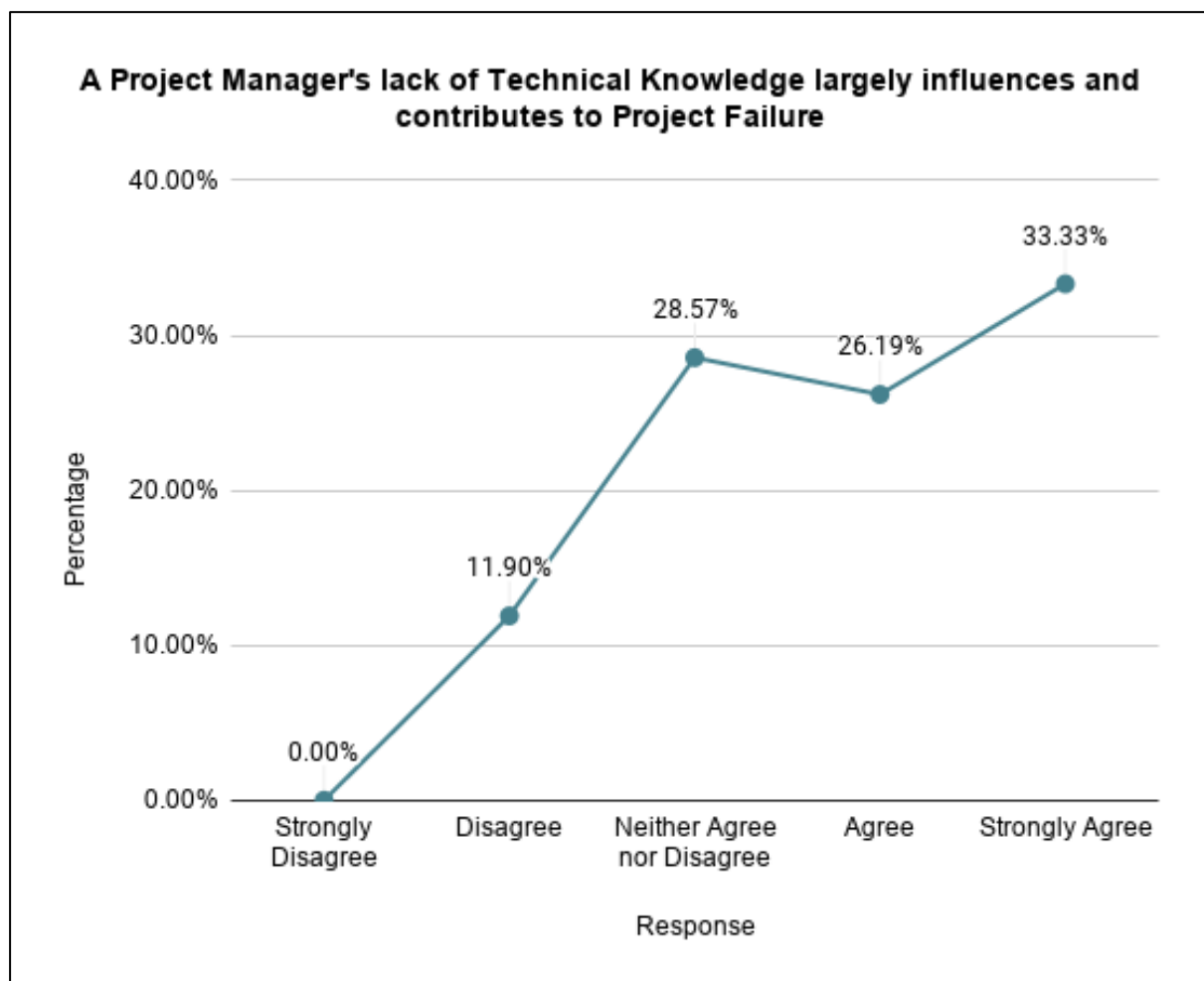


From the data gathered and displayed in figure 5.16 below, it is clear that Project Managers indeed are required on Projects across all three of the represented sectors and that none of the respondents could confidently disagree with the statement – solidifying the need for the research as well as the need to ensure that Project Managers are relevantly taught.

**STATEMENT 11: A Project Manager’s lack of technical knowledge largely influences and contributes to Project Failure**

**RESPONSE:** It was important for the researcher to gain insight into whether a Project Manager lacking industry-relevant knowledge was a contributor to the failure of projects.

**Figure 5.17: A Project Manager’s lack of technical knowledge largely influences and contributes to Project Failure.**



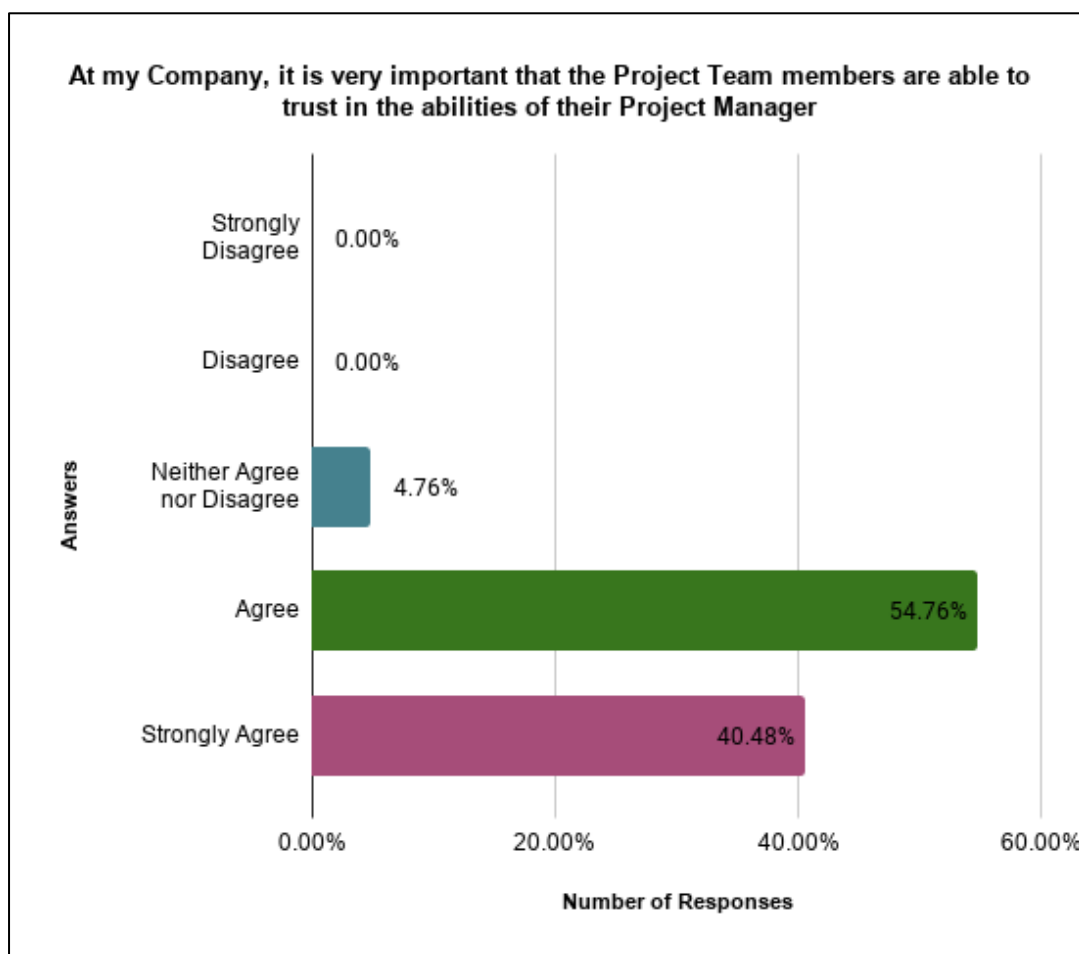
Source: Author’s own construction

Figure 5.17 above shows that 59.52% of respondents agreed with this statement, indicating that this lack of technical knowledge is critical to project success as it is a contributor to project failure across all of the sectors in question. This ties in with the findings of Alotaibi and Nufei (2014: 329) which explains that a generic approach to the teaching of project management as a subject would only equip new project managers with limited knowledge, sending them into the workforce with inadequate industry specific knowledge, both theoretically and practically.

**STATEMENT 12: At my Company, it is very important that the Project Team members are able to trust in the abilities of their Project Manager.**

**RESPONSE:** Since teamwork is heavily involved in the delivery of Projects – it was important for the researcher to engage with respondents on the subject of trust.

**Figure 5.18: At my Company, it is very important that the Project Team members are able to trust in the abilities of their Project Manager.**



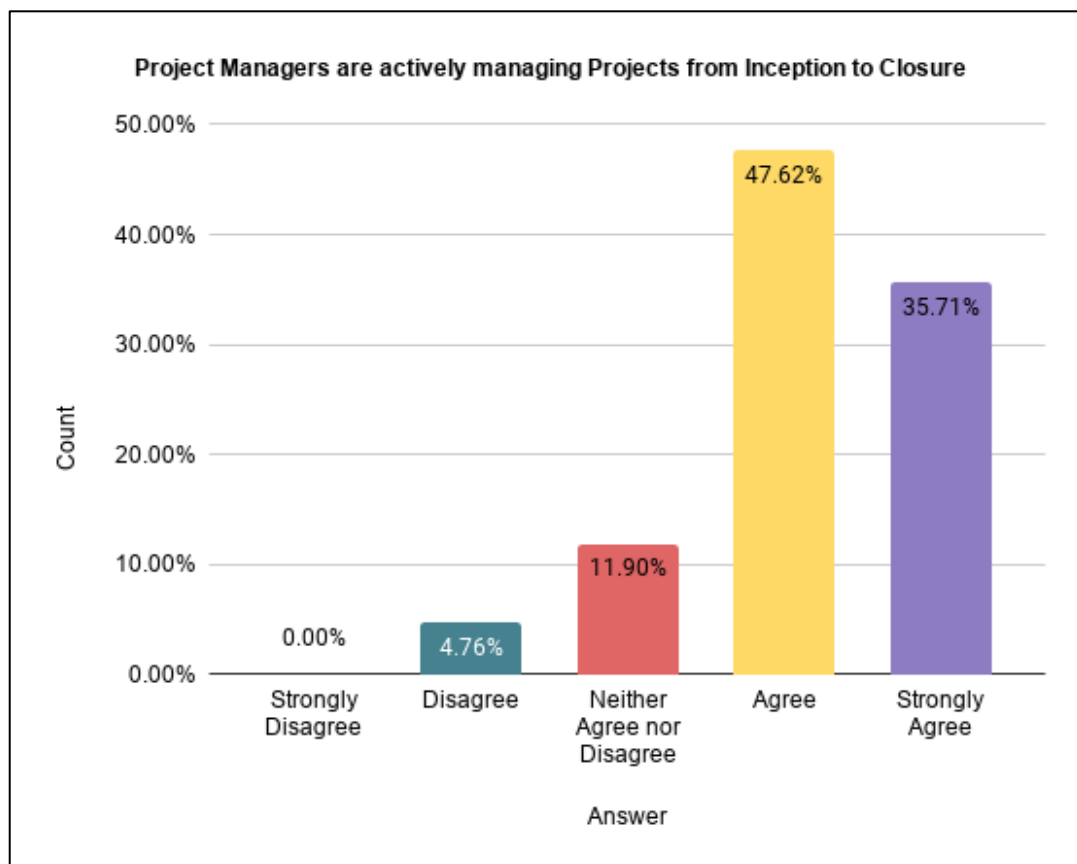
Source: Author's own construction.

From figure 5.18 above, it can be seen that 95.24% of the respondents agree that trusting their Project Manager's abilities are critical to performing well as a team. This statistic indicates that Project Managers must knowledgeable, reliable and competent in order to be a trusted and reliable member of the team. It will be a largely difficult task to lead team members should they not trust the intentions and abilities of their Project Manager.

**STATEMENT 13: At my Company Project Managers are actively managing Projects from inception to closure as well as every phase in between.**

**RESPONSE:** The researcher presented this statement to the respondents in order to ascertain whether Project Managers are involved in Projects at certain stages of the project only or whether they require experience and knowledge of Projects from the outset.

**Figure 5.19: Project Managers actively manage projects from inception to closure.**



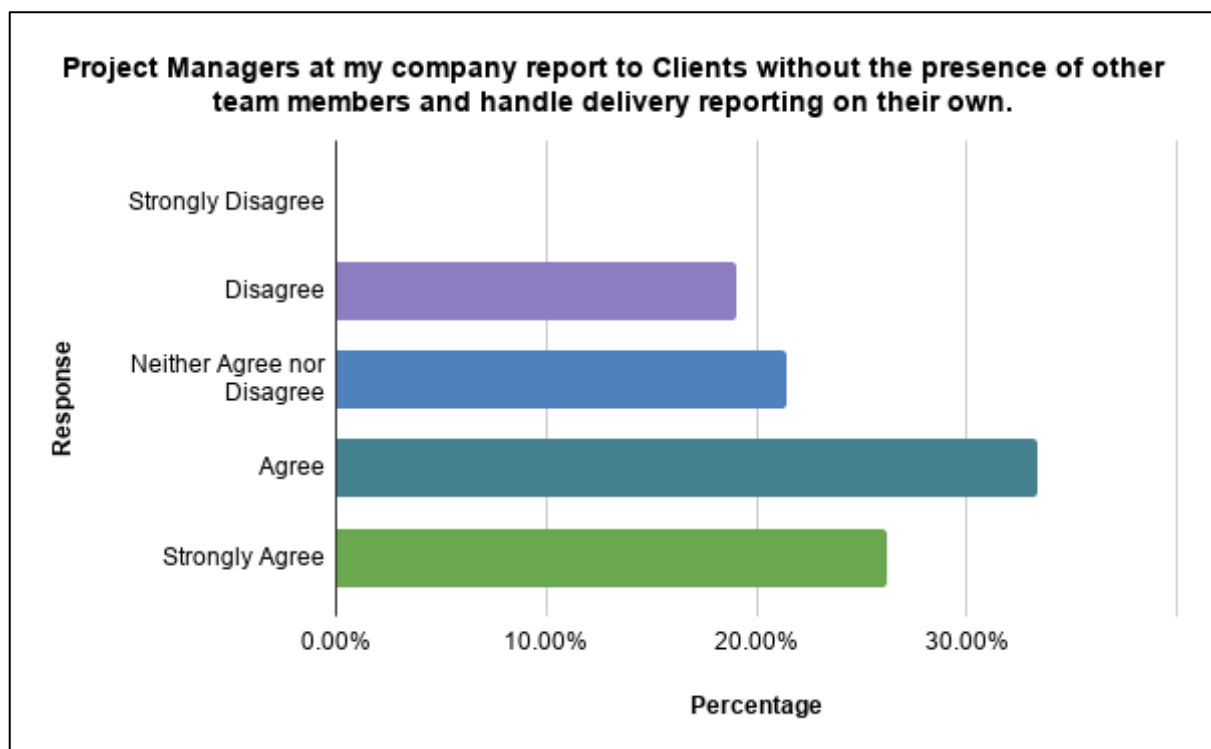
**Source: Author's own construction.**

Figure 5.19 below shows that 83.33% of the respondents agreed with statement indicating that the latter is indeed the case in industry and that Project Managers must be well equipped to handle the issues, communication, client relations and tasks throughout each phase of the delivery of a project.

**STATEMENT 14: Project Managers at my Company report to Clients without the presence of other team members and handle delivery reporting on their own.**

**RESPONSE:** This statement was presented to respondents in order to gather how proficient Project Managers need to be in order to report to Clients.

**Figure 5.20: Project Managers at my Company report to Clients without the presence of other team members and handle delivery reporting on their own.**



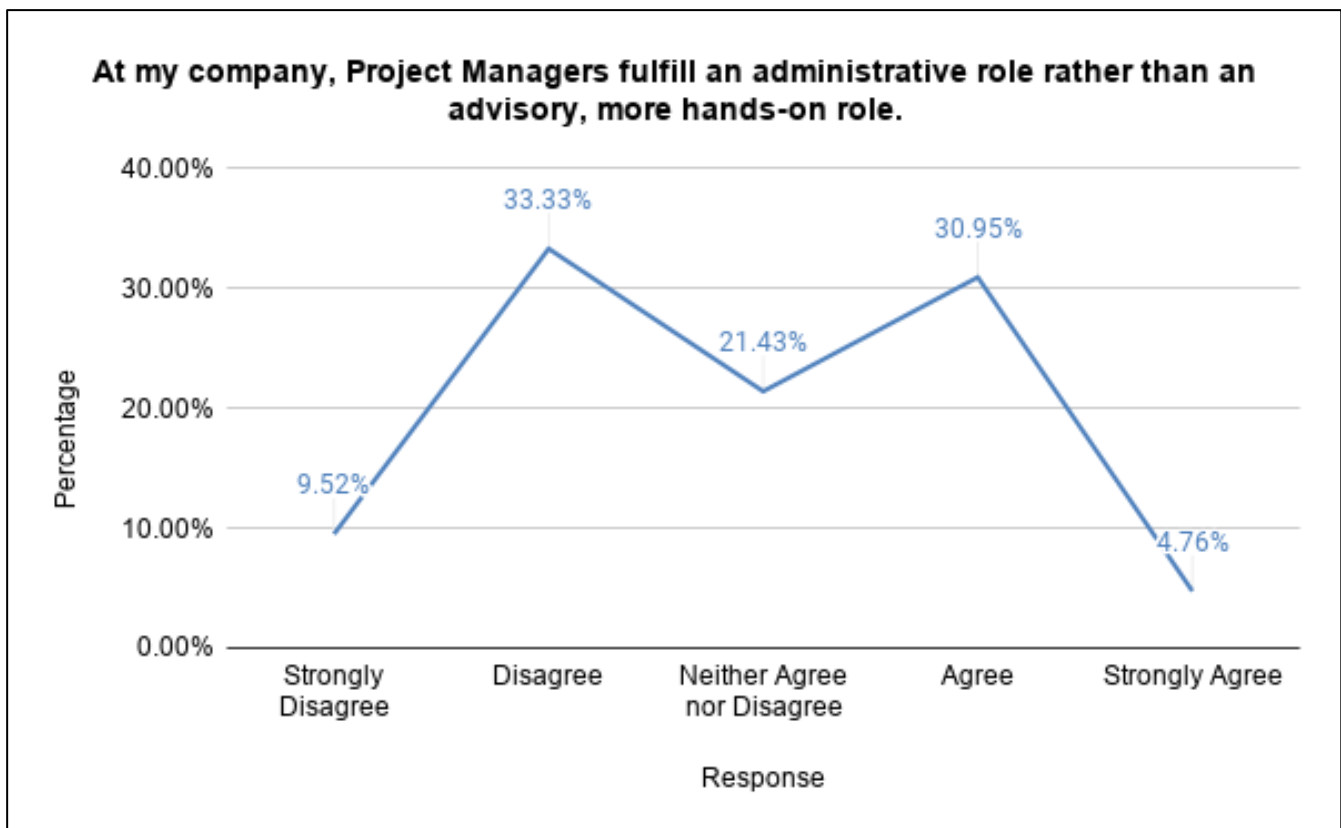
**Source: Author's own construction.**

In Figure 5.20 above it can be seen that 59.62% of the respondents agreed with statement. It is noted that communication between the Project Manager and the client and the Project Manager and the project team are both critical factors in project success as cited by Ahsan et al. (2013: 48), indicating that the ability to efficiently, effectively and independently handle reporting in all aspects should be considered in the training of prospective Project Managers.

**STATEMENT 15: At my Company, Project Managers fulfil an administrative role rather than an advisory, more hands-on role**

**RESPONSE:** Ascertaining which type of role Project Managers are employed to focus on more is critical to analysing what type of knowledge should be acquired at tertiary level.

**Figure 5.21: Project Managers fulfil an administrative role rather than an advisory, more hands-on role.**



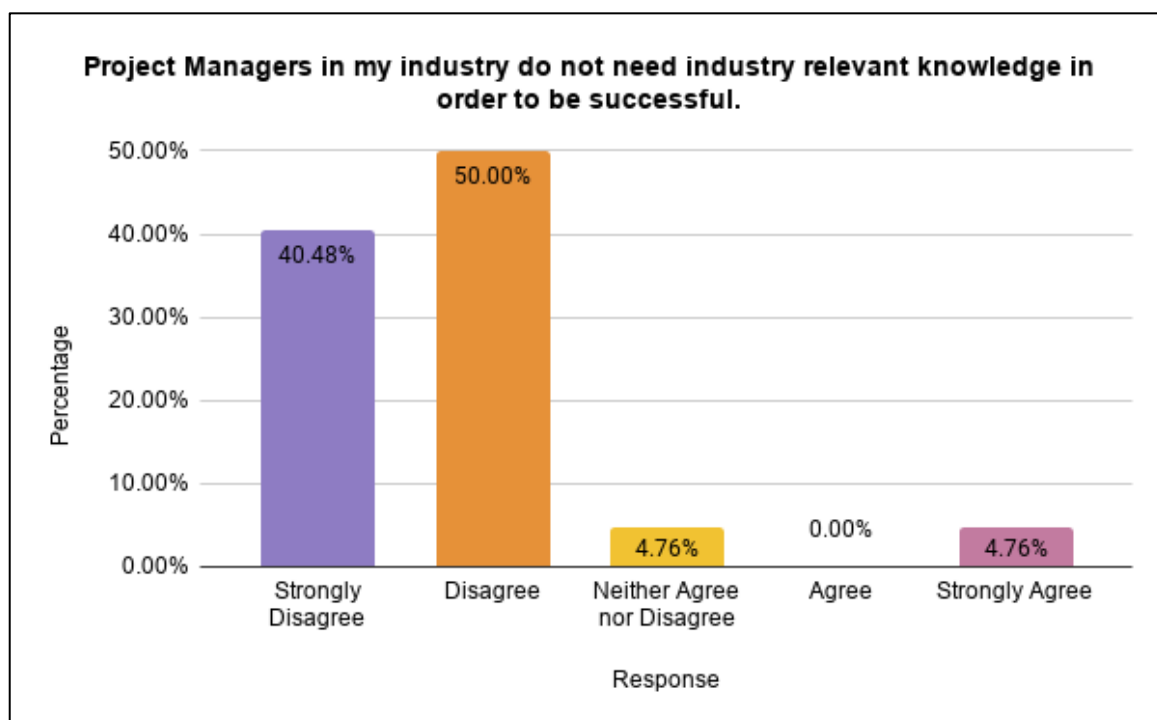
Source: Author's own construction (2019).

The responses to this statement were not unanimous with figure 5.21 showing that 21.43% of respondents were indifferent to this statement, neither being able to agree nor disagree with it. 35.71% of respondents agreed that the Project Managers in their organisations were more administratively focused whilst 42.85% disagreed with this statement. The absence of a large difference between the number of respondents who agreed with the statement in comparison to those who disagreed and the presence of a large percentage of indifferent responses is indicative of administrative and hands-on, advisory and technical roles all being required of Project Managers.

**STATEMENT 16: Project Managers in my industry do not need industry-relevant knowledge in order to be successful.**

**RESPONSE:** This statement was presented to respondents in order to ascertain whether there is a need for industry-specific tuition at tertiary level. Based on the results, it has solidified that knowledge particular to the industry in which the Project Manager finds themselves is critical.

**Figure 5.22: Project Managers in my industry do not need industry-relevant knowledge in order to be successful.**



Source: Author's own construction.

Figure 5.22 above shows that 90.48% of respondents disagree with this statement indicating that indeed industry-relevant knowledge is required by Project Managers in order for them to be successful in the sectors represented at the very least.

### **Section C: Open-ended Discussion Questions**

The last set of questions posed to respondents was a combination of statements and questions in order to establish their outlook on various relevant assertions and hypothetical situations. By exploring this data, the researcher was able to further understand the standpoint of active members of industry as well as make use of the results to guide the recommendations to follow.

The responses to each statement have been grouped for reporting purposes, and appear in no particular order.

**STATEMENT 1: Project Managers should have the following soft skills (interpersonal traits such as leadership, communication etc. that enable them to interact harmoniously with others);**

#### **RESPONSE:**

- Empathy
- Resilience
- Persistence
- Motivation
- Communication
- Time and Task Management
- People Management Skills
- Critical Analysis
- Leadership
- Decision Making
- Negotiation
- Team Building Skills
- Planning

- Fairness and Understanding
- Objectivity
- Vision-oriented
- Mediation Skills
- Critical Thinking
- Confidence
- Patience
- Pro-active
- Good Listener
- Creative
- Approachable
- Structured and Organised

From these responses it can be seen that there is a great need for soft skills in the field of Project Management across the sectors represented by the population studied. This is noteworthy because not only are these traits challenging to master but they also drive an alternate viewpoint in that they should be enhanced and focused on during the development of Project Managers at tertiary level. Considering this feedback, it is of importance that soft skills are honed in on for all sectors of the Engineering industry in the development of Project Managers.

**QUESTION 2: At your company, what would be the most useful skills that Project Management students should have after completing their degree?**

RESPONSE: The responses to this question have been grouped into the items (in the list below) where common answers were noted.

- Technical Skills
- Understanding Processes
- Effective Communication
- Requirements Analysis and Understanding
- Conflict Management
- Domain Knowledge in our field
- Documentation and Planning Skills
- Leadership



- Stakeholder Management
- Technical Building, Construction or Engineering skills
- Agile Methodology
- Industry-focused Knowledge, Interest and Skills
- Resource Co-ordination
- Ability to Read and Interpret Building Plans
- Costing
- Team Management

By probing for opinions on what skills project managers need to be equipped with once graduated, the researcher gains insight into expectations and is able to relay that into the recommendations of the study in an attempt to influence the current curricula and potentially steer it into a more holistic path.

**QUESTION 3: In your opinion, are Project Management graduates equipped enough to function in industry straight after University?**

**RESPONSE:** The answers to the question above were grouped into the responses noted as all of the responses fell into one or more of these categories. The percentages at each noted answer depicts the number of respondents with very similar answers once the researcher collated all of the open-ended feedback.

- 32.6%: No, due to lack of technical knowledge
- 17.8%: No, due to lack of practical training
- 23.4%: No, due to lack of focus on client and team management during tertiary studies
- 19.6%: No, due to lack of industry-focused knowledge
- 2.8%: Yes, if they are paired up with a Senior to mentor them
- 3.8%: Yes, if the student has the ability to think logically and work under pressure

Enquiring about what it is that Project Management students lack upon entering the workforce in these sectors of the Engineering industry allowed the researcher to gain a better understanding, through open-ended feedback, of how those with industry experience perceive the capabilities and competencies of those joining industry. Knowing this is key to creating an informed and industry-led curriculum.

**STATEMENT 4: Project Managers should have the following hard/technical skills (specific, taught abilities);**

**RESPONSE:** The responses of the participants have been grouped when found to be similar. These responses have been listed below, grouped into the following hard/technical skills which the respondents found to be important for Project Managers. It is important to note that the respondents did not list these in any particular order, nor did they all mention the same number of skills in their responses.

- Basic coding knowledge
- Waterfall, Agile principles
- Budgeting and Scheduling
- Procurement
- Design and Construction methods
- Industry specific technical and regulatory knowledge
- Interpreting plans and Engineering diagrams
- Contract Management
- Project Management Software and Tools
- Reporting
- PMBOK Principles

The responses to this statement tie in directly with previous investigative questions regarding the skills which project managers need in order to be successful in industry. This insight is paramount when making recommendations and brings to light focus areas which industry professionals deem critical. Without delving into this, the researcher would not be able to make a sound recommendation or provide well researched and analysed input into the academic realm.

**QUESTION 5: Would you rather employ a generalist (no specific industry knowledge but able to administrate projects well) or specialist (industry-specific knowledge) Project Manager?**

**RESPONSE:** The responses to this question were vast, with most of the respondents leaning toward employing a project manager with industry-specific knowledge as opposed to a generalist. From the feedback, 69.04% of respondents would rather employ a specialist project manager. The reasoning for this varies but of the explanations given, it can be seen that there is more risk involved in hiring a generalist project manager. This view came through in responses which spoke to the possibility of technical team members taking advantage of the lack of knowledge in this area by extending timelines unnecessarily, falsifying progress or results and creating excuses which the generalist project manager would not be able to pick up. A second viewpoint of participants with this opinion is that a generalist project manager would not easily be able to identify and mitigate risks on the project. This group of respondents are also of the view that generalist project managers would not be able to direct a project, hold meaningful conversations or engage with the relevant stakeholders due to their lack of industry specific knowledge – all affecting the progress, quality and overall outcome of the project and the impression of the business.

The other 30.96% of respondents lean more toward employing a generalist project manager. It can be seen from these responses that the reasoning behind their viewpoint is that their specific organisations or experiences value the soft skills more than technical ones. These respondents share the sentiment that if a project is administered well, the issues in any industry will be able to be mitigated, whereas specialist project managers may immerse themselves in too much detail of the project and miss the overall view of the project. It is also discussed that a generalist project manager could at times have more experience than a specialist due them being exposed to multiple industries and situations.

**QUESTION 6: Do you believe that there is a space in your industry for generalist Project Managers?**

**RESPONSE:** 52% of respondents reported that they do not believe there is a space in their industries for generalist project managers. Whilst this is more than half of the respondents, it is important to look deeper into why they have this perception. When probed for further details on their viewpoint it was found that those with this opinion have had experiences where generalist project managers have not had any positive impact on projects previously worked on and in these cases added more risk to the project. The risk factor was that these generalist project managers were not able to effectively manage the team and the project due to their lack of specific and related knowledge. 48% of respondents had the opposite view and believe that there is indeed a place for generalist project managers in their industries.

Respondents who believed that there was a place for generalist project managers had a broader outlook when further explaining their sentiments. These respondents alluded to the fact that a generalist project manager which is a recent graduate would obtain experience once employed and thereby eventually become a specialist. Another viewpoint is that generalist project managers may be more suited to higher levels of management – this opinion was popular amongst respondents of this view however the converse was that these project managers wouldn't be effective on the ground managing day to day projects.

## CHAPTER 6:

### SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

In general, the practise of developing a curriculum should address the objective of the proposed curriculum and how these objectives will be accomplished. Another facet which should be covered during this process is the degree, or expected extent to which these objectives will be achieved; Reading and Reid (2004: 36). The study of curriculum development has come along way with the knowledge base from the turn of the century still ringing true today. Nicholls and Nicholls (1981: 21) emphasised that there is a recurrent approach to curriculum development which fosters the thought that it is the approach to the content and not the content in isolation that should be focused on.

Since the inception of curriculum design and development, it has been found that learners often had a disjointed view of the programme and course content which created further issues impeding the learning process. In an attempt to circumvent this fragmented view which learners had, the integrated curriculum was proposed as a holistic approach to learning, focused on developing understanding through interaction, conversation and discussion; Pidgon and Woolley (1992: 34). In agreement with this, McKimm (2007: 2) explains that there is a clear distinction between a curriculum and a syllabus. "Curriculum" is derived from the latin word "currere" which mean "to run" – thus implying that a key purpose of a curriculum is to propose a guide which will facilitate learning. On the other hand, McKimm (2007: 2), when comparing a curriculum with a syllabus, explained that the syllabus prescribes the actual content within a curriculum.

Considering these definitions and the research concluded by the researcher, this chapter delves into the recommendations of a new curriculum and proposed approaches to training Project Managers, in turn increasing their prospects for success and tertiary institutions ability to fulfil the needs of industry.

Since the research was carried out in Cape Town, South Africa, the researcher has made use of a leading tertiary institute's current syllabus and curriculum in order to draw comparisons between the recommendations of this study and the current situation at tertiary level.

At present, tertiary institutions introduce students to Project Management through various courses as a base of knowledge from which they may reference in industry. For students not in the industry of Project Management, this basic level of understanding of the practice is helpful as they will more than likely form part of a particular project at one point or another throughout their careers. The research is not geared to change this as a framework, instead, the research is focused on students choosing to major in the practice of Project Management once receiving their Diploma or Degree in another area of knowledge.

It is this highly likely that the group of students in the Project Management course at a tertiary institute would consist of individuals from varying industries, backgrounds and professional experiences. Similarly, it also stands to reason that there could be students accepted into the course who have no industry experience and are focused on completing their Project Management qualification before entering industry. The vastness of experience, background and industry is what (as proven by the research) is the current anomaly in the present approach to the curriculum. In the section below, the current subjects and curriculum will be discussed as well as the impact the research has on this current standpoint and where the recommendations could be harnessed.

## **6.1 FINDINGS AND RECOMMENDATIONS**

From the data collected during the research, it was clear that there were focus areas and elements which were key to project teams and leadership deeming a project manager as successful. Taking this and the current subject matter at a tertiary level institute into account, it came to light that the results of the research (which dictate the requirements of the industry at present) and the curriculum were not particularly aligned at every point, and to circumvent this the recommendation was made to ensure that more generalist subjects be shifted into an elective or single-semester approach and in some cases tailored per sector in order for students to gain the most industry-specific knowledge as possible from the subject at hand. It is also recommended that where students choose to remain in a generic stream rather than a particular sector (construction, engineering or information technology for example), they must be fully aware of the current industry expectation and the pro's and con's of their decision.

## **Entrepreneurship**

The course will give students a working knowledge of the small business environment in South Africa, an understanding of entrepreneurial opportunities and best-fit characteristics, developing a workable business plan, registering and running a business, the legal aspects of starting and running a business and the red tape involved in this.

There is currently no pre-requisite for this subject however according to the data collected, this subject matter and skill had not been raised as an important competency throughout the literature review or field research process. A large factor for this is that the entrepreneurial space was not explored hence there being very little proof that this is not a viable competency or skill for a project manager to have however this type of subject matter does improve the skills and abilities of students to contribute positively to the SMME market and the South African economy. Considering the current African context, this subject is critical in fostering an entrepreneurial spirit and start-up culture which ultimately would result in job creation. When further discussing the issues experienced on the African continent and within South Africa, it is clear that there is a huge need for young people to be able to open doors for themselves and others. Currently, there has been a rise in the start-up culture which if fostered, explained and contributed to at tertiary level, would only positively impact the students and the economy.

Despite this area of knowledge not being covered by the specific research in this study and there being no results regarding its place in the engineering industry, basing its inclusion in the new curriculum solely on the data presented would render this subject void in the new curriculum. To do this however would be irresponsible in this case considering the African situation, the requirements of our economy as a whole and the prospects of our future as a country.

## **Operations Research**

According to information gathered at a tertiary institute, this subject covers the concept of probability and its application in project situations regarding the types of probability, mutually exclusive and collectively exhausted events and making decisions under circumstances of certainty, uncertainty and risk. It also covers the formulation of network diagrams, critical paths, forecasting and determining time estimates. Areas such as inventory control models, linear programming and material requirements programming are also covered in this course.

Risk management is one of the key competencies which industry identified as key to being a successful project manager. Without delving into the syllabus, it can be seen from the data collected that it is critical for project managers to be able to identify and mitigate risks. Whether or not it is critical for project managers to be able to calculate the probability or likelihood of a scenario occurring remains to be debated however, this operational research has much to do with what is currently occurring in various sectors of industry. By allowing students to select a knowledge stream, these risks, mitigation and processes for reporting and managing them could be streamlined per sector, giving students the opportunity to focus on a specific space in industry and hone in on how to improve current situations troubling their specific sectors.

The manner in which this subject is taught is also of importance. Dealing with risks is a largely practical experience, and students should be afforded the opportunity to hear from industry professionals regarding the issues currently being experienced, the way it is currently being handled and the need the industry has, thus preparing them more adequately for the nature of the sector they have chosen.



## **Project Accounting**

In accordance with the data collected at the tertiary institute, this subject provides students with the necessary skills to analyse, interpret and understand basic accounting transactions and financial reports such as the income statement and balance sheet in relation to the project environment. It covers the calculating, analysing and interpreting of various numeric models used during project selection, introducing techniques for analysing and interpreting various financial risks and the impact they might have on the project management environment.

Profitability is critical to any business and industry and managing the budgets of projects directly affects the lucrativeness of the business. Students should be equipped with the knowledge and options available to them should they work on projects that have run into budgetary issues however whether or not project managers are responsible for project selection could be further debated. From the research conducted, this is not a necessity and as a result it is recommended that more focus be placed on industry-specific examples and criteria for ensuring that projects are run well and within its budgetary constraints. This ties in directly with reporting, communication with stakeholders and team management.

## **Project Quality**

Upon successful completion of this subject, the student will understand the background, context and history of project management as a business tool for bringing about controlled change. Students will be able to prepare documentation towards gaining approval on a medium to large project, prepare a quality audit and demonstrate the ability to manage quality in the project process and implement control measures where required. It also covers the ability to perform a quality risk assessment of a medium to large project and implement a risk containment plan.

It is critical to note here whilst quality on a project is of crucial importance to stakeholders, the context in which it should be taught to students to from the viewpoint of the holistic project. This can be seen from the responses to the survey as well as the review of literature in that the competence of quality management is rarely at the top of the skillset required by industry or the responses given. From

the research, it is recommended that this subject become an elective or a single semester subject in order to make provision for more learning in other areas.

### **Project Research**

This subject teaches students to identify problems, choose and utilise data measuring instruments as well as provide them with insight into the literature studies, experimental design, analysis and interpretation of data and reporting on research. As this is not a skill or competence that does not arise in any of the research, literature or responses – it is recommended that this is subject (like Project Quality) is approached as a module, or single-semester subject, or even an elective for those students specifically interested in furthering their studies in post-graduate degrees.

### **Project Resources**

Once successfully completed, students will be able to plan and acquire project human resources, develop and manage their project team as well as be capable in project communication management such as reporting, planning, managing and controlling project communication. Project procurement management is also covered, as well as managing and controlling stakeholder engagement and the financial, commercial and legal relationships between the parties involved in the project.

In comparison with the aforementioned subjects already part of the tertiary institute curriculum and learning program, this specific subject is one of the most relevant to the data collected through the survey and the literature review. Not only is the biggest element of a project the team which carries it out, but the most reported soft skill coming from the research data was people and team management. With this, stakeholder management, planning and communication all came through as pertinent competencies – all of which are addressed by this particular subject.

## **Project Management Process**

Project Management Process teaches students to manage project teams, analyse different organisational structures and the impact they have on organisational culture for projects as well as covering client requirements, roles and functions of stakeholders and defining project documentation such as the project brief, scope and work breakdown structures. It also covers the formulation of project plans, critical paths, effective leadership and applying agile project management techniques. It also teaches students to identify and assess risks, analyse probability and integrating projects with the strategic plan.

The data collected during the research emphasises that this subject is critical to the success of a project manager according to its content. Key areas such as team management, project documentation, requirements analysis and stakeholder roles are all elements defined by respondents as a necessity for graduate project managers. As relevant as the content may be, it also stands to reason that processes in various sectors of industry differ. These differences may be seen in the manner in which documentation is put together, how requirements are analysed, differing roles of stakeholders as well as the extent to which Agile methodology can be applied for example. Considering these vast differences in sector requirements, it is recommended that this subject be tailored for a specific sector which students must select, or be aware that they are otherwise receiving generic knowledge and what the implications of this would be.

## **Strategic Management**

This subject, which is about crafting and executing strategy, provides the learner with a framework for the development and evaluation of strategic management in an organisation. The learner will be introduced to the theory and research on strategic management and is expected to become proficient in the actual mechanics of certain processes, indicating that applied knowledge is a critical aspect of this subject. Organisational project management (OPM), which provides a strategic framework to and guide portfolio, programme and project management

in order to deliver organisational strategy and maturity models will be comprehensively covered as part of the strategic project management.

Despite the literature viewpoint that projects are initiated and carried out in order to bring about certain strategic goals, during the research this element had not come to the fore. Whether this means that the subject is irrelevant cannot be derived from this particular research however it does mean that according to the study, this subject is not of great importance or a common function of current project managers working closely with teams in the industry. It is therefore recommended that this subject be approached as a module or single-semester subject in order to cover only the most critical elements of it as well as to make provision for further learning in other important areas.

Experience is another standpoint which was brought to the fore during the research which must be considered. Considering that there would be varying backgrounds, experience and skills it is recommended that experiential training become a compulsory element of this curriculum. This can be made a pre-requisite for acceptance into this specific program, or could be handled as a subject for completion prior to being eligible for graduation. Either way, this element is critical for project managers and having a considerable amount of relevant working hours in the industry not only enhances their employability post-graduation, but also creates job opportunities, fosters relationship with industry and tertiary institutes and better prepares students for the workplace, better managing the expectations of both students and industry.

Considering the findings and recommendations outlined above, the industry-relevant curriculum in the table below has been formulated to best coincide with tertiary, industry and student requirements to bring about the best environments for learning and improve the extent to which students are able to fit in to the expectations of industry, thereby increasing their employability.

<b>Table 6.1.1: Construction and Engineering Stream Approach</b>	
<b>STREAM / SUBJECT</b>	<b>CONSTRUCTION/ENGINEERING</b>
BUILDING ENTREPRENEURSHIP	<p>The course will give students a working knowledge of the small business environment in South Africa, an understanding of entrepreneurial opportunities in their industry, and best-fit characteristics, developing a workable business plan, registering and running a business, the legal aspects of starting and running a business and the red tape involved in this. This must be an industry-specific view on the chosen stream and must equip students with knowledge and inspiration to start their own businesses.</p> <ul style="list-style-type: none"> <li>- Students should be taught theoretical and compliance-related elements as well as have contact time with industry professionals who have started their own business and are currently successful in the industry and entrepreneurial space.</li> <li>- Students must be equipped with the knowledge of various sources of funding currently available as well as the use of tender applications and routes to take in order to harness business opportunities</li> </ul>
CONSTRUCTION LAW & PROCEDURES	<p>This subject must engage industry professionals in the Construction and Engineering sectors in order for students to gain a true understanding of the risks currently being experienced in industry. This, coupled with the theoretical knowledge regarding risk management in Construction and Engineering and testing this theoretical knowledge and industry awareness will better ensure that knowledge imparted on students remains relevant and that students are conscious of laws and procedures pertinent to the industry they will soon be a part of.</p>
PROJECT ACCOUNTING	<p>Students must be exposed to the relevant basic accounting models, profitability models and analytical skills required to make sound judgments based on financial data. Students must also be exposed to what</p>

	profitability means in the Construction and Engineering sector, how these project budgets operate and what causes projects to run over budget, how this affects project success, teams and overall business profitability.
PROJECT QUALITY – ENGINEERING AND CONSTRUCTION	This subject should be an elective or single-semester subject. The need for this subject is that of basic ideals regarding what constitutes good quality in the Construction and Engineering sector and the various ways in which project managers can achieve this quality, also considering their reliability on third parties to complete certain aspects of the project.
PROJECT RESOURCES	This course will ensure that students are able to plan and acquire project human resources, develop and manage their Construction or Engineering project teams. Project communication management such as reporting, planning, managing and controlling thereof for the specific sector must also be covered in detail. Procurement management is also covered, as well as managing and controlling stakeholder engagement and the financial, commercial and legal relationships between the parties involved in the project.
PROJECT MANAGEMENT – ENGINEERING AND CONSTRUCTION PROCESS	This subject must place a strong focus on project documentation required by the Construction and Engineering industry, how this fits into the project lifecycle and how to ensure that documentation is adhered to and managed by various teams and stakeholders. Students should be able to put together relevant documentation, interpret project plans and effectively lead teams to do the same. Contact with industry professionals is key during this subject in order for students to get varying but thorough viewpoints of processes within the industry at present.
STRATEGIC MANAGEMENT	This subject should be an elective or single-semester subject. Students must be equipped with the theoretical knowledge regarding overall business strategy and how projects are used in order to achieve overall business goals.

EXPERIENTIAL TRAINING	To take place for 1 year at an industry-relevant workplace with specific project management areas which the student must be exposed to during their time in training. This should take place once all aforementioned subjects have been successfully completed.
PROJECT RESEARCH	This subject should be an elective for students who are interested in furthering their studies.

**Source: Author's own construction (2019).**

<b>Table 6.1.2: Information Technology Stream Approach</b>	
<b>STREAM / SUBJECT</b>	<b>INFORMATION TECHNOLOGY</b>
ENTREPRENEURSHIP	<p>The course will give students a working knowledge of the small business environment in South Africa, an understanding of entrepreneurial opportunities in their industry, and best-fit characteristics, developing a workable business plan, registering and running a business, the legal aspects of starting and running a business and the red tape involved in this. This must be an industry-specific view on the chosen stream and must equip students with knowledge and inspiration to start their own businesses.</p> <ul style="list-style-type: none"> <li>- Students should be taught theoretical and compliance-related elements as well as have contact time with industry professionals who have started their own business and are currently successful in the industry and entrepreneurial space.</li> <li>- Students must be equipped with the knowledge of various sources of funding currently available as well as the use of tender applications and routes to take in order to harness business opportunities</li> </ul>
OPERATIONAL RESEARCH	<p>This subject must engage industry professionals in the Information Technology sector in order for students to gain a true understanding of the risks currently being experienced in industry. This, coupled with the theoretical knowledge regarding risk management in Information Technology and testing this theoretical knowledge and industry awareness will better ensure that knowledge imparted on students remains relevant.</p>
PROJECT ACCOUNTING	<p>Students must be exposed to the relevant basic accounting models, profitability models and analytical skills required to make sound judgments based on financial data. Students must also be exposed to what profitability means in the information Technology sector, how these project budgets operate and what causes projects to run over budget, how this affects project success, teams and overall business</p>



	profitability. For this specific stream, it would be critical for students to know how various project management techniques such as Agile, Waterfall, Kanban etc. could affect profitability.
PROJECT QUALITY	This subject should be an elective or single-semester subject. The need for this subject is that of basic ideals regarding what constitutes good quality in the Information Technology sector and the various ways in which project managers can achieve this quality, also considering their reliability on third parties to complete certain aspects of the project.
PROJECT RESOURCES - IT	This course will ensure that students are able to plan and acquire project human resources, develop and manage their Information Technology project teams. Project communication management such as reporting, planning, managing and controlling thereof for the specific sector must also be covered in detail. Procurement management is also covered, as well as managing and controlling stakeholder engagement and the financial, commercial and legal relationships between the parties involved in the project.
PROJECT MANAGEMENT PROCESS/AGILE	This subject must place a strong focus on project documentation required by the Information Technology industry, how this fits into the project lifecycle and how to ensure that documentation is adhered to and managed by various teams and stakeholders. Students should be able to put together relevant documentation, interpret project plans and effectively lead teams to do the same. Contact with industry professionals is key during this subject in order for students to get varying but thorough viewpoints of processes within the industry at present.
STRATEGIC MANAGEMENT	This subject should be an elective or single-semester subject. Students must be equipped with the theoretical knowledge regarding overall business strategy and how projects are used in order to achieve overall business goals.

EXPERIENTIAL TRAINING	To take place for 1 year at an industry-relevant workplace with specific project management areas which the student must be exposed to during their time in training. This should take place once all aforementioned subjects have been successfully completed.
PROJECT RESEARCH	This subject should be an elective for students who are interested in furthering their studies.

**Source: Author's own (2019).**

<b>Table 6.1.3: Generic Approach.</b>	
<b>STREAM / SUBJECT</b>	<b>GENERIC</b>
ENTREPRENEURSHIP	<p>The course will give students a working knowledge of the small business environment in South Africa, an understanding of entrepreneurial opportunities in their industry, and best-fit characteristics, developing a workable business plan, registering and running a business, the legal aspects of starting and running a business and the red tape involved in this. This must be an industry-specific view on the chosen stream and must equip students with knowledge and inspiration to start their own businesses.</p> <ul style="list-style-type: none"> <li>- Students should be taught theoretical and compliance-related elements as well as have contact time with industry professionals who have started their own business and are currently successful in the industry and entrepreneurial space.</li> <li>- Students must be equipped with the knowledge of various sources of funding currently available as well as the use of tender applications and routes to take in order to harness business opportunities</li> </ul>
OPERATIONAL RESEARCH	<p>This subject must engage industry professionals from multiple sectors in order for students to gain a true understanding of the risks currently being experienced in the industry as a whole. This, coupled with broad theoretical knowledge regarding risk management in all of the sectors and testing this theoretical knowledge and industry awareness will better ensure that knowledge imparted on students remains relevant.</p>
PROJECT ACCOUNTING	<p>Students must be exposed to the relevant basic accounting models, profitability models and analytical skills required to make sound judgments based on financial data. Students must also be exposed to what profitability means in all of the sectors and have a basic understanding of how these project budgets</p>

	operate, what causes projects to run over budget, how this affects project success, teams and overall business profitability. For this specific stream, a general overview of each sector and its requirements would suffice.
PROJECT QUALITY	For this stream, more time would be required to cover each sector and the quality requirements thereof. For this reason, the option of this subject being an elective or single-semester subject does not apply. The need for this subject is that of basic ideals regarding what constitutes good quality in all of the sectors and the various ways in which project managers can achieve this quality, also considering their reliability on third parties to complete certain aspects of the project.
PROJECT RESOURCES	This course will ensure that students are able to plan and acquire project human resources, develop and manage their Information Technology project teams. Project communication management such as reporting, planning, managing and controlling thereof for the specific sector must also be covered in detail. Procurement management is also covered, as well as managing and controlling stakeholder engagement and the financial, commercial and legal relationships between the parties involved in the project.
PROJECT MANAGEMENT PROCESS	This subject must place a strong focus on project documentation required by the Information Technology industry, how this fits into the project lifecycle and how to ensure that documentation is adhered to and managed by various teams and stakeholders. Students should be able to put together relevant documentation, interpret project plans and effectively lead teams to do the same. Contact with industry professionals is key during this subject in order for students to get varying but thorough viewpoints of processes within the industry at present.
STRATEGIC MANAGEMENT	This subject should be an elective or single-semester subject. Students must be equipped with the theoretical knowledge regarding overall business strategy and how projects are used in order to achieve overall business goals.

EXPERIENTIAL TRAINING	To take place for 1 year at an industry-relevant workplace with specific project management areas which the student must be exposed to during their time in training. This should take place once all aforementioned subjects have been successfully completed.
PROJECT RESEARCH	This subject should be an elective for students who are interested in furthering their studies.

**Source: Author's own (2019).**

It is critical to note that students selecting the generic stream would not have the extensive knowledge which students with a specific stream would on completion of the subject matter for this course. This could make finding placement for experiential training more challenging for this stream of students and would in essence require them to move from sector to sector during the course of the year, limiting their in-depth knowledge but extending their broad base of competencies beyond those whom have chosen a specific stream. These elements of pros and cons must be clearly explained to prospective students in order to ensure that their decision is an informed one and all possible impacts are considered before beginning the course.

## 6.2 CONCLUSION

Considering the data retrieved and analysed from the research it is clear that there is a distinct requirement in industry for project managers with industry-specific capabilities, knowledge and skills. The lack of such skill adds risk to the industry in that the leaders of teams and projects (if not properly equipped) could lead to the failure of a project, thus causing financial and reputable losses. There is also the viewpoint that as students, once graduated they want to enter into the workplace with relevant knowledge and skills as well as the background to be able to make a difference and bring about change by harnessing their modern outlook, technological capabilities and millennial-driven thinking. Research such as this is critical to the improvement and development of tertiary institutes where minds and futures are fostered, grown and influenced. By ensuring that curricula are constantly evaluated, streamlined and contributed to by industry professionals, tertiary institutes not only improve their offering to students but largely enhance the calibre of its graduates and their employability having direct positive spin-offs on the industry and the economy as a whole. It is critical that the African situation of a weak economy, chronic poverty and crippling corruption are addressed at tertiary institutes. It is only once students are made to understand the problem and how they are able to make a difference that the thinking surrounding entrepreneurship, ownership and job creation will begin to change and grow.

For many years the thought of poverty, corruption and job creation was a political issue – an issue that the public relied on political patriarchs to solve, only to fail dismally. For this reason, it must be fostered at tertiary level that these issues belong to each of us, that they can be solved by each of us and that every attempt is one in the right direction. Entrepreneurship and industry-specific knowledge go hand in hand and having the in-depth understanding of both a specific industry as well as the available options to entrepreneurs in the industry will see the number of entrepreneurial-spirited students continuously rise from the exception and grow to be the norm. Providing relevant, sound and secure education propels students into greater careers, achieving more, experiencing more and ensuring that tertiary institutes and industry remain cognisant of the constant of change, adapt thereto and work together to grow future generations of professionals.

## REFERENCES

- Abdelnaser, O., Bazeabaz, A., Abdelwahab, O.G., & Wah, W.S. (2012). Developing competency model for the Project Manager in the Libyan construction industry. *International Journal of Economic Behaviour*. (2). 28-33.
- Ahsan, K., Ho, M., & Khan, S. (2013). Recruiting Project Managers: A comparative analysis of competencies and recruitment signals from job advertisements. *Project Management Journal*. (11). 46-48.
- Al Hadi Tumi, S., Omran, A., & Hamid Kadir Pakir, A. (2009). Causes of Delay in Construction Industry. *ICEA - FAA* (pp. 265-270). University of Bucharest.
- Alaghbari, W. E., Kadir, M. R., & Salim, A. (2007). The significant factors causing delay of building construction projects in Malaysia. *Engineering, Construction and Architectural Management*, 14 (2), 192-206.
- Alami, A. Why do Information Technology Projects fail? (2016). *Procedia Computer Science*. (100). 62-71.
- Alias, Z., Zawai, E.M.A, Yusof, K., & Aris, N.M. (2014). Determining Critical Success Factors of Project Management Practice: A conceptual framework. *Procedia – Social and Behavioural Sciences*. (153). 61-69.
- Alotaibi, A.B. & Nufei, A.F. (2014). Critical Success Factors (CSFS) in Project Management: Critical review of secondary data. *International Journal of Scientific & Engineering Research*. 5(6). 325-331.
- Araújo, C.S.S., & Pedron, C.D. (2015). The IT project manager competencies that impact project success – A qualitative research. *ePress Journal*. 2 (1). 53-75. <https://doi.org/10.5130/opm.v1i1.4142>.
- Bakshi, J., Ireland, V., & Gorod, A. (2016). Clarifying the project complexity construct: Past, Present and Future. *International Journal of Project Management*. 34(7). 1199-1213.
- Ballesteros, A.K., & Chavarria, F. (2015). Human competencies of an effective Project Manager. 14-22.
- Belout, A., & Gauvreau, C. (2004). Factors influencing Project success: The impact of Human Resource Management. *International Journal of Project Management*. 22 (1). 1-11.

Beretu, T. 2017. The employability of Human Resources Management graduates from a selected university of technology in the Western Cape. 21-40. *Cape Peninsula University of Technology*. South Africa, Cape Town.

Besner, C. & Hobbs, B. (2008). Project management practice, generic or contextual: a reality check. *Project Management Journal*, 39(1), 16-33.  
<http://dx.doi.org/10.1002/pmj.20033>

Best, J.W., & Khan, J.V. (2006). Research in Education. 10<sup>th</sup> Ed. Pearson Publishers. *University of Illinois*. United States of America; Chicago. 270-276.

Bloch, M., Blumberg, S., & Laartz, J. (2012). Delivering large-scale IT projects on time, on budget, and on value. *McKinsey & Company - Digital*, 1-3.

Bothma, S.F. (2012). Developing Project Management Competencies in graduate Engineers in the Construction Industry. *Gordon Institute of Business Science*. 10-17.

Braynov, S. (2002). "Contracting with uncertain level of Trust". *Computational Intelligence*. **18** (4): 501–514.

Brioso, X. (2015). Integrating ISO 21500 Guidance on Project Management, Lean Construction and PMBOK. *Procedia Engineering*. (123). 78-94.

Brown, G., & Hirschfeld, G. (2002). Students' Conceptions of Assessment: Links to Outcomes Assessment in Education. 15. 469-478.

Burger, Michelle. (2013). Project Management in the Built Environment: The need for industry specific knowledge. Philosophiae Doctor. University of the Free State.

Burke, R. (2001). Project Management: Planning and Control. 3<sup>rd</sup> Ed. Chichester: Wiley. 12-19.

Caupin, G., Knoepfel, H., Koch, G., Pannenbäcker, K., Pérez-Polo, F. & Seabury, C. (2006). *ICB – IPMA Competence Baseline*. (3). International Project Management Association, Netherlands.

Chouhan, Vikram Singh & Srivastava, Sandeep. (2014). Understanding Competencies and Competency Modeling — A Literature Survey. *IOSR Journal of Business and Management*. 16. 14-22.

Collins, A. & Baccarini, David. (2004). Project success - A survey. (5). 211-231.  
<https://10.1142/S1609945104000152>.



Conforto, E., & Amaral, D. (2016). The Building Blocks of Agiltiy as a Tema's Competence in Project Management. 1-4.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International Journal of Project Management*. 20. 185-190. [http://10.1016/S0263-7863\(01\)00067-9](http://10.1016/S0263-7863(01)00067-9).

Davis, K. (2014). Different stakeholder groups and their perceptions of project success. *International Journal of Project Management*. (32). 189-201.

Discenza, R. & Forman, J. B. (2007). Seven causes of project failure: how to recognize them and how to initiate project recovery. Paper presented at PMI® Global Congress 2007—North America, Atlanta, GA. Newtown Square, PA: Project Management Institute.

Edum-Fotwe, F T. and McCaffer, R. (2000). Developing project management competency: perspectives from the construction industry. *International Journal of Project Management* 18 (2000). pp.111-124 Available at: [http://www.researchgate.net/publication/222532855\\_Developing\\_project\\_management\\_competency\\_perspectives\\_from\\_the\\_construction\\_industry/links/0deec51f8f76828d06000000](http://www.researchgate.net/publication/222532855_Developing_project_management_competency_perspectives_from_the_construction_industry/links/0deec51f8f76828d06000000) [Accessed: 19 March 2018].

Fisher, E. (2011). What practitioners consider to be the skills and behaviours of an effective people project manager. *International Journal of Project Management*. 29 (8). 994-1002.

Frese, R. (2003). *Project Success and Failure: What is Success, What is Failure, and how can you improve your odds for Success?* St. Louis: UM-St. Louis.

Galvez, D., Eripiras, M., Camargo, M., Boly, V., & Claire, J. (2018). Firm Readiness Level for Innovation Projects: A new decision-making tool for Innovation Managers. *Adm Sci*. (8). 4-18.

Ghazi, P., Moreno, A., & Peters, L. (2014). Looking for the Holy Grail of Software Development. *Software, IEEE*. 31. 96-96. <http://10.1109/MS.2014.8>.

Greene, J. (2018). The Top 9 Reasons for Project Failure. Is your Project at Risk? <https://www.atspoke.com/blog/it/reasons-for-it-project-failure/> [Accessed: 12 July 2019].

Grogan, P. (2005). The use of Hypothesis in Ecology. *British Ecological Society Bulletin*. 36 (1). 43-47.

Halone, K.; Cunconan, T.; Coakley, C.; Wolvin, A. (1998). "Toward the establishment of general dimensions underlying the listening process". *International Journal of Listening*. **12**: 12–28.

Hambrick, D. C. (2015). "Upper echelons theory". *The Palgrave Encyclopedia of Strategic Management*. 65-72.

Hamilton, G, Byatt, G & Hodgkinson, J. 2012. Industry Specific Knowledge: Is it a Key Factor to Being a Top-Performing Project Manager?.[ONLINE] Available at: <https://pmhut.com/industry-specific-knowledge-is-it-a-key-factor-to-being-a-top-performing-project-manager>.[Accessed 9 January 2018].

Hamzah, N., Khoiry, M. A., Arshad, I., Mohd, T., Che-Ani, A. (2011). Cause of Construction Delay - Theoretical Framework. *Procedia Engineering*. **20**. 490-495. <http://10.1016/j.proeng.2011.11.192>.

Hamzah, N., Khoiry, M., Arshad, I., Tawil, N., & Che Ani, A. (2011). Cause of Construction Delay - Theoretical Framework. *Procedia Engineering* , 490-495.

Hashin, E., Yusof, A.B.M., & Alamen, K.M. (2018). An integrated model of Project Managers' competencies through factor analysis. *International Journal of Innovative Science and Research Technology*. (3). 336-337.

Hwang, B. and Ng, W. (2013). Project management knowledge and skills for green construction: Overcoming challenges. *International Journal of Project Management* **31** (2013: 272-284.) Available at: [http://www.nus.edu.sg/dpr/files/research\\_highlights/2013\\_10Oct\\_ProjectManagementKnowledge\\_Skills\\_greenConstruction.pdf](http://www.nus.edu.sg/dpr/files/research_highlights/2013_10Oct_ProjectManagementKnowledge_Skills_greenConstruction.pdf) (Accessed: 19 March 2018).

Hyttinen, K. Project Management Handbook. (2017). *Procedia Engineering*. (126). 112-120.

Jaison, R., Deitz, R. & Yaqin, S. (2014). "Are Recent College Graduates". *Current Issues in Economics and Finance*. **20** (1).

Jenner, S. (2015). Why do projects "fail" and more to the point, what can we do about it?. *PM World Journal*. (5). 4-16.

Jensen, L.K., & Dinitzen, H.B. 2011. *Project Management in theory and practice*. 11-17. Copenhagen: Hans Reitzel.

Johnson, R. & Onwuegbuzie, A.J.. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational researcher*. (33). 14. <https://10.3102/0013189X033007014>.

Jorgensen, M., Mohagheghi, P., & Grimstad, S. Direct and indirect connections between type of contract and software project outcome. *International Journal of Project Management*. 35(8). 1573-1586.

Joslin, Robert & Müller, Ralf. (2014). The impact of project methodologies on project success in different contexts. *PMI Research and Education Conference*. 1375-1380.

Jowah, L. E. (2015). Implicit theory; the cognitive prototypes that inform followership - impacts on leadership styles. *International Journal of Research in Economics and Business Management*. 40-47.

Kabir, S.M.S. (2018). Formulating and Testing hypothesis. *Research Journal of America*. (5). 51-58.

Keil, M., Lee, H. K. & Deng, T. 2013. 'Understanding the most critical skills for managing IT projects: A Delphi study of IT project managers', *Information & Management*. 50 (7). 398–414. doi: <http://dx.doi.org/10.1016/j.im.2013.05.005>

Kerzner, H. (2017). *Project Management Twelfth Edition – A Systems Approach to Planning, Scheduling and Controlling*. 3-12.

Khamaksorn, A. (2016). Project Management knowledge and skills for the construction industry. *International Conference on Civil, Architecture and Sustainable Development*. 93-97. (CASD-2016), [online] 93-97. Available at: <http://iicbe.org/upoad/8673DIR1216416.pdf> [Accessed 15 Feb 2018].

Kickul, J.; Neuman, G. (2000). "Emergence leadership behaviors: The function of personality and cognitive ability in determining teamwork performance and KSAs". *Journal of Business and Psychology*. 15: 27–51.

Koskela, J., & Howell, G. (2002). *The Theory of Project Management: Explanation to novel methods*. 3-5.

Kothari, C.R. (2004). *Research Methodology: Methods and Techniques*. 2<sup>nd</sup> Ed. 15-21. *New Age International Limited Publishers*. India: New Delhi.

Krahn, J. & Hartment, F. (2006). Effective project leadership: a combination of project manager skills and competencies in context. *PMI Research Conference: New Directions in Project Management*. Montréal, Québec, Canada. Newtown Square, PA: Project Management Institute. 1-14.

Krishna P. (2011). *Essence of a Manager*. Springer Science & Business Media. 163.

- Krishnan, S., Wang, J., Franklin, M.J., Goldberg, K., Kraska, T., Milo, T., & Wu, E. Sampleclean: Fast and reliable analytics on dirty data. *IEEE Data Eng. Bull.* 38(3). 59–75, 2015.
- Kruss, G., Visser, M., Aphane, M., & Haupt, . 2017. Academic interaction with social partners: Investigating the contribution of universities to economic and social development. 2-15. Cape Town. *HSRC Press*.
- Kumar, R. 2011. *Research Methodology: a step-by-step guide for beginners*. 3<sup>rd</sup> edition. London: Sage Publications. 15-35.
- Landry, J., & McDaniel, R. (2016). Agile Preparation within a Traditional Project Management Course. *Information Systems Education Journal*. 14(6). 27-33. <http://isedj.org/2016-14>.
- Langley, M. (2018). *The Project Management Institute: The Pulse of the Profession*. 10<sup>th</sup> Ed. 5-20.
- Lester, A. (2014). *Project Management, Planning and Control: Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BSI Standards*. 6<sup>th</sup> Ed. 14-21.
- Liphadzi, M., Aigbavboa, C., & Thwala, W. (2015). Relationship between leadership styles and project success in the South African construction industry. *Procedia Engineering*. (123). 284-290.
- Lundgren, M. (2016). "Conflict management capabilities of peace-brokering international organizations, 1945–2010: A new dataset". *Conflict Management and Peace Science*. **33** (2): 198–223.
- MacIntosh, R. , Beech, N. , Bartunek, J. , Mason, K. , Cooke, B. and Denyer, D. (2017), *Impact and Management Research: Exploring Relationships between Temporality, Dialogue, Reflexivity and Praxis*. *Brit J Manage*, 28: 3-13.
- Mahmood, A., Mahmood, A.M., & Shafiei, M.W.M. (2006). What competencies do Project Managers need? *International Conference on Construction Industry (ICCI)*. 12-24.
- Makiwane, M.; Kwizera, S. (April 2009). "Youth and Well-Being: A South African Case Study". *Social Indicators Research*. Springer. **91** (2): 223–242.
- Marnewick, C., Erasmus, W., & Joseph, N. (2016). Information Technology Project Managers' competencies: An analysis of performance and personal competencies. 7-10.

Massilon, P. (2018). Greening construction project managers' competences and practices for nearly zero-energy building projects. 5-11.

Merriam-Webster Dictionary. (2003). 11<sup>th</sup> Ed. *Springfield: MA*. Merriam-Webster. Merriam-Webster.com, Merriam-Webster, www.merriamwebster.com/dictionary/experience.[Accessed Mar. 2018].

Mesly, O. (2017). Project feasibility – Tools for uncovering points of vulnerability. 52-60. New York, NY: Taylor and Francis. *CRS Press*.

Mirza, M.N., Pourzolfaghar, Z., & Shahnazari, M. (2013). Significance of Scope in Project Success. *Procedia Technology*. (9). 722-729.

Mohajan, H.K. (2017). Two criteria for good measurements in Research: Validity and Reliability. *Annals of Spiru Haret Univeristy*. 17 (3). 58-82.

Montequin, V. R., Cousillas, S. M., Alvarez, V., & Villanueva, J. (2016). Success Factors and Failure Causes in Projects: analysis of cluster patterns using self-organising maps. *Procedia Computer Science*. (100). 440-448.

Mourougan, S., & Sethuraman, K. (2017). Hypothesis Development and Testing. *IOSR Journal of Business and Management*. 19 (5). 35-40.

Müller, R., & Turner, R. (2010). Leadership competency profiles of successful project managers. *International Journal of Project Management*. 28. 437-448. <http://10.1016/j.ijproman.2009.09.003>.

Munk-Madsen, A. (2016). The Concept of "Project": A proposal for a unifying definition. 6-12.

Naidoo, N. (2011). What is research? A conceptual understanding. *African Journal of Emergency Medicine*. (1). 47-48.

Newell M., & Grashina, M. N. (2004). *The Project Management Question and Answer Book*. 8-14.

Nijhuis, S. (2012). Learning for project management in a higher education curriculum. Paper presented at PMI® Research and Education Conference, Limerick, Munster, Ireland. Newtown Square, PA: Project Management Institute.

Noble, H., & Smith, J. (2015). Issues of validity in qualitative research. *Evidence-based nursing*. 18. 35-39. <https://10.1136/eb-2015-102054>.

Ogbeiwi, Osahon. (2017). Why written objectives need to be really SMART. *British Journal of Healthcare Management*. 23. 324-336.

Orb, A., Eisenhauer, L., & Wynaden, D. (2000). Ethics in Qualitative Research. *Journal of Nursing Scholarship*. 94-98.

Patel, S. (2015). The research paradigm – methodology, epistemology and ontology – explained in simple language. *Open University*. 2-4.

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc. 434-438.

Pillay, R. (2006). *An Investigation into the Criteria for Project Success within Transnet*. Durban Institute of Technology.

Pinto, J. K., & Samuel J. Mantel, J. (1990). The Causes of Project Failure. *IEEE Transactions on Engineering Management* , 37 (4), 269-276.

PMI. (2015). *Capturing the Value of Project Management*. New York: NY.

Prasad, S., Ajith, R., & Eeshoo, R. (2001). Developing Hypothesis and Research Questions. 8-9.

Project Management Institute. (2018). *PMI's Pulse of the Profession*. PMI.

Project Management Institute. 2008. *Construction extension to the PMBOK guide 3rd edition*. 2nd Ed. Drexell Hill, PA: Project Management Institute.

Project Management Institute. *A guide to the Project Management Body of Knowledge*. (2013). *PMBOK Guide*. 5th Ed. 9-18.

Pucciarelli, J. C., Wiklund, D. (2009). Improving IT Project Outcomes by Systematically Managing and Hedging Risk. *IDC Report*. (2). 5-9.

Radujovic, M., & Sjekavica, M. (2017). Project Management Success Factors. *Procedia Engineering*. (196). 607-615.

Ralph, P., & Kelly, P. (2014). "The Dimensions of Software Engineering Success". *Proceedings of the 36th International Conference on Software Engineering*. ACM: 24–35.

Rankin, N. (2011). "Youth Unemployment, Firm Size and Reservation Waves in South Africa" (PDF). *South African Journal of Economics*. 79 (2): 128–145.

Rajasekar, S., Pitchai, P.N & Veerapadran,C. (2006). Research Methodology. 2-13.

Ramazani, J., & jergeas, G. 2015. Project Managers and the journey from good to great: The benefits of investment in Project Management training and education. *International Journal of Project Management*. (33). 41-52.

Reich, B. H., Gemino, A., & Sauer, C. (2010: 35). Exploring the impact of Knowledge Management on Business Value.

Robbins, S.P. 1996. Organizational behaviour. 7th edition. New York: Prentice Hall.  
Sansoni, J.E. (2011). Questionnaire design and systematic reviews. *University of Canberra*. 8-12.

Saunders, Mark & Lewis, P. & Thornbill, A.. (2000). Research Methods for Business Studies. 65-72.

Sapford, R. & Jupp, V. (2006). *Data collection and analysis*. SAGE. 28-32.

Särndal, C., Swensson, B. & Wretmann, A. (2003). *Model assisted survey sampling*. Springer. 9–12.

Schmalz, M., Carter, M., & Lee, J.H. (2019). The I in team: IT identity and project behaviour. *Twenty-fifth Americas Conference on Information Systems*. 2-17.  
Sebestyn, Z. (2017). Further considerations in Project Success. *Procedia Engineering*. (196). 571-577.

Schoper, Y. (2018). *Plea for a more sustainable definition of project success*. 46-54.

Sein, M., Henfridsson, Ol., Purao, S., Rossi, M., & Lindgren, R. (2011). Action Design Research. *MIS Quarterly*. (35). 37-56. <https://10.2307/23043488>.  
Senthill, M. (2018). Leadership styles and competencies of Project Managers in successful projects. *Walden University*. 1-13.

Serrador, P., & Pinto, J.K. (2015). Does Agile work? — A quantitative analysis of agile project success. 1042-1044.

Shokri-Ghasabeh, M. & Kavousi-Chabok, K. (2009). Generic Project Success and Project Management Success Criteria and Factors: Literature Review and Survey. *WSEAS Transactions on Business and Economics* (6). 456-460.

Slattery, J.M., & Carlson, J.F. (2005). Preparing an effective syllabus: Current best practices. *ProQuest Education Journal*. 52-56.

Sliger, M. (2008). Agile project management and the PMBOK® guide. Paper presented at PMI® Global Congress 2008—North America, Denver, CO. Newtown Square, PA: Project Management Institute. <https://www.pmi.org/pmbok-guidestandards/foundational/pmbok/sixth-edition>.

Smith, D., 2003. Five principles for research ethics. *Monitor on Psychology*, 34(1), p.56. Available at: <http://www.apa.org/monitor/jan03/principles.aspx> [Accessed 17 March 2018].

Stevenson, D.H. & Starkweather, J. (2010). PM critical competency index: IT execs prefer soft skills. *International Journal of Project Management*. (8). 663-667.

Summer, M., & Powell, A. (2013). What Project Management competencies are important to job success? *Americas Conference on Information Systems*. 2-18.

Taherdoost, H. (2016). Validity and Reliability of the research instrument; How to test the validation of a questionnaire/survey in research. *International Journal of Academic Research in Management*. 5 (3). 28-36.

Taherdorst, H., & Keshavarzsaleh, A. (2016). Critical factors that lead to Projects' success/failure in the global marketplace. *Procedia Technology*. (22). 1066-1075.

Trochim, William M. K. & James Donnelly, 2007, *The Research Methods Knowledge Base* (3rd ed.), Mason, OH, Thomson Custom Publishing.

Turk, W. 2007. 21st century Project Management competencies. *Defense AT & L.*, pp. 22-25, January-February.

Turner, J. R., & Müller, R. (2005). The Project Manager's Leadership Style as a Success Factor on Projects: A Literature Review. *Project Management Journal*, 36(2), 49–61.

Visser, J. & Visser, M. (2019). *Seeking Understanding: The Lifelong Pursuit to Build the Scientific Mind*. Leiden: BRILL. 233.

Watt, A. (2014). *Project Management*. 10<sup>th</sup> Ed. <https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=456>. 23-36.

Webb, A. (2017). *Project Management for successful Product innovation*. London: Routledge. 2-17.

Webb, A. 1994. *Managing innovative projects*. London: Chapman & Hall.

Welfolo, T. (2019). Evaluation of core competencies required by project managers to effectively execute a construction project. *Cape Peninsula University of Technology*. 2-6.

Wiesel, A., & Badger, W.W. (2015). Project Managers' competencies needed in 2022 and beyond. *51<sup>st</sup> ASC Annual International Conference Proceedings*. 3-15.



Wirth, I. 1996. How generic and how industry-specific is the project management profession? *International Journal of Project Management*, 14(1):7-11.

Wysocki, R.K. 2011. *Effective Project Management: Traditional, Agile, Extreme*. 1-13.  
Yates, T., Otrsky, M.M., Cheatham, G.A., Fetting, A., Shaffer, L., & Santos, R.M. (2008). Research synthesis on screening and assessing social-emotional competence. *Center on the Social Emotional Foundations for Early Learning*. 5-7. [http://csefel.vanderbilt.edu/documents/rs\\_screening\\_assessment.pdf](http://csefel.vanderbilt.edu/documents/rs_screening_assessment.pdf).

Zulch, B. 2016. A proposed model for construction project management communication in the South African construction industry. *Acta Structilia*. (23). 25-30.

## APPENDIX: QUESTIONNAIRE

### MTech Degree Research Questionnaire

A study focused on the Project Management offerings at Universities of  
Technology in Cape Town.

This data and all of your responses will remain anonymous. Thank you for  
participating.

#### **Section A**

Please tick/mark the appropriate box when answering the questions below.

1. Which industry do you currently work in?

Construction

Engineering

Information Technology

2. How many years of experience do you have?

1 – 5 years

5 – 9 years

10 + years

3. Do you work directly with Project Managers in your organisation?

Yes

No

4. Where do you fit in to your organisation?

Management

Project Team

Project Manager

5. What percentage of your daily activities are project-related?

0% - 30%

30% - 60%

60% - 100%

6. How many projects have you worked on?

1 – 24 projects

25 – 49 projects

50 + projects

7. Of those projects that you have worked on, how many of them were deemed successful?

1 – 24 projects

25 – 49 projects

50 + projects

**Section B**

Please tick/mark the appropriate option when answering the questions below.

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neither Agree nor Disagree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
1. It is important for Project managers to have Industry-relevant technical knowledge.	1	2	3	4	5
2. Soft skills (interpersonal traits such as leadership, communication etc. that enable them to interact harmoniously with others) are more important than technical knowledge for Project Managers.	1	2	3	4	5
3. In my Organisation, Project Team members report directly into their Project Manager.	1	2	3	4	5
4. Project Managers can rely solely on their teams for the technical knowledge required to run the project.	1	2	3	4	5
5. In my company, most of our clients/stakeholders are technical and understand most aspects of the project.	1	2	3	4	5
6. Project Managers must be able to fully understand client requirements in order to run the project.	1	2	3	4	5

- |     |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|
| 7.  | In my company, Project Managers are directly involved in recommending solutions to clients.   | 1 | 2 | 3 | 4 | 5 |
| 8.  | In my company, we make use of software programs to aid us in the running of projects.   | 1 | 2 | 3 | 4 | 5 |
| 9.  | In my company, there are specific, standard documentation required from the Project Manager throughout the lifecycle of the project.    | 1 | 2 | 3 | 4 | 5 |
| 10. | Project Managers in your company contribute largely to project success?   | 1 | 2 | 3 | 4 | 5 |
| 11. | Project Manager's lack of technical knowledge contribute to Project failure?  | 1 | 2 | 3 | 4 | 5 |
| 12. | In my company it is very important that project team members are able to trust in the abilities of their Project Manager.               | 1 | 2 | 3 | 4 | 5 |
| 13. | At my company, Project Managers are actively managing projects from inception to closure.   | 1 | 2 | 3 | 4 | 5 |
| 14. | Project Managers at my company report to Clients without the presence of other team members and handle delivery reporting on their own. | 1 | 2 | 3 | 4 | 5 |
| 15. | At my company, Project Managers fulfil an administrative role rather than an advisory role.   | 1 | 2 | 3 | 4 | 5 |
| 16. | Project Managers in my industry do not need industry relevant knowledge in order to be successful.                                      | 1 | 2 | 3 | 4 | 5 |

**Section C**

Please complete the descriptive questions below.

1. Project Managers should have the following soft skills (interpersonal traits such as leadership, communication etc. that enable them to interact harmoniously with others)

-

-

-

-

-

2. In your company, what would be the most useful skills that Project Management students should have after completing their degree?

-

-

-

-

-

3. In your opinion, are Project Management graduates equipped enough to function in industry straight after University? (Please give us a reason for your answer).

---

---

---

---

---

4. Project Managers should have the following hard/technical skills (specific, taught abilities);

-

-

-

-

-

---

---

5. Would you rather employ a generalist (no specific industry knowledge but able to administrate projects well) or specialist (industry-specific knowledge) Project Manager? (Please give us a reason for your answer).

---

---

---

---

---

6. Do you believe that there is a space in your industry for generalist Project Managers? Please elaborate on this space.

---

---

---

---

---

Thank you for participating in this research.